March 15, 2015

Demand-Side Management

2014 ANNUAL REPORT

SUPPLEMENT 2: Evaluation

Printed on recycled paper

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EVALUATION AND RESEARCH SUMMARY

Idaho Power considers program evaluation an essential part of its demand-side management (DSM) operational activities. In accordance with the 2010 Memorandum of Understanding (MOU) with the Idaho Public Utilities Commission (IPUC) staff, the company contracts with third-party contractors to conduct impact, process, and other evaluations on a scheduled and as-required basis.

Third-party contracts are generally awarded using a competitive bid process and are managed by Idaho Power's Strategic Sourcing department. In some cases, research and analysis is conducted internally and administered by Idaho Power's Customer Relations and Analysis team. Third-party evaluations are specifically managed by the company's Energy Efficiency Evaluator.

Idaho Power uses industry-standard protocols for its internal and external evaluation efforts, including the *National Action Plan for Energy Efficiency—Model Energy Efficiency Program Impact Evaluation Guide*, the *California Evaluation Framework*, the *International Performance Measurement and Verification Protocol*, the *Database for Energy Efficiency Resources*, *National Renewable Energy Laboratory* report[1], and the *Regional Technical Forum's (RTF) evaluation protocols*.

The company also supports regional and national studies to promote ongoing cost-effectiveness of programs, validation of energy savings and demand reduction, and the efficient management of its programs. Idaho Power considers primary and secondary research, cost-effectiveness analyses, potential assessments, impact and process evaluations, and customer surveys, important resources in providing accurate and transparent program savings estimates. Recommendations and findings from evaluations and research are used to continuously refine its DSM programs.

In 2014, Idaho Power completed five program impact evaluations and three program process evaluations using third-party contractors. Tetra Tech, MA was selected to conduct impact evaluations for the Residential Energy Efficient Lighting and ENERGY STAR® Homes Northwest programs. PECI was chosen to provide impact evaluations for the A/C Cool Credit and Irrigation Peak Rewards programs. Evergreen Economics was selected to provide process and impact evaluation for the Custom Efficiency program. Johnson Consulting Group was selected to perform process evaluations for the Home Energy Audit program and Shade Tree project.

Throughout 2014, Idaho Power administered surveys on several programs to measure program satisfaction. Participant surveys were conducted for A/C Cool Credit, Energy House Calls, Home Energy Audit, Shade Tree Project, Weatherization Assistance for Qualified Customers (WAQC), and Weatherization Solutions for Eligible Customers. In addition to these participant surveys, a non-participant survey was issued for Energy House Calls to gain a better understanding of customers' awareness of the program.

In 2014, Idaho Power received the research results for Custom Efficiency, Building Efficiency, and Easy Upgrades. In 2013, the company selected Market Decisions Corporation to conduct customer

[1] "Whole-building Retrofit with Consumption Data Analysis Evaluation Protocol" published in April 2013 by the U.S. Department of Energy (http://energy.gov/eere/about-us/ump-protocols).

research for the Custom Efficiency program and ADM Associates, Inc. (ADM) to produce a technical reference manual (TRM) for the Building Efficiency and Easy Upgrades programs.

Final reports from all evaluations, research, and surveys completed in 2014 and an evaluation schedule are provided in this supplement. The evaluation schedule is intended to be used as a guide and may be changed periodically based on need, timing, or other relevant factors.

EVALUATION PLAN

Customer Relations and Energy Efficiency 2011–2015 Program Evaluation Plan

	2011			2012			2013			2014			2015		
Residential Programs	Impact	Process	Other	Impact	Process	Other	Impact	Process	Other	Impact	Process	Other	Impact	Process	Other
Ductless Heat Pump Pilot													✓	✓	
Energy Efficient Lighting								✓		✓					
Energy House Calls	✓														
ENERGY STAR® Homes Northwest								✓		✓					
Heating & Cooling Efficiency Program				✓				✓							✓
Home Improvement Program	✓												✓	✓	
Home Products Program	✓														
Rebate Advantage	✓														
See ya later, refrigerator®		✓		✓									✓	✓	
Residential Energy Efficiency Education Initiative															
Shade Tree Project											✓				
Home Energy Audit											✓				
Weatherization Assistance for Qualified Customers				✓				✓				✓			
Weatherization Solutions for Eligible Customers				✓				✓				✓			
Commercial/Industrial Programs															
Building Efficiency				✓											
Custom Efficiency	✓									✓	✓				
Easy Upgrades				✓				✓							
Irrigation Programs															
Irrigation Efficiency Rewards						✓	✓								
Demand Response Programs															
A/C Cool Credit	✓				✓	✓				✓					✓
FlexPeak Management			✓			✓		✓	✓						✓
Irrigation Peak Rewards		✓	✓			✓			✓	✓					✓

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ENERGY EFFICIENCY ADVISORY GROUP MINUTES

The following pages include minutes from EEAG meetings held on February 6, March 17, April 24, May 20, August 19, and November 12, 2014.

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Energy Efficiency Advisory Group (EEAG)
Minutes dated February 6th, 2014

Present:

Catherine Chertudi–City of Boise, Public Works Dept.
Ken Robinette–South Central Comm. Action Partnership
Stacey Donohue–Idaho Public Utilities Commission
Nancy Hirsh–Northwest Energy Coalition
Tami White*–Idaho Power
Tom Eckman–Northwest Power & Conservation Council
Ben Otto-Idaho Conservation League
Brittany Andrus-Public Utility Commission of Oregon (on phone)
Lynn Young–AARP
Scott Pugrud–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Kent Hanway-CSHQA
Quentin Nesbitt*–Idaho Power

Not Present:

Don Sturtevant-J.R.Simplot

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Gary Grayson–Idaho Power
Shelley Martin–Idaho Power
Diana Echeverria–Idaho Power
Cheryl Paoli-Idaho Power
Shelley Martin-Idaho Power
Todd Greenwell-Idaho Power
Amanda Richards-Honeywell
Randy Wright-South Central Comm. Action Partnership
Celeste Becia-Clear Results
Donn English-Idaho Public Utilities Commission
Chellie Jensen-Idaho Power
Patti Best-Idaho Power
Sheree Willhite-Idaho Power
Chris Pollow-Idaho Power
Denise Humphreys-Idaho Power
Julia Hilton*-Idaho Power
Kevin Van Den Wymelenberg-Integrated Design Lab
Cory Read–Idaho Power
Theresa Drake*–Idaho Power
Andrea Simmonsen–Idaho Power
Nikki Karpavich-Idaho Public Utilities Commission
Roberta Renee-Idaho Power
Darlene Nemnich-Idaho Power
Katherine Johnson*-Johnson Consulting Group
Steven Keates*-ADM Associates
Crystal Jewitt-ADM (on phone)
Ken Miller-Snake River Alliance
Matt Elam-Idaho Public Utilities Commission
Billie McWinn-Idaho Power
Becky Arte-Howell-Idaho Power
Randy Thorn-Idaho Power
Mindi Shodeen-Idaho Power
Jim Madarieta-Idaho Power
Bryan Lanspery-Idaho Public Utilities Commission

Recording Secretary:

Shawn Lovewell (Idaho Power) with Kathy Yi (Idaho Power)

Meeting Convened at 9:35 am

EEAG members introduced themselves along with the members of the audience. The minutes from the November 2013 EEAG meeting were reviewed. Quentin addressed the topics sent in by EEAG members.

9:43am—Regulatory Update-Tami White

Tami provided the following regulatory update:

On December 20, 2013 the Idaho Public Utilities Commission (IPUC or Commission) issued its order on Idaho Power's (IPC or Company) 2012 DSM prudence request. While the Commission found the vast majority of the 2012 DSM expenses to have been prudently incurred, a prudence determination regarding the 2011 and 2012 Rider-funded labor-related expense increases was again deferred to a later time. The IPUC didn't find them imprudent, but provided the Company with an opportunity to present additional evidence that those expenses were prudently incurred at a later time, preferably in a general rate case proceeding. In this order, the Company was also directed to file a report with the IPUC on its perspective regarding the purpose, and value of EEAG, whether or not EEAG is working, and how EEAG could be improved. This report is due on February 18th. Tami also took an opportunity to inform EEAG that when IPC filed its reply comments in this case in August of 2013, there was an error. In its reply comments, the Company stated that the completion of the load and resource balance was what prompted the discussion with EEAG to talk about filing for a temporary suspension of the Demand Response (DR) programs for the 2013 season. In these reply comments Idaho Power erroneously stated that the load and resource balance was finalized in June of 2012. The load forecast was completed in June; however, the load and resource balance was not completed until November of 2012. Tami wanted to make sure that EEAG knew that IPC did not wait 6 months to share this information with them. Stacey stated that she hadn't read that order in a while, but asked, "Didn't the IPUC say that IPC should have brought up the subjects of CAES Energy Efficiency Research Institute (CEERI) and Northwest Energy Efficiency Alliance (NEEA) to EEAG earlier?" Tami stated that the IPUC did discuss that and read the section of the order where the Commission stated that IPC should have consulted EEAG in regards to the Company's decisions about CEERI and NEEA. Kent asked if members of EEAG will see a draft of the report. Tami stated that the Company was not planning on sharing a draft of the report with EEAG for input because the Company believes that the IPUC wants to hear IPC's perspective on EEAG. Ben stated that he read in the order that Idaho Power was not consulting EEAG enough. Tami stated that Idaho Power has heard that and is making changes to improve the EEAG process. .

9:55am—Weatherization Evaluation-Katherine Johnson

Quentin introduced Katherine Johnson to EEAG. Johnson Consulting performed the process evaluations on both of IPC's weatherization programs. Kathryn stated that there are a lot of good things to report, but there is also some room for improvement within these programs. Ken asked if the Oregon weatherization agencies were included in the evaluation. Katherine stated that all of the agencies, including Oregon, were interviewed for this evaluation. Both of these programs are doing well from a process point of view. Weatherization programs are different from all other programs in that they focus on housing stock that is in poor condition for customers that can't afford to make improvements. Looking at non energy benefits (NEBs) is important. There is good participation in the program and it is filling a need in the low income communities. Most of the agencies are processing the applications in a timely manner. Idaho Power and the agencies are doing a good job at leveraging the money from Department of Energy (DOE). Nancy asked if there was a reason why the smaller agencies average measure total costs are lower, is it because they're not doing as much? Katherine answered that some agencies are installing heat pumps where other agencies are not. Some of the agencies have a broader range of measures. It could be that their customer base is smaller.

Envelope measures account for the majority of installed measures. Tom asked why audits are shown on slide 12 (Installed Measures) since it's not really an energy savings 'measure'. Ken stated that audits are part of client education. Katherine answered that it is on this slide to illustrate where the money is being spent. The program marketing material is easy to understand and read. The brochures are available in Spanish. Customer feedback on these programs has been very positive. Tracking information on the database has been a challenge. Some of the data from the forms is not being transferred to the database and there needs to be more consistency with the agencies on what is and isn't tracked.

Katherine talked about the inconsistencies with the two audit tools available. She does not believe that they are the right tools for determining cost effectiveness. They are designed for auditing, not energy savings. Oregon has a good approach. The audit tool is used to see if it is cost effective but then report savings based on deemed savings. Stacey asked if Katherine would talk about the REM design. Katherine stated that it is a simpler software tool that the Oregon CAP Agencies prefer to use.

The Weatherization Solutions program is unique to Idaho Power. The program focuses on people who just miss the income requirements for the WAQC program. These customers include senior citizens who live on fixed income and may live in inefficient homes. This is a generation that is not used to asking for help so they rarely reach out to participate in the program. Envelope measures are still the most commonly used measure. Nancy asked why there was a difference in health and safety between WAQC and Weatherization solutions on slides 11 and 21. Ken answered that in the WAQC program the agencies are accustomed to allocating the energy savings to IPC and the cost of Health and Safety to the DOE. For Weatherization Solutions there is no leveraging of DOE funds so all of the savings and costs are allocated to IPC. Catherine asked if the audit is as educational in the Weatherization Solutions program as it is in WAQC. Ken said that it definitely is. For the Weatherization Solutions program, there is a team of 2 auditors. One person sits down for an educational discussion with the customer and the other performs the upgrades. In the WAQC program there is usually only one person doing both so there is less time for the educational piece.

Marketing takes on a more important role in the Weatherization Solutions program. A lot of people don't really know about this program so they rely on word of mouth or in some cases flyers that have been put up in common areas of the senior living centers. Application processing is much faster in this program. Measure cost is higher due to more heat pump installations. Most of these homes are using electric resistance heat, but sometimes they're using pellet stoves or propane. Once the heat pump is installed, they stop using these other forms of heat. In essence these customers are fuel switching and not getting credit for it. Ben commented on some of the air quality issues that face Idaho. Being able to monetize the NEBs associated with this program could be very useful. Tom stated that the Regional Technical Forum (RTF) is looking at what the NEBs would be for reduction of wood smoke.

Overall both of these programs are being managed very well but there can be some improvement on how savings is captured. In order for it to be an effective program it doesn't have to be all energy savings. Finding a way to capture the NEBs can help with cost effectiveness. Tami asked if there is a utility or agency in the country that is doing a good job quantifying the NEBs associated with reduced arrearages and bad debt. Katherine stated that Massachusetts has done the best job at quantifying NEBs. New York has also done a good job. We know that these values aren't zero; we know that they are above zero; we just need to find out what the value is. Stacey asked if Katherine was aware of a state that has quantified the reduced reliance on public service benefits. Katherine said that it would probably have to be Massachusetts. Ken stated that even if customers participate in the weatherization program, they will still use public assistance benefits but that money could be stretched out longer.

10:40-Break

10:50—Irrigation Efficiency Impact Evaluation-Steven Keates, ADM Associates

Quentin introduced Steven Keates of ADM Associates to EEAG. ADM Associates performed the impact evaluation on the Irrigation Efficiency Program. The evaluation was completed on both the Custom and the Menu Options of the Irrigation Efficiency Program. The kWh savings was about 50/50 between Custom and Menu projects. There were fewer Custom projects but they were quite large. Site visits and desk reviews were done for Custom and desk reviews only for Menu. Nancy asked Steven how confident he was that the measures were installed if just a desk review was done. Steven stated that he was very confident based on the findings from

the site visits that were done. Quentin also added that if an irrigator didn't install a measure it would affect their crops. There is an inherent motivation to make sure they install the measure. Stacey asked what was being looked at for the onsite verification. Steven answered that, as an example, they looked at how many of the invoiced sprinkler heads were installed. The timing of this evaluation was done at the end of the growing season which posed a challenge. They had to work with the farmers to find out where equipment was located. The data collected from this evaluation was phenomenal. They got a lot of documentation and diagrams showing where fields are located and AMI data from the affected pumps.

There is very little NEB information available for irrigation. There needs to be more research done. The information ADM did receive is from the RTF and it is fairly qualitative and mainly focused on what could have been claimed vs. what was claimed. Nancy asked if there was ex-ante kW savings. Steven answered that there is no realization rate for that component. Quentin stated that both kWh and kW savings are tracked and reported, however the kWh are the main focus for reporting an evaluation. Ben stated that there should be some benefit for the kW savings. Pete stated that there is a capacity component of the "on peak" that values those savings. We have a Summer On-Peak (SONP) capacity value and we do apply it through load shapes. Quentin also added that incentives paid to customers look at both kW and kWh's.

There was a lot of discussion around the NEBs for this program and what is and isn't claimed. IPC's numbers are conservative and more could have been claimed. The Ex-Ante NEBs mainly came from impacts on crop yield and labor costs. The participating irrigation customers were surveyed and asked if they are seeing reductions in labor costs and/or improvements in crop yield. 67% of those surveyed stated that they agree they are seeing these NEBs.

Nancy commented that for the irrigation program, estimations and assumptions were made to put value on the NEBs. The same assumptions could be used for the Weatherization NEBs. How did you arrive at those numbers? Quentin explained that when the program was started, he did a little informal research. He wanted to know why the irrigators were converting from flood to sprinkler especially because it is expensive to convert. The main reasons were for saving on labor costs and crop yield increases. Gary stated that the main goal of this evaluation was to validate the energy savings. This was IPC's first attempt to validate the NEBs. Nancy stated that maybe the calculations are too conservative especially since the savings is quite a bit higher than the estimates. The program is providing more robust savings than what IPC is estimating.

Quentin stated that deemed savings are supposed to be the average. When a project comes in and deemed savings are applied, sometimes those savings seemed too high. Deemed savings were used on all of the projects, but for some projects in which we believed the deemed savings were too high, the savings were adjusted downward.

Tom stated that the RTF measure list for menu items is an approximation. It's not perfect by any means. Being a little conservative is fine since you can't save more than you use.

Pete commented that regarding the weatherization programs, after workshops with IPUC Staff and stakeholders, some progress has been made to quantify those NEBs. Catherine asked what the company's path is for going forward with NEB recommendations. Quentin answered that NEB's are included in some program savings and others are still being researched.

Catherine asked about the inaccurate and incomplete data with the weatherization software. The Program Specialist answered that a programmer has been contacted and a contract initiated to update the software tool.

11:40—Program Update-Quentin Nesbitt

Quentin provided a program update to the group.

The commercial and industrial programs have seen an overall decrease in savings and projects between 2012 and 2013. Tom asked if the decrease in 2013 was due to lighting. The Program Specialist answered that lighting made up 80% of the program in 2012 and 79% in 2013. Building Efficiency had a standout year in 2012, twice the savings as 2013. In 2011 it was about 10 million kWh savings. Nancy suggested that for this 'end of year' look at program participation and savings, it would be helpful to have multiple years for comparison. Kent added that having a trend line would be nice so that he could see if it's flat or going up or down. Nancy asked if the FlexPeak program had the same number of deployments. Quentin answered that the FlexPeak program had 3 events in 2013. The Program Specialist for FlexPeak also stated that 35 MW was the contract but they over performed and got 38.6 MW. Nancy suggested that for this presentation it also would be helpful to show target participation and savings vs. what was achieved.

Quentin highlighted some of the activities for the different programs. The Custom Efficiency program has some large projects in the pipeline for 2014. The Refrigeration Operator Coaching for Energy Efficiency (ROCEE) will start claiming savings. For the Easy Upgrades program there might be some measure incentive amounts adjusted. Stacey asked which measures would be affected. Quentin stated that the measures are being evaluated to see which ones will still be cost effective, and which ones could still be cost effective with an incentive increase. Nikki asked what does "more trade ally outreach" mean for Easy Upgrades? The Program Specialist explained that the feedback from trade allies is that since the economy has picked up, they are focusing on new construction rather than lighting retrofits. Trade allies in the rural areas stated that increasing incentives would make it more attractive to participate. Some of the contractors receive the incentive as a third party payment. The outreach would include more customer visits with the trade allies, and offer more support where needed. Ken asked if IPC was at the Ag show on Feb 1st, and if so, did anyone sign up for the irrigation programs. Quentin stated that yes IPC was present at the workshop. IPC talked about the irrigation programs, the new incentives, and program rules but signups were not part of the workshop.

There will be a total of three customer mailings for the A/C Cool Credit program. There was a mailing in January which went to existing customers. The letters instigated about 200 customers dropping out of the program. It is not uncommon for some number of customers to drop out of this program when IPC sends a communication if, for no other reason, it reminds them that they are in the program. It also generated some calls from customers who had unhooked a switch from their A/C because of repair work that had been done. They called to have the switch re-connected to their new A/C unit. A second letter was sent to previous customers that had moved to a new location and a third letter will be sent to new customers that have moved into a home that currently has a switch. That letter will be mailed before the cycling season starts. Nikki asked what is being done with the old radio control switches that are still on some A/C units. Quentin stated that IPC is working on replacing them before the cycling season begins. The Program Specialist is working on getting that done with Honeywell. Nancy asked if the company has thought about requiring a switch be installed on the A/C units of new home construction. Ben added that IPC could incent people to add the switch at the time of construction. There was some discussion around legal issues with requiring that. Quentin stated that there are multiple ways to market this program, but as a result of the demand response settlement, this program is not being marketed to new customers.

Ken asked if the savings decrease in the Home Improvement program is due to gas heated homes no longer qualifying. Quentin answered that yes that is one of the reasons. The RTF numbers showed that it was no longer cost effective. In addition to that, the duct sealing requirement deters participation. Ben commented that he felt that would be more of a trade ally issue. Ken stated that insulation and duct sealing is two different trade allies. Insulators don't want to do duct sealing. Ben encouraged IPC to help find a way to get these two different trade allies working together on this program. Tom stated that this isn't unique to Idaho Power, but that it's everywhere. A lot of trade allies don't know what each other does. The Program Specialist also stated that she is looking at what other utilities have done to address this problem.

12:15 Lunch

1:05 Meeting Reconvened

1:07—Confidential Flex Peak Program Discussion-Quentin Nesbitt

Julia Hilton from the IPC legal department read a confidentiality agreement to the group. Only members of EEAG and a small number of IPC employees were present for this meeting. Non-Disclosure agreements were signed by all in attendance except for IPC employees and IPUC and OPUC staff members. Before the discussion started, Tom Eckman had to leave the meeting due to an unexpected weather-related airline schedule change. Quentin stated that because of the confidential nature of the discussion everyone was asked to sign the non disclosure agreement. Idaho Power and the members of EEAG proceeded with a confidential discussion of the status of contract negotiations with EnerNOC Inc.

1:35—Continuation of program update discussion-Quentin Nesbitt

Non EEAG members rejoined the group and Quentin continued on with the program update.

Catherine asked which geographic area has shown the most interest in the ductless heat pumps. Quentin stated that it's usually customers who have baseboard heating. The Marketing Specialist also stated that customers in rural areas where there is a higher concentration of electric heating are targeted for marketing.

See ya later, refrigerator (SYLR)-savings from the RTF is starting to become an issue for this program. Stacey previously asked via email about exploring the possibility of expanding this program into the commercial and industrial sectors. There would be a few issues with doing that. In a commercial setting the refrigerator would likely be replaced whereas in the residential market, it's more about taking away an old second refrigerator that will likely not be replaced. It's hard to justify the savings for the commercial replacement. Ben asked if Quentin was talking about residential refrigerators in commercial buildings. Quentin answered that it would be the assumption that commercial customers would be replacing the refrigerator instead of just taking it away. Ben asked if the refrigerator replacement could be included in one of the other commercial programs. Quentin stated that the Easy Upgrades program had a refrigerator incentive but the RTF deemed savings makes it non cost effective.

New numbers from the RTF have shown that refrigerators for the Home Products program are no longer cost-effective. IPC is looking at the possibility of a qualified product list that could include other appliances. It would be a new approach for this program. Instead of incenting just ENERGY STAR® it could include more of the upper tier products. It's a harder program to deliver to retailers, but other utilities have done it. Stacey commented that she appreciated that as a group we were exploring ways to keep this program viable rather than just letting the program go away.

The Home Energy Audit was just rolled out in Blackfoot. The first event was successful and community interest was good. Ken asked how the program is being marketed. The Program Specialist stated that advertising hasn't started yet, but it will be direct mailings and newspaper ads. For the roll out, IPC partnered with senior centers and the Chamber of Commerce. Ken asked if this program goes into the rural areas if there will be information available to customers about the Weatherization programs if they don't qualify for the audit. The Program Specialist answered that there will be information on all of the programs available to them. Ken also asked if his organization could be part of the Magic Valley event coming up. The Program Specialist stated that it is something to consider, but that she wants to make sure they aren't overwhelming the customers with too much information and too many people. Ben stated that these audits are a good way to get customers participating in programs.

There was some discussion about how Rocky Mountain Power plans to begin offering showerheads, CFL's and a few other items through a mail by request program. Customers can call in and request this kit at no charge. Quentin explained that the company doesn't have a specific showerhead program but they are part of several kits

already available. The student energy efficiency kits, the Energy House Calls kits, and the Weatherization Program kits. Showerheads are also part of the Simple Steps promotion within Home Products. Nancy stated that in addition to Rocky Mountain Power offering the mail by request kit, Puget Sound Energy is rolling out a similar program. A Program Specialist stated that a program like this is being looked at for Oregon customers.

Quentin highlighted some of the promotional activities within the community that IPC is part of. He showed a TV ad that Idaho Public Television will be running in February and September. For 2014 we will be doing an integrated marketing campaign. Stacey asked if IPC talks to specific groups that have financial constraints on how they can leverage the programs. She gave the example of churches and how they typically have a lot of volunteer labor doing work because they can't afford to hire it out. The Program Specialist stated that the program requires a licensed electrical contractor to do lighting work. Kent stated that the company needs to be careful in encouraging volunteer labor as this type of work needs to be done by a licensed professional. Nikki stated that she is glad to see the company doing more digital content. She has noticed that social media is driving customers to the company website and she encouraged the company to do more.

2:10—Integrated Design Lab-Kevin Van Den Wymelenberg

Kevin Van Den Wymelenberg is the Director of the Integrated Design Lab in Boise and he gave an overview of how the IDL started and some of the highlights from the past 10 years. The IDL has been in Boise for 10 years. They are part of the University of Idaho. Idaho Power has been a long-time supporter of the IDL. He explained the tool loan library that Idaho Power has contributed to. In 2011, IDL moved into a new space. They made renovations to the building in order to "practice what they preach." By 2012 they had consulted on 600 buildings with 50 of those buildings saving 50% of their energy use. Stacey asked which projects they work on for Idaho Power and if they are paid per project. Kevin stated that for four years the IDL has had a fixed price amount with Idaho Power and NEEA. Roughly 1/3 of their budget is Idaho Power and 1/3 is NEEA. With Idaho Power it has been collaborative and creative where with NEEA; it is more about working on existing initiatives. If they work with NEEA on a project and it fits the initiative then NEEA would pay 75% and the customer would pay 25% of the cost. Ben asked where the funding of the final 1/3 comes from. Kevin stated that it's varied. Idaho Power has been a good supporter of the IDL. The tool loan library is a good example of that. There is a list of tools available for loan on the website. They are available to those in the Idaho Power service area. It's a good faith program and no contracts are signed. If the tool needs to be shipped then the customer pays those fees. Kent stated that the IDL has provided the community with a great educational resource for customers and it is well respected. He stated that he really appreciates their efforts.

2:50—Financial presentation-Pete Pengilly

Appendix 1 shows that 2013's beginning balance in the rider is the same as the ending balance from 2012. The $14 million that was in the regulatory asset account for Custom Efficiency was transferred back into the rider account. Tami asked if the NEEA payments came out of the rider. Pete stated that those are part of the rider expenses. Ken asked if the NEEA payment is included in the totals for Idaho and Oregon. Pete stated that it is a 95/5 split, 95% from Idaho and 5% from Oregon. The Idaho rider balance in Appendix 2 is a bit different from Appendix 1. On the DSM Actual Expense by Program slide, the "Actuals" column is all encompassing and the "Energy Savings" column is preliminary energy savings per program. Ben thanked Pete for including an energy savings column. He stated that it's very helpful and since it's been brought up in numerous meetings it's nice to see it. Nancy stated that she would find it helpful to have expectations, projected budget, and projected savings all on one sheet. There isn't a whole lot to report regarding the cost effective analysis. This is a busy time of year for the department. All of the measure and savings cost are in the process of being finalized. The avoided costs from the 2013 IRP will be used for decision making going forward once it is acknowledged by the IPUC and OPUC. A few things have been incorporated and he is looking at a 10% adder, 100% net to gross, averaging avoided costs, and risk discount rate. The 10% adder has been incorporated in some models. Stacey stated that in the last EEAG meeting she committed to looking into the MOU re-negotiations. It has started but is moving along very slowly.

Brittany stated that they have been talking a lot about this in Oregon and asked Pete if he is trying to put into the model the ability to toggle these things that he mentioned. She also stated that a follow up discussion about the UM551 would be a good idea. She wants to make sure that a path for the Oregon piece is covered.

There was a lot of discussion around how to bridge the gap between achievable and economic potential identified in the most recent DSM potential study. Ben stated that identifying the barriers between what is cost effective and what is achievable is important. From there the company needs to address those barriers and how to "knock them down." Nancy stated that maybe marrying that analysis with the customer survey analysis can help to identify how to have more commercial customer participate. Kevin asked Pete who decides the drop down between economic and achievable and how much detail is that. Pete stated that a third party consultant was hired. They started with the Councils ramp rate and then looked at IPC's ramp rate and went with something in between. It was completed in August of 2012. Stacey stated that if Idaho Power is using historical ramp rates and those are low, that means you are forecasting less in the future which seems counter intuitive. Avista had a higher historical ramp rate and they forecast a higher ramp rate. She also stated that she has heard that Idaho Power customers are more conservative and less likely to participate but Idaho Power customers are more urban than Avista's which are more rural. Quentin stated that because our urban customers have gas heated homes, they can't participate in some programs because they aren't electrically heated. Ben stated that EEAG needs to have a deeper discussion that focuses on how to close this gap and he was happy to help with that effort. Stacey added that there needs to be an action plan. Nancy added that before the next potential study is done she would like IPC to consult EEAG. Donn added that there is always going to be a gap between achievable and economic so the conversation needs to be how that gap can be reduced regardless of the ramp rate that was used. Tami asked if there were implications to IPC if the achievable can't be reached. Donn stated that IPUC Staff has had numerous discussions about setting targets and goals and they are reluctant to do so. He would rather see the company focus on how to close the gap. Stacey added that if IPC continues to have a huge gap between economic and achievable then maybe the company isn't pursuing all cost effective energy efficiency and then it could be running a regulatory risk. Quentin asked the group if this topic should be on the next meeting agenda. Ben stated that the big programs should be identified from the potential study and maybe a workshop should be scheduled. Theresa added that she felt this was an important topic but that specific items have not been solidified. She suggested that Idaho Power send out an email soliciting content for a conference call after March 15th.

Due to time constraints the Account Manager/Behavioral presentation will be moved to the next EEAG meeting in May.

3:46—NEEA Update-Theresa Drake

Before Theresa started her presentation, she passed around an IDL lending library flyer.

Theresa updated the group on recent NEEA activity that has taken place. The next business cycle starts in 2015. Some of the unaddressed issues are an alternative funding cycle and the overlap and or duplication of NEEA and utility funder activity. Small work groups of board members were asked to develop a white paper to give NEEA consistent feedback. The Alternative Funding Model work group recommended the following concepts:

- Five year commitment is important
- Floor or minimum of core funding
- Bottom up funding requirements on core plus initiatives
- Model that encourages focus on highest value work
- Maintain broadest market transformation
- Core activities should not exceed 70% of proposed funding

Stacey asked if the revised business plan will be ready to vote on at the February 25th meeting. Theresa stated that she didn't know the answer to that. Stacey also asked if IPC knows if there are specific core and non-core items that they will support. Theresa answered that it fits with the company wanting a funding model that allows IPC to pay for only those activities that bring value to customers and to not pay for what isn't needed or is duplicative. Ben thanked Theresa for clarifying the core vs. non-core concept because it helped him visualize it better.

Theresa stated that the overlap with the utility is something IPC has struggled with. Ductless Heat Pumps are an example of the challenges of marketing. NEEA staff has made arrangements with Sears and Home Depot for promoting Ductless Heat Pumps. These two trade allies do not have installers qualified by Idaho Power. Therefore NEEA funds are used to promote a product whereby Idaho Power customers cannot earn an incentive paid out of the Idaho Rider account. Nancy asked if the core and non-core concept will be reviewed every five years or does Idaho Power see it evolving on an annual basis. Theresa answered that the 5 year approach works best.
Ben and Stacey thanked Theresa for providing an informative NEEA update.

4:00—EEAG Charter –Quentin Nesbitt

Past EEAG minutes have stated that the EEAG would review the Charter on an annual basis. The development of the Charter came from an IPUC order. The original Charter was written in 2002. There have been a few minor updates (like updating EEAG members' names) to make it more relevant to our present group. Quentin passed out the Charter and asked the group to look at it and if there are any proposed changes those can be discussed at the next meeting in May. Quentin thanked everyone for coming and dismissed the meeting.

4:05 Meeting Adjourned

Energy Efficiency Advisory Group (EEAG)
Conference Call
Minutes dated March 17th, 2014

Present on Phone:

Catherine Chertudi–City of Boise, Public Works Dept.
Kent Hanway-CSHQA
Stacey Donohue–Idaho Public Utilities Commission
Nancy Hirsh–Northwest Energy Coalition
Ben Otto-Idaho Conservation League
Brittany Andrus- Public Utility Commission of Oregon
Tami White*–Idaho Power
Lynn Young–AARP
John Chatburn–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Quentin Nesbitt*–Idaho Power

Not Present:

Ken Robinette–South Central Comm. Action Partnership
Tom Eckman–Northwest Power & Conservation Council
Don Sturtevant–Simplot

Guests and Presenters*:

Pete Pengilly–Idaho Power
Chellie Jensen–Idaho Power
Shelley Martin*–Idaho Power
Billie McWinn–Idaho Power
Nikki Karpavich -Idaho Public Utilities Commission (phone)
Cory Read-Idaho Power
Sheree Willhite*–Idaho Power
Theresa Drake–Idaho Power
Scott Pugrud-Office of Energy Resources (phone)
Steven Keates-ADM Associates (phone)

Recording Secretary:

Shawn Lovewell (Idaho Power) with Kathy Yi (Idaho Power)

Meeting Convened at 9:04 am

Quentin opened the meeting with introductions and agenda topics for the conference call.

9:08 am—Commercial & Industrial Program Modifications-Quentin Nesbitt

The reason for today's conference call is to get input and feedback from members of EEAG on some potential modifications to the Building Efficiency and Easy Upgrades programs. Steven Keates from ADM Associates joined the conference call to add additional information about the Technical Reference Manual (TRM) that his company, ADM Associates, prepared for these two programs. This manual identifies costs as well as replacement savings or savings above code level. There are measures in the programs where the company had incorrect savings numbers or cost data. That information does affect cost effectiveness of those measures. At the last EEAG meeting, Idaho Power committed to identifying and implementing strategies that would help drive program participation. Idaho Power thinks that by making some changes the energy savings numbers can increase. There is

still enough time in the year to make an impact on savings and Idaho Power is looking to EEAG for feedback and suggestions.

The Program Specialist provided some background on the recent process evaluation conducted in 2010 and 2013 and the recommendations, one of which is trade ally outreach and improving those relationships. Trade allies are a key sales force for the Easy Upgrades program. Nancy asked what sort of outreach will be done that will be different from the 2010 process evaluation recommendations. The Program Specialist answered that the 2010 evaluation focused on internal process improvement while the 2013 evaluation made recommendations on trade ally improvements. There will be more non-lighting trade ally support. Power Quality classes will be held throughout the service territory. Idaho Power is looking at what can be done to increase face-to-face time with trade allies. New construction has increased so the trade allies are focusing more on that and retrofits are taking a backseat. They will need encouragement to participate in the Easy Upgrades Program. The Customer Representatives will be more involved with reaching out to trade allies and they are excited to be a part of that process.

The Program Specialist highlighted the targeted town event held in Pocatello last October. Two more events are being planned for the spring. Lighting makes up the bulk of the Easy Upgrade projects and savings and half of the Custom Efficiency projects and savings. This is an area that needs to be addressed in order to have a greater impact. Cost effectiveness has been reviewed and Idaho Power is proposing to increase some of the lighting incentive levels. Last year the average incentive was about $.12/kWh and Idaho Power is looking to increase that to $.18/kWh for standard projects.

Idaho Power is also proposing to remove the 100,000 kWh thresholds and redefine the Custom Efficiency Program incentive. This is where the Complete Lighting Upgrade comes in. The customer would need to affect all of the lighting potential in the space and then they would qualify for 70% of total project cost up to $.18/kWh. These projects would be subject to 100% pre and post inspection. This change should encourage customers to be more inclusive on what they're doing in their facility and hopefully provide deeper energy savings. Ben asked if exterior lighting can be included too. Quentin stated that there are incentive increases in standard lighting and some of those fixtures can be exterior and interior. However, exterior incentives in general are not proposed to be increased and on a complete lighting project are proposed to still be evaluated with the lower incentive. The reason that exteriors lighting isn't included is because the avoided costs on a nighttime load shape doesn't justify the higher $.18/kWh incentive amount. Ben stated if the interior is cost effective then it could override the exterior and be looked at as a complete project. Nancy agreed with Ben and stated that she is seeing other utilities doing these types of whole facility projects. Stacey also added that lighting can carry a lot of other measures and supports what Ben and Nancy stated. She also asked what "all inefficient interior lighting" means. The Program Specialist answered that if a facility has done some upgrades in the past then they would just need to upgrade the inefficient lighting that wasn't done. Quentin asked a clarifying question regarding lighting vs. other measures and that the Memorandum of Understanding (MOU) says to be cost-effective by measure. Stacey answered that Staff has been thinking about loosening the cost effectiveness in the MOU and doesn't fault Idaho Power for sticking to the letter of the MOU. Nancy also stated that if there is room to flex the constraints of the MOU that would be great. Quentin stated that Stacey has accepted the task of addressing the MOU.

The Program Specialist went over the non-lighting measures that will be changing. The VFD's on process applications will be moved to the Custom Efficiency program and Easy Upgrades will retain the HVAC VFD's. Nancy asked for clarification on the meaning of "process applications." The Program Specialist explained that it refers to all VFD's except HVAC such as the processing equipment in an industrial setting such as a waste water treatment plant. It's not as easy to determine the deemed savings so ADM recommended that they be moved out of the prescriptive program and be moved to Custom Efficiency where a more detailed analysis can be performed. The Program Specialist went over which measures will remain in the Easy Upgrade program and what will be removed. Ben asked for a reminder on how avoided costs are approved and decided upon. Pete answered that avoided costs are approved whenever a new Integrated Resource Plan is recognized by the Idaho Public Utilities

Commission and the most recent one was just acknowledged. Quentin asked members of EEAG if there were any additional comments or questions on what was just presented. Members had no further comments.

The Program Specialist for the Building Efficiency program explained the current program requirements. The architects and engineers are the trade allies for this program and any changes in the design phase will be less costly than making changes during the construction phase. The Program Specialist stated that for the lighting incentives she is looking at adding higher efficiency target level of 30% above code. She is also looking at adding a "custom line" on the application to handle building spaces that have higher operating hours which will tie the incentive amount better to savings. The TRM shows incremental costs for exterior lighting that is lower than the current incentive so that incentive will be lowered. Control incentives are currently a prescriptive amount based on square footage. That will be changed to a per ton amount as it ties better to savings. Currently the window measure is being reviewed but may be removed due to cost effectiveness. The HVAC measures have some cost-effectiveness issues as well. Looking to continue paying on these measures and then reevaluate in 2015 with updated weights.

The Program Specialist wanted to get feedback from EEAG on the possibility of adding an incentive for the architect/engineer. The economy is gaining more momentum and the architects and engineers are busy with large projects. On the smaller projects they don't want to spend their valuable time filling out paperwork for the Building Efficiency program. This wouldn't be a profit making incentive but rather recognition for their time used for paperwork. She thinks this small incentive will help get projects submitted to the program. There were focus groups held with architects, building owners, and engineers where they stated that one of the biggest barriers to selling the program is the paperwork. Kent Hanway stated that in order to comply with the program requirements, sometimes it means chasing down paperwork from contractors and building owners and this small incentive will help them to continue to champion this program. Nancy stated that she is starting to see how over time some of these buildings are not performing how they were originally designed to. Is there room for an incentive for ongoing commissioning to make sure the buildings continue to perform as they should? The Program Specialist stated that commissioning is difficult and costly. Steven Keates stated that commissioning is a difficult measure to deem or even evaluate the energy impacts due to building variability. The Program Specialist stated that this isn't part of the prescriptive programs but the Custom Efficiency program has something similar to this. The Program Specialist for the Custom Efficiency program stated that the ROCEE and WWEEC programs use monitoring software where behavioral savings are tracked for persistence. Nancy stated that commissioning is the new frontier to ensure savings over time. It is a real opportunity to ensure that incentives that have been paid by utilities for these savings will continue over time. The Program Specialist stated that Idaho Power is participating in the Kilowatt Crackdown and those participants monitor their energy savings. Stacey stated that offering an incentive to architects and engineers is a good idea. She also agrees with Nancy that commissioning is difficult but that it is something that needs to be explored for commercial and industrial customers. This could be another EEAG topic, maybe it could be a pilot program where it wouldn't be subject to rigorous cost effectiveness.

Quentin stated that the purpose of today's call was to get feedback from members of EEAG on the changes being proposed. He then asked the group if they had any more comments or questions. Ben commented on the proposed incentive for engineers and architects. He agrees that an incentive for those filling out the paperwork is appropriate but he also stated that finding a way to streamline the paperwork process to make it easier should be looked at too. The Program Specialist stated that she has tried to streamline the form. The large projects typically have numerous cut sheets and invoices. She agreed that finding a way to reduce the amount of paperwork is a goal and she is looking at other ways to do that such as a web portal or a drop location. Quentin thanked the group for their feedback and comments. Catherine asked for a copy of the PowerPoint presentation to be sent out.

10:11 am —PCA Mitigation-Tami White

Tami read the confidentiality agreement to the group because she will be talking about an upcoming filing that is not public yet. This filing will be in Idaho only and is associated with Idaho Power's annual power cost adjustment (PCA) filing. Tami shared that the company is considering making a request to mitigate the PCA increase by using some Rider funds as part of this filing. Currently the Rider account is collecting 4% of base rate revenue and collects about $36 million per year. The near term forecast for Rider spending is about $20 million per year over the next two years. The projected Rider balance for June of 2014 is $12 million. Looking forward into 2015 the Rider balance is forecasted to be $26 million by the end of May. Idaho Power previously filed to update its base net power supply expenses (NPSE) which would move $100 million out of PCA collection and into base rate collection. If approved, base rate revenue will increase by approximately $100 million and, as a result the Rider collection will increase by about $4 million a year. The intent of the NPSE update filing is to be revenue neutral for all Idaho customers. Therefore, Idaho Power plans to request to offset that increase by transferring $4 million from the Rider to the PCA. Idaho Power is also considering an additional transfer of Rider funds to the PCA to mitigate what is expected to be an increase in the PCA. The PCA is currently projected to increase but we won't know by how much until the 4th or 5th working day of April. This one time transfer would mitigate the impacts of the PCA increase to the customer. The company has looked at a few different scenarios. If $15 million were transferred from the Rider to the PCA, the Rider would have a $15 million projected balance by the end of May 2015. If $20 million was transferred, the projected balance would be $10 million by the end of May 2015. This transfer would provide immediate rate relief and help customers in the short term. Idaho Power is not planning to file for a change in the Rider rate. This additional amount would be a one-time transfer and does not in any way suggest that Idaho Power is pulling away from its DSM efforts.

Stacey stated that it was said the Rider balance is $9 million now, so where does the $4 million or $15 million come from. Tami stated that it is a forecast. PCA collection begins June 1st 2014 through May 31st 2015. This potential transfer would be effective June 1st and it would lower PCA collection from customers. If $15 million was transferred, the Rider balance would go contra (meaning an uncollected balance) for one month. If $20 million was transferred, the Rider balance would go contra for four months. Ben commented that the FCA was just filed which, if approved, would increase customer rates so it would be nice to offset that. Tami pointed out that the FCA affects residential and small commercial customers and the PCA and Rider affects all customers. Ben stated that carrying a negative balance also affects the customers. He also commented that there seems to be a lot of potential that is not being acquired. Ben expressed concern that if this transfer is made that there would not be a sufficient balance in the Rider to go after all potential. Tami stated that at the last EEAG meeting it was decided that a discussion would take place about ideas around how to close the potential savings gap. Stacey stated that she appreciates that Idaho Power is not considering reducing the 4% Rider collection and she is not opposed to a transferring some of the balance but not the entire forecasted surplus. She did state however that looking at the savings from 2009 till now, savings have decreased by about 40%. There has been a lot of discussion about behavioral based programs and there still isn't any resolution on NEEA. She would hate to see this money transferred and then not have enough for cost-effective savings. Stacey stated that crediting back all of the money with known and unused options probably runs afoul of the IPUC's mandate to pursue all cost effectiveness.

Quentin stated that the 2013 savings are down. Part of the reason for this on some of the measures is due to building codes being more stringent, the cost effectiveness in residential programs, and lower deemed savings from the RTF. The company is looking at new ideas and measures that can meet cost effectiveness. Spending over the Rider balance has never limited the company in the past. The company has demonstrated many times where it has spent more than it had collected in the Rider. Tami stated that the Idaho Public Utilities Commission (IPUC) in the past approved Idaho Power transferring $10 million from the PCA into the Rider. The company believes that the IPUC would consider that again if needed. Idaho Power should feel confident that if energy efficiency activities are prudent, then recovery of those dollars would be allowed regardless of the balance in the Rider. Stacey thanked Tami for pointing out that the company has had large negative balances in the Rider account in the

past. Nancy stated that she isn't opposed to a one time transfer but wouldn't want this to be the beginning of an ongoing transfer. It raises the questions of how avoided costs are calculated so that we can avoid this situation in the future. Tami just wanted to remind everyone again that Idaho Power is not planning to file a request to change the current Rider collection rate of 4%. Ben stated that he appreciates that the company continues to pursue energy efficiency projects despite the Rider balance. Another component to this is making sure the company has sufficient staffing to pursue these higher levels of energy efficiency savings.

Kent stated that he is looking forward to how the Building Efficiency Program will evolve in the future. Code changes are making some of the current program offering obsolete and energy efficiency will be harder to obtain. Stacey added that EEAG has been talking about "what's next" for the future for a year and a half. This conversation has been more about money being refunded and not a lot about the "what's next." Quentin stated that Idaho Power values the ideas from members of EEAG and a sub group of employees has been formed to continually look at new ideas. Stacey stated that a business plan should be developed for DSM and what Idaho Power will do in the future. Show what will be different going forward from what has been done in the past. When this conversation started, it was said that the company is projecting to spend $20 million going forward, give us some context of what kind of change this is. Nancy stated that it would be one thing if the fall off was based on no more savings opportunities but she knows that is not true. Stacey asked what the 2013 savings were compared to IRP targets. The Energy Efficiency Analyst answered that the target was missed by about 4 average MW. Market transformation is not included in the target. Stacey asked if targets were met in 2011 and 2012. The Energy Efficiency Analyst stated that one year was very close and the targets were exceeded the other year. Stacey commented that Avista exceeded their targets on average by 190%. There are certainly differences in how targets are set but there is still more that Idaho Power could be doing.

Brittany Andrus just joined the conference call. Tami stated that she would follow up with her and get her up to speed. Lynn stated that this has been a healthy discussion and she will wait to see what happens next. Sid also joined the call late and said that he would like to know ideas for potential savings. Quentin will call Sid and get him up to speed. Nancy commented on the presentation earlier regarding the Easy Upgrades program and the community based outreach. It sounds like it resulted in a lot of audits. Is the goal to turn all 50 of those audits into projects? The Program Specialist answered that is exactly what Idaho Power wants to happen. The customer reps will touch base with the trade allies.

Stacey thanked the company for bringing the planned filing to transfer Rider funds to the PCA to the EEAG in advance of a filing. Quentin thanked everyone for their participation and closed the meeting.

10:55-Meeting adjourned

Energy Efficiency Advisory Group (EEAG)
Conference Call
Minutes dated April 24th, 2014

Present on Phone:

Catherine Chertudi–City of Boise, Public Works Dept.
Ben Otto-Idaho Conservation League
Stacey Donohue–Idaho Public Utilities Commission
Nancy Hirsh–Northwest Energy Coalition
Kent Hanway-CSHQA
Tom Eckman–Northwest Power & Conservation Council
Todd Schultz-Idaho Power
Tami White–Idaho Power
John Chatburn–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Brittany Andrus-Public Utility Commission of Oregon

Not Present:

Ken Robinette–South Central Comm. Action Partnership
Lynn Young–AARP
Don Sturtevant–Simplot

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Billie McWinn–Idaho Power
Quentin Nesbitt–Idaho Power
Bryan Lanspery-Idaho Public Utilities Commission
Randy Lobb-Idaho Public Utilities Commission
Billie McWinn–Idaho Power
Theresa Drake*–Idaho Power
Randy Thorn-Idaho Power
Nikki Karpavich-Idaho Public Utilities Commission

Recording Secretary:

Shawn Lovewell (Idaho Power) with Kathy Yi (Idaho Power)

Meeting Convened at 9:33 am

Todd Schultz opened the meeting with introductions and agenda topics.

9:37 NEEA 2015-2019 Business Plan Timeline—Theresa Drake

The purpose of today's conference call is to share NEEA's proposed business plan for the 2015-2019 funding cycle. Idaho Power would like to highlight some of the components of the business plan and hear comments and feedback from members of EEAG. Most of the slides presented today are from NEEA's prepared presentation. Idaho Power will be hosting NEEA's public meeting on April 28th in the auditorium and all EEAG members are welcome to attend. There is also a link to the 2015-2019 business plan on NEEA's website. The largest funder of NEEA is BPA, second is Energy Trust of Oregon (ETO), third is Puget Sound Energy, and fourth is Idaho Power. Nancy pointed out that the Alliance slide is not an all-inclusive list. There are states represented on the Board as well as non-profit representatives. Theresa stated that this slide is from NEEA but Nancy is right, there are other funders and special interest groups and they are all listed on NEEA's website.

The term market transformation means different things to different people. Idaho Power might say that it means making lasting changes with measures to transform the market. NEEA might say it's working on codes and

standards and working with vendors at a national level. Some market transformation successes have been energy efficient televisions that started in California and then the Northwest region was invited to participate. Another market transformation success is the Integrated Design Lab that is located in Boise. It was started as part of a lab network through NEEA and Idaho Power provides additional funding. Theresa provided some background history of how the company has been working with NEEA towards this next funding cycle. Idaho Power expressed its desire to work with NEEA on a way to change the funding model because we have recognized that the company has developed certain expertise within the organization that may be duplicated by some of NEEA's efforts. Trade allies have seen duplication in the efforts of both NEEA and Idaho Power. In 2009 the company expressed its concerns to NEEA and that it would prefer to use its internal expertise for some activities. The company still funded the current cycle but expressed its concerns about the potential duplication. In 2012 verbal notice was given to NEEA about these concerns. Idaho Power believes its customers' money is paying for similar offerings in different ways. The door has been open for discussion on these issues. In February of 2014 Theresa provided an update to EEAG on the business plan that the NEEA board had developed. Since February the NEEA board has met numerous times. In March there was a motion developed to provide a scenario for the upcoming strategic plan. The board looked at reducing the budget while preserving the savings that were forecasted for the next funding cycle. Theresa asked if there were any questions from those on the phone. Ben asked if Theresa could provide details and examples of NEEA's overlap of efforts with Idaho Power's. Theresa stated that later in the presentation there would be some specific examples. Nancy stated that she just wants everyone present and on the phone to be aware that NEEA's budget has changed quite a bit since the original business plan. Theresa agreed and stated that NEEA's Business Plan and budget has been through multiple iterations and there have been several discussions with NEEA board members.

The budget range for NEEA's draft 2015-2019 business plan is between $145 and $169 million. It focuses on four strategic markets. It offers funders roughly $24 million in optional activities. Tom asked if the stated amounts of $18.5 million in New Initiatives and $6 million in New Opportunities were part of the base budget or part of the optional amount. Theresa answered that they are part of the core base budget which is what all funders would pay. There were originally six strategic markets but that has been reduced to four. The strategic markets that were removed were industrial and agriculture and the other was commercial real estate. Nancy stated that the original proposed budget was somewhere closer to $185 million. Theresa stated that in November the budget was $184 million.

The Initiative infrastructure programs slide (#18) shows the programs for the draft 2015-2019 plan. The asterisks denote items that are optional for funders. On the Optional Activities slide (#19) Ben asked Theresa to describe Idaho Power's capabilities in providing distribution channel development. The Program Specialist answered that it was more on an initiative level. Nikki asked for clarification on the optional activities. If the company opts out of the distribution channel option then is it for the whole five year funding cycle? Theresa answered yes. Nancy stated that it was her understanding that with each initiative you could opt out within each initiative and not overall, is this correct? The Program Specialist answered that it would be either opting in for all or opting out for all, but not all of the initiatives have that component. Theresa stated that this was NEEA's recommendation because it is more manageable for them. They didn't want a "pick and choose" scenario.

Theresa asked the Engineering Project Leader to speak on the industrial technical training option. He showed a breakdown of current training costs provided by NEEA. He compared that slide to what it would cost for Idaho Power to provide that same training if the company were to opt out of that NEEA offering. The costs are considerably lower. If eight trainings a year are provided by Idaho Power it would save about $64,000. Ben asked if it is the same training where are the cost savings coming from. The Engineering Project Leader answered that he believes that these are costs associated with NEEA's contractor who coordinates the training for them. NEEA hires a third party to coordinate the trainings and a third party to conduct the trainings. John asked, since the NEEA costs were used, what is the overhead and mark-up costs that haven't been backed out? The Engineering Project Leader answered that those costs do not include the NEEA overheads. Nancy asked if it was included in the $5,000 per class coordination costs. He answered that the overhead is not included in that amount. Idaho

Power would pick-up the coordination costs and the $1,000 is probably a high estimate in the amount of time it would take for the Idaho Power resource. Stacey stated it would be interesting to see a similar comparison of the NEEA costs for other initiatives vs. how Idaho Power can do the same for less money. The Program Specialist gave another example in which NEEA had $120,000 in its original plan for Refrigeration Engineers & Technicians Association (RETA) certification training. Idaho Power felt it could do a better job and was already implementing the Refrigeration Operator Coaching for Energy Efficiency (ROCEE) training and RETA certification. NEEA asked to partner in ROCEE which Idaho Power accepted to leverage NEEA funding. Idaho Power had already developed relationships with these customers and that is where some of the redundancy that Idaho Power is concerned about comes in that Theresa spoke about. Stacey thanked her for that single example, but would like to see examples for every initiative that the company plans to opt out of. The Program Specialist stated that it is really a case by case basis because not all initiative's have options to opt out of. Another example would the reduced wattage replacement lamp. Other utilities are already doing this like Snohomish PUD (SnoPUD). Our Program Specialist identified that Idaho Power could launch its own similar program. It wasn't an appropriate task for NEEA to take on when Idaho Power has the capabilities to do it. Stacey stated that she would be hesitant to endorse Idaho Power of opting out of everything with just a few examples. Nancy asked about the other three optional items besides the industrial technical trainings. Theresa stated that Idaho Power wants to recognize that this is a proposal and to honor the fact that this will up for public comment and could change. The company isn't in a place where it can say whether or not it will opt in or opt out. It's important for this public process to take place first. John wanted to remind everyone that this is a draft proposal. The board has not considered this and it could change. Ben stated that it was his understanding that this scenario came out of the executive committee so some of the board has endorsed this, is this correct understanding? Theresa answered that the public process can bring forth other ideas. Based on public comments the board can still take those into consideration when creating the final draft.

The Program specialist spoke to some of the other optional programs. Portions of the Top Tier Trade Ally initiative NEEA could be the right organization to provide support and value. Theresa went over the Budget and Savings Comparison slide (#25). The $188 million of the current cycle is based on budget amount. We are in the last year of the current cycle and it has been forecasted that the actual expenditures will be $181 million. Tom spoke about the two initiatives that were removed. The agricultural initiative originally $6 million budgeted for 2 aMW of savings in 5 years and 25 aMW in 10 years, but NEEA wasn't confident it could achieve those savings. It spurred some good discussion among the utilities and NEEA about savings potential and whether or not it could be achieved especially in those niche applications. Tom asked if some of the money that had been earmarked for those programs was transferred to help develop the New Initiative offerings. Theresa stated that the original $6 million was reduced to $3 million and the balance was moved to the New Initiative category where it is earmarked for rural and agriculture initiatives. This is an example how the budget was condensed. As a result, the forecast of projected savings that was already uncertain was removed. There are no projected savings for the $3 million dollars but it is there to focus on Ag customers. One of the Engineering Project Leaders spoke about the original Ag Plan initiative that was removed. It included soil moisture monitoring and equipment standards and protocol. It was then expanded to field demonstrations and research sites. It was only applicable to certain sites, and the aMW savings estimates were very loose. From an irrigation program perspective, if there is a particular technology that demonstrates energy savings, Idaho Power can do the field demonstrations and work with dealers. NEEA doesn't have the same type of relationships with its customers and dealers that Idaho Power does. This is another example of overlap and of NEEA defining market transformation in a very broad sense instead of working with manufacturers. Sid stated that when you are in agriculture, it takes a certain amount of water to grow crops. The program NEEA ran in Grandview was not successful. The local irrigators felt that NEEA's field personnel did not know what they were doing, did not know the customers and did not understand their operations. The irrigators that he represents on these issues are not excited to spend energy efficiency dollars on programs like this. As irrigators, we have yet to figure out how computer automation can determine how to irrigate and how much to irrigate. The crop that was produced from these NEEA demonstrations did not look good at all.

Theresa stated that determining where the best place to utilize the expertise of NEEA and the appropriateness of that is a continuous learning process. This irrigation issue is a perfect example of NEEA moving away from the original scope of the project. This new NEEA proposal should help with these issues. It should provide better coordination efforts and engage stakeholders earlier in the process.

Theresa asked Pete to walk through the Expected Value Delivery: Savings slide (#27). Pete stated that this is total regional savings. It includes baseline savings that would happen with or without NEEA, local programs, and net market effects which are total regional savings less baseline and local program savings. Net market effects have been called NEEA Savings in the past. Now NEEA combines it with local savings and calls it co-created savings. When NEEA calculates levelized costs they include benefits like transmission and non energy benefits. These are based on forecasts done by third parties that give them a 20 year forecast of savings. Idaho Power does not provide them with a forecast of local program savings. Tom asked if baseline savings have error bands around them. Pete stated that he didn't believe the historic savings did but wasn't sure about the forecast. He hasn't seen the breakdown of the calculations. Ben stated that he just compared these savings with the 2010-2014 business plan and the current plan looks like there is a 25% reduction and over 10 years a 33% reduction. Is there a potential study out there looking at where these numbers come from. Pete answered that he didn't know but he would probably call the Total Regional Savings a potential study. NEEA determines either on its own or from a third party what the potential savings are. Pete clarified that he didn't mean that the Total Regional Savings was modeled like a potential study. NEEA determines what the savings could be on each initiative. The Program Specialist stated that in comparing the 2010-2014 plan to the proposed one, NEEA said they had a slam dunk with the TV initiative. The new initiatives budget could find the next technology. NEEA made it clear that they are not confined by the 149 aMW savings. They have a budget set aside for other potential possibilities. Theresa added that before the 2010 cycle the big surprise was CFL's. The current cycle it was TV's and for the future funding cycle we have no idea what that next thing could be. As the Program Specialist pointed out, the $18.5 million in the NEEA 2015-2019 business plan has no forecasted savings associated with it but it is ready to develop and plan for those savings opportunities.

Tom stated that the TV initiative took off faster than anticipated and NEEA had to ask for more funding. Is this envisioned that something similar could happen in the next cycle. Theresa stated that the board has talked about that and they have acknowledged that if a new opportunity presents itself it would consider it. Ben asked if there is more or less money than the last plan for these new opportunities. Theresa stated that she did not know the answer to that. Nancy pointed out that the areas of opt out within initiative, there is a lot of trade ally, market development, distribution channel component that Idaho Power might choose to take on itself. If this budget gets adopted and Idaho Power does opt out, how will that impact the budget and saving? She would like to see some kind of plan that would expand on the components of the programs Idaho Power plans to opt out of. Theresa stated that this is recognition that Idaho Power already has the resources. It could certainly be expanded but we don't have the impacts quantified now.

Todd gave an example of the lighting trade allies and the contracting community. The Program Specialist spends a lot of time working with contractors, organizing trainings and working with customers. These activities benefit our programs from a savings perspective. Nancy said that she thought those activities are good. She is just worried that this will result in cost savings for the company and not an expansion or shifting. One of the NEEA board members said not to look at this as a cut of the NEEA budget but as an expansion of the local utility. If that is true, then that is great. She recognizes that Idaho Power could do it better with less money, but she doesn't want to see it as a net reduction to the budget and not an opportunity to expand. Tami stated that the example that Todd gave is a great example of what Idaho Power is already doing. She sees a cost savings while still maintaining the same amount of energy savings as good for customers. As long as the company isn't pulling away from its energy efficiency activities and there is not a reduction in energy savings. Nancy stated that there has been some reduction in savings so the question is where the balance is. Ben stated that if the budget is lower and savings remain the same or even increase than that is a good thing. But if budget is lower and savings drop that might hurt the customer. Tami added that lower savings might not be because Idaho Power is doing less, but could be

because of lower deemed savings from the Regional Technical Forum. John stated that as a group, no one is interested in having actual energy savings reduced. But if you double the size of the entity and do other things that NEEA did in the last funding cycle, are we getting the most energy savings for the dollar invested. Dollars spent doesn't mean anything. Stacey agreed with John's point that dollars and savings aren't necessarily linear. If Idaho Power opts out then the burden is on the company to show how it's already doing activities or can do those activities as effectively or more effectively as NEEA. The company will need to provide more than just a handful of examples, admittedly very good examples, but will need to see an example for all activities the company will opt our of. John said that he didn't disagree completely with Stacey he just wished NEEA got as much scrutiny as Idaho Power did.

Theresa thanked everyone for a very spirited discussion. Idaho Power wants to spend its customers' money wisely and prudently and get the most value for each dollar spent. John added that he wanted to encourage everyone to show up for NEEA's public presentation on April 28th to further open dialogue and get everyone's perspective. Catherine stated that this was a great conversation. She appreciates the openness of Idaho Power to comments and feedback. She sees this as an opportunity to maximize the value. NEEA does have value but Idaho Power can provide a more practical approach at the local level. She thinks there is some value in NEEA providing market transformation. She appreciated Stacey's comment that it is Idaho Power's burden to show how it can do things better than NEEA. Stacey stated that since most of the conversation was around the optional activities, is it reasonable to believe that Idaho Power will be signing on with NEEA for another funding cycle? Theresa stated that Idaho Power is working very hard with NEEA and the executive team. Idaho Power will be watching how this plan might change when it is voted on in May. The company wants to be respectful of the public process as well. Idaho Power is optimistic that the plan is reflective of the company's historical concerns.

11:05 wrap up—Todd Schultz

Todd reminded everyone of the next EEAG meeting on May 20th. Pete added that a doodle poll will be going out for the potential study workshop. He wants it to be an interactive discussion so it would work best as an in person meeting. He asked for feedback on having it the day before the next EEAG Meeting. Looking at the afternoon of May 19th so that people who need to fly in for the EEAG meeting on May 20th could come over a day early. Most of the members agreed that back to back meetings would work well for them. Pete stated that a doodle poll would go out later today. Brittany had some questions around cost effectiveness and avoided costs. Pete stated that the workshop will be to get ideas on how we can close the gap between achievable and cost effective potential. The goal is to get EEAG to help Idaho Power brainstorm on how to do that. Ben stated that Brittany brought up a good point and maybe some background should be provided around the potential study. Todd thanked the group again for their time and input and closed the meeting.

11:15—Meeting Adjourned

Energy Efficiency Advisory Group (EEAG)
Minutes dated May 20th, 2014

Present:

Tami White*–Idaho Power
Ken Robinette–South Central Comm. Action Partnership
Stacey Donohue–Idaho Public Utilities Commission
Nancy Hirsh–Northwest Energy Coalition
Tom Eckman–Northwest Power & Conservation Council
Lynn Tominaga-Irrigation Pumpers Association
Juliet Johnson-Public Utility Commission of Oregon
Todd Schultz*–Idaho Power
John Chatburn–Office of Energy Resources
Ben Otto*-Idaho Conservation League

Not Present:

Don Sturtevant–Simplot
Sid Erwin-Irrigation Pumpers Association
Lynn Young–AARP
Kent Hanway-CSHQA
Catherine Chertudi–City of Boise, Public Works Dept

Guests and Presenters*:

Pete Pengilly–Idaho Power
Diana Echeverria–Idaho Power
Roberta Renee–Idaho Power
Erinn Monroe*-Opinion Dynamics
Nikki Karpavich-Idaho Public Utilities Commission
Amanda Richards-Honeywell
Theresa Drake-Idaho Power
Dennis Merrick-Idaho Power
Darlene Nemnich-Idaho Power
Ben Lampron-Honeywell
Quentin Nesbitt-Idaho Power
Chellie Jensen-Idaho Power
Chris Pollow-Idaho Power
Cheryl Paoli-Idaho Power
Becky Arte-Howell-Idaho Power
Jim Madarieta-Idaho Power
Todd Greenwell-Idaho Power
Cory Read–Idaho Power
Theresa Drake–Idaho Power
Andrea Simmonsen–Idaho Power
Marian Goebes*-TRC
Donn English-Idaho Public Utilities Commission
Celeste Becia-Clear Results
Shelley Martin-Idaho Power
Denise Humphreys-Idaho Power
Kevin Lauckner-Honeywell
Paul Carp-Honeywell
Sheree Willhite-Idaho Power
Billie McWinn-Idaho Power
Randy Thorn-Idaho Power
Gary Grayson-Idaho Power
Patti Best-Idaho Power
Lisa Nordstrom-Idaho Power

Recording Secretary:

Shawn Lovewell (Idaho Power) with Kathy Yi (Idaho Power)

Meeting Convened at 9:36 am

EEAG member introduced themselves along with members of the audience. Housekeeping and safety items were discussed. The minutes from the February 6th EEAG meeting, the March 17th and April 24th conference calls were reviewed. Stacey had some revisions to the March 17th minutes in the second paragraph on page 4. She would like her statement "she may not be opposed to a one time transfer" clarified. What she said was stated during that meeting was that she might not be opposed to transferring some of the balance but maybe not the entire forecasted surplus. She also would like a comment that she stated in the meeting added to the minutes that was not captured in the original minutes. "Crediting back all of the money with known and unused options probably runs afoul of the IPUC's mandate to pursue all cost effectiveness." She would like this statement inserted at the end of the second paragraph on page 4. Stacey also stated that she has concerns with these minutes since Idaho Power summarized them and used them in a filing (the annual Power Cost Adjustment (PCA) filing) before members of EEAG had a chance to review them. Tami stated that Idaho Power did not use the EEAG minutes in this filing, but simply referred to the fact that Idaho Power had a conversation with the EEAG in advance of the filing regarding its proposal to transfer Rider funds as a credit to customers through the PCA. Tami also stated that she was sensitive to the fact that the PCA case is an open case and requested that this discussion be held after the comment period closes. Ben stated that this isn't really about the PCA case. The point is that if minutes are going to be used then members of EEAG should be reviewing them beforehand. John stated that if what is said in these meetings is being mischaracterized and being used in filings without being reviewed then he has a problem with that. Tami asked members if the minutes were capturing the right amount of detail, or is too much detail is being captured during these meetings. Some members stated that they liked the minutes as it helps to refresh their memories of what occurred during the previous meeting. Stacey disagreed and feels that the minutes are not necessary at all. Stacey went on to say that at the Integrated Resource Plan Advisory Committee ("IRPAC") meetings minutes are not taken and she believes it is a similar structure to EEAG. The group consensus is that the minutes are not too extensive and could be reviewed in a week by EEAG if necessary. The February 6th meeting and April 24th conference call minutes were reviewed and EEAG had no changes.

Todd went over the suggested topics that EEAG members sent in. As usual, if the topics are covered during the presentations they will be crossed off and those that aren't covered the group may have further discussions.

10:15 am EEAG Charter Review—Todd Schultz

A hard copy of the EEAG Charter was passed out. Todd reminded the group that last year it was stated that this Charter would be reviewed on an annual basis. This is also a time to make any revisions or corrections that may be needed. Ben would like a change made to the last sentence of the first paragraph. Since Demand Response ("DR") is no longer funded by the Rider it should be clarified that "the purview of the group is energy efficiency programs and demand response programs that are funded through the DSM Rider or other regulatory mechanism(s), unless specifically noted." Quentin wanted to point out that the administrative costs for DR is still covered under the Rider. Todd asked the group if there were any changes that needed to be made under the heading Operating Principals. Lynn Tominaga asked if a person owns stock in the company would they have a conflict of interest. Tami stated that she would take that question to the legal department to see if there are issues with that bullet point. She stated that when confidential information is presented at the meetings a non-disclosure statement is read beforehand. In the first bullet of Operating Principals, is the goal of all discussions to come to consensus? Todd stated that there might be times where the group will not reach consensus. Maybe this can be re-worded. John suggested striking out the word "collaborative" in the first paragraph. Todd asked the group if there were any changes that should be made under the heading "Membership." Tami suggested getting rid of the words "particularly at first" in the third sentence and adding the word "confidential" in the fifth sentence. Under the heading "Meetings" Stacey wants to remove the words "instead of" in the last sentence regarding webinars and conference calls. Todd then stated that some members, due to conflicts in scheduling, have been unable to attend meetings. Should this issue be addressed with members of EEAG? The group consensus is that it is not the job of EEAG to police other members. It would be advisable for Idaho Power to have a conversation with the individual

that is not attending to see if an alternative solution can be found. Todd thanked everyone for their input and stated that changes to the Charter will be incorporated and sent out to members for review.

10:30 am Recap Potential Study Workshop—Ben Otto

Ben volunteered to recap the Potential Study Workshop meeting that was held on May 19th. Idaho Power did a potential study in 2012 and the workshop was held to discuss ideas to close the gap between economic and achievable potential. Ingrid Rohmund of EnerNOC joined the meeting via phone and recapped the potential study presentation. Residential lighting and duct sealing are two areas that have potential. The group then talked about ways to affect the potential. In what ways can customers be encouraged to participate more? Ben then went over the list that was created from the workshop.

Marketing

- Radio Commercials
- Awards (recognition) for Contractors/Trade Allies. It's a form of free advertising for the programs
- Program Convenience. Streamline the application process, could be a barrier to participation
- "Feel Good" incentives
- Program Metrics
- Peer "Statements"-Success stories
- Changing past perceptions/Second Look. (Gave example of the CFL and how people don't like them and may never attempt to use again).
- Utilities are most trusted source for energy information (Putting energy savings in context. Saying you saved 1000 kWh doesn't mean much to people)
- More aggressive marketing (behavioral)
- Motivating individual customers-heads up displays
- Behavioral letters/comparing your energy usage to your neighbors

Commercial Customers

- Profile non-participants. (How can we address non participant barriers)
- Owners not tenants/Direct install
- Small commercial targeted programs
- Reasons why customers say "no" to a project
- Follow-up survey's (on audits)
- Energy Trust of Oregon ("ETO") has a "good, better, best" type of offering. (Narrows down program to meet specific needs of customers)
- Seattle City Light has a Community Case Worker EE program
- Leveraging economic grants

Ben stated that the discussion was good and hopefully this will be a good beginning for further discussions. Nancy stated that there should be some "next steps" with this process. Todd opened it up to the group for discussion. Todd started the discussion by stating that at yesterday's workshop, Idaho Power listened to what everyone had to say. There are things that the company already does, but there is opportunity to learn. How would the group want to carry this forward? Stacey stated that Idaho Power should report how they are going to go after the residential lighting savings and how they are going to increase participation. Ben brought up how he believes that the current Memorandum of Understanding ("MOU") on cost-effectiveness hobbles the company. Ben stated that in concert with any effort to update the MOU, this needs to be addressed so some of these ideas can be implemented. Lynn asked why the MOU is a barrier. Stacey summarized the agreement between Idaho Power and

the Idaho Public Utilities Commission ("IPUC"). The MOU has some restrictive language regarding cost-effectiveness on individual measures. If that language was broadened, Idaho Power would have more room to operate some of these programs if some measures happen to fall below cost-effectiveness. Tom stated that we should focus on areas where there is a larger impact. Go over the things where performance can change. Let's look at the ones that have leverage and start where there is a greater opportunity for savings. Nancy stated that there are two camps: Program development and enhancing existing programs. Some of the suggestions from the workshop were how to enhance existing programs. Stacey stated that we might need to have more time on the agenda to go over each idea.

11:00 Break

11:15 am Regulatory Update—Tami White

Tami stated that most of the cases are still open so she can't go into detail. She summarized the filings. Stacey asked what the amount of recovery was for Fixed Cost Adjustment ("FCA"). Tami answered $14.9 million. During the discussion of the PCA filing, Nancy commented in regards to the one-time nature of fund movement, the best way to mitigate cost to the customer is to implement energy efficiency, not just move funds. If power costs are going up then customers need to be aware and get the right price signal. Nancy also stated that dampening the costs with Rider funds sends the wrong signal to customers that energy efficiency isn't important to the company. There was some discussion around the Time of Day ("TOD") pilot. Stacey asked why renters were not solicited to participate in the pilot. The regulatory analyst stated that renters tend to have a high turnover rate and having consistent data for 12 months before and after enrolling in the pilot was ideal. Lynn asked why electric homes in more rural areas were not solicited. The regulatory analyst answered that when this pilot was started it had to do with the timing of Advanced Metering Infrastructure ("AMI") meter installations. Canyon and Ada counties were the first areas to receive the AMI meters in a broad deployment sense, so that is why those customers were solicited. Tami stated that the TOD pricing plan is open to all customers that have an AMI meter, but during the pilot only certain areas and customers were invited to participate. Tom stated that he was concerned with self-selection bias because if customers that may have already not been using energy during peak times are allowed to self-select, they may do nothing to change their behavior. Stacey stated that if people can do nothing and still save money on their bill, then they will not change their behavior.

Tami stated that there is a study being done to determine how this pilot impacted how participants use energy. Stacey expressed concern that this study might not produce a lot of useful information and wouldn't want the company to then not revisit TOD rates for a long time. Tom stated that at best it will be a conservative estimate because of the self selection bias. Tami stated that there are other benefits to TOD pricing. It provides customers with options and the company believes that it is more representative of cost of service. This study won't be put on the shelf. Ben stated that in reporting back on this study it would be interesting to see the customers who were structural losers and changed their behavior. Nancy asked if the company is looking at payment options such as pre-payment options now that it has AMI meters widely deployed. Tami stated that there is nothing in the works for that. Nancy stated that she would encourage the company to not go down that path because she believes that those types of options are usually discriminatory against low income even if it is optional. Nancy stated that data from studies have shown that the biggest improvements are self-shut off and that isn't the type of savings the company should pursue. Ben stated that he believes that pre-payment plans encourage people to use more energy.

11:45 am Financial Report—Pete Pengilly

Pete presented Appendix 1 and reminded the group that these are liability accounts. Nancy asked, if $20 million is transferred from the Rider account to the PCA, where would it be reflected on this spreadsheet? Tami answered that if approved by the IPUC, it would show up like an expense to the Rider, but would be reflected on a separate line so there would be good visibility. There was more discussion regarding the possibility of moving money from the Rider balance. Tami stated that since this is still an open case she would rather the group not discuss it at this time.

Appendix 2 includes all funding from both Riders and base rates along with preliminary energy savings to date. Ben stated that having the preliminary energy savings included in this appendix is very helpful.

11:56 am Program Update—Todd Schultz

The program updates presentation highlights a few of the residential and commercial programs. Stacey asked what the process is to have the A/C Cool Credit switch installed on the new unit if a customer upgrades their air conditioner. The engineering project leader answered that the customer needs to initiate the change out. They would call Idaho Power and Honeywell will re-attach the switch to the new air conditioner. Amanda of Honeywell added that it takes about 14 days for Honeywell to perform the change out.

Nancy referenced Appendix 2 (Expenses w/Savings) and asked if the Building Efficiency savings numbers includes the Kilowatt Crackdown. Todd answered that the savings from the Kilowatt Crackdown have not been reported so they were not included in Appendix 2. Stacey asked what the cost share on tuition is for the participants of the commercial education offerings. Todd answered that is about 50%. Slide 6 (Custom Efficiency WWEEC) highlights some of the savings that were not included in Appendix 2. Nancy asked if these are what the company would consider behavioral savings. Todd answered that they are and they will get included in the savings that is reported. Ben asked if there are any capital investments yet from this program or is it just behavioral savings. A senior engineer answered that if they have a capital project it will get pulled into the Custom Efficiency program and then the savings will be taken out of the model.

Todd highlighted some of the residential programs. The participation contractors for the Heating & Cooling Program have increased from 2010 levels. The Home Audit program provides a detailed energy analysis to customers along with CFL's and showerheads. Nancy asked if the open house events are targeted towards high energy users. The engineering project leader answered that they are targeted toward communities that are all electric, so they are typically high users. Todd passed around the Free Standing Insert that is included in the Idaho Statesman. The Shade Tree Project has been receiving terrific reviews from customers. Ben added that this was a very well thought out project that is seeing good response from the public.

Todd wanted to share some thoughts from yesterday's Potential Study Workshop. It was a listening exercise for the company, and highlighted the benefits of the dialogue. Todd also thanked the program staff for the work they do on their programs.

12:22 pm Lunch

12:45 pm Easy Upgrades Process Evaluation— Opinion Dynamics, Erinn Monroe

Erinn presented the results of the Easy Upgrade process evaluation. Overall, satisfaction is very high for this program. Nancy asked if the lighting tool was produced by Idaho Power. Todd answered that the tool was developed by the company with the help of a third party and launched in 2011. On slide 39 (Project Inspections) Nancy asked why there is a 50% inspection rate and did something lead up to inspecting that many projects. Todd answered that a lot of projects come in one way and then once completed won't match up with the pre application. It's a quality assurance issue that is necessary. Todd stated that the final results of this evaluation were received in February of this year. The company is looking at the recommendations to see what can be implemented now and which ones can be packaged together.

1:30 pm Residential Program Evaluations—TRC, Marian Goebes

Marian presented the results of the residential program process evaluation. The programs evaluated were the Heating and Cooling Program, Energy Efficient Lighting, and ENERGY STAR© Homes. The final report was

delivered to Idaho Power in December 2013 on 2012 activities. Some of the changes may have already been made. On slide 14 (Energy Efficient Lighting) Stacey asked what is meant by using the Regional Technical Forum's ("RTF") savings retroactively. Marian answered that because the RTF changes savings, Idaho Power changes their savings retroactively. Pete added it depends on the reason for the change and if it makes sense. If it's a significant change in savings, then it will be done retroactively, but if it is savings over time then it's not changed. On slide 15 (Heating & Cooling program), Stacey asked if non participant surveys were done. Marian answered no. It is harder to find people to participate in interviews if they're not participants. She stated that it was more beneficial to speak to contractors that went through the training but didn't submit projects.

2:02 pm-Break

2:12 pm Behavioral Program Ties—Quentin Nesbitt, Randy Thorn

Before the presentation began, Connor Saxe was introduced to the group. He is a junior mechanical engineering student from the University of Idaho and will be interning in the Customer Relations & Energy Efficiency department for the summer.

Idaho Power's Account Manager has been re-branded with the name myAccount. Nancy asked how many customers have signed up for myAccount. There are roughly 40,000-50,000 customers registered as an account manager. Once logged in, customers can see their energy usage. This information has been facilitated by the AMI data. Customers can enter their own data into the Energy Tool so that the graph shown represents their home. Ben asked how many customers have gone in to fill out personal profiles. Theresa stated that a follow-up email can be sent out with that information. Quentin explained how the Energy Tool works. Customers can answer questions about their specific home. If they don't know the information, the software will make some assumptions modeled on data for northwest homes of the same size, same occupancy. The more information the customer can give the closer the comparison will be to other similar homes. Ben asked how many clicks it takes to get this information, is it buried or obvious. The Program Specialist answered that it takes 3 clicks. Stacey asked how many questions need to be answered. The Program Specialist stated that it is about 15-17 questions. Then if the customer wants to do a home profile or an appliance profile then there are more questions depending on how much is known about the home.

The campaign for myAccount will focus on customers to empower them to take charge of their energy use. This campaign is happening right now and has some strong ties to behavioral changes. Todd added that this is a very powerful tool that will send a terrific signal to customers. Nancy stated that the company's responsiveness relates to when the customer calls you, will you take the next step and look at high use customers and do more targeted work with them to get them to use this tool. This could be done proactively instead of waiting for customers to come to you. Ben stated that the company has this information so does it wait until the customer contacts Idaho Power, or does it start pushing the data to the customer while being respectful. Stacey added that the company is at a place where they have tools that customers can take advantage of but the company isn't pushing out the information. She also stated that this feels more customer service oriented and while not diminishing that aspect of it, energy efficiency doesn't seem like the driving force.

The Program Specialist answered that these are building blocks. The team was looking at the high interest items that will get customers there first, and they once they get there what other things they can do. Ben stated that comparing people to "norms" can be very motivating for people to change behavior. Maybe having some data that compares their homes usage to other similar homes would help. Quentin said that is something that can be looked into. A Corporate Communication Specialist came back into the meeting with the information that Theresa was going to follow up on. She stated that as of 2009 about 200,000 customers have signed up for myAccount. These are new sign ups.

Randy Thorn's presentation focused on Idaho Power's multiple Commercial/Industrial Behavioral program comparisons to Bonneville Power Administration's ("BPA") Energy Smart Industrial Program ("ESIP"). He

covered the three key elements of the ESIP; Energy Project Manager, High Performance Energy Management, and Track and Tune. He compared these offerings to what Idaho Power currently offers through the Custom Efficiency Program. On slide 10 (ESIP Key Elements) Tom referenced the bullet point that spoke about developing an energy management plan with goals. He asked if these goals would be the same for The Refrigeration Operator Coaching for Energy Efficiency ("ROCEE") and The Wastewater Energy Efficiency Cohort ("WWEEC"). Tom asked if the plant managers will have a game-plan or roadmap to implement improvements. The Senior Engineer answered that all participants have a scoping audit and an energy management plan to start with. At the workshops they work on developing their energy savings goal.

The same type and number of training classes have been offered but participation rates had dropped off. Idaho Power decided to change up the type of class offerings and there have been higher participation rates. Todd added that the trainings offered by Idaho Power are the highest attended with other trainings offered throughout the region. Tom stated that earlier it was mentioned that some of the self-directed customers are sitting on their hands and not taking advantage of those funds. Puget Sound Energy opened up their self-directed funding for a short period of time and if the industrial customers didn't use it then the funds were made available for other industrial customer to use. Idaho Power could do something similar to motivate these customers. Pete answered that Idaho Power's self-directed option is on a 3 year funding cycle, and if it isn't used, it goes back into the Rider. Ben agreed that competition is a strong motivation to move people to action. Nancy asked if there are any programs that target the dairy sector. Randy answered that there isn't anything specific to the dairies. Idaho Power has done a lot of lighting upgrades at dairies. Quentin added that most of the dairies in Idaho are pretty new and have already incorporated the new technologies into their buildings.

3:20 pm Wrap Up—Todd Schultz

Stacey had asked for an update on Idaho Power funding Boise State University Research & Development outside of CEERI and the status of Idaho Power participation in NEEA. Theresa stated that there is nothing to report in regards to negotiations to fund Boise State University Research & Development outside of the CAES Energy Efficiency Research Institute ("CEERI"). The Northwest Energy Efficiency Alliance ("NEEA") has extended the comment period until May 27th. There is a board meeting on May 29th that is open to the public. On June 20th the board will vote on the new business plan. When the plan has been finalized Idaho Power will update EEAG. Stacey asked if people can call into the board meeting if they can't be present in person. Theresa answered that she thinks NEEA's preference is for in person attendance, but Stacey could call the Executive Director of NEEA, Susan Stratton to confirm that. Theresa addressed the topic of how the proposed optional funding of Commercial Real Estate through NEEA would affect the Integrated Design Lab ("IDL"). The foundational funding for the IDL is part of the core funding; the two smaller additional contracts are separate. Ben stated that the myAccount presentation was interesting, but he feels that there needs to be more discussion around behavioral programs. Tom wanted to know when EEAG members would hear about the final decision on the NEEA Business Plan. Theresa answered that if everything stays on track, Idaho Power would be able to update EEAG regarding the final decision on NEEA's business plan after June 20.

Stacey stated that it was her understanding that one of the main reasons Idaho Power chose not to fund CEERI was because of intellectual property issues. She doesn't understand how Idaho Power can contract with the IDL under the university without the help of NEEA with these same issues. She feels that it would be unfortunate that if Idaho Power chose to opt out of NEEA partnering with the IDL and then not be able to contract with the IDL outside of NEEA.

3:35 pm Meeting Adjourned

Energy Efficiency Advisory Group (EEAG)
Minutes dated August 19th, 2014

Present:

Catherine Chertudi–City of Boise, Public Works Dept.
Randy Wright–South Central Comm. Action Partnership
Nikki Karpavich–Idaho Public Utilities Commission
Nancy Hirsh–Northwest Energy Coalition
Tami White–Idaho Power
Todd Schultz*–Idaho Power
Lynn Young–AARP
Jennifer Pope–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Kent Hanway-CSHQA

Not Present:

Tom Eckman–Northwest Power & Conservation Council
Don Sturtevant–Simplot
Stacey Donohue-Idaho Public Utility Commission
Ben Otto-Idaho Conservation League
Brittany Andrus-Public Utility Commission of Oregon

Guests and Presenters*:

Pete Pengilly–Idaho Power
Quentin Nesbitt*–Idaho Power
Shelley Martin–Idaho Power
Dave Joerger*–Idaho Power
Jim Madarieta*–Idaho Power
Cheryl Paoli-Idaho Power
Darlene Nemnich-Idaho Power
Diana Echeverria-Idaho Power
Randy Thorn-Idaho Power
Ken Miller-Snake River Alliance
Amanda Richards-Honeywell
Dennis Merrick-Idaho Power
Matt Elam-Idaho Public Utilities Commission
Patti Best-Idaho Power
Jim Jauregui-Idaho Power
Cory Read–Idaho Power
Alexis Freeman–Idaho Power
Andrea Simmonsen–Idaho Power
Celeste Becia-CLEAResult
John Morris-CLEAResult
Bill Shawver-Idaho Power
Roberta Rene-Idaho Power
Connor Saxe-Idaho Power Engineering Intern
Chellie Jensen-Idaho Power
Billie McWinn-Idaho Power
Todd Greenwell-Idaho Power
Bryan Lanspery- Idaho Public Utilities Commission
Chris Pollow-Idaho Power
Denise Humphreys-Idaho Power

Recording Secretary:

Shawn Lovewell (Idaho Power) with Alexis Freeman (Idaho Power)

Meeting Convened at 9:33am

The EEAG members and guests introduced themselves and Todd Schultz relayed some general housekeeping and safety items. The General Manager of Customer Service and Regional Operations, Dave Joerger, introduced himself to the group, described his current role and gave some background on the previous positions he has held at Idaho Power. Todd asked the EEAG members to briefly review the minutes that had previously been sent out via email and there were no edits suggested by the group. Todd stated that future meeting minutes will be at a

higher level and will not have the level of detail as they have in the past. This will assist the time needed for EEAG members to review the minutes. No objections were received from the group. Todd also discussed that agenda items for future meetings will be solicited from the group at the end of each meeting during the wrap up discussion rather than in advance of each upcoming meeting in order to give Idaho Power enough time to evaluate the request and prepare a presentation or discussion for the next meeting if appropriate. No objections were received from the group. Todd also informed the group that the EEAG Charter that was recently updated with input from the EEAG will be reviewed on an annual basis with EEAG.

9:45 am-Demand Response Update—Quentin Nesbitt

Quentin presented a historical look at Idaho Power's three Demand Response (DR) programs and explained why Idaho Power participates in DR. Quentin also discussed the misconceptions that surround these programs. The DR workshops that were held in July of 2013 aligned on the conclusions that in order to achieve short-term demand response, a long-term perspective should be held, and continuity of program delivery is important. During the discussion of the program changes Nancy referred to the system peak of 3407 MW that occurred on July 2nd, 2013, and which programs were called during that time, She asked if there would have been enough resources available to meet that load even if FlexPeak hadn't been dispatched (Slide 12). Quentin answered that the Integrated Resource Plan (IRP) suggests that in a 1 in 10 water year scenario there would have been extra resources to cover it. Quentin explained that July 14th was the system peak day for 2014 and all three DR programs were called. Nancy asked if the costs of running the DR programs were compared to the costs of buying energy or using existing peaker plants. Quentin answered that in theory there was no cost. On that day, Idaho Power avoided purchasing energy off the market at roughly 4 cents a kWh. Tami added that there was no incremental cost to call the event.

Nikki asked if customers have requested to be removed from any of these programs. Quentin stated that some of the irrigation customers have chose to opt out of events and others to not participate in the program at all this year. There have been drop-outs from the A/C Cool Credit program mostly after each event. Sid stated that the irrigation customers that he has visited with are pleased with the program. . He had two of his pumps not turn off and had to do it manually. In one case it was because of the pumping station lost a fuse. He makes the point because even though there have been some discomfort issues with the program, overall the irrigation customers are extremely pleased and hope that the program continues to run as it has. Todd reiterated to the group how pleased he is with how all of the Program Specialists have dealt with these challenges.

10:40 am-International Facilities Managers Association (IFMA)—John Rimer

John Rimer introduced himself to the group and gave his background and experience in facility management. John spoke to the group about the primary role of IFMA, some of the obstacles that are faced, and the educational trainings that are provided to its members and some of the obstacles that facilities managers face when trying to convince their management or customers to implement energy efficiency solutions. Nikki asked what the biggest hurdle was for participants besides the cost. John answered that getting participants to attend events is challenging. In 2015, along with the usual class offerings, there will also be online education and bite-size educational presentations.

11:30 am-Financial Update—Jim Madarieta, Financial Analyst

Financial Analyst Jim Madarieta presented Appendix 1 which outlines expenses and balances of the Idaho and Oregon Rider and NEEA payments through July 2014. The DSM Summary slide outlined the actual expenses and preliminary energy savings by each program through July 2014. Nancy asked what the projected ending balance of the rider would be in December. Jim answered that it is projected to be approximately $2.2 million at 12/31/14.

11:40 am-Programs Update—Todd Schultz

Todd spoke about the program changes that have gone into effect for the commercial and industrial programs. Kent commented that he was glad to see the new Professional Assistance incentive for the Architects and Engineers. Nancy asked if Idaho Power has considered looking into reserving a portion of the incentive for building operators. A small amount could be set aside and paid out once the building is complete. It would be an incentive to maintain the energy savings over time. The Program Specialist answered that as far as new construction, that concept could be problematic as far as baselines are concerned since baseline is code.

Todd next spoke about a few residential programs and their operational issues. Todd invited Program Specialist Patti Best to speak to the group about Energy Efficient Lighting, Home Products, and See ya later, refrigerator® (SYLR). The Home Products program has traditionally focused on Energy Star© products as it is an easy way for customers to determine if a product is eligible. As time has gone on, it is harder to identify products that meet cost effectiveness. Idaho Power has been exploring different options; a qualified products list and upstream incentives. The upstream option is where Idaho Power partners with the manufacturer and then the incentives are passed down to the customer at the retail level. The qualified products list would maintain the basic program design but would be limited to the most energy efficient Energy Star© models. Patti presented the group with the pros and cons and asked for input from EEAG members. Lynn commented that in the upstream model, it is hard to have utility recognition. She stated that when she worked for a utility, they advertised to customers that this program was coming, and put a model in the lobby of their building. They provided customers with a voucher in order to purchase the item at the retailer. She recommended advertising the benefits of purchasing the more expensive, energy efficient model to the customer. Nancy stated she preferred the upstream regional approach. It leverages the collective investment of the marketplace, and it is easier for the consumer to figure out. Educating the retail staff is a key component. She stated that she would like to see more direct marketing and education with customers so that they are thinking about energy efficiency when they decide to purchase these items. Nikki added that PacifiCorp just changed to the CEE model and according to their analysis it was cost effective. She feels that the upstream model would be a good model for a pilot program as long as the energy efficiency message is being promoted. Catherine stated that the customers who would benefit the most are often the ones that won't buy the most expensive model. She thinks it is important to send the message to purchase the most energy efficient model that you can get because the customer will still gain financially even if they don't qualify for the incentive.

Next Patti presented information regarding the SYLR program and how the program in its current state is struggling to maintain its cost effectiveness, and a potential change to the program design. Some of the options being considered are removing the incentive and not restricting the program to pre-1995 units or keeping the incentive and restricting the program to pre-1995 units. Patti asked the group for input. Tami asked if the second option include unit pick up, incentive or both. Patti answered it would include the pick-up and incentive. Sid added that if someone purchases a new refrigerator and the appliance store won't pick-up the old unit, it could be up to $50 to have it removed. Even if there is not an incentive associated with the program, just having the old unit removed would still be of value to customers. The Marketing Specialist added that the survey that was done around the SYLR program showed that what was of high value to the customer was the convenience factor of having the old unit removed. Nancy asked if the program would be cost effective if the incentive was dropped. Patti informed the group that it would meet cost effectiveness if the incentive was removed along with cutting back on some of the administrative costs and not restricting the program to pre-1995 units. The group expressed a preference for the option of removing the incentive and not restricting the program to pre-1995 units.

12:30 Lunch

During the lunch break, Engineering Intern Connor Saxe- gave a presentation to members of EEAG on his internship experience working in the Customer Relations and Energy Efficiency Department at Idaho Power.

1:30 Meeting Reconvened

1:30 pm-Wastewater Energy Efficiency Cohort (WWEEC) Update—Chellie Jensen, Senior Engineer

Senior Engineer Chellie Jensen gave a presentation to the group on the WWEEC and explained that the focus of the training is on energy management. The cohort training approach provides onsite and remote engineering support, technical training with Continuing Education Units, energy management training, site audit, and energy management assessments. There are eleven participants representing 64 million kWh. The main goal is to create energy awareness without affecting safety, lower current energy usage, enhance technical skills, and create a sustainable solution. Chellie showed a video that highlighted this program.

Chellie then introduced Robyn Mattison PE LEED of the City of Ketchum. Robyn gave her experience working with Idaho Power in the WWEEC program. She explained how she was skeptical at first with how much time it was taking from her day, but through the process she has come to realize the value and it has given her the opportunity to use it in other functions of her job. She stated that having presentations from outside her organization has opened the minds of her plant operators to new ideas and has helped them overcome the "old school" mindset. The City of Ketchum has saved 115,000 kWh since March of this year, and because of the money saved in power bills, she has been able to budget some money for capital improvements for 2015.

Chellie next introduced Royce Davis of the City of Boise. He is the Lander Street Plant Manager. Royce explained that this facility was built in the 1950's so the building and the technology are dated. The lessons learned from participating in WWEEC would be that it isn't always about the major projects, it is about operational improvements. They haven't spent much money on making changes but rather have improved the way things are done. Nancy asked if there are other utilities doing anything similar to this. Chellie answered that there are other programs out there like this, but they aren't driven by local utilities. Kent stated that these are really great results. Is Idaho Power planning another cohort offering? Chellie stated that Custom Efficiency has been talking about a compressed air cohort. One of the challenges with compressed air would be dealing with the structure of the plant since there would be other areas of the plant that would need to be involved.

2:25pm- New Ideas—Quentin Nesbitt, Pete Pengilly, Todd Schultz

Quentin started out the presentation by stating that Idaho Power is looking at four new program ideas: (1) Single Family Home Duct Sealing, (2) Residential Whole House Fan, (3) Residential Electronically Commutated Motor (ECM) Blower Motor, and (4) High School Student EE kit. The program ideas are in various stages of development. Internal review and research has been done on how they could be implemented and delivered, but there are still unanswered questions around savings and cost. Quentin gave an overview of the four ideas and asked for feedback from the group. There were questions and discussion about each program, outside contractors, cost, funding, incentives, customer participation, testing, and vendors. **Single Family Home Duct Sealing:** The Regional Technical Forum (RTF) has prescriptive savings in place for this. In the past the savings has been specific to having the ducts tested before and then after. The RTF is looking at changing that to a more prescriptive approach. If Idaho Power were to move forward with this program, it would need to be the more prescriptive approach as the test in/test out model is not cost effective. Randy asked if Idaho Power has any specific contractors lined up. Quentin answered that two companies locally have just purchased equipment that would allow them to do the internal duct sealing. Bryan asked if the company has looked at this from a total resource cost (TRC) perspective where gas heated homes could be included. The Energy Efficiency Analyst answered that the difficulty with adding natural gas benefits to the TRC for weatherized homes with central air conditioning is that while NEB's help the TRC, they do not help the utility cost (UC). Cooling benefits usually do not exceed 10% of the total measure savings potential so the UC test in most cases fail. Jennifer asked if Idaho Power would be paying for the whole project or just a portion. Also, what percentage of customers would be able to participate in the program? Quentin answered that about 30% of customers are electric heat only. The incentive would just be a portion of the overall cost.

Nancy asked Quentin to discuss in more detail the reason why the pre and post testing would be dropped. Quentin stated that generally a test in/test out has been required by the RTF to achieve the savings. It has not been a

successful program for others because it is too expensive. The Program Specialist added that this testing is pretty tedious for the contractor and most them want to get rid of that requirement. One of the things the RTF found is that about 30% of the homes they tested didn't need it. Pete also added that he envisions setting up some level of quality control done by a third party. Quentin stated that this program could land nicely with the Heating & Cooling Efficiency program or even possibly the Home Improvement program. This program would not impact Energy House Calls. Nikki added that this program seems like it could be a nice progression from the Home Energy Audit.

Residential Whole House Fan: This is not something common in Idaho Power's service territory. It is a large air flow fan that is placed in a central location of the home. It pulls air from the outside into the attic space. It pushes hot air out and pulls cool air in through open windows. It is much cheaper to run than an air conditioning unit. This wouldn't do much for peak days but there are some benefits in the shoulder months. The company is looking at prescriptive savings and it might be good for a pilot program in order to verify savings. Nancy stated that these fans provide more benefit at night so it's not a huge savings opportunity but she likes the idea. Quentin stated that one of the things the New Idea Team discussed is how area's like McCall and Sun Valley could utilize this and refrain from using their air conditioners. There is a behavioral component to this as the customer will need to pay more attention to the temperature and actually turn on the fan. Pete added that from a customer satisfaction standpoint, it should be available to both gas and electrically heated homes. The general group consensus was for Idaho Power to continue looking into this program.

Residential ECM Blower Motor: This would be a program designed to replace a Permanent Split Capacitor blower motor (PSC) with a new Electronically Commutated Motor (ECM) in central systems. Blower motors are a common item to fail in household HVAC systems. Amanda asked if the vendor would be incented on this item. Quentin stated that if this became a program, likely the vendor would be incented. The customer isn't going to know much about what type of motor they need. Bryan asked what the incremental cost of an ECM vs. PSC is. Quentin answered that it is a couple hundred dollars. The general consensus from EEAG members is that this is a good idea and to move forward with more investigation.

High School Student EE kit-The student ee kits are something that is currently targeted to elementary aged students. Idaho Power is looking at developing a more age appropriate kit targeted towards high school students. The Program Specialist gave some more detail about how the kits would be structured, the target market, costs and timelines, and savings, benefits and issues.

There was a lot of discussion regarding cost and how effective these kits would be with Senior high school students. Lynn stated that consulting a group of high school teachers and have a round-table discussion with them to get their feedback would be a good idea. They have many time constraints with the regular curriculum and adding this to it might not work. Catherine suggested looking into youth group organizations, 4H, FFA, The Boy Scouts, Girl Scouts, and church groups. These organizations typically have a service learning requirement that this kit could fulfill. Kent brought up that it might be a struggle to keep these older students engaged. At this age they have their own lives outside of school. Also, kids get their information from online sources. If you hand them a stack of papers, chances are they aren't going to read through them. Jennifer suggested having some kind of kit like this that targeted the first time home buyer. Idaho Power could partner with financial institutions.

Nikki asked what the process and implementation of the new ideas. Pete explained that the New Ideas team has developed a process to track these ideas as they are discussed. The ideas presented were all possibly cost effective and that is why they were brought before the EEAG for discussion. There are still numerous steps that need to happen before they become a program. Tami stated that for the November meeting there could possibly be more information available on these items.

3:45 pm-Wraps up, Questions, Comments

Nancy suggested having the new ideas piece much earlier in the meeting or to receive the presentation sooner so that members can be looking into things and be able to have more input during the meeting. Kent added that he really enjoyed the New Ideas presentation rather than re-hashing the current programs. Sid commented that he has been very impressed with the Just Drive campaign. Todd asked the group if there were any topics that they would like to see discussed at the next meeting.

Nancy asked if the Idaho Public Utilities Commission (IPUC) would be ready to talk about the Memorandum of Understanding (MOU). She would also like to have a follow-up discussion of the Potential Study workshop that was held in May. Nikki answered that as far as the MOU discussion, they would need to have a meeting with the utilities to talk about how to proceed and then they would be able to make a presentation at EEAG.

4:05-Meeting Adjourned

Idaho Power
Energy Efficiency Advisory Group (EEAG) Meeting
Minutes dated November 12th, 2014

Present:

Catherine Chertudi–City of Boise, Public Works Dept.
Ken Robinette–South Central Comm. Action Partnership
Stacey Donohue–Idaho Public Utilities Commission
Nancy Hirsh–Northwest Energy Coalition
Tami White–Idaho Power
Tom Eckman–Northwest Power & Conservation Council
Ben Otto-Idaho Conservation League
Don Strickler–Simplot
Quentin Nesbitt*–Idaho Power
John Chatburn–Idaho Governor's Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Kent Hanway*–CSHQA
Michael Breish- Public Utility Commission of Oregon (via webinar)

Not Present:

Lynn Young–AARP

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Theresa Drake–Idaho Power
Shelley Martin–Idaho Power
Diana Echeverria–Idaho Power
Roberta Rene–Idaho Power
Amanda Richards–Honeywell
Donn English– Idaho Public Utilities Commission
Andy Healy-CLEAResult
Chris Pollow-Idaho Power
Chellie Jensen-Idaho Power
Brad Acker-Integrated Design Lab
Patti Best-Idaho Power
Cheryl Paoli-Idaho Power
Denise Humphreys-Idaho Power
Cory Read–Idaho Power
Bill Shawver–Idaho Power
Andrea Simmonsen–Idaho Power
Billie McWinn*–Idaho Power
Paul Carp–Honeywell
Ken Miller–Snake River Alliance
John Morris–CLEAResult
Dennis Merrick-Idaho Power
Sheree Willhite-Idaho Power
Darlene Nemnich-Idaho Power
Kevin Van Den Wymelenberg*-Integrated Design Lab
Todd Greenwell-Idaho Power
Anne Alenskis-Idaho Power
Mindi Shodeen-Idaho Power
Brian Reich* - Idaho Power

Meeting Facilitator:

Quentin Nesbitt (Idaho Power)

Recording Secretary:

Shawn Lovewell (Idaho Power) with Kathy Yi (Idaho Power)

Meeting Convened at 9:37am

Quentin welcomed the participants and the EEAG members and guests introduced themselves. Tami introduced Michael Breish, the new staff member who will be replacing Brittany Andrus as the Public Utility Commission of Oregon representative serving on the EEAG. Quentin noted that topics that do not appear on the agenda, but were suggested by members of EEAG as things to discuss will be discussed throughout the course of the day. Tami updated the group regarding Idaho Power's recent filing with the Idaho Public Utilities Commission (IPUC) for authority to continue participation in the Northwest Energy Efficiency Alliance (NEEA). Stacey updated the group on staffing changes at the IPUC and gave an update on the status of the Memorandum of Understanding (MOU) that IPUC staff has been working on. The minutes from the August meeting were reviewed. There were no changes or edits suggested.

9:45am-IRP Planning & Analysis—Pete Pengilly. Pete gave a presentation about the Integrated Resource Planning process and shared some slides that were presented at the Integrated Resource Planning Advisory Group (IRPAC) meeting last week.

Key points that were presented were:

- Ingrid Rohmud from AEG will be presenting the updated Potential Study results at the January 8th IRPAC meeting.

There were questions and discussion about:

- Ben asked if this potential study will have all levels of potential. It will.

- Discussion around code changes and how those would present program challenges, especially with new construction projects. Ben stated that the utilities can have a role in driving the "next thing" in the market.

- How it will be important for utilities to change their incentive programs. In the lighting arena it might be how, as a utility, you drive the market to uptake LED technology. Tom added that Idaho Power isn't the only utility facing this issue.

- Ben stated that it might be nice to see the alternative cost comparison number broken out in various categories rather than seeing it as one number. The Energy Trust of Oregon sent a spreadsheet to the Oregon Public Utility Commission showing their avoided costs that way. Pete stated it is something that Idaho Power could look in to.

10:15am-New Program Ideas Update—Billie McWinn

Billie highlighted the following four new program ideas that had been discussed at the August 19th EEAG meeting and led a discussion about LED bulbs. There was a lot of good feedback and ideas from members during that meeting. Since then, the New Ideas Team has taken that feedback and incorporated some of it and updated the analysis.

Single family home duct sealing-

Key points that were presented were:

- Idaho Power is looking at a soft launch of this measure early in quarter 1 of 2015 which would provide time to work through any issues before an official launch in quarter 2.

- This program will be more prescriptive in nature.

- The overall savings goals for this program have not been set yet.

There were questions and discussion about:

- Would there be different incentives based on different heating zones? Differing incentive levels have historically caused customer confusion and can be administratively burdensome, but if there are issues with customer update, the incentive amount could be adjusted within the limits of cost effectiveness.

Residential ECM blower motors-

Key points that were presented were:

- This idea is not as far along in its development.
- The Integrated Design Lab (IDL) is working on a report to determine savings. Because energy savings is not yet available, an analysis was done to determine what level of savings would be required in order to achieve cost effectiveness.
- In order to be cost effective, a minimum of 410 kWh savings is needed.
- If savings come in higher, then this program could be launched in quarter 1 of 2015.

There were questions and feedback about:

- Ben suggested that since this is an "emergency" type repair program, Idaho Power should work with contractors to ensure that these items are in stock and on the trucks.
- Is this was a do it yourself type program or will customers need to use a contractor? Because these motors are wired differently than what a customer would likely be replacing, they would need to be replaced by a contractor.
- Having the customer receive a small incentive would help keep the contractor accountable.

Residential whole house fan pilot-

Key points that were presented were:

- An analysis was also done for this idea and final savings data should be available in February of 2015.
- Idaho Power is evaluating a quarter 2 launch.
- Because this pilot has a behavioral component to it, Idaho Power solicited feedback and ideas on how to market this to customers so energy savings could be realized.
- Some of the ideas that Idaho Power has heard and would like feedback on are:
    - Sending out postcards during specific times of the year, using instructional stickers, installing indoor/outdoor thermometers, opening it up to more contractors.

Specific feedback was:

- Ken stated that electricians and electrical contractors should be used and not HVAC contractors or carpenters because electrical service will need to be brought to the fan.

- Nancy stated that because there are two components; getting the fan installed and then the behavioral component of the customer actually using it, marketing will play a large role in this pilot

- A two year time frame for analysis is good.

- Catherine added that longevity in messaging will be needed. Tenants of a home change so there needs to be a mechanism for keeping track of that.

- Ben suggested sending out a postcard to customers on a monthly basis before the actual cooling season might be effective.

High School EE Kits program-

Key points that were presented were:

- The Program Specialist was able to meet with two vendors on pricing. She also worked with a couple of science teachers that felt it could work well with their curriculum because outside content has good uptake with students.

- There is the potential to change the components of the kit. In the original kit there was a smart strip which may be good for this age group because of their frequent use of electronics.

Specific feedback was:

- Catherine suggested picking a school or schools that do not have a lot of resources.

- Because the power strip is expensive, you might consider making it the reward. If you send the message that it is valuable, then it will get used.

- Before you give them the power strip; give them a watt meter to see what they are already using. If their equipment is newer (i.e. has sleep mode, auto shut off, etc.) there won't be as much savings as with older equipment.

- Consider developing a mobile app for the phone because this age group is engaged socially with friends. The competition factor could help to motivate them.

LED Bulbs-

Key points that were presented were:

- LED's are a hot topic right now and people seem to be excited about this technology. At a recent local event in Boise, Idaho Power used LED's as a giveaway for customers to sign up for myAccount.

- Idaho Power would like to be able to give LED's to customers, but they do not pass the Utility Cost test (UC), however, they do pass the Total Resource Cost test for cost effectiveness.

Specific feedback was:

- Stacey stated that the Company is probably safe under the current Memorandum of Understanding (MOU) to do this. Hitting the market while there is a lot of interest is an excellent idea. If the bulbs don't pass cost effectiveness tests, there just needs to be an explanation and there are some pretty good reasons presented here.

- LED's have some similar features as the incandescent bulbs and last longer than the CFL bulbs. That could be a good talking point.

- Sid stated that since there is pushback on the CFL bulbs because of disposal issues, there may be a potential for customers to trade in their CFLs for LEDs.

11:23am-CSHQA Building Remodel—Kent Hanway

Kent gave an overview and discussed all of the design elements of the remodel work done on the space that CSHQA currently occupies.

Key points that were presented were:

- An old, unoccupied warehouse on Front Street became their new home in August of 2013.

- The design goals were to get everyone onto one floor, reintroduce CSHQA in the community by providing visibility, and "walking the talk" of energy efficient building design.

- Idaho Power paid approximately $18,000 of incentives on this project.

Kevin Van Den Wymelenberg of the Integrated Design Lab spoke to the group about the radiant cooling slab technology that was used in the remodel and noted that the IDL is evaluating the use of this technology in the future. The IDL is supporting CSHQA in further commissioning efforts and hoping to use their building for a platform for further research.

12:10 Lunch

1:05pm Meeting Reconvened

1:05pm–Commercial, Industrial, Irrigation Programs Update—Quentin Nesbitt

Quentin highlighted the savings, participation, and expenses for each of the commercial programs, and discussed an email that an EEAG member had sent him before the meeting about how Rocky Mountain Power (RMP) has combined their commercial lighting programs.

Key points that were discussed were:

- An RMP customer only has one application to fill out and one program specialist to work with as a single point of contact.

- Idaho Power is working on something similar for the lighting program.

- RMP is also looking at a small business outreach. They are looking at hiring auditors to visit with small businesses to do an audit to help facilitate energy efficient measures.

- Idaho Power is also looking at something similar, more of a direct install that the customer can do themselves.

1:20pm-Oregon Exceptions filing—Billie McWinn

Idaho Power filed an application with the OPUC on November 4, 2014 (UM 1710) seeking an exception to cost effectiveness requirements for certain measures and one program in the residential and irrigation programs. Billie summarized this filing.

1:30pm-Residential Program Update—Billie McWinn

Billie highlighted the savings, participation and expense comparisons for the residential programs. There was some discussion about the audit tool used for the Weatherization programs and some of the changes being made to that tool. Ken stated that because of some of these issues, they have had to hand calculate the savings on the applications. That has slowed down some processes on their end and they have 17 projects that still need to be submitted which will add to the overall savings numbers for the Weatherization programs.

Key points that were presented were:

- There will be some changes to the See Ya Later, Refrigerator (SYLR) program and Home Products.
- The incentive for SYLR will be removed but Idaho Power will still offer free unit removal for customers.
- For the Home Products program, the Regional Technical Forum (RTF) has updated their savings numbers and refrigerators and freezers are no longer cost-effective.

There were questions and feedback about:

- Are these items no longer cost-effective because these appliances are more efficient in general? Appliance standards have gone up 25%.
- Idaho Power is investigating additional direct install measures for the Energy House Calls program such as LED's, low flow showerheads, faucet aerators, water heater covers, and thermostats. Catherine suggested that these items should be brought in for proper disposal because the old thermostats have mercury in them. Idaho Power expects that a contractor would install the thermostats and set the controls so the customer wouldn't need to worry about disposal.

Marketing update:

Billie passed around a copy of the current Free Standing Insert (FSI) and the group viewed the KTVB interview with Theresa Drake that was about how customers can save energy.

Key points that were presented were:

There is a digital online campaign that identified people's interest from their travel on the web.

- The Marketing Specialist gave the example of the techniques of airline companies marketing to consumers after they have made an airline ticket purchase.

There were questions and feedback about:

- Nancy asked if an assessment has been done on customers who have signed up for myAccount since they are already engaged with Idaho Power and more likely to participate in programs. Idaho Power will follow-up on that question.

- How are people who don't receive a paper bill identified for marketing campaigns?

2:13pm-Financial Update—Pete Pengilly

Pete provided a financial update and reviewed Appendix 1 and the DSM Expense by Program.

There were questions and feedback about:

- Donn stated that it seems as if more money is being collected in the rider than is being spent. What is the plan for this account going forward?

- Changing how you calculate program savings may use up those funds.

2:20 Break

2:36-Demand Response as Operating Reserves—Quentin Nesbitt & Brian Reich

Quentin and Brian presented Idaho Power's Demand Response as Operating Reserves Report that was filed with the IPUC in September 2014 and was a requirement from the Demand Response Programs Settlement Agreement.

Brian described:

- The three regulatory agencies and the requirements that Idaho Power must follow in regards to maintaining reserves.

- How the company balances supply and demand on the electrical grid.

- What spinning and non-spinning reserves are and why demand response (DR) could only be used for the non-spinning portion of Contingency Reserve Obligation (CRO).

Quentin described:

- Idaho Power's three DR programs and the system modifications needed to use these as non-spinning CRO.

- The cost and benefits of using DR as non-spinning CRO.

- The three scenarios that were analyzed by the Company.

- The company's conclusion that the risks outweighed the benefits of using DR as CRO at this time.

There were questions and feedback about:

- A reserve program is very different than a DR peak shaving program. The company could design a different variation for a different group of participants.

- Compared to a DR program, it would be a fairly small incentive for the amount of work required from the irrigators. Sid added that from the irrigator perspective, it would be difficult to design a program that would allow for numerous outages in one day, like what might be required of CRO. Irrigators need water when they need it so they sometimes won't even participate in the Irrigation Peak Rewards Program which has a higher incentive. Sid doesn't think it would be possible to create a program to allow for the events Idaho Power needs in a reserve program. It would be easier for the dispatcher to choose the option that he wouldn't have to think about.

- Stacey stated that if the company has more irrigation DR than it needs, maybe a different program that targets a subset of the irrigation customers and maybe it would have a higher incentive, and there could still be a path. Quentin stated that market prices have been low for a while. There is a small benefit; high risk today, but it might not always be that way.

- Ben stated that the reason he negotiated for this report in the DR Workshops was that he wanted the company to evaluate using its DR as operating reserves and the company had met that request with this report. He would like to see more forward looking planning and "next steps" as the region implements more variable energy. This region will have more variability in the future and we need to be thinking about how it can be integrated.

- Nancy thanked the company for looking into this and noted that this report can be used for future analysis if it makes sense financially to use DR as operating reserves in the future, then we have created a model to guide us on how to do that.

- Nancy asked if the Flex Peak program could become more of a load control program. Quentin stated that EnerNOC does offer a reserve program at a much higher cost to its customers. Grid operators have to go through certification to maintain system integrity. If they are going to be held responsible, then they need to control the load reduction in order to be in compliance with the standards.

- Stacey asked if these costs were for all three DR programs. These costs are only for using the Irrigation Peak Rewards as CRO.

3:33-Prudence Order Errata—Quentin Nesbitt.

Quentin reviewed the prudence order and the errata that the company had recently received in IPUC Case No. E-14-04 and solicited EEAG's input about how the company best meets the directive contained in the errata.

Specific feedback received was:

- How is the company interpreting the errata? The Integrated Resource Plan (IRP) looks at the potential study for planning how much energy efficiency to include. The issues brought up by Commission Staff and parties go beyond the IRP.

- The 2013 IRP targets were not met by programs. That can be stressful on the planning side. How will the company meet its IRP goals through marketing and customer engagement?

- John stated that just because something is economic or cost-effective doesn't mean people are going to participate. There are some people that no matter what will not avail themselves of programs. You can't force people to do things.

- Stacey stated that Idaho Power had a steep decline in energy savings that didn't happen in the rest of the state with the other utilities. Maybe Idaho Power should consider forming and energy efficiency working group of the IRPAC similar to the Solar Working Group.

- There was more discussion about the interpretation of the Errata and how it translates to the IRP.

- The refreshed potential study will be done in December and will be presented at the January 8th IRPAC meeting.

- Sid expressed his concerns about how the company convinces the average irrigator to participate and still be productive. The irrigation community is going to have to look at improving efficiency because they deal with a limited resource (water). The question posed to the group is, "we need to look at more of the psychology of the project and convince people they need to be efficient.

- There needs to be a different way to disseminate this information. This needs to be addressed, but the IRP is not the right forum to do that in. There is still a segment of the population that doesn't want to change. Some customers do not look at their Idaho Power bill or insets because in October one of the EEAG members was on the cover of the Currents issue. When this individual asked people he knows how many people actually looked at their bill stuffers he found that about 50% read it and the other 50% just threw it away.

- If customers are going to pay for marketing, it needs to be effective.

- Nancy stated that she knows the company is doing a lot in the way of marketing and promotions, but it doesn't feel innovative and may need to be refreshed. There is something that isn't clicking with customers.

Before the meeting was adjourned, Nancy informed the group that she will be taking a new position in January and will no longer be participating in the EEAG.

Quentin thanked everyone for their time and participation. Shawn will be sending out a doodle poll for 2015 EEAG meeting dates.

4:13-Meeting adjourned.

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NEEA MARKET EFFECTS EVALUATIONS

Table 1. 2014 NEEA Market Effects Evaluations

Report Title	Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
2013 Energy Savings Results for the Commercial Real Estate Cohorts	Commercial	Cadmus Group	NEEA	Impact
BOC-Expansion Initiative Market Progress Evaluation Report #1	Commercial	Research Into Action	NEEA	Market
Consumer Electronics Television Initiative Market Progress Evaluation Report #3	Residential	Research Into Action	NEEA	Market
Energy Forward Consumer Messaging Study	All	Opinion Dynamics	NEEA	Market
Evaluation of ACE Model Key Assumptions for Commissioning and Retrocommissioning	Commercial	Cadmus Group	NEEA	Market
Evaluation of Key ACE Model Assumptions for Motor Rewinds	Industrial	Cadmus Group	NEEA	Cost Effectiveness
Final Summary Report for the Ductless Heat Pump Impact and Process Evaluation	Residential	Ecotope Inc.	NEEA	Impact/Process
Heat Pump Water Heaters for Demand Response and Energy Storage	Residential	ECOFYS	NEEA	Demand Response
Hospital & Healthcare Initiative 2013 Energy Savings Validation	Commercial	SBW Consulting	NEEA	Impact
Inventory of Industrial Energy Management Information Systems for M&V Applications	Commercial	PECI	NEEA	Assessment
Long-Term Monitoring and Tracking Distribution Efficiency	Utility	Navigant Consulting, Inc.	NEEA	Market
Marginal Impact of Electric Heat Pumps on Home Sale Price	Residential	ECONorthwest	NEEA	Market
Market Characterization and Establishing the Market Baseline for the Commercial Real Estate Initiative	Commercial	Cadmus	NEEA	Market
NEEA Dryer Field Study	Residential	Ecotope, Inc	NEEA	Market
NEEA Existing Building Renewal: Process Review Results	Commerical	Navigant Consulting, Inc.	NEEA	Process
NEEA Hospitals and Healthcare Initiative: Market Progress Evaluation Report 6	Commercial	Evergreen Economics	NEEA	Impact
NEEA Industrial Initiatives—Market Progress Evaluation Report #8	Industrial	DNV KEMA Energy & Sustainability	NEEA	Market
Northwest Commercial Buildings Deep Energy Retrofit Market Characterization and Twenty Year Market Baseline Assessment	Commercial	Navigant Consulting, Inc.	NEEA	Market
Northwest Commercial Lighting Retrofit Market Characterization	Commercial	Heschong Mahone Group, Inc.	NEEA	Market
Northwest Ductless Heat Pump Initiative:Market Progress Evaluation Report #3	Residential	Evergreen Economics	NEEA	Market
Northwest ENERGY STAR Homes Retrospective Report	Residential	TRC Energy Services	NEEA	Assessment
Oregon Residential Energy Code Compliance	Residential	Cadmus Group	NEEA	Compliance
Regional Industrial Training Update	Industrial	NEEA	NEEA	
Residential Building Stock Assessment: Metering Study	Residential	Ecotope, Inc.	NEEA	Market
RETA CRES Initiative: Market Characterization, Baseline Study, and Forecast Report	Commercial	Research Into Action, Inc.	NEEA	Market
Seattle LED Adaptive Lighting Study	Commercial	Clanton & Associates, Inc.	NEEA	Market
Small to Medium Industrial SEM Energy Savings Validation	Industrial	Energy 350	NEEA	Impact

For NEEA reports, see the CD included at the back of this supplement.

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INTEGRATED DESIGN LAB

Table 2. 2014 Integrated Design Lab

Report Title	Sector	Analysis Performed by	Study Manager	Type
Building Efficiency Verification	Commercial	IDL	Idaho Power	Quality Assurance
Building Metrics Labeling	Commercial	IDL	Idaho Power	Building Metrics
Building Simulation Users Group	Commercial	IDL	Idaho Power	Training
Customer Representative Training	Commercial	IDL	Idaho Power	Training
Electronically Commutated Motors	Residential	IDL	Idaho Power	Literature Review
Fall Education Series	Commercial	IDL	Idaho Power	Education
Foundational Services	Commercial	IDL	Idaho Power	Training
Heat Pump Calculator	Commercial	IDL	Idaho Power	Development
Lunch and Learn	Commercial	IDL	Idaho Power	Training
Planning and Commissioning for Daylight Harvesting	Commercial	IDL	Idaho Power	Training
Simulation QA	Commercial	IDL	Idaho Power	Quality Assurance
Tool Lending Library	Commercial	IDL	Idaho Power	Training

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2014 Task 6: Building Efficiency Verifications

Summary of Projects

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_006-01

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Acronyms and Abbreviations

BEV	Building Efficiency Verification
HVAC	Heating, Ventilation, and Air Conditioning
IDL	Integrated Design Lab
IPC	Idaho Power Company
UI	University of Idaho

1. Introduction

The University of Idaho Integrated Design Lab (UI-IDL) had two roles for the Building Efficiency Verification (BEV) task in 2014. The primary role was to conduct on-site verification reports for approximately 10%, typically seven to eight, of projects that participated in Idaho Power Company's (IPC) Building Efficiency Program. The verified projects were randomly selected from the entire pool of projects, and at least two projects were required to be outside the Boise area. The secondary role was to review the photo controls design and function for every project whose application included incentive L3: Daylight Photo Controls within the Building Efficiency Program. Once each review was concluded, a letter of support for the incentive was submitted to Idaho Power. This review and letter were intended to increase energy savings and quality of design through the inclusion of additional design and commissioning recommendations.

2. 2014 Building Efficiency Verification Projects

The UI-IDL completed seven Building Efficiency Verification projects in 2014. A detailed report for each project was submitted to IPC, including claimed and actual savings for each specific incentive the project applied for. All of the projects reviewed in 2014 were completed under the Building Efficiency's 2011 Program that included the following specific incentives:

Table 1: 2011 Build Efficiency Program Specific Incentives

Lighting	L1	Interior Light Load Reduction
	L2	Exterior Light Load Reduction
	L3	Daylight Photo Controls
	L4	Occupancy Sensors
	L5	High Efficiency Exit Signs
Air Conditioning (HVAC)	A1	Premium Efficiency HVAC Units
	A2	Additional HVAC Efficiency Unit Efficiency Bonus
	A3	Efficient Chillers
	A4	Air Side Economizers
Building Shell	B1	Reflective Roof Treatment
	B2	High Performance Windows and Skylights
Controls	C1	Energy Management Control System
	C2	Demand Control Ventilation
	C3	Variable Speed Drives

Below is a summary of the seven projects and the incentive measures each qualified for, that were verified by UI-IDL.

Table 2: BEV Project Summary

IPC Project #	Facility Description	Location	Incentive Measures	UI-IDL Site-Visit Date
11-055	Retail	Payette, ID	L1, A4, B1	11/19/14
11-244	Manufacturing	Chubbuck, ID	L1, L5	7/31/14
11-264	Office 1	Boise, ID	A1, B2, C1	8/8/14
11-265	Food Service	Nampa, ID	L1	7/24/14
11-290	Bank	Eagle, ID	L4, L5 ,A1, B1, B2	12/22/14
11-309	Industrial	Twin Falls, ID	C3	10/17/14
11-363	Office 2	Meridian, ID	L1, L4	12/22/14

3. 2014 Photo Controls Review Projects

In 2014, the UI-IDL received at least five inquiries regarding the Building Efficiency photo controls incentive review. Documentation was received and final letters of support were submitted to IPC for photo controls incentive applications, which included two educational facilities and one office building.

2014 Task 1: Building Metrics Labeling

Summary of Effort and Outcomes

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_001-01

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Acronyms and Abbreviations

App	Application
BOMA	Building Owners and Operators Association
BSUG	Building Simulation Users' Group
CREW	Commercial Real Estate Women (Network)
EUI	Energy Use Intensity
IDL	Integrated Design Lab
IMG	Intermountain Gas
IPC	Idaho Power Company
KWCD	Kilowatt Crackdown
UI	University of Idaho
USGBC	United States Green Building Council

1. Introduction

The Building Metrics Labeling (BML) task was a continuation of work done by the University of Idaho Integrated Design Lab (UI-IDL) for Idaho Power Company (IPC) beginning in 2012. A stand-alone energy specific label was developed in 2012 and a web-portal was created in 2013 so the label could be automatically generated once information was submitted by users. The 2014 task focused on providing user support, general promotion of the tool, and tool debugging with minor functionality improvements.

2. Summary of Progress

2.1 Website Progress

The majority of the progress made in 2014 was the debugging and minor improvements made to the online web tool. The website was updated with improvements to the daylighting calculation and the addition of a frequently asked questions page. Other debugging and website improvement progress is listed below.

- Rolled out version 1.0
- Posted legal terms following review by both UI and IPC
- Implemented an administration log for viewing all BML sheets generated with option and filters
- Made cosmetic fixes
- Completed minor clean-up of coding
- Verified website functionality within multiple browsers
- Updated ENERGYSTAR® Portfolio Manager template for tool
- Troubleshot pdf generation and saving issues
- Added functionality to input a goal value

2.2 Marketing

Once the initial online tool was published to the website, marketing brochures were created. The UI-IDL created a two-sided flyer that was used as the main method for marketing in 2014. The flyer can be seen in the figures below.

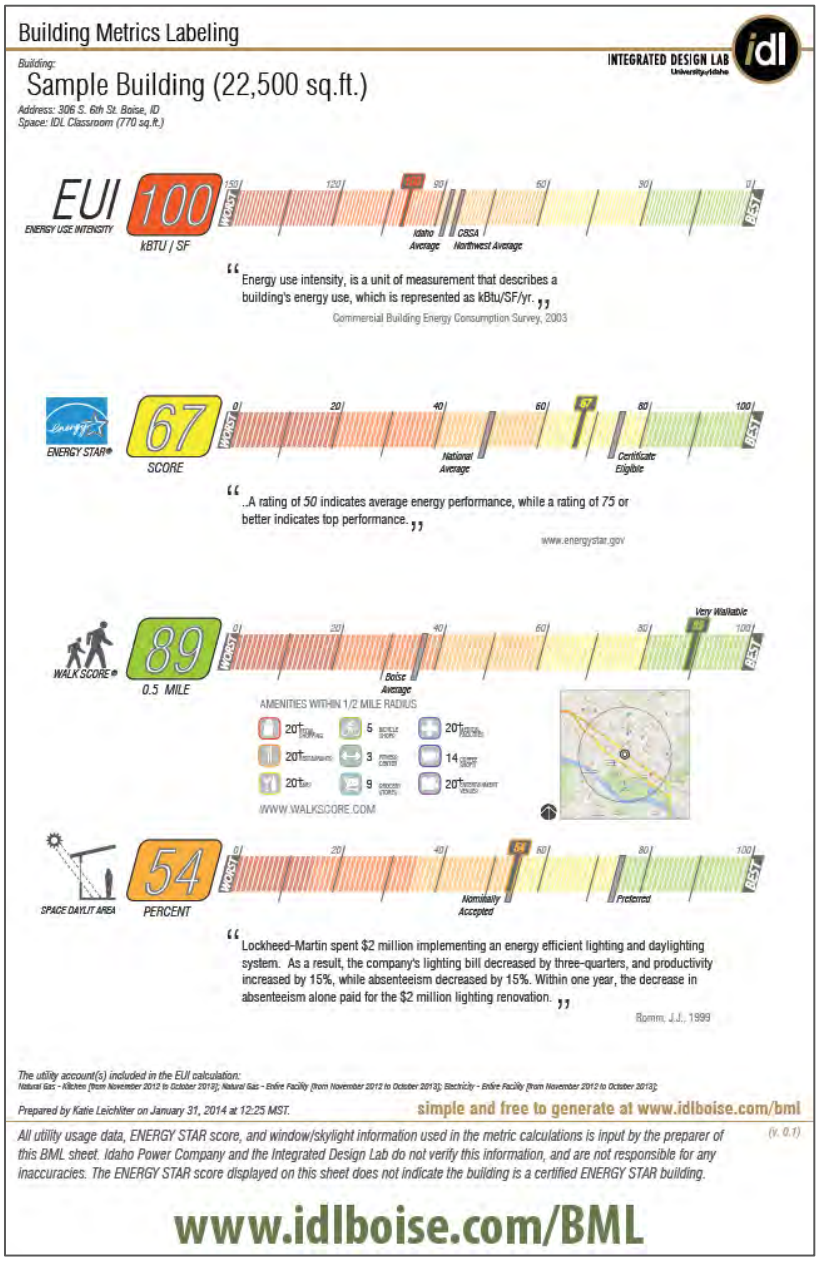

Figure 1: BML Flyer Front

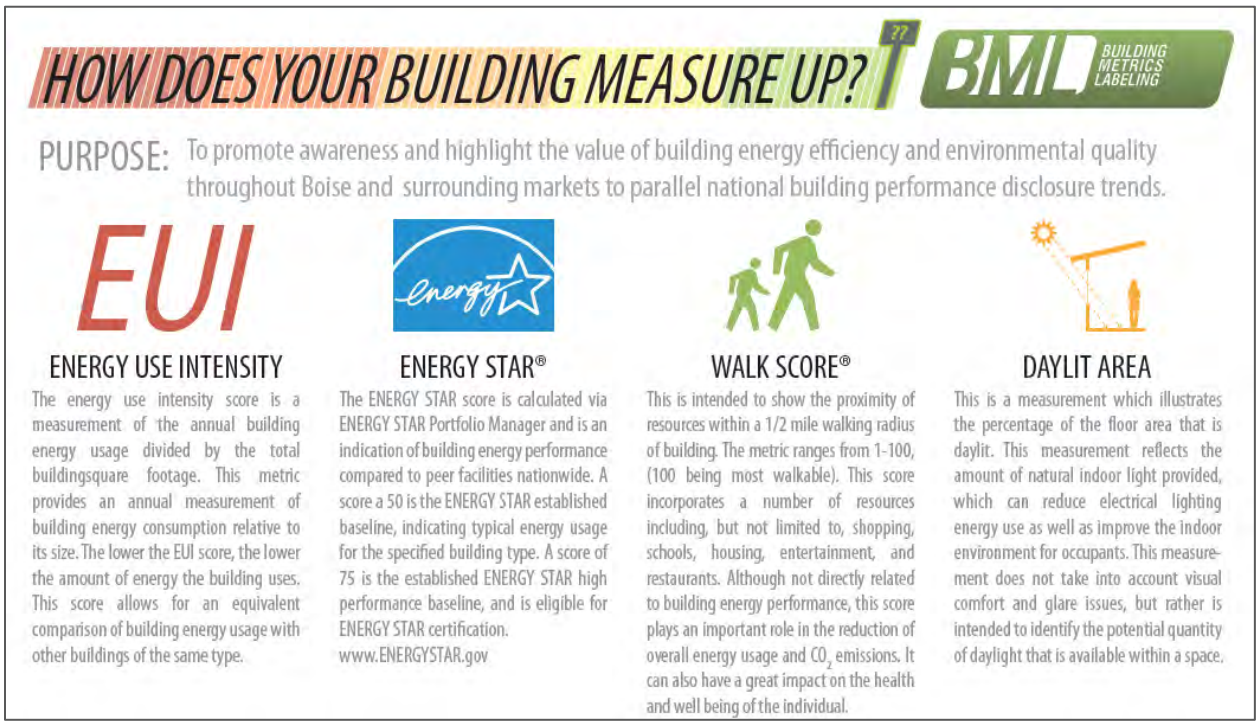

Figure 2: BML Flyer Back

During 2014, the tool was discussed and/or the flyer was distributed at multiple events, listed below.

- BOMA Annual Symposium (2/11/14)
- BOMA KWCD Awards Ceremony (4/16/14)
- Tool highlighted at a presentation to BOMA (5/28/14)
- Tool highlighted at a presentation to a group of City of Boise employees (6/5/14)
- 17 Lunch and Learn presentations to architecture or engineering firms and organizations (flyers and a slide following the main presentation)
- Multiple Central Addition planning meetings hosted by USGBC
- Multiple BSUG events
- Four Fall Lecture Series events
- Emails to Commercial Real Estate Women's Network

One-on-one marketing and support was also available when requested. In 2014, four sessions were requested: one by a local development firm, one by a City of Boise employee, one by USGBC staff, and one by a UI law group interested in energy use disclosure.

3. Next Steps

In preparation for additional marketing and community engagement in 2015, the UI-IDL created a list of potential users and stakeholders. The list comprises of approximately 20 individuals, organizations, and businesses to contact in 2015.

To improve the tools usability and promote its wider use, other potential future work was identified and is listed below. The feasibility and value of each of these items will need to be determined before implementation.

- Develop additional website functionality
  - Progress bar to option ”goal” markers
  - Dynamic average walkability for areas outside Boise
  - Dynamic EUI averages for other areas and building-type specifics
  - 15-minute walk map instead of circle
- Add automation from ENERGYSTAR® if capabilities become available
- Develop a new database of comparable building utility usages
- Solicit targeted tenants for feedback
- Coordinate with IPC and IMG to pursue increased automation of data flow directly to building owners and real estate agents

2014 TASK 4: BSUG

SUMMARY OF EFFORT AND OUTCOMES

IDAHO POWER COMPANY YEAR-END REPORT

December 31, 2014

Prepared for:

Idaho Power Company

Author:

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Report Number: 1401_004-01

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3.3 Session 3: Daylight Analysis Directly in Revit: Cloud Integration of BIM and Simulation (4/4/14) 6

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3.5 Session 5: Retrolux – A New Boise-Based Company and Simulation Tool for Lighting Retrofits (6/11/14) 8

3.6 Session 6: Student Simulations: UI Arch 574/ME 571|Building Performance Simulation for Integrated Design (7/23/14) 9

3.7 Session 7: From BIM to Sim – How Do You Get All That Rich Data Into Simulations Without Re-entering? (8/27/14) 10

3.8 Session 8: OpenStudio Features Update: Radiance Support and Large Scale Parametric Analysis with AWS and OpenStudio Server (9/24/14) 11

3.9 Session 9: Energy Tools, Tips, and Tricks (10/29/14) 12

3.10 Session 10: Modeling and Calibrating Radiant Systems in OpenStudio (11/19/14) 13

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Acronyms and Abbreviations

AIA	American Institute of Architects
AIT	Architect in Training
AMY	Actual Meteorological Year
App	Application
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
AWS	Amazon Web Services
BEMP	Building Energy Modeling Professional
BEQ	Building Energy Quotient
BESF	Building Energy Simulation Forum (Energy Trust of Oregon)
BIM	Building Information Modeling
BOMA	Building Owners and Managers Association
BSDF	Bidirectional Scattering Distribution Function
BSEE	Bachelor of Science in Electrical Engineering
BSME	Bachelor of Science in Mechanical Engineering
BSUG	Building Simulation Users' Group
CIBSE	Chartered Institution of Building Services Engineers
CTA	CTA Architects Engineers
DOE	Department of Energy
Elec.	Electrical
eQUEST	Quick Energy Simulation Tool
FASHRAE	Fellow of ASHRAE
FIBPSA	Fellow of IBPSA
GBXML	Green Building Extensible Markup Language
HAP	Hourly Analysis Program (Carrier)
HVAC	Heating, Ventilation, and Air Conditioning
IBPSA	International Building Performance Simulation Association
IDL	Integrated Design Lab
IEQc	Indoor Environmental Quality credit
IES VE	Integrated Environmental Solutions Virtual Environment
IPC	Idaho Power Company
LEED	Leadership in Energy & Environmental Design
ME	Mechanical Engineer(ing)
Mech.	Mechanical
MEME	Master of Engineering in Mechanical Engineering
MEP	Mechanical, Electrical, and Plumbing
NREL	National Renewable Energy Laboratory

PAT	Parametric Analysis Tool
RDA	Revit Daylighting Analysis
SaaS	Software as a Service
Sim	Simulation
TMY	Typical Meteorological Year
UDC	Urban Design Center
UI	University of Idaho
USGBC	U.S. Green Building Council
VRF	Variable Refrigerant Flow

1. Introduction

The 2014 Idaho Power scope of work for the Building Simulation Users' Group (BSUG) task included hosting 11 monthly meetings, recording attendance and evaluations, archiving video of the presentations, and maintaining the BSUG 2.0 website.

2. 2014 Summary and Cumulative Analysis

In 2014, 11 sessions were coordinated and hosted. Sessions are summarized below with details in the following sections.

Table 1: Overall Summary of Sessions

Date	Title	Presenter	Presenter Company	RSVPs		Attendees	
				In-person	Online	In-person	Online
1/15	The State of the Union on Building Simulation	Jacob Dunn	IDL		18	13	12
2/26	Daylighting Analysis through Revit - The Saga Continues	Lauren Hemley & Ciera Shaver	IDL	27	55	27	34
4/4	Daylighting in Revit	David Scheer	Autodesk		58	33	42
4/30	Building Energy Simulation - Wider and Deeper	Prasad Vaidya	Consultant		29	13	16
6/11	Retrolux - A New Boise-Based Company and Simulation Tool for Lighting Retrofits	Justin Schwartz	Retrolux	14	40	16	21
7/23	Student Simulations for Building Performance Course	Shrief Shrief & Eric Henderson	UI Students	6	54	9	24
8/27	From BIM to Sim - How Do You Get All That Rich Data Into Simulations Without Re-entering	Dru Crawley	IDL	22	79	22	47
9/24	Open Studio Features Update	Rob Gugliemetti	NREL	11	94	16	47
10/29	Energy Tools, Tips, and Tricks	Tim Johnson & James Rono	CTA	13	76	12	36
11/19	Modeling and Calibrating Radiant Systems in OpenStudio	Damon Woods	IDL	7	73	13	39
12/17	BSUG 2.0 Brainstorming Session for 2015 Topics/Speakers	(meeting style)	None	4	n/a	5	0
			Total:	**104**	**576**	**179**	**318**

2.1 2014 Attendance

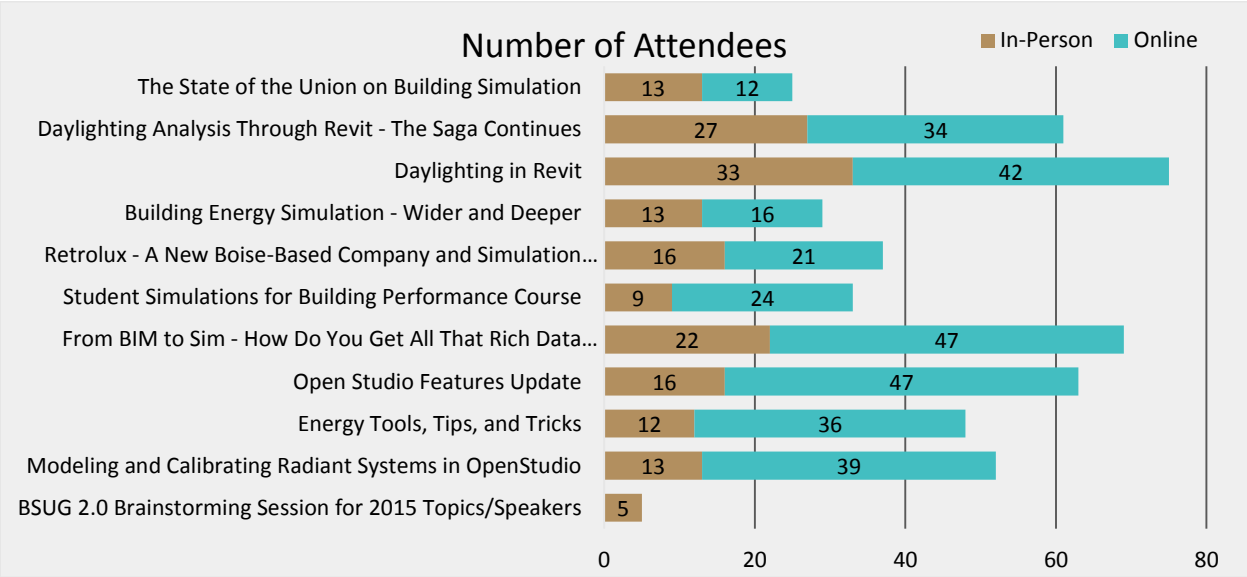

Figure 1: Attendee Count by Session and Type

Table 2: Overall Attendance Breakdown

Architect:	77	Electrician:	
Engineer:	9	Contractor:	
Mech. Engineer:	53	Other:	25
Elec. Engineer:		None Specified:	333
Total (In-Person):	**179**		
Total (Online):	**318**		
Total (Combined):	**492**		

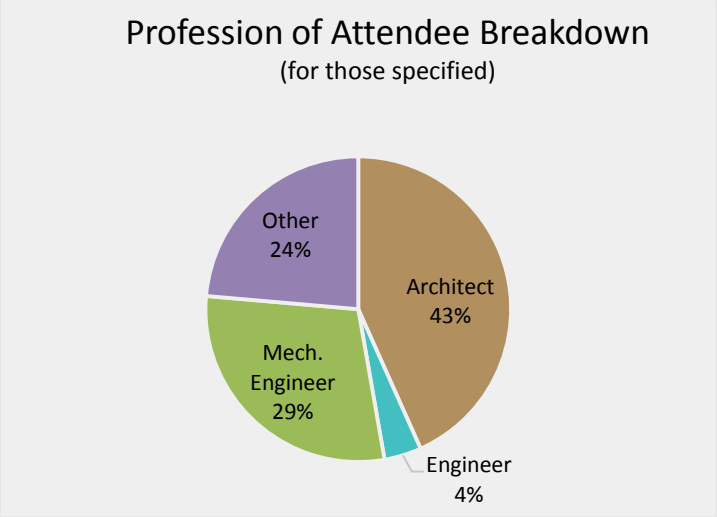

Figure 2: Attendee Profession Breakdown

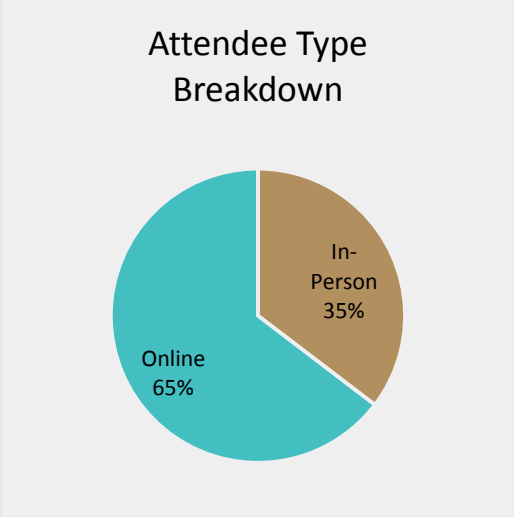

Figure 3: Attendee Type Breakdown

2.2 2014 Evaluations

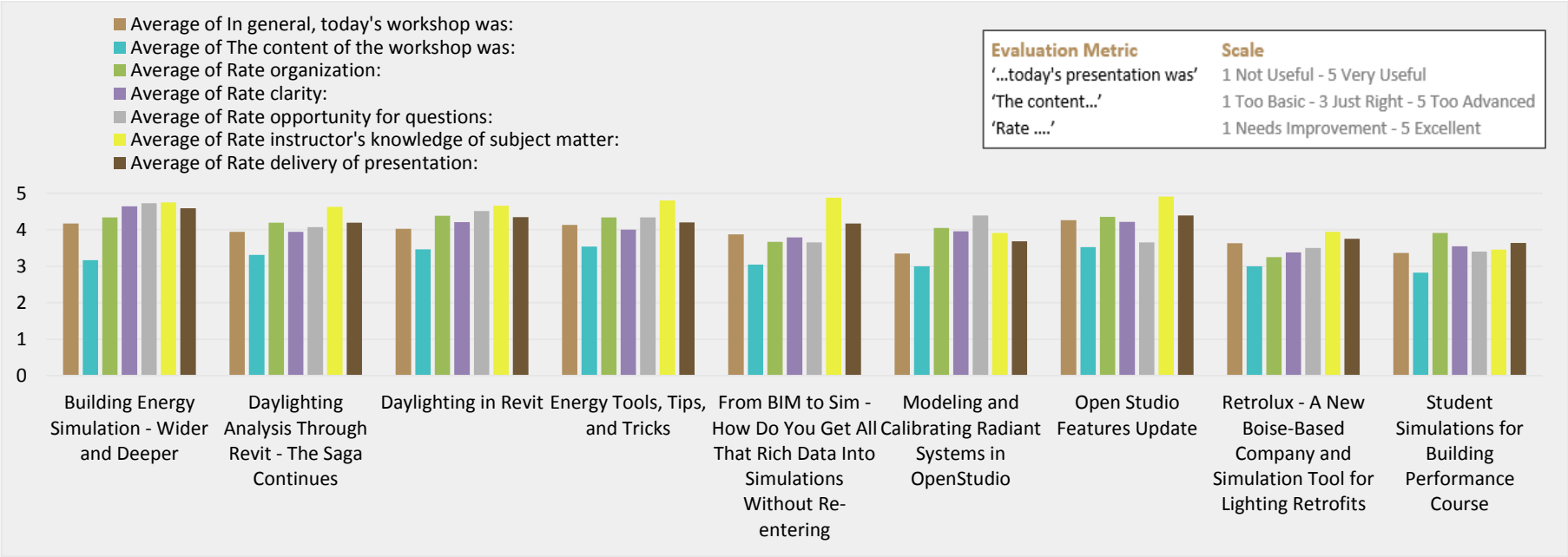

Figure 4: Average Evaluations by Session

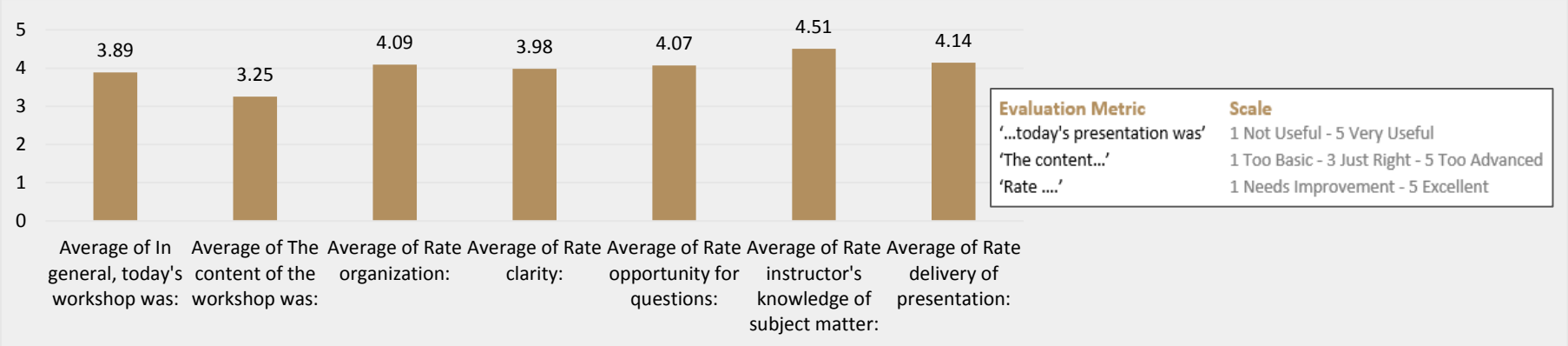

Figure 5: Average Evaluation Scores for All Sessions

3. Session Summaries

3.1 Session 1: The State of the Union on Building Simulation in Boise, Idaho (1/15/14)

Title: The State of the Union on Building Simulation in Boise, Idaho

Date: 1/15/14

Description: How important is building simulation to the local architecture and engineering community here in Boise, Idaho? How many firms use simulation, how many projects utilize its predictive powers for LEED or design, and what software programs are popular these days? In 2013, the UI-IDL conducted a market assessment on building simulation that will answer these types of questions while benchmarking their progress throughout the future. Join us for the first BSUG meeting in 2014, where we will present the findings from the market assessment while forecasting what's on the books for BSUG in 2014. Participants will also have a chance to provide feedback on topic ideas and meeting times.

Presenter: Jacob Dunn – Jacob is a research scientist at the University of Idaho's Integrated Design Lab (UI-IDL) in Boise, where he works on a daily basis with building performance simulation in both the realm of academic research and the professional world of sustainability consulting. He also manages multiple education and training programs, including this Building Simulation Users' Group (BSUG), residential and commercially-focused lecture series, and multiple workshops on various energy efficiency topics.

Attendance:

Architect:	6	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	2	Other*:	4
Elec. Engineer:		None Specified:	13
Total (In-Person):	**13**		
Total (Online):	**12**		
*If 'Other' was noted:	IPC Programs (3), USGBC		

Evaluation Highlights: Evaluation records could not be found at the time of this report.

3.2 Session 2: Daylight Analysis through Revit – The Saga Continues (2/26/14)

Title: Daylight Analysis through Revit – The Saga Continues

Date: 2/26/14

Description: As Revit evolves and gains more embedded analytical capabilities, its ability to perform daylight analysis is also rapidly developing. Currently two workflows exist. A new feature in Revit 2014

utilizes the Autodesk 360 cloud rendering platform to conduct illuminance and luminance analysis in perspective renderings. However, this new Revit analysis does not include creating illuminance maps for horizontal or vertical plane analysis. The second workflow involves exporting the Revit model as a GBXML file type for importing into third party daylight analysis tools such as Radiance. The UI-IDL has been interested in the latter workflow, as it would provide a pathway from Revit into the most powerful and flexible daylighting analysis tools available. However, the Revit to GBXML export process has historically been a tedious process riddled with issues and inconsistencies. For Revit 2014, Autodesk boasts a new "building elements" export workflow, which uses sophisticated algorithms that AUTOMATE the GBXML file creation from the native Revit model, automatically! This has the potential to quicken the export process and add significant value to this type of daylight analysis workflow. Join us for the February 26 BSUG, where two of the UI-IDL's research support staff will be presenting on the Revit GBXML export to Ecotect and Radiance analysis workflow.

Presenters: Lauren Hemley - Lauren Hemley is a recent graduate of the Maters of Architecture program at the University of Idaho and fills a part-time research support position at the UI-IDL. She is involved in a wide spectrum of projects at the lab including supporting simulation efforts, detailed climate analysis, project reporting, etc. Lauren also works part-time as an AIT at Point Architects, an architecture firm in the Boise area, as she aims to maintain and incorporate both lines of work.

Ciera Shaver – Ciera is a graduate architecture student at the U of I Urban Design Center (UDC) in Boise, Idaho. She also works part-time as a student intern at the University of Idaho Integrated Design Lab (UI-IDL) and works on a wide range of projects including daylight simulation, urban energy modeling research, and electric lighting research.

Attendance:

Architect:	15	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	3	Other*:	2
Elec. Engineer:		None Specified:	41
Total (In-Person):	**27**		
Total (Online):	**34**		
*If 'Other' was noted:	IPC Programs (2)		

Evaluation Highlights (What attendees found most valuable):

- Excellent session - concise, clear, informative presentation backed up by very useful demonstrations.
- It was good to see the similarities between my daylight modeling workflow & what your team has come up with at IDL! It can be such a cumbersome process & changes to the revit model mean starting over - so I'm always looking for ways to streamline. It was actually re-assuring to hear that others have the same challenges.
- Reaffirmed some of my own feelings and suspicions about the process. It was nice to have a balance between background information and demos.

3.3 Session 3: Daylight Analysis Directly in Revit: Cloud Integration of BIM and Simulation (4/4/14)

Title: Daylight Analysis Directly in Revit: Cloud Integration of BIM and Simulation

Date: 4/4/14

Description: The Revit Daylighting Analysis plug-in (RDA) is specifically designed to be able to complete fast and physically accurate daylighting analysis directly within Revit, without spending years becoming an expert in a specialty simulation platform or requiring days to set up a model. For better or worse, daylighting analysis is one of the truly apprentice skills in the world of building performance analysis. The simulation process can be overly technical and computationally-intensive, and proper interpretation of results requires an experienced eye. Unfortunately, there will never be enough masters able to work fast enough with existing tools to facilitate efficient and wonderful daylighted environments for all buildings. The industry needs new tools that streamline the analysis process while consolidating modeling and simulation efforts.

This presentation and live DEMO focuses on the significant strides made recently at Autodesk to embed daylight visualization and analysis capabilities inside Revit to effectively integrate BIM and simulation. The RDA plug-in can currently be used to generate the necessary daylighting simulation results to keep track of your LEED 2009 IEQc8.1 performance during project design, and to execute iterative daylight analysis to optimize performance. This, combined with Revit 2014's existing 360 Rendering Advanced Illuminance feature can be used to create analytical visualization renderings for both quantitative and qualitative analysis. By integrating the scalability of RDA's analysis engine with cloud computing resources, Autodesk 360 Rendering can quickly and accurately simulate daylight in a variety of outputs and visualization options.

Presenter: David Scheer – Building energy engineer and senior software developer at Autodesk

Attendance:

Architect:	16	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	3	Other*:	1
Elec. Engineer:		None Specified:	55
Total (In-Person):	**33**		
Total (Online):	**42**		
*If 'Other' was noted:	IPC Programs		

Evaluation Highlights (What attendees found most valuable):

- Made Revit daylight analysis less intimidating & reliable
- I am not a revit user, others in the office do that work for me. So it was good to know the automated aspects of the revit software.
- Inside knowledge speaker could offer on future direction of software.
- Demo. I will be looking at the recording.

3.4 Session 4: Building Energy Simulation – Wider and Deeper (4/30/14)

Title: Building Energy Simulation – Wider and Deeper

Date: 4/30/14

Description: Prasad Vaidya will discuss the challenges in making energy simulation more mainstream and his efforts to achieve this reality in an emerging economy in India, where floor space growth has exceeded 8% in recent years. Join us for this special April BSUG (fifth Wednesday of the month instead of the fourth), where Prasad will present the features of a brand new facility at Lawrence Berkeley National Laboratory (FLEXLAB) that allows the building industry to mock-up and test the impacts and performance of integrated building systems. The audience will have an opportunity to learn and discuss how such a facility could provide value to their practice by increasing the credibility of energy simulations, validating algorithms, and reducing the risks for various actors in design-construction-operations.

Presenter: Prasad Vaidya is a consultant working on energy policy, program development, and net zero energy buildings. His experience in the building energy efficiency industry spans over 20 years and he has consulted on over 150 building projects, facilitating technical analysis and guiding decision-making. He led the development of an online simulation based energy code compliance tool for India. Mr. Vaidya also teaches workshops on daylighting design, compliance with ASHRAE standards, and LEED rating systems. He is a LEED Fellow and serves as a technical resource to the Clinton Climate Initiative.

Attendance:

Architect:	5	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	6	Other*:	1
Elec. Engineer:		None Specified:	17
Total (In-Person):	**13**		
Total (Online):	**16**		
*If 'Other' was noted:	IPC Programs		

Evaluation Highlights (What attendees found most valuable):

- One Great organization and unique engagement of the audience by starting questions for us. Really great talk. Lots of info into a short time
- Web interface of a simulation engine, Flexlab advantages and opportunities.

3.5 Session 5: Retrolux – A New Boise-Based Company and Simulation Tool for Lighting Retrofits (6/11/14)

Title: Retrolux – A New Boise-Based Company and Simulation Tool for Lighting Retrofits

Date: 6/11/14

Description: BSUG on June 11 will feature a new software program developed by a local startup company, Retrolux, aimed at streamlining electrical lighting retrofit analysis via a custom app. The presentation will focus on the role of technology and simulations, commercial lighting as the low-hanging fruit of efficiency measures, the current state of the lighting industry and simulation, and simulations and sustainability. The new tool hopes to reduce product takeoff and installation costs by over 30%, streamline utility rebate programs, integrate with existing business systems, and provide a centralized project information database that can be updated with future improvements. There will be a short demonstration of the tool at the end of the presentation.

More on Retrolux as a company: Retrolux is a startup enterprise software as a service (SaaS) software company that seeks to provide energy auditors, electrical contractors, distributors, and utilities with the most comprehensive and integrated product supply chain logistics and energy efficiency software. The initial focus will be lighting products but the long term vision includes the entire electrical product lines and eventually mechanical products as well. Simply, Retrolux is a mobile-based data collection and product management software that will centralize all business functions required to specify and install building lighting solutions.

Presenter: Justin Schwartz – President and co-founder, Retrolux.

Attendance:

Architect:	6	Electrician:	
Engineer:	4	Contractor:	
Mech. Engineer:	5	Other*:	8
Elec. Engineer:		None Specified:	14
Total (In-Person):	**16**		
Total (Online):	**21**		
*If 'Other' was noted:	Energy engineer (2), sustainability consultant, IPC programs (2), consultant, researcher/architect, teacher		

Evaluation Highlights (What attendees found most valuable):

- Simplicity of the tool
- Just the basic orientation to Retrolux
- His knowledge

3.6 Session 6: Student Simulations: UI Arch 574/ME 571|Building Performance Simulation for Integrated Design (7/23/14)

Title: Student Simulations: UI Arch 574/ME 571|Building Performance Simulation for Integrated Design

Date: 7/23/14

Description: BSUG on July 23 will feature two presentations by students from the U of I class "Building Performance Simulation for Integrated Design" a semester-long EnergyPlus course taught by Ery Djunaedy. The students, Eric Henderson and Shrief Shrief, will each present their final projects for the class.

Eric's presentation will detail his experience building and calibrating a simulation of an existing Florida print shop. The shop has high process loads and many pieces of specialty equipment. Eric will also discuss the measures he recommended, the development of the proposed model, and the savings results.

Shrief will be discussing his first impressions of the EnergyPlus software, his experience in the course, as well as his final project. His final project was a model of a future technology mall planned for Boise, Idaho, including both an ASHRAE baseline and a proposed VRF system.

Presenters: Eric Henderson graduated from Pensacola Christian College in 1994 with a BSME degree and has since been employed by the college. In 2007, Eric also graduated with a BSEE from the University of Florida and is currently pursuing his MEME from the University of Idaho. At Pensacola Christian College, Eric serves as the chief engineer with responsibilities including the design, programming, and management of the campus Building Automation System and the oversight of the campus HVAC equipment. More recently, he has had a focus on investigation and implementation of opportunities for energy conservation measures.

Shrief Shrief is currently a research assistant at the UI- IDL and is pursuing his MSME through the U of I. He received his BSME from Ain Shams University (Cairo, Egypt) in 2004. Shrief's professional experience includes MEP design on multiple projects, including a large district cooling plant with 150,000+ tons of cooling. Shrief has been developing building simulations in EnergyPlus at the IDL since 2012 and is involved with a variety of other projects including measurement and verification, data logging, and tool loans.

Attendance:

Architect:	3	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	5	Other*:	1
Elec. Engineer:		None Specified:	24
Total (In-Person):	**9**		
Total (Online):	**24**		
*If 'Other' was noted:	IPC Programs		

Evaluation Highlights (What attendees found most valuable):

- features of EnergyPlus and what it is capable of
- User experiences with energy model calibration was interesting

3.7 Session 7: From BIM to Sim – How Do You Get All That Rich Data Into Simulations Without Re-entering? (8/27/14)

Title: From BIM to Sim – How Do You Get All That Rich Data Into Simulations Without Re-entering?

Date: 8/27/14

Description: BSUG on August 27 will feature Dru Crawley, "the Father of EnergyPlus," discussing capturing rich data from Building Information Modeling (BIM) for simulation. BIM is one of the most powerful tools that designers have to create and visualize 3-D building models. BIM allows the designer to track thousands of building components in 3-D and thus detect potential interferences. It also makes it easy to visually display a potentially complex design in a way that building owners can easily understand. Similarly, building energy simulation (SIM) has evolved into a powerful tool for evaluating the energy performance of potential or existing buildings. Building simulation allows easy comparison of the energy and environmental performance of many hundreds of design or retrofit options. Because much of the data that building simulation tools require already exists in the BIM models, it's critical that simple methods for sharing that data are available. This presentation describes the opportunities and challenges for sharing data between BIM and SIM and recent advances in data exchange. This will be followed by a demonstration of creating energy models from various sources – 3-D, 2-D, and images – using Bentley's AECOsim Energy Simulator.

Presenter: Drury B. Crawley, Ph.D., FASHRAE, BEMP, FIBPSA, AIA; Bentley Systems, Inc. – Dru Crawley is director, Building Performance and Bentley Fellow focusing on building performance, energy efficiency, renewable energy and sustainability. Before joining Bentley in 2010, he led development of EnergyPlus and the US-DOE's Commercial Buildings Initiative (now Better Buildings) promoting creation of zero-energy buildings. He has more than 35 years of experience in building performance, energy efficiency, renewable energy, and sustainability. He received his PhD in mechanical engineering from University of Strathclyde in Glasgow, Scotland. His doctoral thesis focused on building simulation as a policy tool, looking at the potential impact of climate change on the built environment. He also has a Bachelor of Architecture from University of Tennessee and is a registered architect.

Dr. Crawley is an active member in ASHRAE (Fellow in 2009; Exceptional Service Award in 2013; BEMP certification in 2012 and member and chair of numerous technical and standards committees), International Building Performance Simulation Association (IBPSA - Fellow in 2012 and at-large board member), IBPSA-USA (treasurer and board member), the American Institute of Architects (AIA), U. S. Green Building Council (USGBC), and an affiliate member of CIBSE. He has published more than 125 papers and articles, testified before the U.S. Congress, lectured at more than 20 universities, and made

more than 400 presentations on building performance, energy efficiency, sustainability, and renewable energy throughout the world.

Attendance:

Architect:	9	Electrician:	
Engineer:	1	Contractor:	
Mech. Engineer:	8	Other*:	4
Elec. Engineer:		None Specified:	47
Total (In-Person):	**22**		
Total (Online):	**47**		
*If 'Other' was noted:	IPC programs (2), sales engineer, project manager		

Evaluation Highlights (What attendees found most valuable):

- Limits of SIM to BIM and projection about when it is headed
- Nice to hear someone acknowledge that things are not going as fast as we would like, but they are moving
- The experience of the instructor was very valuable. Specifically, I appreciated hearing the instructor's view of the current best way to create or transfer building geometry into building simulation models.

3.8 Session 8: OpenStudio Features Update: Radiance Support and Large Scale Parametric Analysis with AWS and OpenStudio Server (9/24/14)

Title: OpenStudio Features Update: Radiance Support and Large Scale Parametric Analysis with AWS and OpenStudio Server

Date: 9/24/14

Description: Rob Guglielmetti from the National Renewable Energy Laboratory in Golden, Colorado will present a live demo of two of the latest features added to the OpenStudio applications suite:

Radiance 3-phase support – leveraging the latest additions to Radiance 4.2 and BSDFs for window shading devices – is ready for release, and BSUG members will be one of the first groups to see it in action! Next, Rob will show how to set up a parametric analysis of building models using OpenStudio measures, a simple spreadsheet interface, and OpenStudio Server, which can automatically leverage the power of Amazon's AWS cluster, bringing supercomputer resources to even the smallest design or engineering shop.

Presenter: Rob Guglielmetti; NREL – Rob joined NREL in May of 2009, having previously worked as a daylighting engineer, lighting designer, and lighting simulationist for firms in Boulder, Colorado and New York, New York. In total, Rob has over 20 years' experience in lighting, from lighting for the stage, to lighting some of the most prestigious cultural institutions in the world. Rob's specialization is in physically-based lighting simulation, the integration of lighting simulation with whole-building energy

simulations, and the application of high dynamic range imaging toward more pleasant -- and energy-efficient -- built environments.

Attendance:

Architect:	8	Electrician:	
Engineer:	1	Contractor:	
Mech. Engineer:	6	Other*:	1
Elec. Engineer:		None Specified:	47
Total (In-Person):	**16**		
Total (Online):	**47**		
*If 'Other' was noted:	IPC Programs		

Evaluation Highlights (What attendees found most valuable):

- Web links. Please publish video/presentation location so I may follow those.
- The news features of the OpenStudio.
- visualizations of data – Examples

3.9 Session 9: Energy Tools, Tips, and Tricks (10/29/14)

Title: Energy Tools, Tips, and Tricks

Date: 10/29/14

Description: As design decisions become more data driven, quick and accurate energy calculations become crucial to a project's success. Traditional energy modeling can be a long, resource intensive process that isn't nimble enough to influence design as it happens. This session will focus on energy calculation strategies and tools to equip building owners, designers, and energy analysts to make informed decisions in a timely manner. Energy specialists from CTA Architects Engineers will review and demonstrate several useful tools for energy modeling, benchmarking, renewable energy calculations, and quality control.

Presenters: James Rono received his Bachelor of Science in mechanical engineering from Boise State University and is a registered engineer in training in the state of Idaho. James specializes in energy simulation using eQUEST, OpenStudio, and EnergyPlus as well as custom spreadsheets. James has performed energy simulations for optimizing and documenting energy performance in office buildings, financial centers, supermarkets, and government buildings.

Tim Johnson received his Bachelor of Science in mechanical engineering from North Dakota State University. He is a registered professional engineer, an ASHRAE certified building energy modeling professional, a LEED accredited professional, and a Green Globes professional. Tim has seven years of experience as a design engineer specializing in energy analysis and energy modeling using eQUEST, EnergyPlus, and IES VE energy modeling software. His experience also includes mechanical and plumbing design and document production for schools, commercial offices, supermarkets, healthcare,

light industrial buildings, and government buildings. His mechanical design experience includes developing energy efficient designs incorporating energy modeling and analysis techniques such as life cycle cost/payback analysis, improving ease of system maintenance, and developing construction drawings and specifications. Tim works from CTA's Boise, Idaho office.

Attendance:

Architect:	5	Electrician:	
Engineer:	1	Contractor:	
Mech. Engineer:	6	Other:	
Elec. Engineer:		None Specified:	36
Total (In-Person):	**12**		
Total (Online):	**36**		

Evaluation Highlights (What attendees found most valuable):

- I will use some of the climate tools that were described.
- The tips and tricks of how to analyze weather data
- Just enough information for quite a lot of things at one go. Content coverage and depth was good.

3.10 Session 10: Modeling and Calibrating Radiant Systems in OpenStudio (11/19/14)

Title: Modeling and Calibrating Radiant Systems in OpenStudio

Date: 11/19/14

Description: In this lecture, Damon Woods will discuss using OpenStudio to model radiant HVAC systems and leverage its Parametric Analysis Tool (PAT) capabilities for calibration. Developing and calibrating a model for a building with a complex HVAC system can be a significant challenge for architects and engineers alike. However, new versions of OpenStudio are making this process easier.

This presentation will include a demonstration of setting up a simple building model with a radiant slab in OpenStudio. Once constructed, the model can be adjusted in hundreds of ways very quickly by using the Parametric Analysis Tool that is now available. For existing projects, the building's actual consumption data can be imported to OpenStudio so that the effects of the parametric adjustments on the model can be contrasted against the building's actual behavior. This can save significant time and energy during the calibration process.

Presenter: Damon Woods is a PhD student at the University of Idaho. He is studying mechanical engineering with a focus on increasing the energy efficiency of buildings by using modeling and predictive control of radiant systems. Damon received his Bachelor of Science in mechanical engineering from Montana State University in 2006 with minors in aerospace and English literature. He graduated with a Master of Science in mechanical engineering from Boise State University in 2013, and is now working as a research assistant at UI-IDL while pursuing his doctorate.

Attendance:

Architect:	4	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	6	Other*:	3
Elec. Engineer:		None Specified:	39
Total (In-Person):	**13**		
Total (Online):	**39**		
*If 'Other' was noted:	IPC programs (3)		

Evaluation Highlights (What attendees found most valuable):

- Glad to see you guys pushing O(pen)S(tudio) to the limits. Good to see another perspective on what in can/cannot do.
- Learning capabilities of software, what is difficult and what is easy, to decide what to spend my energy/time on.
- A short introduction to OpenStudio, Measures and PAT - also some earnest comments on current limitations, crash warnings etc.

3.11 Session 11: BSUG 2.0 Brainstorming Session for 2015 Topics and Speakers (12/17/14)

Title: BSUG 2.0 Brainstorming Session for 2015 Topics and Speakers

Date: 12/17/14

Description: An in-person only meeting was held to discuss possible improvements and ideas for the 2015 BSUG programming. All local participants were invited via standard BSUG advertising, an IDL email to the BSUG distribution list, and personal email invitations to frequent attendees. The invitations also suggested that recipients who were unable to attend should email any thoughts or ideas for 2015. Outcomes from this session are detailed in Section 5.

Attendance:

Architect:		Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	3	Other*:	2
Elec. Engineer:		None Specified:	
Total (In-Person):	**5**		
*If 'Other' was noted:	IPC programs (2)		

4. Website Maintenance and Statistics

The Google site "BSUG 2.0" was maintained and updated monthly. Each month, details about the upcoming presentation were posted to the 'UPCOMING EVENTS' page. These pages also included links to both webinar and in-person registration. Monthly emails also linked to these pages as well as directly to the registration sites. If the monthly session included a webinar recording, the video was edited and posted to the YouTube channel with a link at the BSUG 2.0 website. Session 5: Retrolux – A New Boise-Based Company and Lighting Simulation Tool was the exception to this, due to technical difficulties saving the file after the webinar.

Between January 1, 2014 and December 18, 2014, total page views summed to 4,680 with unique page views at 3,909 for 2,150 total sessions at the site. Of the 2,150 sessions, 1,132 (58%) of the sessions were by users in Idaho. Below are charts showing a summary of website activity for the most popular pages, as well as for the site as a whole.

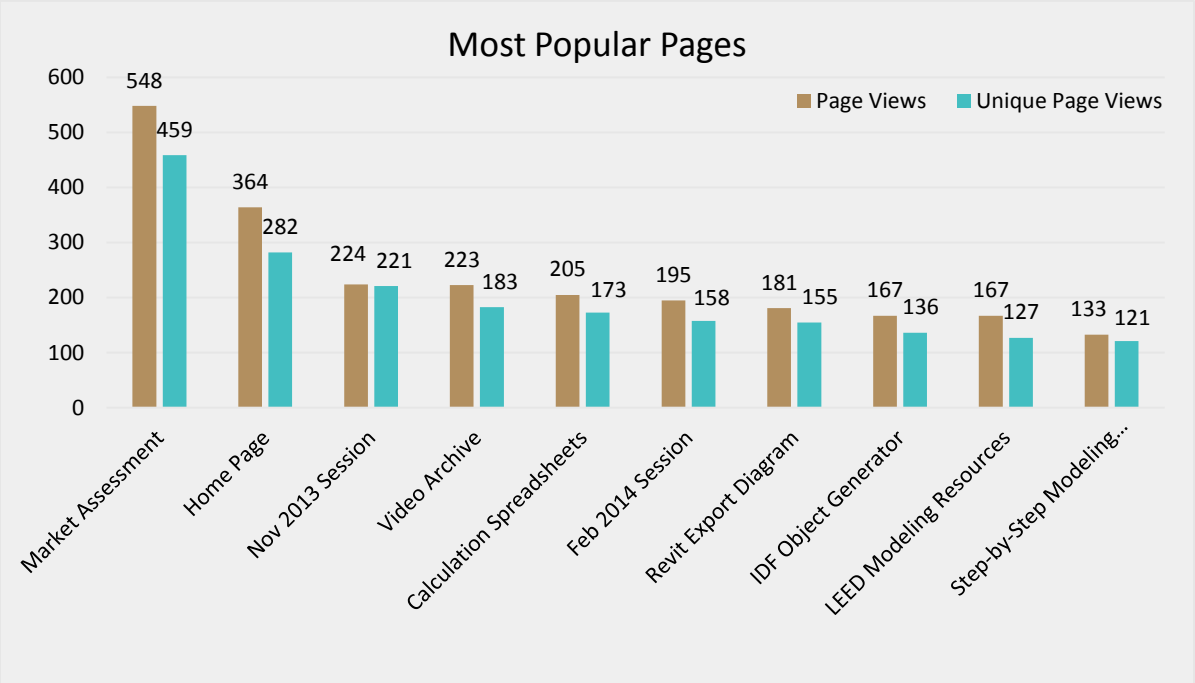

Figure 6: Number of Page Views for the Ten Most Popular Pages in 2014

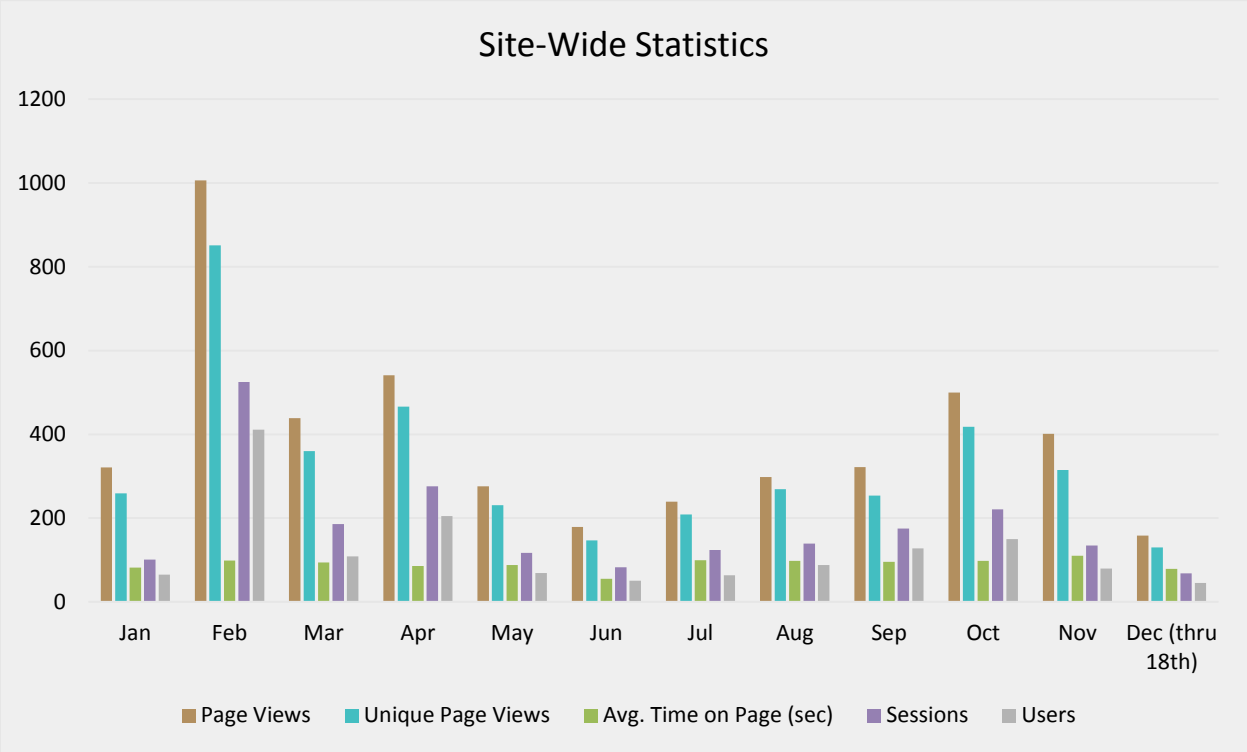

Figure 7: Monthly Site-Wide Statistics

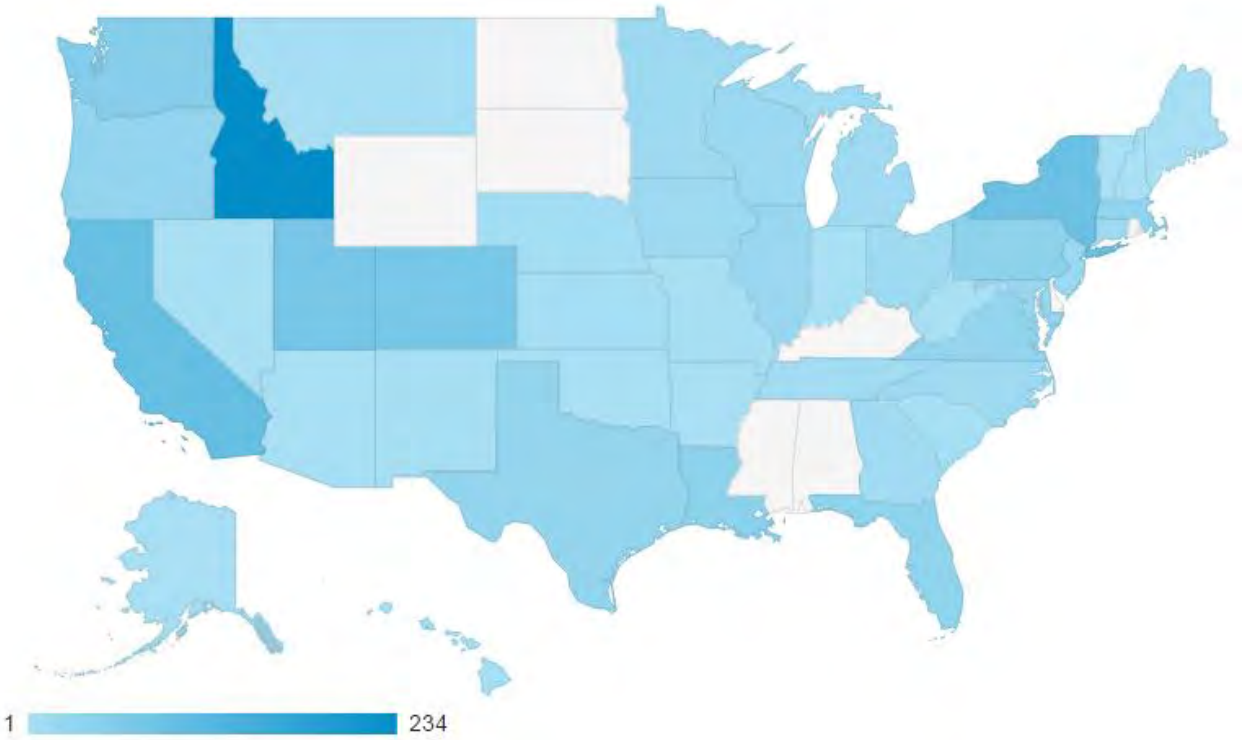

Figure 8: Heat Map of All U.S. Sessions in 2014

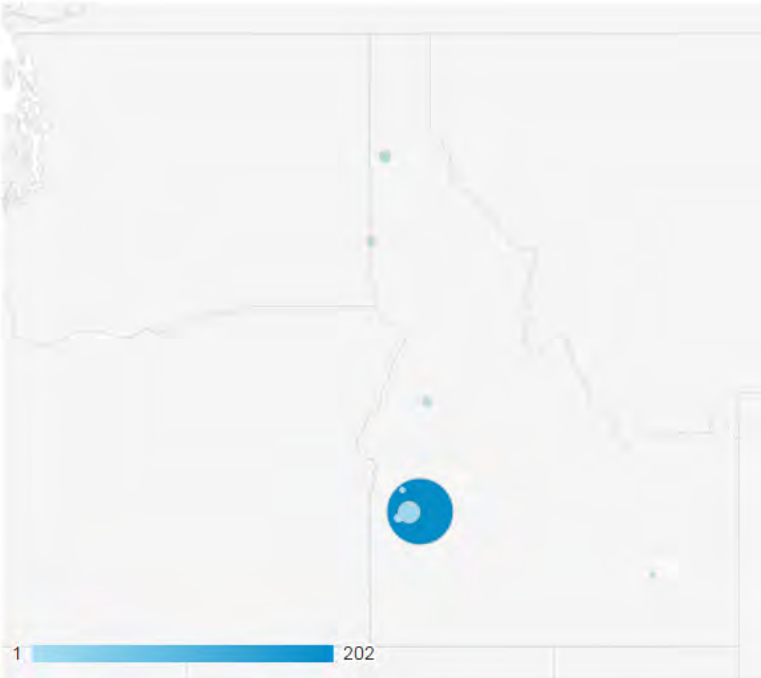

Figure 9: Bubble Map of All Idaho Sessions in 2014

5. Other Activities and Suggestions for Future Improvements

2014 was a successful year for the BSUG task with 11 sessions completed and 497 total attendees – 179 in-person and 318 online. Feedback was provided by attendees via the evaluation forms, 196 of which were collected. These offered a starting point for determining future improvements to the program.

A brainstorming session was also held for the December meeting due to a last minute cancellation by the Energy Trust of Oregon's Building Energy Simulation Forum (BESF) which BSUG Idaho had planned to view remotely. At the December meeting, discussion centered on potential topics for 2015 as well as general improvements and ways to increase attendance. Below is a short summary of main takeaways from the December meeting as well as the feedback from the evaluations.

Potential Topics:

- CTA/NREL collaboration: guide for heat reclamation from refrigeration spreadsheet
- Heat pump calculator spreadsheet tool and comparison study to eQUEST and EnergyPlus
- Weather Data – Meteorologist (possibly with ASHRAE) and TMY vs. AMY
- Autodesk upcoming products and capabilities
- Keeping up with OpenStudio
- Revit workflow, general Revit topics
- Business case for simulation (possibly with BOMA)
- Certification application process from a simulation standpoint (LEED, BEQ, Green Globes, etc.)
- Daylighting in OpenStudio
- Carrier HAP/Trane Trace information adaptation for EnergyPlus
- Evaluation of Sefaira plugin for Sketchup
- OpenStudio web of programs and how they integrate with the program
- Radiance training, Grasshopper, Green Building Studio, Simergy
- Ruby scripting
- Leveraging policy using simulation and results
- HVAC controls in simulation
- Spreadsheet modeling
- Beginners' tutorial
- Data collection for calibration process

Potential Speakers:

- Jacob Dunn
- Dennis Knight
- James Dirkes
- eQUEST expert
- Andrew Parker

Attendance and Marketing:

- Try to hold joint meetings with other organizations (such as ASHRAE, AIA, BOMA, and others)
- Include calendar invitations on any notices or reminders
- Market toward eastern Idaho and other remote locations
- Attendance prizes

2014 Task 12: Customer Representative Training

Summary of Effort and Outcomes

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

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Report Number: 1401_012-01

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Acronyms and Abbreviations

ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
BCA	Building Contractors Association
BOC	Boise Operations Center (Idaho Power Company)
BOMA	Building Owners and Managers Association
CDD	Cooling Degree Day
COC	Canyon Operations Center (Idaho Power Company)
Com	Commercial
CR(s)	Customer Representative(s) (Idaho Power Company)
DDC	Direct Digital Controls
EE	Energy Efficiency
EMS	Energy Management System
EUI	Energy Use Intensity
HDD	Heating Degree Day
HVAC	Heating, Ventilation, and Air Conditioning
IBOA	Intermountain Building Operators Association
IT	Information Technology
PE	Professional Engineer
POC	Pocatello Operations Center (Idaho Power Company)
Res	Residential
RTU(s)	Rooftop Unit(s)
TFOC	Twin Falls Operations Center (Idaho Power Company)
USGBC	U.S. Green Building Council
VAV	Variable Air Volume
WSHP(s)	Water-Source Heat Pump(s)

1. Introduction

The Customer Representative (CR) Training task was new within the University of Idaho Integrated Design Lab (UI-IDL) scope of work in 2014. Idaho Power Company requested that the UI-IDL develop training for identifying potential energy savings measures at various building types common within its service territory (excluding industrial). The training material was based on common energy efficiency opportunities seen during the UI-IDL's involvement with energy efficiency scoping audits for the Boise Kilowatt Crackdown Program held in 2013. The training included both classroom-style learning modules and on-site learning sessions, administered throughout IPC's service territory to IPC customer service representatives.

2. Classroom Training

Three 1-hour classroom training modules were developed for the course. The three modules are listed below with descriptions of the main topics included:

- Module 1: Pre-Walk Benchmarking and Analysis
  - Organize and benchmark energy use data
    - Review walk-through template
    - Use the pre-walk benchmarking spreadsheet
    - Calculate the building's Energy Use Intensity (EUI)
    - Use other available resources
- Module 2: Typical Building Systems and Efficiency Opportunities
  - General HVAC opportunities
  - Air-side systems (RTUs, VAV systems, heat recovery, general)
  - Water-side systems (WSHPs, fan coils, large equipment, general)
  - Data centers
  - Destratification
- Module 3: Specialty Systems and Efficiency Opportunities
  - Building envelope, role and components
  - Solar gain, when and how to reduce it
  - Daylighting and photo controls
  - Restaurant and grocery potential measures
  - IT equipment considerations

Supporting documents and forms were developed to aid the CRs with data analysis and organization, including:

- **Energy Efficiency Walk-Through Checklist.docx**
  - This list specified the steps recommended for a scoping study.
- **Energy Efficiency Walk-Through Template.docx**
  - This form summarized the building information and recommendations. It was intended to be the final report once completed and had two sections:
    - Building Information – to be filled out by CR and building contact prior to the visit
    - Energy Summary – the building systems and energy savings opportunities summary
- **Pre-Walk Benchmarking Utility Spreadsheet.xlsx (and example)**
  - This form was to be used to analyze the energy usage from all utilities and to calculate the building EUI. It was to be completed before the site visit.

The Energy Efficiency Walk-Through Checklist.docx is included below. It lists the recommended steps for the walk-through process as well as references additional resources that were provided to the CRs as supporting documents.

Quizzes were developed for each of the three classroom training modules and were provided to the Idaho Power Company project team. Each quiz included 20 questions with multiple answer choices. This quiz was intended for use with IPC's self-study program as a way to continue training beyond the 2014 scope of work.

ENERGY EFFICIENCY WALK-THROUGH

WORKFLOW CHECKLIST

- ☐ Complete 'Part 1: Building Information' in the **Energy Efficiency Walk-through Template.docx** document with the help of the building contact.
- ☐ Input all utility data into **Pre-Walk Benchmarking Utility Spreadsheet.xlsx** and calculate the building's energy use intensity (EUI).
- ☐ Use one of the recommended resources to compare the building EUI to a baseline EUI to determine if the building use is higher than expected.
  - www.buildingbenchmarks.com
  - **ENERGYSTAR EUI by Property Type.pdf**
  - ENERGY STAR® DataTrends documents
- ☐ Do further utility use analysis with any data available such as:
  - Peak vs. nighttime base load (typically 35-40% max)
  - HDD/CDD analysis
  - Year-to-year and seasonal trends
  - What is the primary heating fuel?
  - If electric is secondary heating, is it too high?
  - Sub-meter data (if available) vs. typical end-use breakdowns.

  If any of the trends seem to differ from expected, try to find out more info during the visit. For example, a night-walk may be recommended if the base load is high.
- ☐ Review best practices for HVAC and any other large systems and equipment identified
  - http://www.betterbricks.com/building-operations/tools/om-best-practices-0
- ☐ Site-visit (gather any instruments that may help)
  - **Pre-walk documents**
  - **Camera** (pictures are very helpful for filling out recommendations)
  - **Flashlight**
  - IR temperature gun
  - Light meter
  - Any documents you'd like to give the owner/operator (DataTrends for their building type or general benchmarking info etc.).
- ☐ Document recommendations in 'Part 2: Energy Summary' in the **Energy Efficiency Walk-Through Template.docx** document.
- ☐ Review recommendations with customer.

INTEGRATED idl DESIGN LAB

Figure 1: Energy Efficiency Walk-Through Checklist.docx

2.1 Delivery

Each of the three classroom training modules was delivered at each of the IPC's four operations center locations. A total of (12) 1-hour modules were delivered across IPC's service territory. The course instructors were Brad Acker and Katie Leichliter, both UI-IDL mechanical engineers who were involved with the 2013 Kilowatt Crackdown Program. The training information is summarized below, including the name of the instructor for the session. Some modules were administered consecutively on one date and some were administered on separate dates. Attendance for each session is listed in Table 1 and Figure 2 below. Attendees included the Idaho Power Customer Representatives and other Idaho Power staff. Evaluation forms were collected at each session and the results can be seen in Figure 3.

Table 1: Classroom Training Schedule

Date	Location	Module	# of Attendees	Instructor
7/16	COC	Module 1	7	Katie
7/24	BOC	Module 1	13	Brad
7/30	POC	Modules 1 & 2	3	Katie
7/31	TFOC	Modules 1 & 2	4	Katie
9/2	COC	Module 2	6	Brad
9/5	BOC	Modules 2 & 3	12	Brad
9/30	TFOC	Module 3	3	Brad
10/1	POC	Module 3	3	Brad
10/23	COC	Module 3	4	Brad
			55	

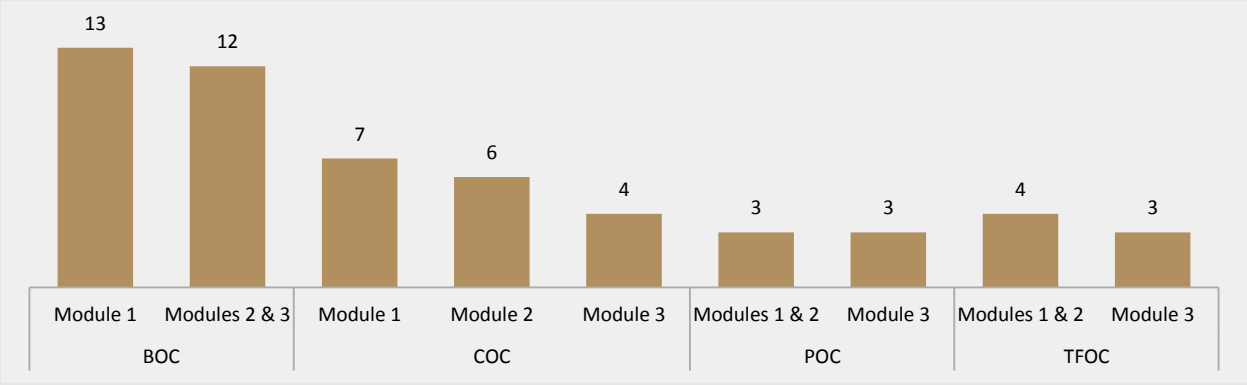

Figure 2: Classroom Training Attendee Counts

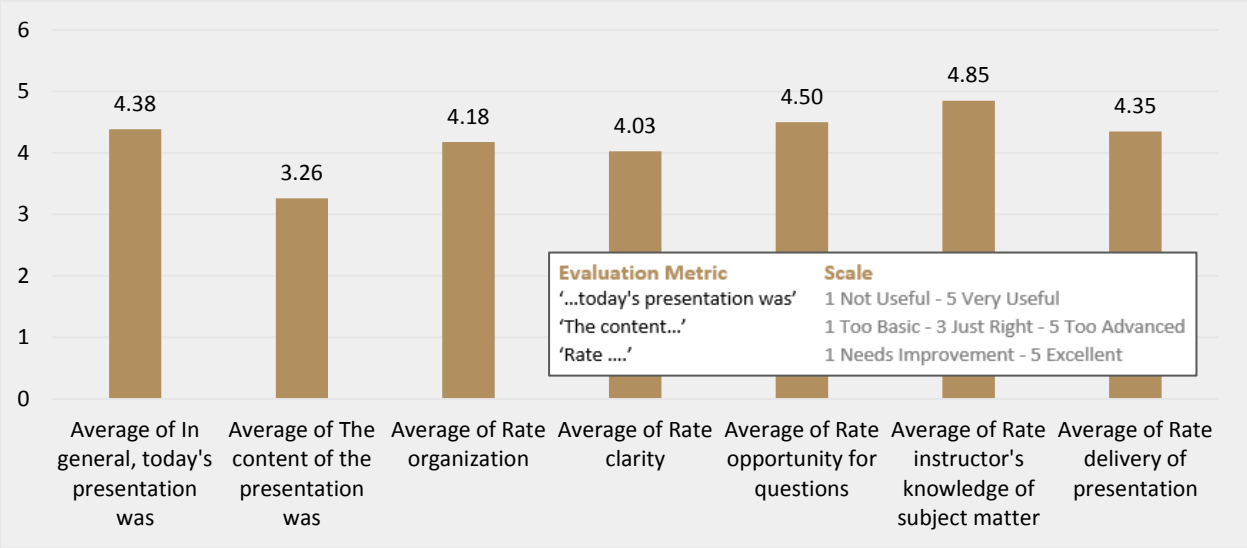

Figure 3: Evaluation Scores from All Classroom Training Sessions

3. On-Site Training

For the on-site training portion of the course, the CRs were asked to identify customers who could benefit from a walk-through and then coordinate a two-hour on-site session for the group of CRs and the instructor. The CRs were requested to follow the Walk-Through Checklist and to submit the utility data and the Energy Efficiency Walk-Through document, with Part 1 completed, to the instructors a week prior to the visit. A total of eight site visits were completed. A ninth session included a follow-up meeting with both instructors and the

respective Customer Representatives to review the three final reports completed in the Boise area. Table 1 below summarizes the site visits plus the BOC review meeting. Following each site visit, the Energy Efficiency Walk-Through Template was completed. The customer's CR then delivered the report and reviewed the findings with the customer.

Table 2: Site Visits Summary

Date	Location	Facility	CR Organizer	# of Attendees	Instructor
9/25	BOC	Restaurant 1	Russ Hahn	6	Katie
9/29	BOC	Community Center 1	Melanie Pinkston	7	Katie
9/30	TFOC	School 1	Leo Sanchez	3	Brad
10/1	POC	Workforce Training Facility 1	Gary Peck	4	Brad
10/8	BOC	Grocery 1	Tonja Dyke	6	Brad
10/17	TFOC	Healthcare Facility 1	Leo Sanchez	4	Katie
10/20	BOC	None – Review Meeting	Tonja Dyke	7	Brad and Katie
10/23	COC	Workforce Training Facility 2	Greg Evans	4	Brad
11/4	COC	Community Center 2	Pat Sullivan	4	Katie
			Total:	**45**	

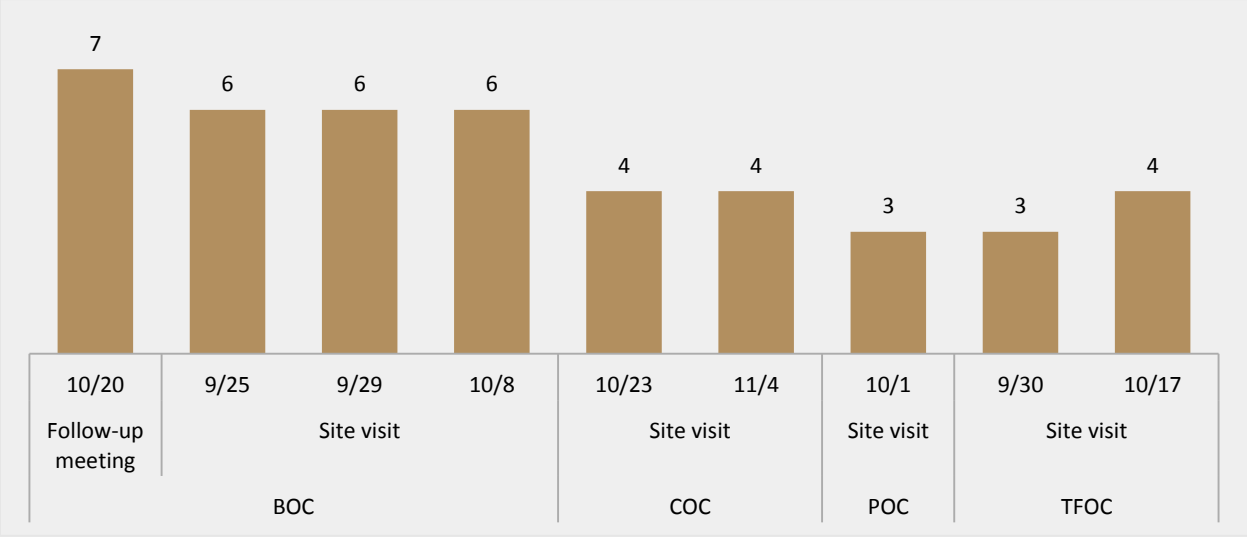

Figure 4: On-Site Training Attendee Counts

ELECTRONICALLY COMMUTATED MOTORS

LITERATURE REVIEW

December 31, 2014

Prepared for:

Idaho Power Company

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Report Number: 1408_032-01

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1. Executive Summary

Idaho Power Company (IPC) wants to expand the energy efficiency offerings of its Residential Incentive Program. The IPC team has decided to investigate the energy savings potential of electrically commutated motors (ECM) in split system blower housings. IPC wants a program that would give incentives to HVAC technicians to install an ECM blower motor at the time of failure of an existing permanent-split capacitor (PSC) motor. To aid in the preliminary design of such a program, a review of current programs and literature was requested. Specifically, IPC wanted to look at the application of a 2003 Wisconsin study by Scott Pigg to the weather conditions of Idaho. Additionally, residential air conditioner logging, which was done in the summers of 2011 and 2012 by the University of Idaho Integrated Design Lab (UI-IDL), was analyzed to determine observed hours of fan operation.

Table 1. Summary of Findings

	Heating Hours (Average)	Cooling Hours (Average)	Fan-on Mode (Average)
Wisconsin Study – Wisconsin Weather	1,090	290	7,400
Wisconsin Study – Boise Weather	790	410, 682 (no probability model)	7,560
Idaho Residential Economizer Data	N/A	676 (152 day season) 404 (91 day season)	N/A

2. Introduction

Residential furnace fans have been a target for increased energy efficiency by many organizations, and various energy efficiency measures have been investigated. According to Residential Energy Consumption Survey 2009 (RECS 2009) data, 60.8% (67.6 million) of U.S. homes have central warm-air furnaces. Efficiency improvements in this area would have great impacts on the overall energy use in the residential sector. The U.S. Department of Energy (DOE) has been looking at multiple improvements that could be made in this area.

Target areas for DOE efficiency improvements:

- Improvement to fan housing and airflow path design
- High efficiency fan motors
- Permanent-split capacitor motors (PSC) with inverter drives
- Fan impellers with backward-inclined blades
- Improved motor transformers using toroidal transforms
- Replacement of linear power regulators with switching mode power supplies

This work by the DOE has focused on improvements to new furnaces and the standards by which furnaces are manufactured. While this is a much needed area of energy efficiency, these improvements to manufacturing standards would take time to impact the existing installed base energy-use profiles. Utility incentive programs that impact the energy-use profiles of existing residential furnace systems would have immediate impacts on use profiles. Of the above listed measures, high efficiency fan motors could be readily retrofitted to existing systems and are the focus of this paper. More information on the other measures can be found in the final rule document from the U.S. Department of Energy (2014).

2.1 Residential Blower Motor Types

There are two major types of furnace fan blower motors and a few variations of each type. Table 2 below outlines the two types of motors commonly in use.

Table 2. Blower Motor Types

Motor Type	Sub-Type	Notes
Permanent-Split Capacitor (PSC)	PSC	Baseline motor, lowest cost
	Inverter Drive - PSC	Improved efficiency, highest cost
Electronically Commutated Motor (ECM)	Constant Torque ECM	Improved efficiency, medium cost
	Variable Speed ECM	Improved efficiency, high cost

A PSC single speed motor is considered the baseline motor in residential furnace applications and has been the predominant motor in use for many years (Michael, 2009). The PSC technology has been proven as simple, reliable, low cost, and somewhat flexible in manufacturing options. This technology is referred to as an induction motor because the inner rotating element of the motor, called the rotor, has a magnetic field induced in it through electro-magnetic induction supplied by the current in the stator. The stator is the outer portion of the motor that remains stationary and also has a magnetic field generated in it via the main electrical feed of the motor. The two magnetic fields in the stator and rotor are constantly changing producing an overall resultant rotating magnetic field, therefore causing the rotor to spin. The term asynchronous is used for this operation because the rotor is constantly trying to align magnetic fields with the stator, but always lags behind. The amount of lag is expressed as a percentage of synchronous speed and is called slip. This aspect of the design results in low efficiency (approximately 60%) and high heat generation (Michael, 2009). While PSC motors are not variable speed without external controls, these motors are produced with multiple

winding/speed taps, usually up to four. These taps are used by equipment installers to fine-tune the system air flow based on the specific static pressure of the ductwork system. This allows for a range of motor horsepower outputs for the installer and allows for use of a slightly lower speed for constant fan operations compared to full heating or cooling mode. Michael (2009) found 552 Watts as typical in full cooling operation and 515 Watts in continuous fan mode.

PSC motors can operate as variable speed motors with the addition of an external invertor drive, and PSC motors with inverter drives were once seen as an option for gaining efficiency. However, improvements to fan housing, airflow paths, and the use of electronically commutated motors (ECM) were determined to be more cost effective (U.S. Department of Energy, 2014).

An ECM is a brushless direct current motor with electronics built into the housing that allow for two important features of this motor design. First, the switching of the electric current from alternating current to direct current allows standard 120V single phase power to be supplied to the motor. Second, the built-in electronics generate pulses of current that determine the speed and torque of the motor. It is these two features that generate the term electronically commutated motor (ECM). An ECM is sometimes more generically referred to as a brushless permanent magnet (BPM) motor. There are two major types of ECMs: constant torque and variable speed. A variable speed ECM, also sometimes called a constant air flow motor, is capable of changing its speed in reaction to different static pressure operating conditions. This speed change at different static pressures results in a constant air flow. The variable speed ECM is also referred to by the various versions which have been produced such as ECM 2.3, 2.5, or 3.0. One negative aspect of the variable speed ECM, from an energy

efficiency standpoint, is that it uses more power in high static pressure installations than the traditional PSC motor. The PSC motor delivers less air flow in a high static pressure situation and, because air flow is directly related to energy use, the PSC motor uses less energy and delivers less air in high static pressure situations. The variable speed ECM increases its speed to deliver the proper air flow and uses more energy. With proper air flow being critical to refrigeration and burner system performance, as well as occupant comfort, the variable speed ECM delivers better overall performance. Largely due to this issue, the DOE determined the metric of Watts / cfm as the best way to rate motor types. This metric is referred to as the fan energy rating or FER. Any ECM uses fewer Watts / cfm than a PSC motor (U.S. Department of Energy, 2014). Michael (2009) reported energy use of variable speed ECMs at 413 Watts in full operation and 83 Watts on fan-only mode.

The other type of ECM is often referred to as a constant torque, standard ECM, or X13 motor. In this paper this type is referred to as a constant torque motor. The term X13 is a brand name of the Genteq Company. The X13 name resulted from this motor being used to meet the 2006 DOE equipment requirements for seasonal energy efficiency ratio (SEER) to be at a level of 13 or higher (Michael, 2009). The constant torque ECM is based on the same technology as the variable speed ECM, but it is programmed in the factory to operate only at pre-set torque levels. The torque levels are assigned via taps much like the PSC motor. Due to this, the constant torque motor can suffer from airflow lowering in a high static pressure situation, although it is reported to not be as pronounced as with a PSC motor. The constant torque motor is something of a mix between the PSC motor and variable speed ECM in that it offers the efficiency of the ECM technology with discrete torque taps for the installer to fine-tune

installations. Both types of ECMs produce less heat and noise than PSC motors, and are more efficient because they do not need to provide excitation voltage to the rotor. In general an ECM is 80% efficient while a PSC motor is 60% (Michael, 2009).

3. Existing Use of ECMs in Incentives

Internet searches were performed and two utility program operators were called to determine the use of ECMs in utility incentive programs. Both commercial and residential programs were found for the direct replacement of an existing older motor technology with an ECM.

In commercial settings ECM applications are popular with grocery stores in refrigeration systems for the evaporator motors and fan head motors for compressors. In the Northwest, most utilities that operate this incentive do so through the Energy Smart Grocer Program. On the East Coast, programs were found for the replacement of variable air volume fan powered boxes, fan coil units, and other HVAC supply fans for commercial applications.

In residential applications, limited ECM replacement programs were found. Replacement of hydronic system circulation pumps with new pumps driven by ECMs was found on the East Coast. Several programs exist in which ECM blower motors are part of an equipment package, such as the installation of a new high efficiency furnace. Several residential programs were found that replaced older motor technology with ECMs in furnace-fan blowers. Most of which were in the mid-west. Table 3 below is a summary of the utility program findings that address only direct installations of an ECM.

Table 3. Summary of ECM Incentive Programs

Utility	Incentive Type	Incentive
Avista	Commercial	Energy Smart Grocer Program, Evaporator Motors
Avista	Residential	None
BPA	Commercial	Energy Smart Grocer Program, Evaporator Motors, Compressor Heads
Grant County PUD	Commercial	Energy Smart Grocer Program, Evaporator Motors, Compressor Heads
Puget Sound Energy	Commercial	Energy Smart Grocer Program, Evaporator Motors, Compressor Heads
Clark Public Utilities	Commercial	Energy Smart Grocer Program, Evaporator Motors, Compressor Heads
Mass Saves (Massachusetts area)	Commercial	VAV boxes, fan coils and HVAC supply fans
Mass Saves (Massachusetts area)	Residential	ECM circulation pumps for hydronic heating, HVAC equipment
Duke Energy (South Carolina)	Residential	ECM required on indoor fan for HVAC equipment
Consumers Energy (Michigan area)	Residential	Factory installed ECM on new HVAC equipment
NIPCO (Indiana)	Residential	Direct PSC for ECM replacement, amount not given, program on active in 2015
Michigan-energy.org (nine Michigan utilities)	Residential	$150 for either a furnace with an ECM or replacement of PSC with ECM
Wright-Hennepin Co-op (Minnesota)	Residential	$25 for either a furnace with an ECM or replacement of PSC with ECM
Minnesota Power	Residential	$200 for a new furnace with an ECM. $100 to replace an ECM in existing unit
MVEC (Minnesota)	Residential	$50 for either a furnace with an ECM or replacement of PSC with ECM

4. Past Studies

Several studies were examined that address the energy savings aspects of applying the ECM technology to residential blower motors. One 2008 study that reported energy savings from variable speed ECMs also addressed the issue of duct static pressures (Franco, Lutz, Lekov, & Gu, 2008). As noted above, variable speed ECMs can have negative savings in situations of high duct static pressure. Savings for cold climates were reported as 47%, 37%, and 10% for ideal ducts, good ducts, and typical ducts respectfully (Franco, Lutz, Lekov, & Gu, 2008). Table 4 below shows the duct static pressures used in the study. This study points out the differences in static pressures found in field studies compared to the DOE values used. These differences can be significant and show the value of limiting ECM replacement to constant torque motors, as is being suggested for this investigation by Idaho Power Company.

Table 4. Static Pressure Levels

Category	Static Pressure Rating	Citation
DOE Test Procedure (Ideal Ducts)	0.18 for 2-ton AC, .20 for 3-ton AC, .23 for 4-ton air conditioner, and .28 for 5-ton AC at the nominal heating airflow	(U.S. Department of Energy, 2008)
Manufacturer Ratings (Good Ducts)	0.5 in.w.g. at the nominal AC airflow	(U.S. Department of Energy, 2008)
Field Data (Typical Ducts)	0.8 in.w.g. static pressure at nominal AC airflow	(Wilcox 2007)

A 2003 field report from Wisconsin looked at 32 homes, 14 with ECM blowers and 18 without ECM blower motors. This study was also done with variable speed/constant airflow ECMs, as the constant torque ECMs were not yet on the market. This study found that on a per-therm of input fuel basis, furnaces with ECMs used half as much electricity as non-ECM

furnaces (Pigg, 2003). The Wisconsin study also found that electric use was higher than that of rating test conditions. This was believed to be due to higher static pressures found in the field, which was later confirmed in the 2008 study as previously noted. Regardless of static pressure issues, ECM blowers were found to be more efficient than standard PSC motors. In the Wisconsin climate, the average savings was found to be 465 kWh/yr with most of this coming from the heating season. A much larger savings value of 3,000 kWh/yr was found for homes that operated the fan in continuous mode. With overall savings being very sensitive to this value, program managers would benefit from a good understanding of how many homes run in continuous fan mode and why. An issue was found at four of the 14 ECM sites in which the fan speed for continuous operation was set higher than the recommended value, something that would reduce this savings. This also would be an important aspect to track in program design.

5. Run Time Models

This study is focused on determining run time estimates for residential blower motors in the Boise, Idaho climate. Two sources of data were used to accomplish this: the 2003 Energy Center of Wisconsin (ECW) Study by Scott Pigg and previous research conducted in 2011 and 2012 by the UI-IDL focused on energy savings from residential economizers (Acker, et al., 2012). The 2003 ECW study developed annual models based on short-term monitoring. These models were then used with Boise, Idaho weather data to determine run times. The UI-IDL studies are based on summer season monitoring of residential split systems and can serve to inform the results as adapted from the ECW study. The UI-IDL study can only inform the cooling mode of operation as heating season data was not collected.

5.1 Regional Comparisons

Climate characteristics are an important part of any energy model or evaluation program. For the purpose of this literature review, a 2003 study conducted in Wisconsin by the Energy Center of Wisconsin was analyzed for energy savings potential using Idaho weather. For this approach to be applicable, a few higher level characteristics of the regions should be compared. As described in the Building America Climate Guide (BACG, 2010), Idaho and Wisconsin are both in the "cold" region of the U.S., which consists of 5,400 to 9,000 heating degree days. This indicates that the general climate conditions in the two locations are similar, and practices such as building construction and insulation levels should also be investigated.

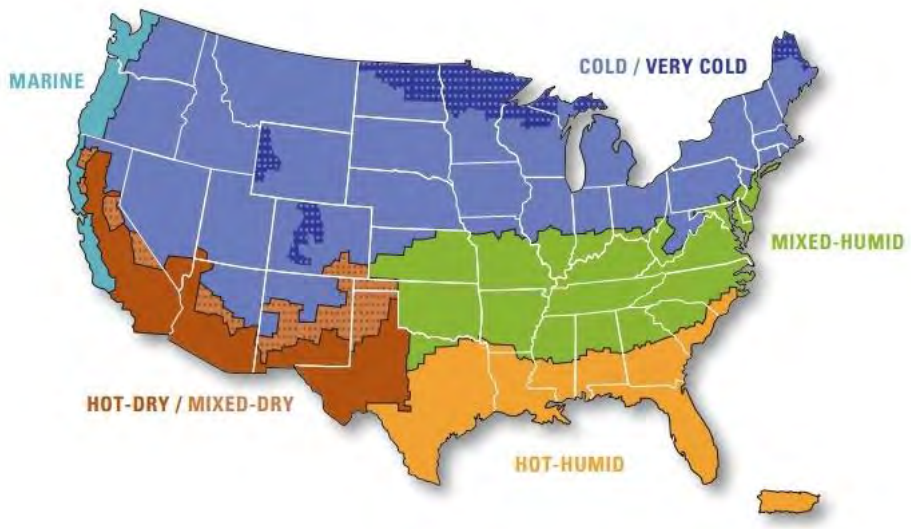

Figure 1. Climate Zone Map, BACG

Further analysis and comparison of several aspects of data between the two regions was conducted using 2009 data from the Residential Energy Consumption survey (RECS). The two regions being compared are Wisconsin and the Intermountain West (which comprises Idaho,

Montana, Utah, and Wyoming). Idaho-specific data was not available due to population and sample size. Table 5 below, shows the similarity in the number of homes in these two regions.

Table 5. Home Comparisons, RECS

Home Data	Intermountain West	Wisconsin
Total square footage	4.3 billion	5.9 billion
Total number of homes	2 million	2.3 million
Square feet per home	2,150 square feet	2,565 square feet

The following graphs show the year of construction, number of levels, adequacy of insulation, and number of rooms in the homes. Some categories are empty because the data had high relative standard error or no cases were reported in the sample. Of these four characteristics, the year of construction is visually the most different. This could be attributed to the earlier development of Wisconsin and the growth of the Intermountain West in the last 30 years. The age of the homes is also reflected in the adequacy of insulation. The graphs show a slight advantage in well insulated and adequacy insulated homes in the Intermountain West and a slightly higher number of poorly insulated homes in Wisconsin. Looking at one story and two story homes, Wisconsin has a more even distribution of the two types of homes but both regions favor single story homes. These data are reflected in the number of rooms in a home, with more two story homes and four or five room homes in Wisconsin.

Considering this data, it can be concluded that the two regions are similar enough to apply the ECW study data and developed models to Idaho-specific weather data and produce credible results.

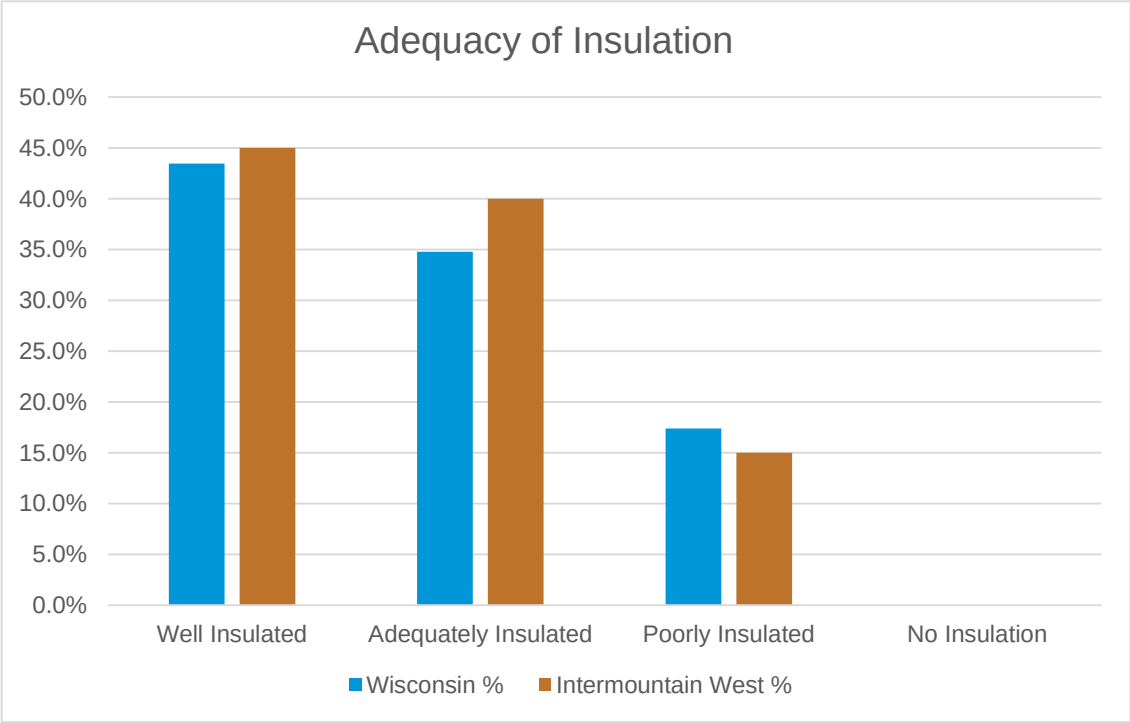

Figure 2. Adequacy of Insulation

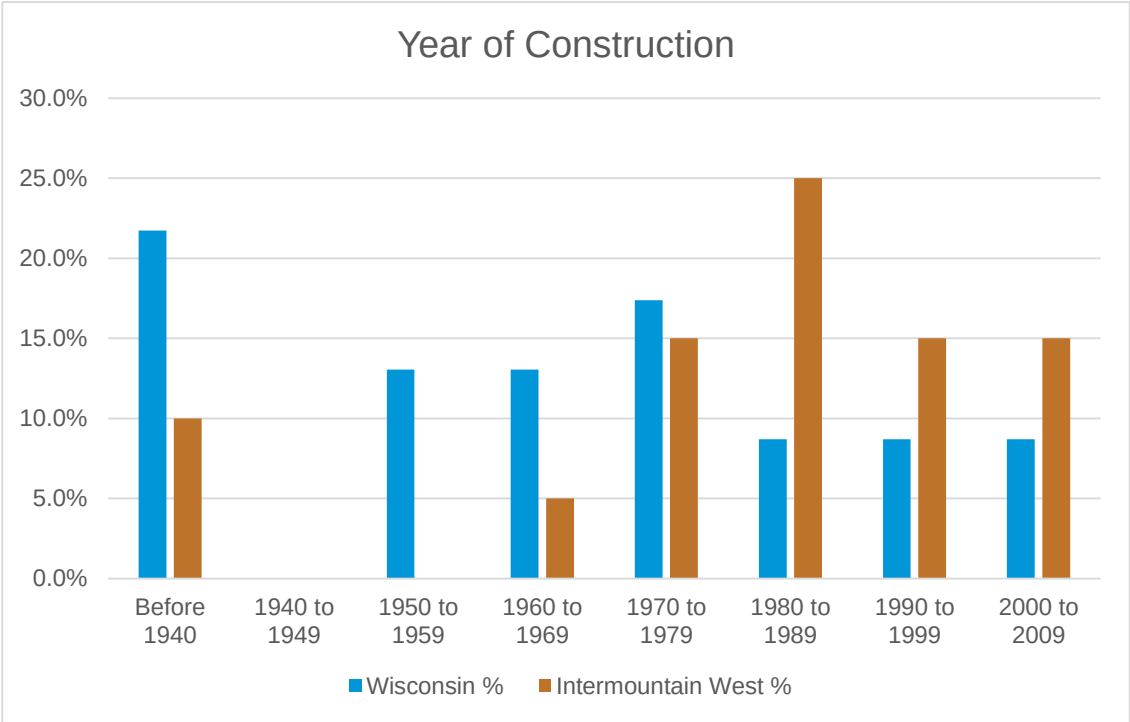

Figure 3. Year of Construction

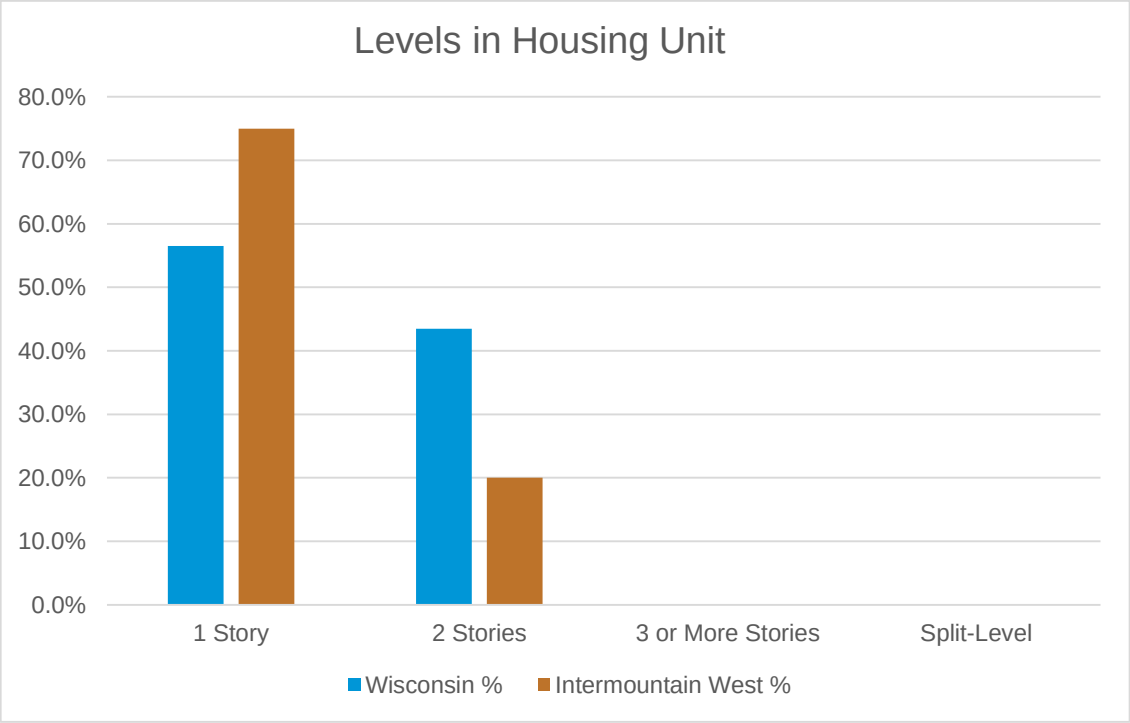

Figure 4. Levels in Housing Unit

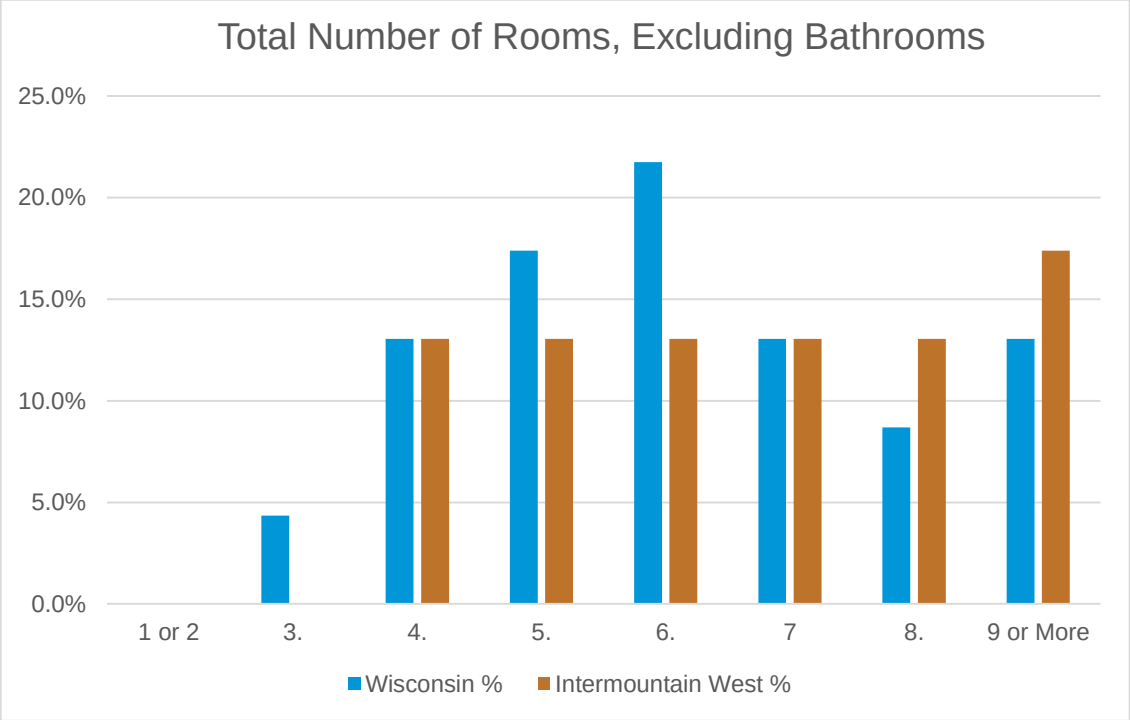

Figure 5. Total Number of Rooms

5.2 Adaption of the Energy Center of Wisconsin Study

The 2003 study from the Energy Center of Wisconsin was used as a basis to determine run time hours in heating, cooling, and fan-only mode. The methods from this study were replicated and Boise weather was used. The weather used was 30 year average typical meteorological year, third generation (TMY3) from the Boise airport weather station. This study included 32 sites: 14 sites had furnaces equipped with constant air flow ECMs and 18 sites had PSC motors. With regard to the run time analysis being performed, the blower type is not of concern. This analysis is focused on determining the run time hours of the blower in heating, cooling, and fan-only mode.

5.2.1 Methods, Wisconsin Study

The Energy Center of Wisconsin used a combination of short term reading, longer term logging, and annual modeling to determine findings. A heating and cooling model was developed for each site studied. Using the longer term logging data, home balance points and curves were developed based on heating and cooling degree days. These curves, along with the cycle times in different modes, were used to apply annual weather data to calculated run time hours. The Wisconsin study looked at a wide range of aspects of furnace operation from run time in each operational mode to energy savings of constant air flow ECMs over PSC motors. The UI-IDL investigation looked only at run time hours in heating, cooling, and fan-only mode. To determine the cooling hours of operation, a logistical model was developed in an attempt to explain the discretionary nature of air conditioner use. For example, if a balance point of a home is determined to be 67 F, the probability of the home owner using air conditioning at an

outdoor temperature of 75 F is less than it is at 85 F. Detailed methods can be found in the Wisconsin study documents.

5.2.2 Run Time Results, Wisconsin Study

Table 6 below shows the run time hour comparison between the original Wisconsin study and the same models using Boise, Idaho weather data reported as the average value of all sites. The fan-on mode lists the hours excluding the hours of operation of the blower if it was in heating or cooling mode. For any one site the heating, cooling, and fan hours should equal 8,760; however, because average values are being reported, the three modes do not total 8,760. Also, in Table 6 below, the cooling hours are reported in two ways: with and without the probability model that was discussed in the methods section above. More discussion about this methodology will follow in Section 6.

Table 6. Run Time Results

	Heating Hours (Average)	Cooling Hours (Average)	Fan-on Mode (Average)
Wisconsin Study – Wisconsin Weather	1,090	290	7,400
Wisconsin Study – Boise Weather	790	410, 682 (no probability model)	7,560

5.3 Analysis of Idaho Residential Economizer Data

The UI-IDL conducted IPC-sponsored research in the summers of 2011 and 2012. This research was focused on energy saving aspects of residential economizers fitted onto residential split systems (Acker, et al., 2012). While this research was not specifically focused on

fan run time, data were collected on fan power use and from these data run time can be determined.

5.3.1 Methods, Idaho Residential Economizer Data

Several aspects of residential air conditioning systems were recorded for the 2011 / 2012 residential economizer study. See the references section of the 2012 report from Acker, et al. for a complete description of this study. Data were collected on average fan-power levels over 15 minute intervals then converted into fan run time by taking the 15 minute average energy draw, in kWh, and dividing this by the maximum fan power recorded over the total logging period, in kW. This resulted in an hour value of fan run time on a 15 minute basis. Only data that were in the baseline condition of the original residential economizer study were used. This fan run time was summed over the entire logging period. Not all homes were logged for the exact same amount of time. From the data analyzed, the shortest logging period was 18 days and the longest was 113 days, with an average of 56 days. A metric of fan hours per day was developed because of this difference in logging intervals. The cooling season in Boise, Idaho was determined to be from May 1 to September 30, or 152 days. This season was determined by reviewing the residential economizer data and TMY3 weather data. The value for fan hours per day was than multiplied by the days in the cooling season. Other more complicated methods involving regressions of fan run time with OAT were possible. This simple method is valid due to the sample size and coverage of early, middle, and late cooling season, which makes the average fan hours per day more accurate than if data were collected in only one part of the cooling season. A total of 1,973 days of data were analyzed covering 35 homes.

5.3.2 Run Time Results, Idaho Residential Economizer Data

Idaho residential economizer data focused only on the cooling season; therefore, no data was reported with regard to heating fan use. Converting 15 minute average power data into fan run time per day was the first step in this process.

Figure 6 below shows these values.

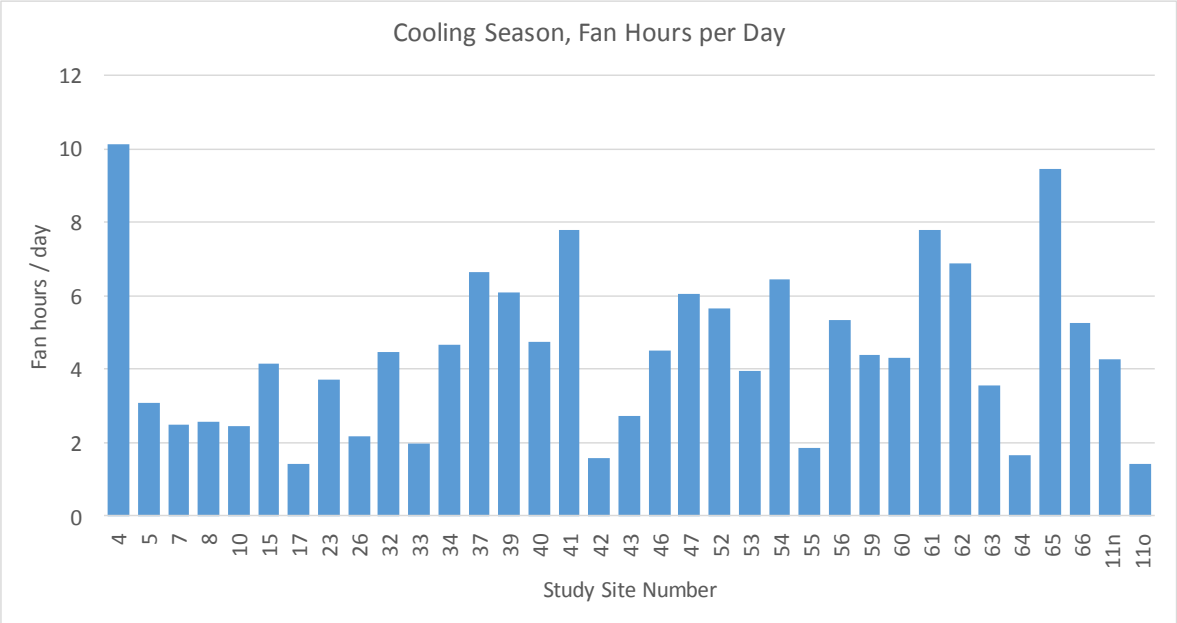

Figure 6. Cooling Season, Fan Hours per Day

After the determination of the fan hours per day, each site was multiplied by the length of the cooling season, resulting in an average fan run time of 676 hours. Figure 7 below shows the values for each site.

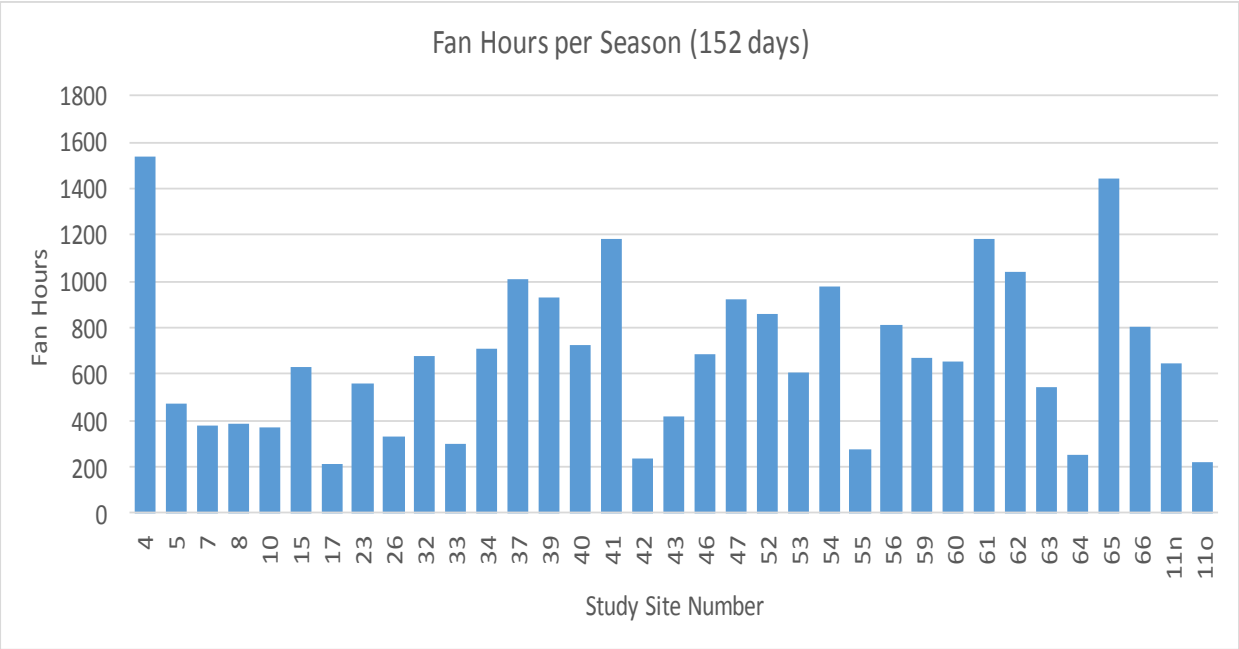

Figure 7. Fan Hours per Season

6. Conclusion

Table 7 below summarizes the studies that were modified or data mined to help determine the fan run time hours for a residential split system. The original Wisconsin study was supplied as a reference point. The Idaho residential economizer study is limited by its ability to supply data only on cooling hours. It is now clear why the Wisconsin study presented data both with and without the probability model. The probability model used was very logical in that it attempted to model the discretionary nature of air conditioning use in Wisconsin during the cooling season. It is possible that the use of air conditioning is less discretionary in Idaho because of the greater number of cooling degree days. Wisconsin has a 91 day cooling season as reported the Pigg report, while a 152 day season was used for Boise, Idaho. While the Wisconsin study did not limit the calculation of cooling hours based on a range of dates, when

the average fan hours per day from the Idaho study were used with a 91 day cooling season, the values matched very closely.

Table 7. Final Comparisons

	Heating Hours (Average)	Cooling Hours (Average)	Fan-on Mode (Average)
Wisconsin Study – Wisconsin Weather	1090	290	7400
Wisconsin Study – Boise Weather	790	410, 682 (no probability model)	7560
Idaho Residential Economizer Data	N/A	676 (152 day season) 404 (91 day season)	N/A

7. References

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INTEGRATED DESIGN LAB
University of Idaho

2014 Task 3: Fall Educational Series

"Design Decisions and Outcomes"

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_003-01

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Acronyms and Abbreviations

AIA	American Institute of Architects
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
Elec.	Electrical
EUI	Energy Use Intensity
HSW	Health, Safety, and Welfare (AIA continuing education unit distinction)
HVAC	Heating, Ventilation, and Air Conditioning
ICEA	Insulated Cable Engineers Association
IDL	Integrated Design Lab
IESNA	Illuminating Engineering Society of North America
IPC	Idaho Power Company
LEED	Leadership in Energy & Environmental Design
ME	Mechanical Engineer(ing)
Mech.	Mechanical
NCQLP	National Council on Qualifications for the Lighting Professionals
PDH	Professional Development Hour
RESNET	Residential Energy Services Network
ROI	Return on Investment
UI	University of Idaho
ULI	Urban Land Institute
USGBC	U.S. Green Building Council

1. Overview

The University of Idaho – Integrated Design Lab (UI-IDL) 2014 Fall Lecture Series, titled "Design Decisions and Outcomes," included four presentations at the Idaho Power Company's headquarters in downtown Boise, Idaho. These presentations attracted 92 total online and in-person participants. The series focused on energy efficient building projects from a variety of viewpoints including development, architectural, mechanical design, and daylighting. Based on feedback from previous programs, local speakers were scheduled for three of the four sessions. Two sessions included panels of three local speakers each, and one session had one local speaker, for a total of seven local speakers. One session was presented by a regional expert. The UI-IDL enlisted Ken Baker, a local building efficiency expert, to take the lead role in planning and facilitating the sessions.

Although the timeline was short due to a late decision to move forward with the lecture series, marketing was executed through multiple avenues. Five hundred flyers were printed and distributed, including hand-delivery to more than 15 local architecture and engineering firms. Organizations including the local AIA and ASHRAE chapters were notified of the events and were asked to announce them at their regular meeting or distribute the details to their members. Email advertisements were sent to the UI-IDL distribution list and a digital flyer was sent to participants of any UI-IDL educational event in the three months prior to the final event. A similar flyer was used for both hard copy and digital distribution: the hard copy version is shown below in Figure 1.

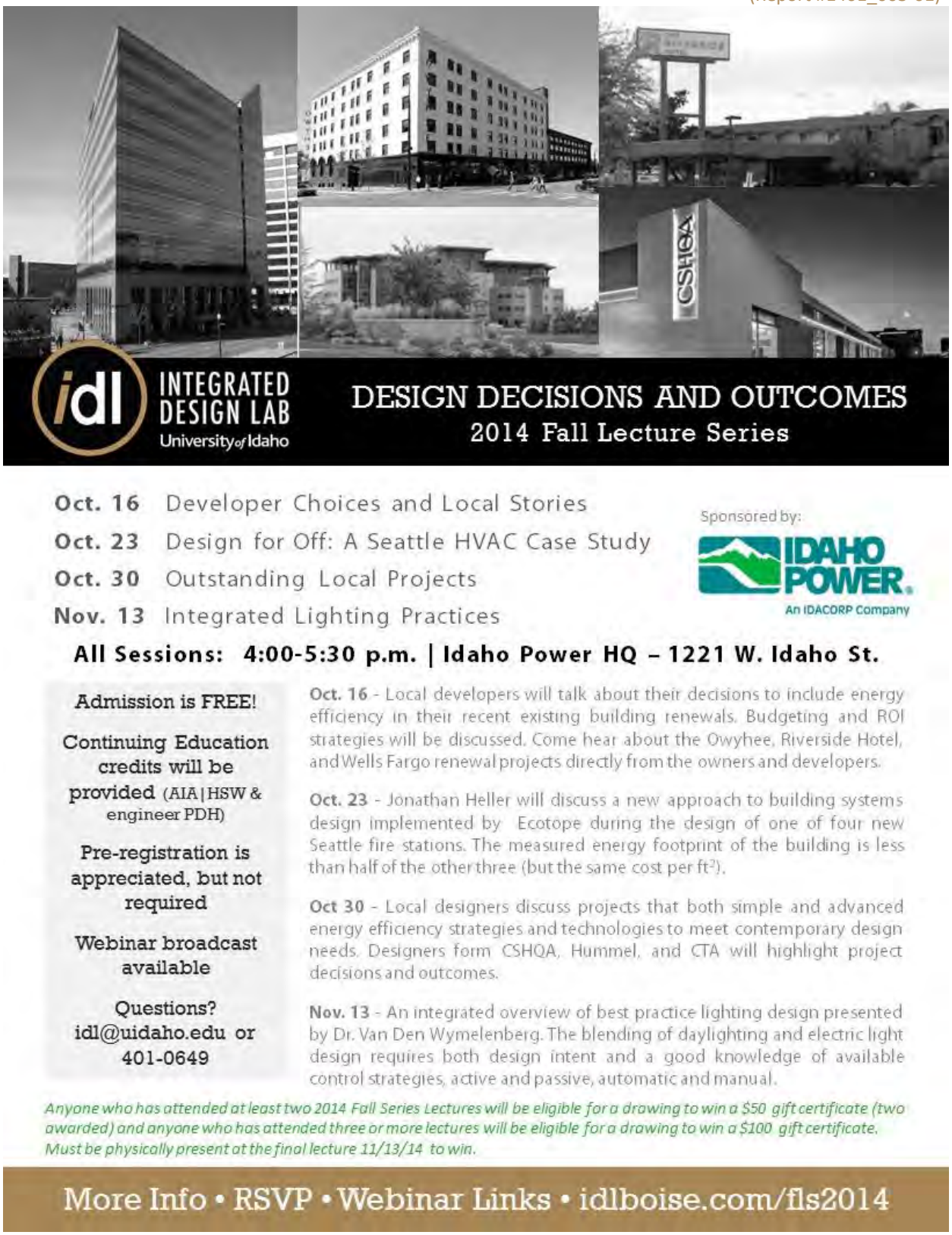

Figure 1: Marketing Materials

All four sessions were broadcast via live webinar and were recorded. The UI-IDL executed all audio and video requirements. Recordings were uploaded to a UI-IDL specific YouTube® Channel, and had 42 total views through 2014.

Each speaker received high approval ratings on the evaluations collected from both online and in-person attendees. Evaluation responses are detailed in this report.

2. 2014 Summary and Cumulative Analysis

Table 1: Overall Summary of Sessions

Date	Title	Presenter(s)
10/16	Energy Efficient Development Projects	Coby Barlow (Oppenheimer Development Corp.) David Ruby (Erstad Architects) David Johnson (Riverside Hotel)
10/23	Design for Off: A Seattle HVAC Case Study	Jonathan Heller (Ecotope)
10/30	Energy Efficient Architectural Projects	Gunnar Gladics (Hummel Architects) Tim Johnson (CTA Architects Engineers) Russell Pratt (CSHQA)
11/13	Integrated Lighting Practices	Kevin Van Den Wymelenberg (UI-IDL)

Table 2: Overall Attendance Breakdown

Architect:	28	Electrician:	
Engineer:	5	Contractor:	1
Mech. Engineer:	15	Other:	16
Elec. Engineer:	1	None Specified:	26
Total (In-Person):	**69**		
Total (Online):	**23**		
Total (Combined):	**92**		

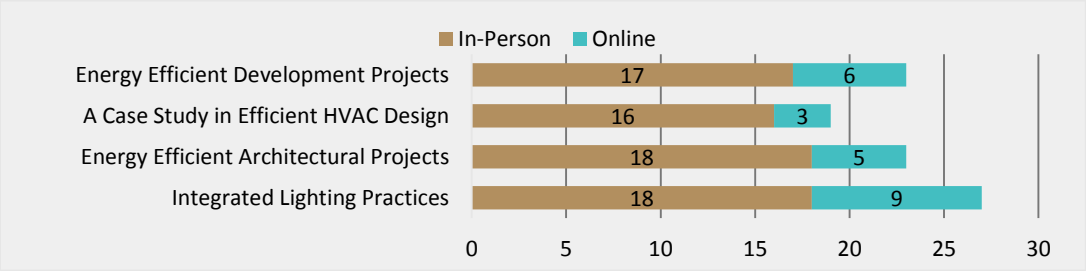

Figure 2: Attendee Count by Session and Type

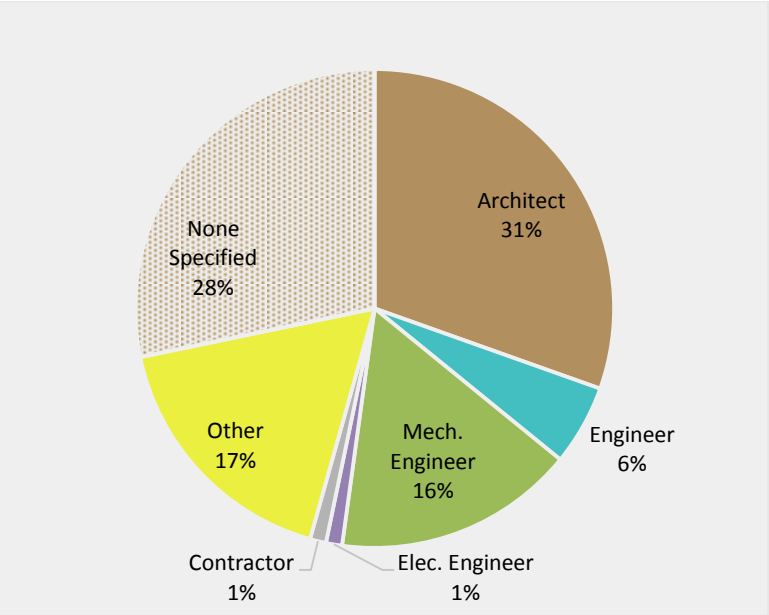

Figure 3: Attendee Profession Breakdown

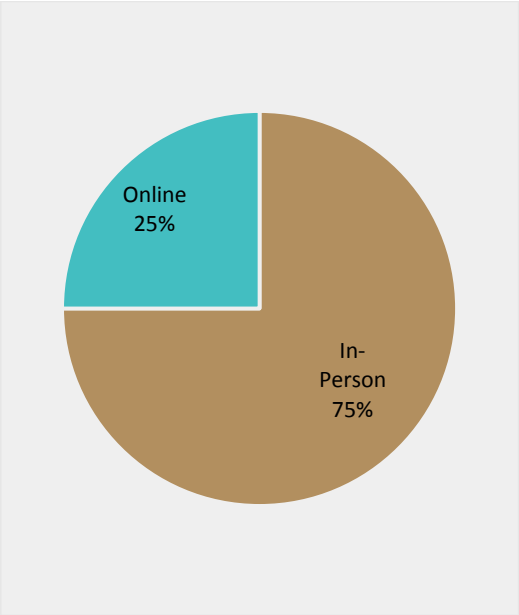

Figure 4: Attendee Type Breakdown

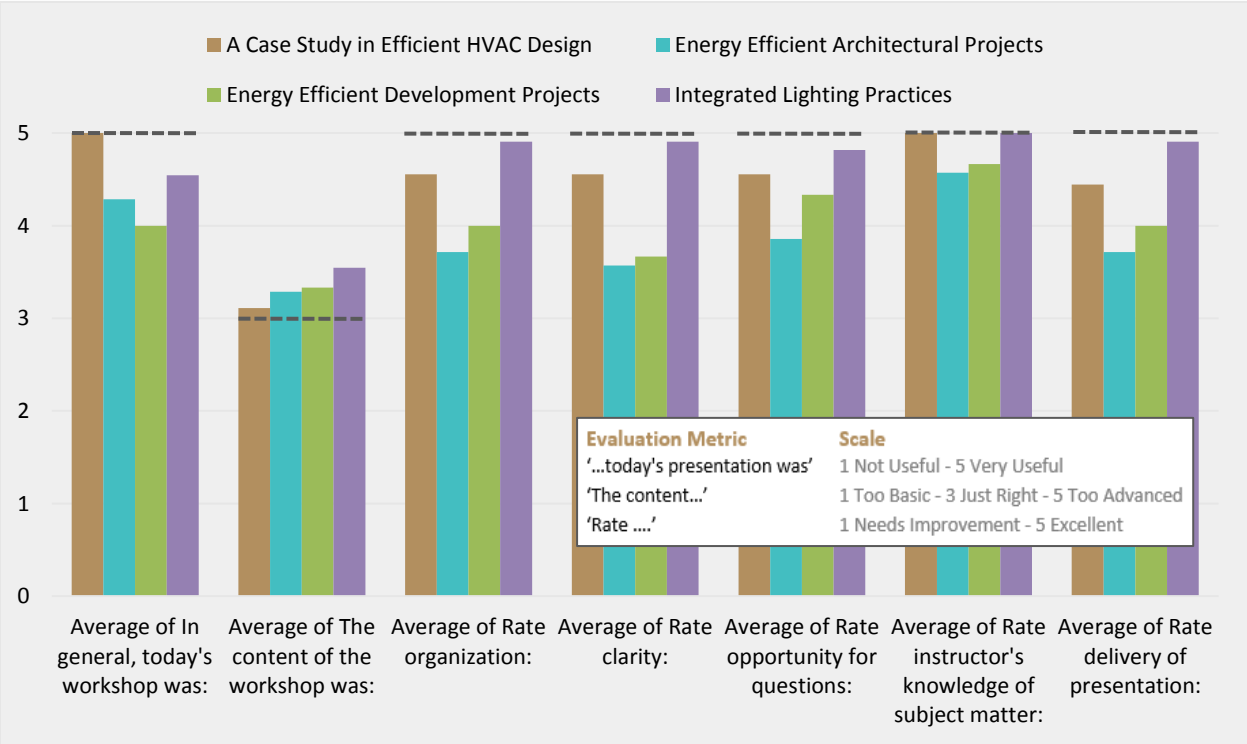

Figure 5: Average Evaluation Scores by Session

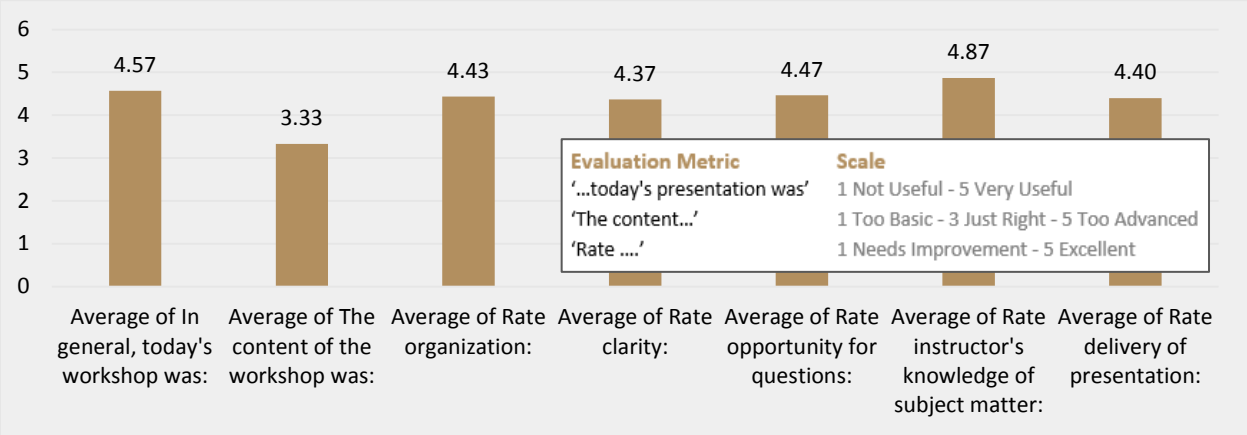

Figure 6: Average Evaluation Scores for all Sessions

3. Session Summaries

At the conclusion of each Fall Lecture Series session, an evaluation form was requested from each participant. The feedback was used to improve future sessions. Below are summaries of the feedback received from the evaluation forms, session information with original descriptions, and attendance counts. It should be noted that comments recorded from evaluations have not been edited in most cases; many appear exactly how the participant entered them online or how they were interpreted for translation from hand-written forms.

3.1 Session 1: Energy Efficient Development Projects (10/16/14)

Title: Energy Efficient Development Projects

Description: Three prominent developers will highlight recent retrofits done with a focus on energy efficiency. Coby Barlow from Oppenheimer Development Corporation will be presenting the strategic approach he has taken to upgrade the Wells Fargo Center over time, with major changes still in the works. Featuring low hanging fruit and operational changes plus analysis used to determine large capital upgrades—and how this affects tenants. Clay Carley recently completed the renovation of The Owyhee and will be discussing how he balanced energy conservation with other priorities. How does one juggle a tight upfront budget with a long-term vision for a good ROI? David Johnson has been making major changes to The Riverside Hotel to save energy. How to enhance guest experience while reducing operating costs and maintenance demands. (NOTE: Clay Carley was unavailable to present on The Owyhee. David Ruby, the design architect on the project, spoke in his place).

Presentation Info:

Date:	10/16/2014
Location:	Idaho Power Headquarters Building
Presenters:	Coby Barlow – Oppenheimer Development Corp. – Wells Fargo Center David Ruby – Erstad Architects – The Owyhee David Johnson – The Riverside Hotel

Attendance:

Architect:	11	Electrician:	
Engineer:	1	Contractor:	1
Mech. Engineer:	1	Other*:	3
Elec. Engineer:		None Specified:	6
Total (In-Person):	**17**		
Total (Online):	**6**		
*Other included:	City of Boise, building management, IPC programs		

Evaluations:

		Scale
In general, today's presentation was:	**4.0**	1 Not Useful - 5 Very Useful
Rate organization:	**4.0**	1 Needs Improvement - 5 Excellent
Rate clarity:	**3.7**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.3**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.7**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.0**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.3**	1 Too Basic - 3 Just Right - 5 Too Advanced
# of Evaluations:	**3**	

Comments:

What attendees found most valuable:

- Update on projects
- Postmortem of completed project challenges.

Professional associations of which attendees are members:

- RESNET, Home Innovation Research Lab, Efficiency First
- AIA, USGBC

Other types of training attendees would find useful:

- Start at 4:30 instead of 4pm.

How the online attendees heard about the webinar:

- ICEA email
- IDL e-mail notice

How was the audio quality of the webinar?

- A little sketchy but probably on my end....
- Fine

How was the video quality of the webinar?

- A little sketchy but probably on my end....
- Fine

3.2 Session 2: Design for Off: A Seattle Case Study in Efficient HVAC Design (10/23/14)

Title: Design for Off: A Seattle Case Study in Efficient HVAC Design

Description: The last 30 years have seen some significant changes in the technologies and techniques used in creating new commercial buildings. While this has included significant strides in the energy efficiency and performance of lighting systems, window glazing, building insulation, and HVAC equipment efficiencies, this has not translated to consistently high performing buildings. Typical new buildings are using nearly the same energy use per square foot as buildings built in the 1980s. This presentation seeks to demonstrate how it is possible to meet the ambitious goals of the 2030 Challenge in commercial buildings - Net Zero Energy by the year 2030. To do this we will present lessons from our experience auditing typical new buildings as well as from our successful design experience producing buildings that are meeting the 2030 Challenge. From these case studies of real buildings we will pull out the essential ingredients to produce highly energy efficient buildings. This points to a new approach to building systems design which we call "Design for Off."

Presentation Info:

Date:	10/23/2014
Location:	Idaho Power Headquarters Building
Presenter:	Jonathan Heller

Attendance:

Architect:	8	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	4	Other*:	3
Elec. Engineer:		None Specified:	4
Total (In-Person):	**16**		
Total (Online):	**3**		
*Other included:	IPC programs, facilities management, energy consultant		

Evaluations:

		Scale
In general, today's presentation was:	**5.0**	1 Not Useful - 5 Very Useful
Rate organization:	**4.6**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.6**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.6**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**5.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.4**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.1**	1 Too Basic - 3 Just Right - 5 Too Advanced
# of Evaluations:	**9**	

Comments:

Attendee suggested improvements for the instructor:

- Less intro stuff, more system depth!
- Only to add climate/geographic specific to this area.
- Can't think of any - great presentation! Thanks!
- More explanation on how these systems work.
- Acronyms, more explanation. I got most but forgot a few.
- Examples from a multitude of climate types.

What attendees found most valuable:

- Decentralize/decouple
- Good real world info
- Jonathan's 3 secrets!
- Found the comparison of EUIs of old buildings vs. new "efficient" buildings very interesting. Was also surprised to see how poorly some of the LEED buildings performed.
- Diversity of options covered and new vs. old building performance.
- The breakdown of systems and how that relates to EUI.
- Hard data, proof.
- The comparisons of building forms and types.

Professional associations of which attendees are members:

- AIA (3)
- USGBC (2)
- ASHRAE

Other types of training attendees would find useful:

- More on simplification of system decentralize.
- Matching space/use types with some of the options to drive home understanding.
- How do I find an ME in Boise who does this?
- Electrical design sustainability and loads.

How the online attendees heard about the webinar:

- School posting

3.3 Session 3: Energy Efficient Architectural Projects (10/30/14)

Title: Energy Efficient Architectural Projects

Description: During this session, architects from three local firms will each present one case study on energy efficient design. Each presentation will highlight the design strategies and technologies used to create high performance buildings and discuss the as-built performance and lessons learned.

Presentation Info:

Date:	10/30/2014
Location:	Idaho Power Headquarters Building
Presenters:	Gunnar Gladics – Hummel Architects Russell Pratt – CSHQA Tim Johnson – CTA Architects Engineers

Attendance:

Architect:	4	Electrician:	
Engineer:	3	Contractor:	
Mech. Engineer:	6	Other*:	3
Elec. Engineer:	1	None Specified:	6
Total (In-Person):	**18**		
Total (Online):	**5**		
* Other included:	IPC programs (2), marketing		

Evaluations:

		Scale
In general, today's presentation was:	**4.3**	1 Not Useful - 5 Very Useful
Rate organization:	**3.7**	1 Needs Improvement - 5 Excellent
Rate clarity:	**3.6**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**3.9**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.6**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**3.7**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.3**	1 Too Basic - 3 Just Right - 5 Too Advanced
# of Evaluations:	**7**	

Comments:

Attendee suggested improvements for the instructor:

- Did the presenters share each other's talks ahead of time?
- One presenter seemed a little scattered.

What attendees found most valuable:

- Practical stories
- Interesting results on thermal mass
- All subject matter. - Extremely viable.

Professional associations of which attendees are members:

- NCQLP, LEED AP, IESNA
- ASHRAE (2)
- AIA, urban land institute.

Other types of training attendees would find useful:

- Great subject/dialogue, would encourage more!

How the online attendees heard about the webinar:

- Email
- U of I IDL email

3.4 Session 4: Integrated Lighting Practices (11/13/14)

Title: Integrated Lighting Practices

Description: This session provides an integrated overview of best practice lighting design. The blending of daylighting and electric light design requires both design intent and a good knowledge of available control strategies passive and active, automatic and manual. The session is based on the body of work of Dr. Van Den Wymelenberg and includes a view of the new LEED daylight metrics and the Daylight Pattern Guide.

Presentation Info:

Date:	11/13/2014
Location:	Idaho Power HQ
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	5	Electrician:	
Engineer:	1	Contractor:	
Mech. Engineer:	4	Other*:	7
Elec. Engineer:		None Specified:	10
Total (In-Person):	**18**		
Total (Online):	**9**		
* Other included:	IPC Programs, facilities management, City of Boise, modeler, solar lighting distributor (Solatube), student, artist		

Evaluations:

		Scale
In general, today's presentation was:	**4.5**	1 Not Useful - 5 Very Useful
Rate organization:	**4.9**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.9**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.8**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**5.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.9**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.5**	1 Too Basic - 3 Just Right - 5 Too Advanced
# of Evaluations:	**11**	

Comments:

Attendee suggested improvements for the instructor:

- Well done!
- None- really good.
- None - excellent as always.
- Lots of info- need more time or break into sections. Want to know more about direction of new research and tech. especially daylight autonomy.

What attendees found most valuable:

- The necessity of varied solutions to finding the right amount
- very interesting metrics
- The pictures of how spaces looked with more/less daylight and kinds of light.
- Visualization of daylighting w/ energy metrics.
- The slide shows going through day in a space as lights go on and off. Very visual!
- All!
- Metrics comparison, qualitative discussion.

Professional associations of which attendees are members:

- IESNA
- USGBC (3)
- Land Trust of TV
- ASHRAE
- Idaho Clean Energy Association
- ULI
- AIA (2)

Other types of training attendees would find useful:

- Residential examples with the same content.
- I love these talks
- Software, how do you get the data out? How do you verify results?
- How to perform daylight analysis
- Software/tools - but not for the advanced.
- More regional or national speakers.

How the online attendees heard about the webinar:

- Email
- My Boss sent me an email with a variety of webinars

How was the audio quality of the webinar?

- A bit choppy but mostly in line with presenter
- Audio quality was very clear, only had one cut out.

How was the video quality of the webinar?

- Good
- Great!

2014 Task 5: Foundational Services

Summary of Projects

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_005-01

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Prepared for:
Idaho Power Company

Contract Number:
3094

Please cite this report as follows: Leichliter, K. (2014). *2014 TASK 5: Foundational Services – Summary of Projects* (1401_005-01). University of Idaho Integrated Design Lab, Boise, ID.

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Acronyms and Abbreviations

AIA	American Institute of Architects
ASHRAE	American Society of Heating, Refrigeration, and Air-conditioning Engineers
BEQ	Building Energy Quotient
BOMA	Building Owners and Managers Association
EMS	Energy Management System
HID	High Intensity Discharge
IDL	Integrated Design Lab
IPC	Idaho Power Company
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
Op-Ed	Opinion Editorial
TI	Tenant Improvement
UI	University of Idaho

1. Introduction

The University of Idaho Integrated Design Lab (UI-IDL) provided technical assistance in 2014 for energy efficiency building projects through the Foundational Services task. This program, supported by Idaho Power Company (IPC), offered three phases of assistance for customers to choose from. A marketing flyer outlining the three phases is shown below.

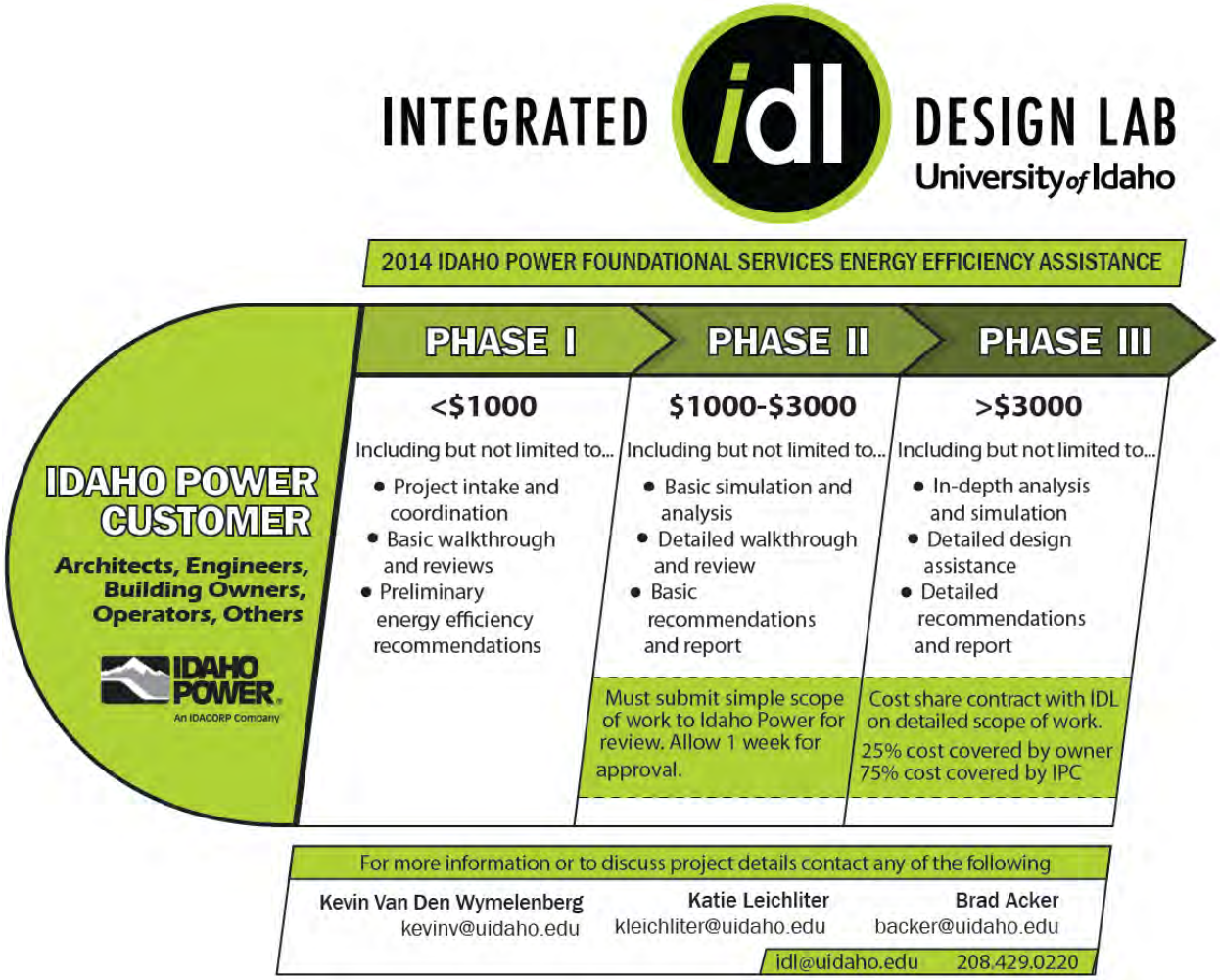

Figure 1: Foundational Services Flyer Outlining Phases

The Foundational Services program was marketed at numerous events and to multiple organizations in 2014, which included all IDL Lunch and Learn series presentations, local architect and engineering firms, ASHRAE, AIA, BOMA, and local government.

2. Project Summary

Forty-nine projects received technical assistance through the Foundational Services program. These ranged from short phone call consultations to detailed building simulations. Building owners, property managers, building operators, architects, design engineers, utility customer representatives, government staff, energy management staff, program administrators, and contractors contacted the IDL. The full list of projects is shown below. Details on Phase 2 and Phase 3 projects are included in the individual project reports submitted to IPC.

Table 1: 2014 Foundational Services Project Summary

	Project	Approximate Area (ft2) (if applicable and known)	New or Existing	Location
	Phase 1			
1	Multifamily project support and completion			
2	TI daylight recommendations			Boise
3	School incentive discussion	18,000		Sun Valley
4	Hotel strategic energy management meetings	308,000	Existing	Boise
5	Office high-rise preliminary discussions			
6	Benchmarking inquiry (BEQ)			
7	Community building incentive meeting	65,000	New	Boise
8	Cool-roof literature review			
9	Hotel EMS inquiry			
10	District energy research and presentation			Boise
11	LED vs HID inquiry			
12	Specialty facility energy efficiency measures	9,600	Existing	Boise
13	Industrial facility lighting upgrade inquiry		Existing	Jerome
14	Tenant sub-charging questions and research			
15	School building scoping study	55,845	Existing	Wilder
16	Industrial facility design assistance	300,000	New	Twin Falls
17	Idaho Code Collaborative meetings			Idaho
18	Office building preliminary meetings	22,000	Existing	Boise
19	Greenhouse gas emissions inquiry for high equipment load facility		Existing	Boise
20	Gymnasium lighting upgrade inquiry		Existing	Boise

21	Market lighting analysis		Existing	Boise
22	Office high-rise scoping study and night walk	96,000	Existing	Boise
23	Energy Management Systems general inquiry			
24	Weather station installation as high-rise			Boise
25	Health care facility design assistance	1,840,000		Boise
26	Residential and multifamily benchmarking inquiry			Idaho
27	Transit facility design assistance		New	Sun Valley
28	Industrial facility light tube inquiry		New	Boise
29	Call center design assistance	25000	New	Boise/Meridian
30	Community center preliminary discussion		Existing	Sun Valley
31	School preliminary discussions		Existing	Boise
32	Idaho Green Building Code stakeholders meetings			Idaho
33	Residential retrofit program design assistance		New	Boise
34	Building simulation support		New	Various
35	Education facility LEED support	38,000	New	Twin Falls
36	LED tube replacement inquiry			
37	Trailhead renovation - design assistance	20000	Existing	Boise
	Phase 2			
38	Lighting case studies (Op-Ed)			
39	Prospective net zero office building design support	100,000	New	TBD
40	Industrial facility lighting analysis	766,000	New	Boise
41	Office building design optimization	19,740	New	Boise
42	Athletic facility energy management support	336,400	Existing	Boise
43	Prospective net zero government building design assistance	13,000	New	Boise
44	Office building daylighting study	10,000	New	Idaho Falls
45	Health care facility daylighting study	3,200	New	Boise
46	Office high-rise model updates for daylighting and incentive support	290,000	Existing	Boise
	Phase 3			
47	Office building energy model iterations for retrofit design assistance	43,000	Existing	Boise
48	Education campus build-out energy analysis	825,000	New	Nampa
49	Office building energy model calibration for design assistance	300,000	New	Boise
	TOTAL:	**4,000,000+**		

2014 Task 10: Heat Pump Calculator

Summary of Progress

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_010-01

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Prepared for:
Idaho Power Company

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Acronyms and Abbreviations

ASHRAE	American Society of Heating, Refrigeration, and Air-conditioning Engineers
BTU	British Thermal Unit
BTUH	BTU/hour
COP	Coefficient of Performance
DCLF	Design Cooling Load Factor
DHI	Diffuse Horizontal Irradiance
DNI	Direct Normal Irradiance
Eff	Efficiency
E_G	Solar Radiation
ePlus	EnergyPlus
Eq	Equipment
eQUEST	Quick Energy Simulation Tool
EUI	Energy Use Intensity (kBtu/ft^2-yr)
GRR	Ground-Reflected Radiation
GSHP	Ground-Source Heat Pump
HePESC	Heat Pump Energy Savings Calculator

HP	Heat Pump
hr	Hour
HVAC	Heating, Ventilation, and Air Conditioning
IDL	Integrated Design Lab
IPC	Idaho Power Company
Misc	Miscellaneous
PVAV	Packaged Variable Air Volume
RTS	Radiant Time Series
SEER	Seasonal Energy Efficiency Ratio
TMY	Typical Meteorological Year
TRACE™	Trane Air Conditioning Economics
UI	University of Idaho
VRF	Variable Refrigerant Flow
WSHP	Water-Source Heat Pump

1. Introduction

The 2014 Heat Pump (HP) Calculator task was a continuation of work done by the University of Idaho Integrated Design Lab (UI-IDL) for Idaho Power Company (IPC) in 2013. A Heat Pump Energy Savings Calculator (HePESC) spreadsheet was developed in 2013 to compute hourly load calculations, energy consumption estimates using regression curves from simulation, and simple cost calculations. Details on the 2013 effort, progress, and methods are in the IDL technical report number 1301_010-01, "*2013 Heat Pump Calculator – Development and Methodology*." The 2014 scope of work focused on improving the tool by means of verification and user feedback. Details of these improvements are outlined in this report.

2. Initial Revisions

In 2014, troubleshooting and debugging edits were made including scripting and regression corrections. Two major enhancements were added to calculate the effect of radiant time delay based on the construction class chosen, and improvements to the glazing heat gain methods.

2.1 Radiant Time Series

The first major improvement added calculations to account for the radiant time delay following methods outlined in Chapter 18 of the 2013 ASHRAE Handbook of Fundamentals. The radiant time series (RTS) method was implemented using the recommended radiative/convective splits from Table 14 and the representative nonsolar RTS values for 50%

glass in Table 19, both from the 2013 ASHRAE handbook. These modifications dampened the HePESC results to more closely align with those of simulation software.

2.2 Glazing Solar Heat Gains

The second change was required to account for solar heat gain through fenestrations in the total building loads. Using methods outlined in the 2013 ASHRAE handbook, the hourly total solar radiation (E_G) was calculated in each of the possible surface directions, multiplied by the glazing area of the respective surface, and then summed. A RTS method was also applied to the glazing heat gains by using the representative solar RTS values for 50% glass in Table 20 of the handbook. This method was an improvement over the outdated Design Cooling Load Factor (DCLF) method previously used. The process of calculating E_G is detailed in Appendix A.

3. Tool Verification

The calculation methods and results were verified and validated by dual means. After the initial revisions were made, the tool was reviewed by an outside engineering firm and, separately, by the IDL through multiple simulation studies.

3.1 Third Party Verification

A local engineering firm was selected to administer an in-depth review and verification of the tool using one of its past projects on which a comprehensive building simulation had already been completed. The values in the simulation were input into the HePESC. The firm was provided with a copy of the HePESC, a template for comparing results from both the tool and the simulation, and an instruction and feedback memorandum.

The engineering firm chose to compare the results for a 73,000 ft^2, three-story office building for which they had a Trane TRACE™ model. The results from this comparison are in the following figures.

Peak Heating Load		
	HePESC	3rd Party Software
Total Btu/hr	1,093,536	1,045,021

Peak Heating Breakdown		
	HePESC	3rd Party Software
Envelope (Btu/hr)	291,048	215,045
Glazing (Btu/hr)	117,717	122,034
Ventilation (Btu/hr)	577,791	590,266
Infiltration (Btu/hr)	106,980	117,676

Peak Cooling Load		
	HePESC	3rd Party Software
Total Btu/hr (Btu/hr)	1,418,047	1,320,107

Peak Cooling Breakdown		
	HePESC	3rd Party Software
Envelope (Btu/hr)	93,813	103,702
Glazing (Btu/hr)	393,982	292,959
Ventilation (Btu/hr)	205,654	198,843
Infiltration (Btu/hr)	38,078	38,321
People (Btu/hr)	77,850	77,614
Lights (Btu/hr)	422,458	422,456
Plug Loads (Btu/hr)	186,212	186,212

Figure 1: Load Results Comparison between HePESC and Third Party Software

Baseline System Efficiency Input		
	HePESC	3rd Party Software
HVAC Type	5-PVAV	5-PVAV
SEER	-	-
COP - Cooling	3	3
Therm Eff	0.8	0.8

Proposed System Efficiency Input		
	HePESC	3rd Party Software
HVAC Type	WSHP	WSHP
SEER	-	-
COP - Cooling	3.52	3.52
COP - Heating	4.2	4.2
Therm Eff	0.8	0.8

Figure 2: HVAC Definition Inputs Comparison

EUI Comparison		
	HePESC	3rd Party Software
Baseline EUI	66.03	
Proposed EUI	55.36	48.98
EUI Savings	10.67	-48.98

Baseline EUI Breakdown			% Difference
	HePESC	3rd Party Software	3rd Party to HePESC
Lighting (kBtu)	1,366,588	1,353,910	99%
Plug Loads (kBtu)	883,370	850,673	96%
Heating Energy (kBtu)	629,678	559,596	89%
Heating Misc Eq Energy (kBtu)	82,955	112,971	136%
Cooling Energy	1,120,135	190,984	17%
Cooling Misc Eq Energy (kBtu)	737,529	12,451	2%
Total	**4,820,255**	**3,080,585**	**64%**

Proposed EUI Breakdown			% Difference
	HePESC	3rd Party Software	3rd Party to HePESC
Lighting (kBtu)	1,366,588	1,353,910	99%
Plug Loads (kBtu)	883,370	850,673	96%
Heating Energy (kBtu)	206,478	212,995	103%
Heating Misc Eq Energy (kBtu)	49,960	181,220	363%
Cooling Energy	1,075,118	527,869	49%
Cooling Misc Eq Energy (kBtu)	459,425	449,110	98%
Total	**4,040,939**	**3,575,777**	**88%**

Figure 3: HVAC Energy Results Comparison

The results showed fairly good agreement with the exception of the cooling energy and miscellaneous cooling equipment energy; and, in some instances, the heating energy. As outlined in the final report submitted by the outside firm, the engineers could not confirm the accuracy of the tool for heating or cooling loads because they were not confident the Trane TRACE™ software was modeling the heating and cooling energy correctly. The outside firm's report was submitted to IPC.

Other notable comments from the outside firm:

- Interface of the tool is very intuitive
- Tool offers a wide range of flexibility
- Top three strengths of tool:
    - Payback analysis
    - Little time required
    - Depth of information
- Greatest weaknesses of the tool:
    - Training could be useful for users
    - When comparing different systems, navigation between tabs is required to view results and change systems
    - Tool name HePESC is not descriptive for designers, would prefer something simpler such as 'Heat Pump Tool'
- Ventilation effectiveness ratio was left out of the tool, recommendation to include
- Glazing loads and energy consumption appeared to be the least accurate when compared to the Trane TRACE™ model
- Schedules have a large effect on results; HePESC schedules appeared more realistic than the other software, so comparison was made with both schedules matching those from HePESC
- The HePESC tool calculations assume a block load, but the Trane TRACE™ models zones separately

3.2 Simulation Studies

While the outside engineering firm was doing verification work, the IDL was simultaneously conducting internal simulation studies. Three existing building models were selected; each using one type of heat pump computable by the HePESC: water-source heat pump (WSHP), variable refrigerant flow (VRF), and air-source heat pump (ASHP). The same template was used to compare results from both the internal studies and the outside verification. An effort was also made to compare the baseline version of the simulations to the baseline results from the HePESC.

Interpreting results from the internal simulation studies was difficult for multiple reasons:

- The models were calibrated simulations and therefore included many more inputs and edits than an initial or first pass model would include.
- The EnergyPlus software had an abundance of possible outputs and it wasn't always clear whether the correct output or combination of outputs had been selected for comparison purposes.
- The simulations had multiple zones and the heat pumps had different efficiency ratings, so averages had to be used.

These complications resulted from the lack of options to edit the simulations. It was necessary to input identical values into both the simulation software and the HePESC tool to produce a useful simulation study. This method increased confidence for in-depth analysis of differing results.

An in-depth load analysis study compared the HePESC tool to both an EnergyPlus and an eQUEST simulation. The EnergyPlus small office reference building was used for the geometry and initial loads. Inputs for all three tools were adjusted to be identical and results were extracted for each contributing load including lighting, occupants, miscellaneous equipment, infiltration, and envelope. This process produced interesting data showing that the tools produced similar patterns even though their calculation methods differed. For example, when lighting loads were compared, the parameter pulled from EnergyPlus was simply the lighting power multiplied by the fraction schedule. The eQuest parameter included the effect of radiant time delay and only reported a load when the HVAC unit was in heating mode. Fortunately, it was possible to pull either parameter from the HePESC tool, and both showed alignment with the other software programs. The lighting results are shown in Figure 4. For all charts in Figures 5 through 10 the x-axis values represent weekly hours.

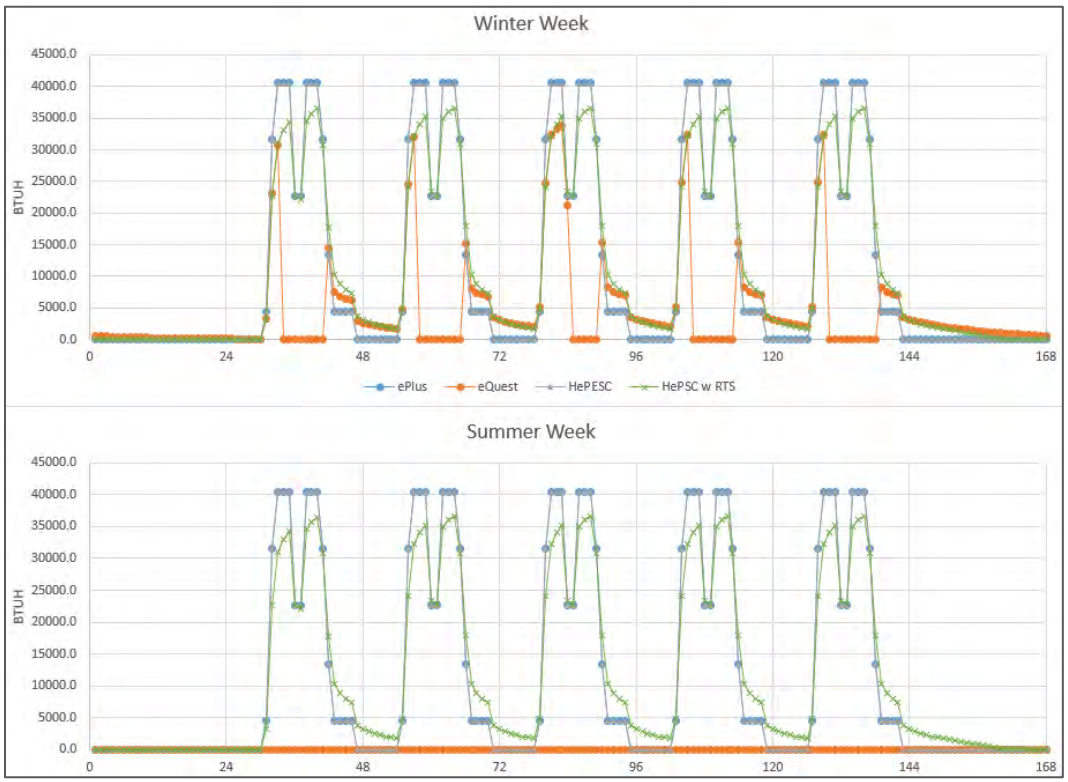

Figure 4: Lighting Loads Comparison in Winter and Summer

Other significant findings are listed here, but were not investigated further.

- The infiltration heat gains showed major discrepancies between the EnergyPlus and eQUEST models at times, specifically in summer (Figure 5).
- Solar heat gains from glazing varied significantly in summer as well (Figure 6), which could be partially explained by the differences in the interpretations of the weather files (Figure 7).
- The same weather TMY data was used in all three tools; however, different file formats are required for each, so the specific file may vary slightly.

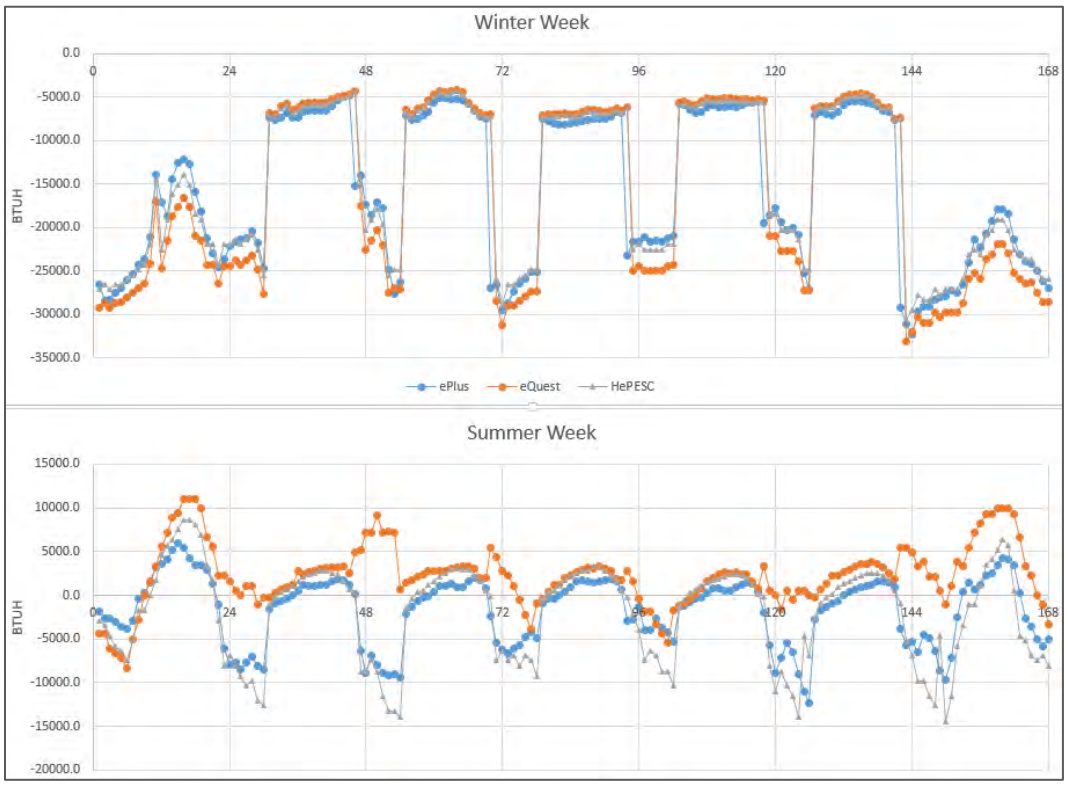

Figure 5: Infiltration Heat Gain Loads Comparison

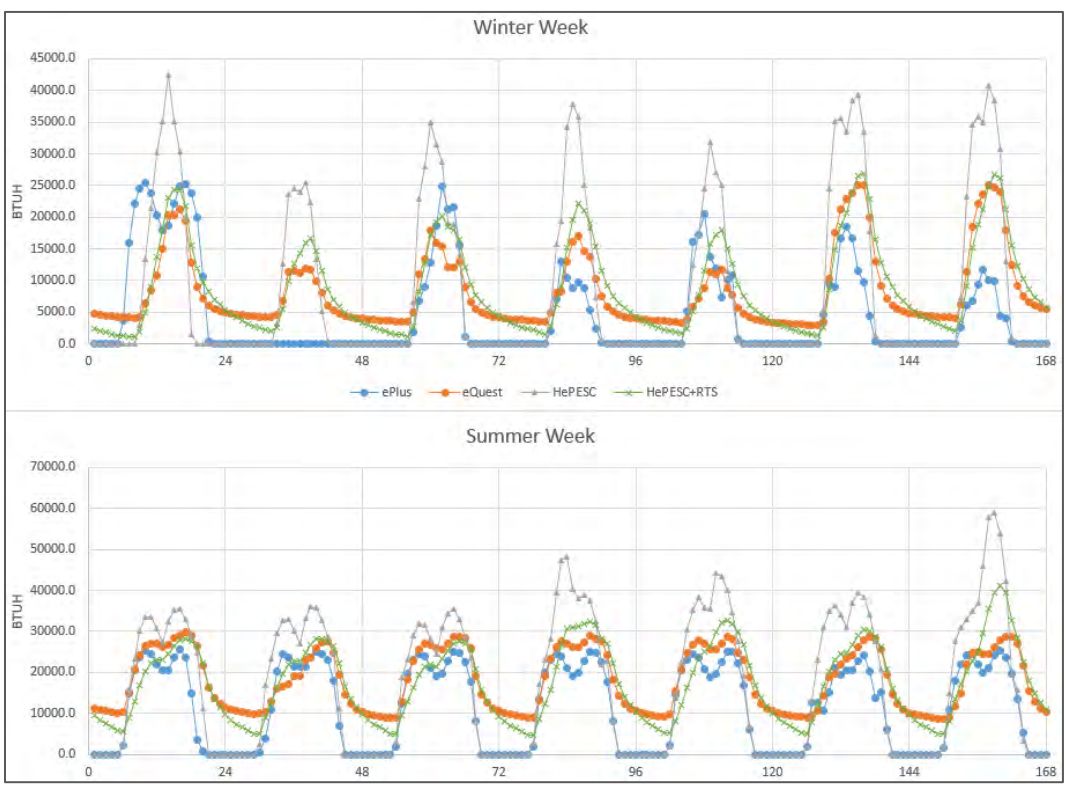

Figure 6: Glazing Solar Heat Gain Comparisons

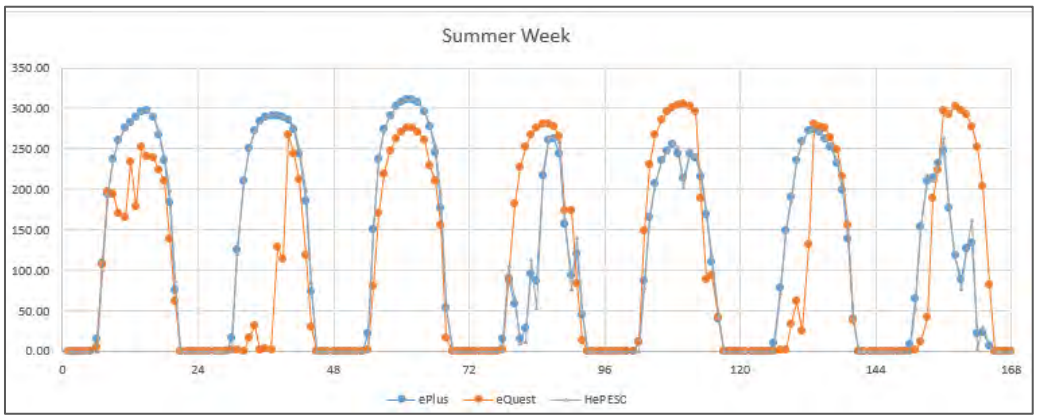

Figure 7: Direct Normal Irradiance (Btu/hr-ft^2) from Weather Files

During the simulation study, it was found that the HePESC zone temperature was always equal to one of the set-point or setback temperatures for heating or cooling. The temperature never floated between these points as it would in an actual environment. This was due to the method used for selecting whether the zone was in heating or cooling. A significant revision implemented a predicted load method, similar to that used by EnergyPlus. This required the loads to be calculated at both heating and cooling set-points so a type of interpolation could be applied to reach the zone temperature. Figure 8 shows the HePESC temperature floating in a similar manner to the other software results.

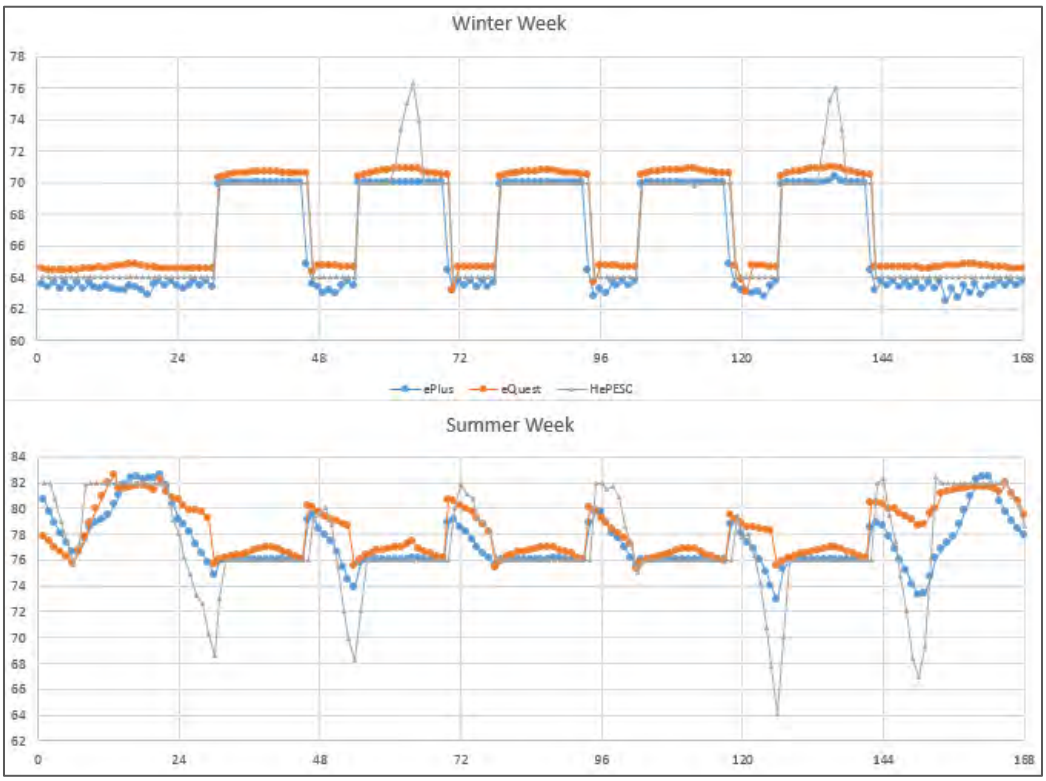

Figure 8: Zone Temperature (F) Comparisons after Tool Revisions

The total building loads were charted after the load components were reviewed and edits were made to improve agreement between methods. These are shown in Figure 9. The summer loads show more variation between tools, probably because of glazing and infiltration discrepancies mentioned previously. The significant variability in summer loads may also be due to differences in calculation methods. The energy consumption results shown in Figure 10 do not appear as would be expected from the load results in Figure 9. Figure 9 shows HePESC tracking more closely with the eQUEST results than the EnergyPlus results; however, Figure 10 shows that HePESC tracks more closely with EnergyPlus for the final energy consumption results. Since the consumption results for the HePESC remained near the bounds of the results from the other two programs, the project team deemed the methods and accuracy of the HePESC tool were acceptable.

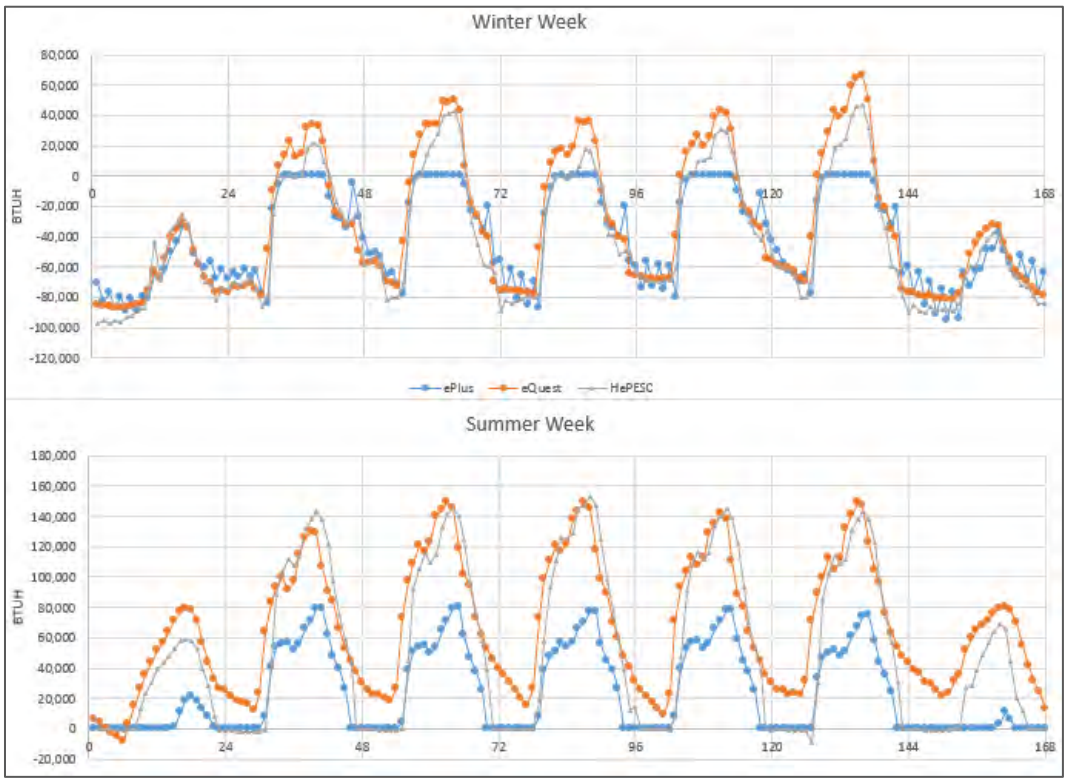

Figure 9: Total Building Loads Comparison

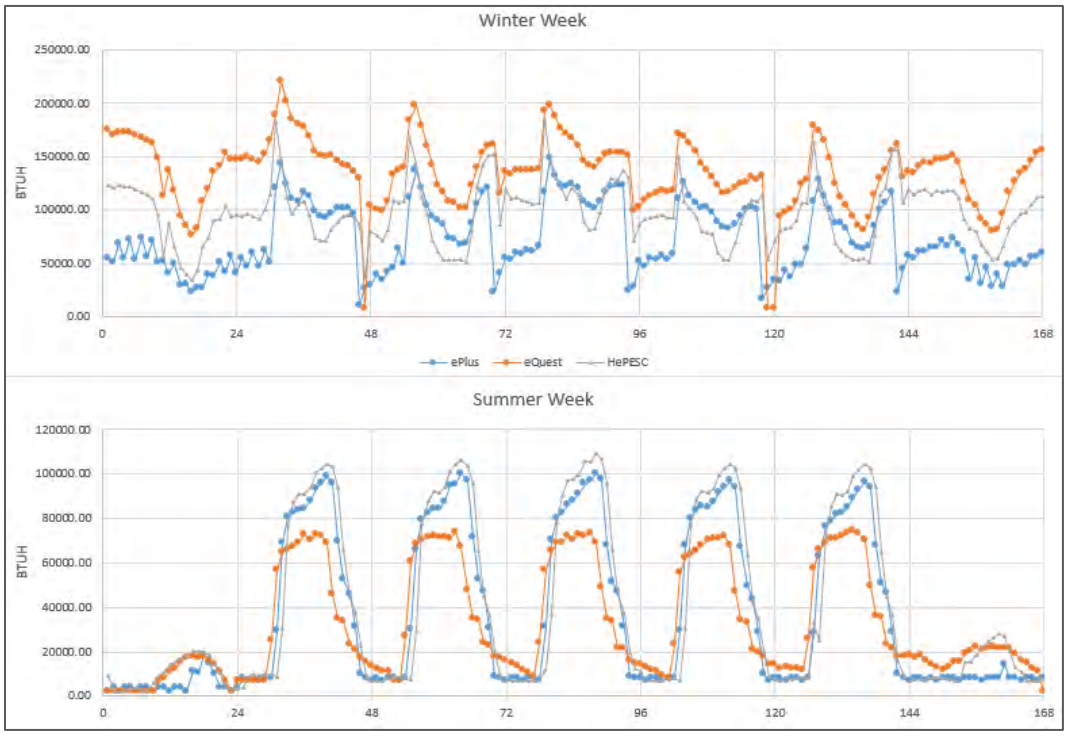

Figure 10: Energy Consumption Results Comparison

4. Training

A hands-on training session was held for Idaho Power staff after all calculation methods were finalized and the tool was updated. A brief presentation outlined the goals of the tool and shared some background information. Each attendee was provided a copy of the HePESC tool and was given a worksheet to use to test different features of the tool. Attendees were asked to track any bugs or glitches they found and share any recommendations they had to improve the tool. Feedback forms were collected and will inform future edits and improvements.

5. References

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6. Appendices

Appendix A: Glazing Solar Heat Gain Calculations

Total solar radiation, defined by Equation 1 below, is comprised of components of direct normal irradiance (DNI), diffuse horizontal irradiance (DHI), and ground-reflected radiation (GRR). Typically, ground-reflected radiation is considered negligible compared to DNI and DHI, so it was ignored for these calculations. It was possible to simply extract the DNI and DHI values directly using the TMY weather data previously integrated within the calculator. Finding the appropriate component of DNI to include for each of the surface directions required the majority of calculations, as it is dependent on the solar angle of incidence to the normal of the surface (θ).

Equation 1

$$E_G = DNI \times \cos\theta + DHI + GRR$$

E_G : total solar radiation W/m^2
DNI : direct normal radiation W/m^2
DHI : diffuse horizontal radiation W/m^2
Θ : solar angle of incidence to the normal of the surface *degrees*
GRR : ground-reflected radiation (assumed to be 0 for these calculations) W/m^2

The solar angle of incidence is the angle between the surface normal and the direct solar radiation and is dependent on multiple variables. Some variables change hourly or daily due to the rotation of the earth around the sun; others change based on surface location and tilt. The variables required to determine the angle of incidence are defined below. For variables not defined below refer to "*The Sun's Position*" or Masy's doctoral thesis, both listed as References in Section 6.

Equation 2

$$\delta = 23.45° \times \sin\left[\frac{360}{365} \times (j - 81)\right]$$

δ : solar declination (multiply by -1 for locations in the southern hemisphere) *degrees*
j : day of the year (1 ≤ j ≤ 365) *day*

Equation 3

$$\omega = 15°(LST - 12)$$

ω : hour angle *degrees*
LST : local solar time *hours*

Equation 4

$$\gamma_s = \sin^{-1}[\cos\omega\cos\varphi\cos\delta + \sin\varphi\sin\delta]$$

γ_s : solar altitude *degrees*
ω : hour angle *degrees*
φ : latitude *degrees*
δ : solar declination *degrees*

Equation 5

$$For\ 0 < LST \leq 12, \qquad \alpha_s = 180 + \cos^{-1}\left[\frac{\sin\gamma_s\sin\varphi - \sin\delta}{\cos\gamma_s\cos\varphi}\right]$$

$$For\ LST > 12\ or\ LST = 0, \qquad \alpha_s = 180 - \cos^{-1}\left[\frac{\sin\gamma_s\sin\varphi - \sin\delta}{\cos\gamma_s\cos\varphi}\right]$$

α_s : solar azimuth *degrees*
γ_s : solar altitude *degrees*
φ : latitude *degrees*
δ : solar declination *degrees*

Using these variables to define the vector components in each direction for the direct solar vector and the vector normal to the surface, the scalar product can be found and the

cosine of the angle of incidence (θ) can be calculated using Equation 6. Equation 7 shows the most simplified version of Equation 6 with all components included. Because the angle of incidence is dependent on the surface normal, it must be calculated separately for each surface azimuth (wall direction).

Equation 6

$$N \cdot S = N \times S \cos\theta$$

N : vector normal to the surface
S : direct solar vector
Θ : solar angle of incidence to the normal of the surface *degrees*

Equation 7

$$\cos\theta = -\cos\gamma_s \sin\gamma_t \cos(\alpha_s - \alpha_t) + \sin\gamma_s \cos\gamma_t$$

Θ : solar angle of incidence to the normal of the surface *degrees*
γ_s : solar altitude *degrees*
γ_t : slope of surface *degrees*
α_s : solar azimuth *degrees*
α_t : surface azimuth (south=0, east=-90, west=90, north=180) *degrees*

Equation 8 is used to determine the heat gain load. The global irradiance for each surface is multiplied by the area and solar heat gain coefficient of the fenestrations on that surface. When the cosine of the angle of incidence is less than zero, the DNI value will be zero because the DNI is only incident to the back side of the surface, which is not exposed for this application. This value can then be converted to Btu and added to the other loads within the tool Load Calculation Engine.

Equation 8

$$For\ cos\theta > 0, \qquad SHG = A_G \times SHGC(DNI\cos\theta + DHI)$$

$$For\ cos\theta < 0, \qquad SHG = A_G \times SHGC \times DHI$$

Θ : solar angle of incidence to the normal of the surface *degrees*
SHG : solar heat gain *W-hr*
A_G : glazing area m^2
SHGC : solar heat gain coefficient
DNI : direct normal radiation W/m^2
DHI : diffuse horizontal radiation W/m^2

2014 Task 2: Lunch and Learn

Summary of Effort and Outcomes

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_002-01

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3094

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DISCLAIMER

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Acronyms and Abbreviations

AIA	American Institute of Architects
AICHE	American Institute of Chemical Engineers
Arch	Architect(ure)
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
BICSI	Building Industry Consulting Service International
Bldg.	Building
BOMA	Building Owners and Managers Association
CSI	Construction Specifications Institute
DCV	Demand Control Ventilation
Elec.	Electrical
GSHP	Ground Source Heat Pump
HVAC	Heating, Ventilation, and Air Conditioning
IBOA	Intermountain Building Operators Association
IBPSA	International Building Performance Simulation Association
IDL	Integrated Design Lab
IDP	Intern Development Program (NCARB)
IECC	International Energy Conservation Code
IESNA	Illuminating Engineering Society of North America
IMP	Integrated Measures Package
IPC	Idaho Power Company
IREM	Institute of Real Estate Management
LEED	Leadership in Energy & Environmental Design
LED	Light Emitting Diode
M&V	Measurement and Verification
Mech.	Mechanical
Mgmt.	Management
MRT	Mean Radiant Temperature
NCARB	National Council of Architectural Registration Boards
RTU	Rooftop Unit
TAB	Testing, Adjusting, and Balancing
TBD	To Be Determined
UI	University of Idaho
ULI	Urban Land Institute
USGBC	U.S. Green Building Council

1. 2014 Summary and Cumulative Analysis

Table 1: 2014 Lunch and Learn Summary

	Date	Title	Presenter	Group / Location	Attendees
1	5/1	High Performance Retrofits	Ery Djunaedy	Architecture Firm 1 – Boise	3
2	5/13	Integrated Design Principles	Kevin Van Den Wymelenberg	Architecture Organization 1 – Boise	44
3	5/15	Integrated Design Principles	Jacob Dunn	Architecture Organization 2 – Pocatello	13
4	5/28	IDL Overview*	Katie Leichliter	Industry Organization 1 – Boise	25
5	6/3	Radiant System Design Considerations	Damon Woods	Engineering Firm 1 – Boise	15
6	6/5	IDL Overview*	Katie Leichliter	Government Organization – Boise	12
7	6/26	Daylight Sensing Electric Lighting Controls	Kevin Van Den Wymelenberg	Architecture Firm 2 – Boise	5
8	7/16	Climate Responsive Design - Tools & Methods	Katie Leichliter	Architecture Firm 1 – Boise	4
9	7/24	M&V + Tool Loan Library	Carlos Duarte	Engineering Firm 1 – Boise	12
10	8/14	Daylight Sensing Electric Lighting Controls	Kevin Van Den Wymelenberg	Architecture Firm 3 – Boise	7
11	8/26	Architectural HVAC Integration Strategies	Kevin Van Den Wymelenberg	Architecture Firm 2 – Boise	4
12	8/28	Architectural HVAC Integration Strategies	Kevin Van Den Wymelenberg	Engineering and Architecture Firm – Boise	34
13	9/9	High Performance Classrooms	Brad Acker	Architecture Firm 3 – Boise	7
14	9/17	Integrated Design Case Studies	Kevin Van Den Wymelenberg	Architecture Organization 2 – Pocatello	9
15	9/18	Daylight in Buildings - Schematic Design	Kevin Van Den Wymelenberg	Architecture Organization 3 – Ketchum	13
16	9/18	Daylight in Buildings - Getting the Details Right	Kevin Van Den Wymelenberg	Architecture Organization 3 – Ketchum	13
17	9/25	Integrated Design Case Studies	Kevin Van Den Wymelenberg	Engineering and Architecture Firm – Boise	37
18	10/15	High Performance Classrooms	Brad Acker	Architecture Firm 4 – Boise	6
19	12/18	Radiant System Design Considerations	Damon Woods	Architecture Organization 3 – Ketchum	18
20	1/29	Benchmarking, M&V, + Tool Loan Library**	Brad Acker	Industry Organization 2 – Chubbuck	20 expected

* This was a new topic in 2014.

** This session was moved to early 2015 due to scheduling conflicts. It was not complete at the time this report was written.

Table 1 above summarizes all Lunch and Learn presentations given in 2014. Eighteen presentations were slated to specific organizations or companies during the project planning phase of the task. Two additional sessions were left open to be filled by request. Nineteen sessions were held in 2014 and due to a scheduling conflict, one session was rescheduled for January 29, 2015.

The statistics in this section are cumulative for the first 19 presentations. The final session is scheduled for January 2015; therefore, the data for it is not included.

Table 2: Overall Attendance Breakdown

Architect:	173	Electrician:	
Engineer:	17	Contractor:	
Mech. Engineer:	15	Other:	25
Elec. Engineer:	6	None Specified:	37
Total (In-Person):	**273** + Session 20 attendance		

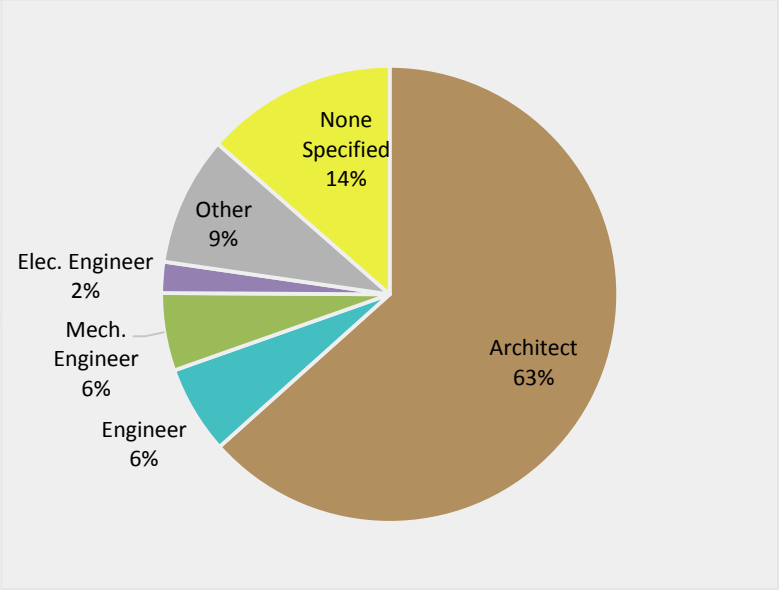

Figure 1: Attendee Profession Breakdown

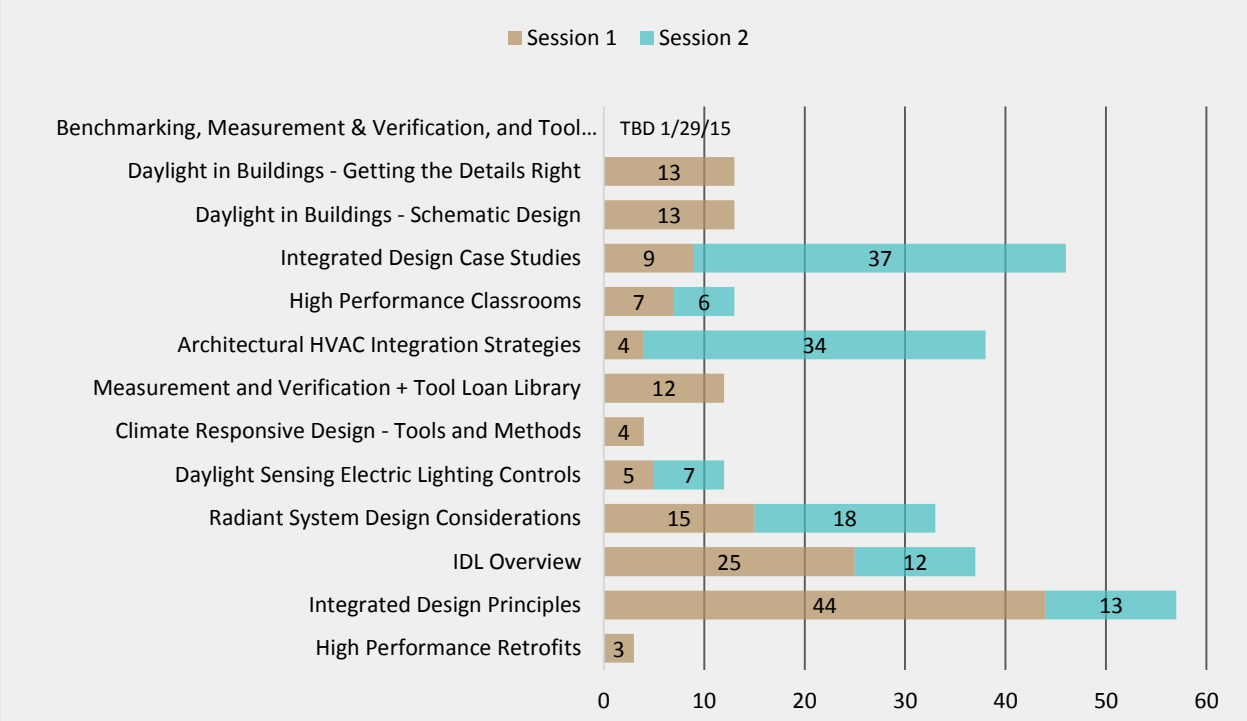

Figure 2: Attendee Count by Title and Session

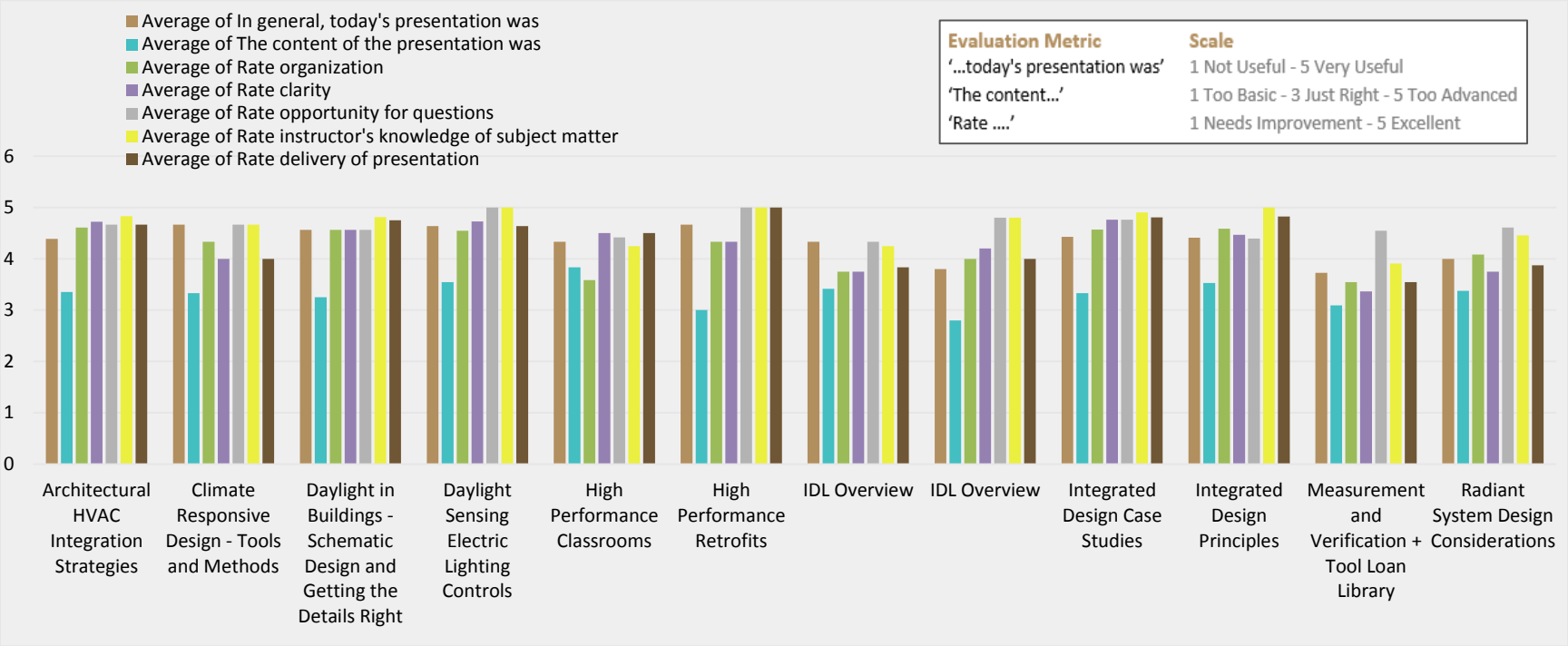

Figure 3: Average Evaluations by Session Title

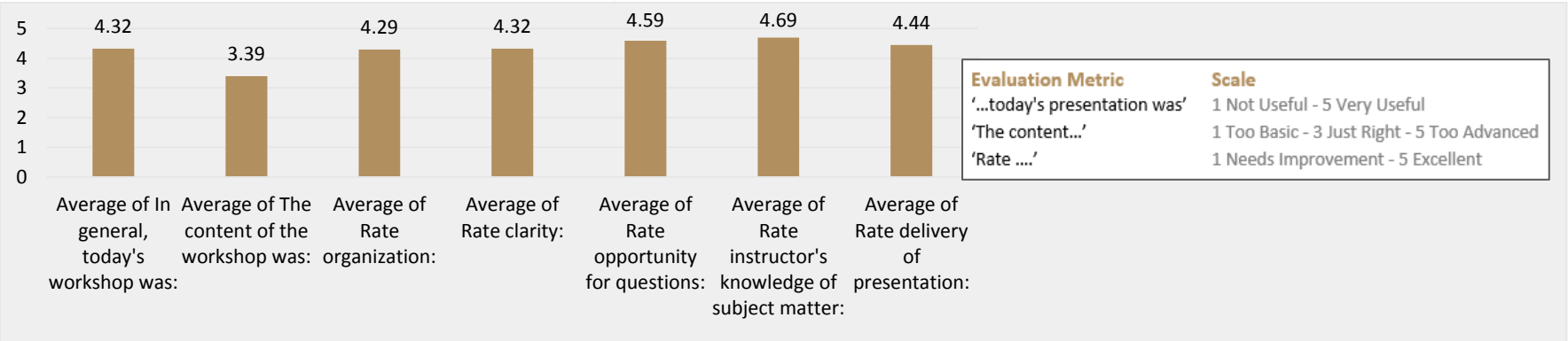

Figure 4: Overall Averages of Evaluations for all Sessions

2. Session Summaries

At the conclusion of each lunch and learn session, an evaluation form was requested from each participant. The feedback was used to improve future sessions. Below are summaries of the feedback received from the evaluation forms, session information, and attendance counts. It should be noted that comments recorded from evaluations have not been edited in most cases, many appear exactly how the participant entered them online or how they were interpreted for translation from hand-written forms.

2.1 Session 1: High Performance Retrofits (5/1/14)

Title: High Performance Retrofits

Description: Our existing building infrastructure consumes tremendous energy resources. This provides an opportunity for conservation on an expansive scale if progress can be made toward identifying a replicable technical and economic template for deep-energy renovations. Fundamentally, this is a question of how today's existing buildings currently operate, and how they will operate a generation from now. This lecture will present interim results of the development phase of an initiative that targets deep energy savings in retrofits of existing buildings into high performance buildings. The session will focus on medium (3-5 stories) buildings, which require a different approach to deep renovation when compared to high-rise buildings. For example, a big chiller replacement that can be used to leverage other energy efficiency measures. This session will discuss the Integrated Measure Packages (IMPs) for medium buildings, which can be used to achieve deep energy savings. Two medium office buildings in the Northwest will be used as platforms for simulation-based investigations of these IMPs. This session will present simulation work for the pilots, examples on how to respond to occupant's complaints, and anecdotal evidence and cost analysis for the renovation projects.

Presentation Info:

Date:	5/1/2014
Location:	Architecture Firm 1 – Boise
Presenter:	Ery Djunaedy

Attendance:

Architect:	2	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	1
Total (In-Person):	**3**		

Evaluations:

		Scale
In general, today's presentation was:	**4.7**	1 Not Useful - 5 Very Useful
Rate organization:	**4.3**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.3**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**5.0**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**5.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**5.0**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.0**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Possibly more examples of real projects. And how the principles are applied
- I didn't know what one or two of the Acronyms meant

What attendees found most valuable:

- Opportunity to discuss issues and ideas related to the subject
- The specific retrofits

Professional associations of which attendees are members:

- AIA
- NCARB, USGBC

Other types of training attendees would find useful:

- Training on the operation of measurement tools. More info on cogeneration systems and the current state of the technology.
- All

2.2 Session 2: Integrated Design Principles (5/13/14)

Title: Integrated Design Principles

Description: The discussion will include a brief overview of the 2030 challenge, the status of current building stock, and its relationship to code. Most of the discussion will be centered on the process of design and the associated inputs of climate, building use, site design, and building design. The creation of loads by the necessary inputs will be addressed as an element to be reduced in order to mitigate system size and energy use. The aim is to provide an example of what can happen when we reduce energy loads through climate and use responsive design. Additionally, the presentation will cover some of the tools and techniques used to help guide decisions in the integrated design process.

Presentation Info:

Date:	5/13/2014
Location:	Architecture Organization 1 – Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	37	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	7
Total (In-Person):	**44**		

Evaluations:

		Scale
In general, today's presentation was:	**4.4**	1 Not Useful - 5 Very Useful
Rate organization:	**4.4**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.4**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.1**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**5.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.7**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.4**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Very beneficial presentation. For a large group you kept it general - perfect. RE: The 2030 challenge & how we locally can meet it, there needs to be a candid smaller discussion to line out strategies. I'd love to meet W/you or a small group to brainstorm on this, otherwise it's obvious we are going to struggle to meet it. Thanks for all of your help over the years!
- Walk through a full example project
- Shorten material for full presentation
- Really Great Presentation!
- Less charts more help. stuff
- Larger type
- Customers presentation for time excited
- Possibly cater presentations to your audience. Too many skipped slides. It's obvious that this presentation is recycled - Still don't understand what I was supposed to learn today.

What attendees found most valuable:

- Helpful charts
- The discussion at the end
- educational
- Tools for implementation
- Good reminder of important & relevance of int. design
- Overview of effectiveness of integrated design in recent years
- How we are doing US profession?

- The concept of Int. Design!
- Energy Utility don't teach / Show / Introduce any new information

Professional associations of which attendees are members:

- BOMA
- AIA (9)
- USGBC
- Green Globe Professional
- NCARB (2)
- Preservation Idaho
- CSI
- CHAMBER

Other types of training attendees would find useful:

- Suggestions for writing contracts + educating clients to move towards zero net buildings
- Next steps
- Similar solar progress
- Solar

2.3 Session 3: Integrated Design Principles (5/15/14)

Title: Integrated Design Principles

Description: The discussion will include a brief overview of the 2030 challenge, the status of current building stock, and its relationship to code. Most of the discussion will be centered on the process of design and the associated inputs of climate, building use, site design, and building design. The creation of loads by the necessary inputs will be addressed as an element to be reduced in order to mitigate system size and energy use. The aim is to provide an example of what can happen when we reduce energy loads through climate and use responsive design. Additionally, the presentation will cover some of the tools and techniques used to help guide decisions in the integrated design process.

Presentation Info:

Date:	5/15/2014
Location:	Architecture Organization 2 – Pocatello
Presenter:	Jacob Dunn

Attendance:

Architect:	10	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other*:	2
Elec. Engineer:		None Specified:	1
Total (In-Person):	**13**		
*Other included:	IPC Customer Rep (2)		

Evaluations:

		Scale
In general, today's presentation was:	**4.5**	1 Not Useful - 5 Very Useful
Rate organization:	**4.9**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.5**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.9**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**5.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**5.0**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.8**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- The power point slides were small hard to read
- All good thank you.
- Well done
- Jake is a Very Skilled Presenter

What attendees found most valuable:

- Q & A
- Access to tools - knowledge of how to get there
- Given a better realization of energy conservation

Professional associations of which attendees are members:

- AIA (6)
- CRSA
- LEED
- NCARB (2)

Other types of training attendees would find useful:

- How to use a few of the tools

2.4 Session 4: IDL Overview (5/28/14)

Title: IDL Overview

Description: Come see how the IDL can benefit your buildings and your business! The IDL is dedicated to the development of high performance, energy efficient buildings. It is a collaboration of architecture and engineering staff and students working with building owners, managers, and operators, as well as professional design and construction teams to transform practice for reduced energy use. The resources available through the IDL help design buildings that are more comfortable, require less energy to maintain and operate, and enhance the health and productivity of occupants. At this talk, we will be discussing the resources available through the IDL and how they can benefit your bottom line. These resources include energy audits, energy benchmarking, tool loan library, technical assistance, deep energy retrofits, simulation capabilities, daylighting potential, available funding for low-cost or no-cost analysis, and more.

Presentation Info:

Date:	5/28/2014
Location:	Industry Organization 1 – Boise
Presenter:	Katie Leichliter

Attendance:

Architect:	3	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	1	Other*:	6
Elec. Engineer:		None Specified:	15
Total (In-Person):	**25**		
*Other included:	IPC Programs (2), USGBC, City of Boise, Property Mgmt, Energy Specialist		

Evaluations:

		Scale
In general, today's presentation was:	**4.3**	1 Not Useful - 5 Very Useful
Rate organization:	**3.8**	1 Needs Improvement - 5 Excellent
Rate clarity:	**3.8**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.3**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.3**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**3.8**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.4**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Local data on real estate data
- A handout of power point would help. Wasn't noted that Idaho Power was providing Lunch.

What attendees found most valuable:

- Project help that IDL can provide
- Tools available
- Contacts
- IDL services - Foundational training
- Proforma for commercial efficiency & net zero office bldg

Professional associations of which attendees are members:

- AIA (3)
- USGBC
- BOMA (3)
- Conservation Specification Institute
- NCARB
- ULI
- IREM

Other types of training attendees would find useful:

- Codes, Whole systems & built enviro.
- Similar for residential buildings

2.5 Session 5: Radiant System Design Considerations (6/3/14)

Title: Radiant System Design Considerations

Description: Designing for radiant systems and thermally active surfaces represents a key opportunity for integrated design and high performance buildings. While radiant systems can be inherently more energy efficient than air-based systems, their success requires close collaboration between architects and engineers to ensure that the building facade reduces loads to levels achievable by radiant systems. This integration between the disciplines has a direct relationship to the performance of the system and comfort of the building, which is not always so closely related in more typical forced-air systems. Key design decisions must be made early in the design process to ensure the feasibility and performance of radiant systems down the road. A wide spectrum of configurations and types of radiant systems are available for designers, with each having different strengths, capacities, and complexities according to their setup. This presentation will cover some general rules of thumb to consider for radiant systems, as well as provide an overview of the key architectural and engineering design decisions associated with each system configuration.

Presentation Info:

Date:	6/3/2014
Location:	Engineering Firm 1 – Boise
Presenter:	Damon Woods

Attendance:

Architect:		Electrician:	
Engineer:	7	Contractor:	
Mech. Engineer:	3	Other:	
Elec. Engineer:		None Specified:	5
Total (In-Person):	**15**		

Evaluations:

		Scale
In general, today's presentation was:	**4.1**	1 Not Useful - 5 Very Useful
Rate organization:	**3.8**	1 Needs Improvement - 5 Excellent
Rate clarity:	**3.5**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.4**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.3**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**3.8**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.3**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- More eye contact. After slide description delay before next
- Focus on topic to its completion
- Great job overall
- Practice presentation a bit more

What attendees found most valuable:

- Learning different types of systems available
- Some indications of design temps and concepts

Professional associations of which attendees are members:

- ASHRAE

Other types of training attendees would find useful:

- mechanical systems similar to this one
- Controls programming
- Don't know offhand

2.6 Session 6: IDL Overview (6/5/14)

Title: IDL Overview

Description: Come see how the IDL can benefit your buildings and your business! The IDL is dedicated to the development of high performance, energy efficient buildings. It is a collaboration of architecture and engineering staff and students working with building owners, managers, and operators, as well as professional design and construction teams to transform practice for reduced energy use. The resources available through the IDL help design buildings that are more comfortable, require less energy to maintain and operate, and enhance the health and productivity of occupants. At this talk, we will be discussing the resources available through the IDL and how they can benefit your bottom line. These resources include energy audits, energy benchmarking, tool loan library, technical assistance, deep energy retrofits, simulation capabilities, daylighting potential, available funding for low-cost or no-cost analysis, and more.

Presentation Info:

Date:	6/5/2014
Location:	Government Organization – Boise
Presenter:	Katie Leichliter

Attendance:

Architect:		Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other*:	10
Elec. Engineer:		None Specified:	2
Total (In-Person):	**12**		
*Other included:	City of Boise (9), USGBC		

Evaluations:

		Scale
In general, today's presentation was:	**3.8**	1 Not Useful - 5 Very Useful
Rate organization:	**4.0**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.2**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.8**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.8**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.0**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**2.8**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

What attendees found most valuable:

- Knowledge of web tools
- Learning about IDL's tools available

Professional associations of which attendees are members:

- Treasure Valley Clean Cities Coalition

2.7 Session 7: Daylight Sensing Electric Lighting Controls (6/26/14)

Title: Daylight Sensing Electric Lighting Controls

Description: Daylighting alone does not necessarily save energy. While a good daylighting design will optimize the envelope to minimize unnecessary heat gain and heat loss, the bulk of the energy savings from spaces with the significant inclusion of daylight comes from dimming or switching off electric lighting systems. There have been several examples of successful daylighting-sensing lighting controls systems and even more tough lessons learned from systems that did not perform adequately. The general concepts of various daylight harvesting strategies will be presented. Then, the seven most common challenges to creating functional daylight-sensing lighting control systems will be reviewed in detail. Finally, several successful examples will be highlighted to promote more successful applications in future projects.

Presentation Info:

Date:	6/26/2014
Location:	Architecture Firm 2 – Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	5	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	
Total (In-Person):	**5**		

Evaluations:

		Scale
In general, today's presentation was:	**5.0**	1 Not Useful - 5 Very Useful
Rate organization:	**4.8**	1 Needs Improvement - 5 Excellent
Rate clarity:	**5.0**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**5.0**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**5.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.8**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.0**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- None - Very good Presentation

What attendees found most valuable:

- Very informed & relates very well
- The data provided real world application of daylighting systems
- Presenter's knowledge and experience

Professional associations of which attendees are members:

- AIA (3)
- NCARB

Other types of training attendees would find useful:

- None right now
- HVAC controls

2.8 Session 8: Climate Responsive Design – Tools and Methods (7/16/14)

Title: Climate Responsive Design – Tools and Methods

Description: Advances in mechanical design and aesthetic ambition have lead modern architecture away from buildings designed to be climate-accepting and towards an often irrational response to place. This can create buildings that reject their climate and, thus, are fundamentally adrift when it comes to rooting their design within their context and location. This session will briefly cover the basics of climatic and passive design strategies, while focusing on several passive design tools that are widely available and free to designers. The presenter will briefly cover the use of the tools and energy and cost implications of their results as well as demonstrate how they can be used in practice. Such tools include: night flush ventilation, balance point calculators, shading, cross and stack ventilation, passive solar, peak cooling, and earth tube design.

Presentation Info:

Date:	7/16/2014
Location:	Architecture Firm 1 – Boise
Presenter:	Katie Leichliter

Attendance:

Architect:	2	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	2
Total (In-Person):	**4**		

Evaluations:

		Scale
In general, today's presentation was:	**4.7**	1 Not Useful - 5 Very Useful
Rate organization:	**4.3**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.0**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.7**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.7**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.0**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.3**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Real life applications. Show examples of how to increase thermal mass, etc. Show for example if cooling load is too high what part of the building should be changed.
- Dig into specific real world examples ... Spend more time with the case studies
- HVAC performance data to back up projections

What attendees found most valuable:

- The tools are useful, but show what components of the building influences. For example, concrete block vs. steel framing.
- Tools for use during design
- Energy modeling systems

Professional associations of which attendees are members:

- AIA, USGBC

Other types of training attendees would find useful:

- Passive design, passive ventilation
- Passive heating/cooling strategies...
- What goes into measuring real time performance of existing building

2.9 Session 9: Measurement and Verification + Tool Loan Library (7/24/14)

Title: Measurement and Verification + Tool Loan Library

Description: This talk will go in depth on the use of data logging equipment and energy management systems to verify designs, verify equipment performance, and establish trend logs. Our Benchmarking and Energy Goal Setting talk explains how to establish building-level energy goals and how to track performance at the building level. This talk will focus on system- and component-level issues, which are not visible at the building level. Common data analysis tools and techniques will be presented. It will also

discuss the role that the Integrated Design Lab's Tool Loan Library can play in your projects within Idaho Power's Service Territory. This talk will serve as a prerequisite training in order to check out most of the tools (data loggers) available through the tool loan library.

Presentation Info:

Date:	7/24/2014
Location:	Engineering Firm 1 – Boise
Presenter:	Carlos Duarte

Attendance:

Architect:		Electrician:	
Engineer:	10	Contractor:	
Mech. Engineer:	2	Other:	
Elec. Engineer:		None Specified:	
Total (In-Person):	**12**		

Evaluations:

		Scale
In general, today's presentation was:	**3.7**	1 Not Useful - 5 Very Useful
Rate organization:	**3.5**	1 Needs Improvement - 5 Excellent
Rate clarity:	**3.4**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.5**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**3.9**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**3.5**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.1**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Spend more time on practical uses for the measurement equipment (where and when to use)
- Make presentation "Flow" tell a story
- Great Job!

What attendees found most valuable:

- The informative explanations
- The links for further info
- All the resources & keeping up to date
- Tool library, m&v instruments
- Tool loan library seems very useful but under utilized

Professional associations of which attendees are members:

- ASHRAE (2)

Other types of training attendees would find useful:

- All UI IDL's
- any
- EnergyPlus
- Idaho Power Energy Incentive Training

2.10 Session 10: Daylight Sensing Electric Lighting Controls (8/14/14)

Title: Daylight Sensing Electric Lighting Controls

Description: Daylighting alone does not necessarily save energy. While a good daylighting design will optimize the envelope to minimize unnecessary heat gain and heat loss, the bulk of the energy savings from spaces with the significant inclusion of daylight comes from dimming or switching off electric lighting systems. There have been several examples of successful daylighting-sensing lighting controls systems and even more tough lessons learned from systems that did not perform adequately. The general concepts of various daylight harvesting strategies will be presented. Then, the seven most common challenges to creating functional daylight-sensing lighting control systems will be reviewed in detail. Finally, several successful examples will be highlighted to promote more successful applications in future projects.

Presentation Info:

Date:	8/14/2014
Location:	Architecture Firm 3 – Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	7	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	
Total (In-Person):	**7**		

Evaluations:

		Scale
In general, today's presentation was:	**4.4**	1 Not Useful - 5 Very Useful
Rate organization:	**4.4**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.6**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**5.0**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**5.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.6**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.9**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- More intro as to what it is about. Kind of got confused at the beginning

What attendees found most valuable:

- actual cost savings and modeling imaging
- Commissioning Aspect
- Real Life Examples

- Actual cases. We can/have been to

Professional associations of which attendees are members:

- Daylight Pattern Guide
- Just licensed

2.11 Session 11: Architectural HVAC Integration Strategies (8/26/24)

Title: Architectural HVAC Integration Strategies

Description: The relationship between architecture and mechanical systems design is often one of neglect, dysfunction, and sometimes even abuse. It has not always been like this, nor does it have to be moving forward. Aesthetic meaning and design concept can be derived from the interdependent relationship between architecture and mechanical engineering, distribution system and interior design, or even equipment and facade expression. Sometimes the most profound architectural moments are deeply informed by their integration with how the building delivers comfort to its occupants. A successful marriage of these concepts can even lead to reduced energy bills, lower capital costs, and, most importantly of all, occupants who love the building. This presentation will focus on breaking down exemplary case studies of architecture's courtship of both passive and active systems.

Presentation Info:

Date:	8/26/2014
Location:	Architecture Firm 2 – Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	4	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	
Total (In-Person):	**4**		

Evaluations:

		Scale
In general, today's presentation was:	**5.0**	1 Not Useful - 5 Very Useful
Rate organization:	**5.0**	1 Needs Improvement - 5 Excellent
Rate clarity:	**5.0**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**5.0**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**5.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**5.0**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.0**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Well done

What attendees found most valuable:

- Integration of architecture w/engineering and HVAC. Excellent case studies
- discussion

Professional associations of which attendees are members:

- IDP. NCARB
- AIA

Other types of training attendees would find useful:

- all related

2.12 Session 12: Architectural HVAC Integration Strategies (8/28/14)

Title: Architectural HVAC Integration Strategies

Description: The relationship between architecture and mechanical systems design is often one of neglect, dysfunction, and sometimes even abuse. It has not always been like this, nor does it have to be moving forward. Aesthetic meaning and design concept can be derived from the interdependent relationship between architecture and mechanical engineering, distribution system and interior design, or even equipment and facade expression. Sometimes the most profound architectural moments are deeply informed by their integration with how the building delivers comfort to its occupants. A successful marriage of these concepts can even lead to reduced energy bills, lower capital costs, and, most importantly of all, occupants who love the building. This presentation will focus on breaking down exemplary case studies of architecture's courtship of both passive and active systems.

Presentation Info:

Date:	8/28/2014
Location:	Engineering and Architecture Firm – Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	26	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	3	Other*:	2
Elec. Engineer:	3	None Specified:	
Total (In-Person):	**34**		
*Other included:	Structural Engineer, Elec. Designer		

Evaluations:

		Scale
In general, today's presentation was:	**4.3**	1 Not Useful - 5 Very Useful
Rate organization:	**4.5**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.7**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.6**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.8**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.6**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.4**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- More performance data as projects age
- Keep it within time
- Make it shorter, less time on case studies, pull more info from attendees
- Energy Use
- Great case studies, perhaps provide tools to balance design decisions

What attendees found most valuable:

- exposure to new concepts/project studies
- Visual Examples
- ARCH/HVAC circle
- Re invigorated my love of design
- integration of technologies
- Inspirational architecture
- All of it
- understanding of why, what, and how very clear

Professional associations of which attendees are members:

- AIA (2)
- BICSI
- IESNA
- USGBC (3)
- ASHRAE
- IBPSA

Other types of training attendees would find useful:

- positive systems
- Continued info on integrated solutions
- Integrated bldg management
- Net zero energy buildings/ energy modeling and simulation

2.13 Session 13: High Performance Classrooms (9/9/14)

Title: High Performance Classrooms

Description: This session will cover a variety of issues facing the design of a healthy, productive, and energy efficient classroom environment. A quick look at the state of the last 50 years of school design will give an introduction to the problems faced by designers. This session will look at several case studies of high performance schools in the Northwest to address daylighting, natural ventilation, and integration of mechanical systems. Each passive strategy will be addressed in detail with regional examples and performance research.

Presentation Info:

Date:	9/9/2014
Location:	Architecture Firm 3 – Boise
Presenter:	Brad Acker

Attendance:

Architect:	6	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	1
Total (In-Person):	**7**		

Evaluations:

		Scale
In general, today's presentation was:	**4.4**	1 Not Useful - 5 Very Useful
Rate organization:	**4.0**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.6**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.4**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.4**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.3**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.7**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Less repetition
- Examples outside the Pacific NW
- more in depth, less review and overview
- Introduce the relationship of lighting (natural) and insulation heat gain

What attendees found most valuable:

- Graphics
- The tools available to us as designers
- How to adjust thermal comfort
- daylighting pressure
- overall basics
- Studies showing how the different strategies work in reality

Professional associations of which attendees are members:

- NCARB

2.14 Session 14: Integrated Design Case Studies (9/17/14)

Title: Integrated Design Case Studies

Description: In this session, the integrated design process will be reviewed and several case study examples will be presented. The case studies highlight both the successes and challenges of executing the integrated design process to create buildings that save significant energy compared to code baseline. Each project will be placed in the context of the 2030 Challenge, with the goal of establishing both the viability and the difficulty of reaching the milestones of the challenge. Most of these projects are regionally and climatically significant to Idaho and the Northwest.

Presentation Info:

Date:	9/17/2014
Location:	Architecture Organization 2 – Pocatello
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	9	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	
Total (In-Person):	**9**		

Evaluations:

		Scale
In general, today's presentation was:	**4.4**	1 Not Useful - 5 Very Useful
Rate organization:	**4.4**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.9**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.8**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.9**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.9**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.4**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Very Clean and Concise

What attendees found most valuable:

- the information about "what can be done " art of the possible
- case studies that related to our area
- Opportunities for good design - this realization
- The idea that there are many strategies to get closer to net zero usage

Professional associations of which attendees are members:

- CSI
- AICHE
- Historic Preservation
- AIA (5)
- NCARB (2)
- LEED

Other types of training attendees would find useful:

- More information about the heat transfer models used in some of the tools
- Commission city of Pocatello

2.15 Sessions 15 & 16: Daylight in Buildings – Schematic Design & Getting the Details Right (9/18/14)

Evaluations for sessions 15 and 16 were combined, as they were presented together.

Title 1: Daylight in Buildings – Schematic Design

Description 1: High quality daylighting design is a lost art. Several generations of designers and engineers have been trained to rely on electrically-illuminated spaces in order to meet minimum lighting criteria for functional environments occupied by humans. This presentation is the first in a sequence intended to revive the lost art of daylighting design. It teaches concepts of designing in the overcast sky as well as under sunny skies. Additionally, it focuses on how to provide useable workplane illumination and the importance of creating visually comfortable and balanced daylit spaces. This presentation highlights the architectural form generators and interior surface brightness to produce high quality and comfortable daylit spaces, minimizing the reliance on electric lighting.

Title 2: Daylight in Buildings – Getting the Details Right

Description 2: The second talk in a sequence intended to instruct on the process of creating high quality and comfortable daylit spaces focuses on getting the details right. After the schematic design is formed to appropriately deliver daylight to the important surfaces within a space, there are several details that can make or break the overall success of the project. This presentation discussed several details, ranging from interior surface colors and reflectance, to interior space layouts, furniture design, window details (including glazing specifications), and shading strategies. The presentation introduces concepts of lighting control systems to ensure that energy is saved from the inclusion of daylight.

Presentation Info:

Date:	9/18/2014
Location:	Architecture Organization 3 – Ketchum
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	13	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	
Total (In-Person):	**13**		

Evaluations:

		Scale
In general, today's presentation was:	**4.6**	1 Not Useful - 5 Very Useful
Rate organization:	**4.6**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.6**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.6**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.8**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.8**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.3**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- It really felt like a single workshop should not have been listed as two
- Kevin's on it

What attendees found most valuable:

- Diagrams of the daylighting models
- Great Program! Would like to see a little more info on overhead daylighting - Thinking back to historic sawtooth and monitor forms.
- Daylighting building: getting the details right. Good practical examples
- References to websites/software to MD in daylighting design
- Getting the details right-Learned the most
- Daylighting Distances accent lighting w/Daylighting
- Rules of Thumb
- Instructor
- Toplit solutions
- Good examples

Professional associations of which attendees are members:

- AIA (7)
- NCARB (2)
- LEED

Other types of training attendees would find useful:

- Idaho Power Presentation
- residential applications for daylight design in cold climates - cost effectiveness and simple strategies
- Energy Modeling
- LED Lighting
- LED/Light fixtures/Glass (what's new)
- Interested to learn more about optically advanced "Gadgets"

2.16 Session 17: Integrated Design Case Studies (9/25/14)

Title: Integrated Design Case Studies

Description: In this session, the integrated design process will be reviewed and several case study examples will be presented. The case studies highlight both the successes and challenges of executing the integrated design process to create buildings that save significant energy compared to code baseline. Each project will be placed in the context of the 2030 Challenge, with the goal of establishing both the viability and the difficulty of reaching the milestones of the challenge. Most of these projects are regionally and climatically significant to Idaho and the Northwest.

Presentation Info:

Date:	9/25/2014
Location:	Engineering and Architecture Firm – Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	27	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	4	Other*:	2
Elec. Engineer:	3	None Specified:	1
Total (In-Person):	**37**		
*Other included:	Telecom, Elec. Designer		

Evaluations:

		Scale
In general, today's presentation was:	**4.4**	1 Not Useful - 5 Very Useful
Rate organization:	**4.7**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.7**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.8**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.9**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.8**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.3**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Bring pens for evaluations
- Material is very "narrative" driven. Metrics& performance data may be useful

What attendees found most valuable:

- pictures of strategies and measurements
- Case Study follow ups/updates always good
- The energy system uses in the building. (ie. New ways to save energy or capture energy)
- Green it
- everything

Professional associations of which attendees are members:

- AIA (2)
- USGBC (3)
- BICSI
- ASHRAE
- IBPSA

Other types of training attendees would find useful:

- Daylighting calculation process
- commissioning & user building management & balancing
- Trends for I.T, to contribute to energy goals
- Energy Plus, Open Studio

2.17 Session 18: High Performance Classrooms (10/15/14)

Title: High Performance Classrooms

Description: This session will cover a variety of issues facing the design of a healthy, productive, and energy efficient classroom environment. A quick look at the state of the last 50 years of school design will give an introduction to the problems faced by designers. This session will look at several case studies of high performance schools in the Northwest to address daylighting, natural ventilation, and integration of mechanical systems. Each passive strategy will be addressed in detail with regional examples and performance research.

Presentation Info:

Date:	10/15/2014
Location:	Architecture Firm 4 – Boise
Presenter:	Brad Acker

Attendance:

Architect:	3	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other*:	1
Elec. Engineer:		None Specified:	2
Total (In-Person):	**6**		
*Other included:	Designer		

Evaluations:

		Scale
In general, today's presentation was:	**4.2**	1 Not Useful - 5 Very Useful
Rate organization:	**3.0**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.4**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.4**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.0**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.6**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**4.0**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Great job.
- Define acronyms.
- Avoid eating while presenting.

What attendees found most valuable:

- Ventilation discussion.
- The graphics and case studies were helpful and can be used with our clients.
- Graphics/diagrams.
- Daylighting methods.

Professional associations of which attendees are members:

- AIA (2)

Other types of training attendees would find useful:

- Perhaps the daylighting refreshment course could be useful.

2.18 Session 19: Radiant System Design Considerations (12/18/14)

Title: Radiant System Design Considerations

Description: Designing for radiant systems and thermally active surfaces represents a key opportunity for integrated design and high performance buildings. While radiant systems can be inherently more energy efficient than air-based systems, their success requires close collaboration between architects and engineers to ensure that the building facade reduces loads to levels achievable by radiant systems. This integration between the disciplines has a direct relationship to the performance of the system and comfort of the building, which is not always so closely related in more typical forced-air systems. Key design decisions must be made early in the design process to ensure the feasibility and

performance of radiant systems down the road. A wide spectrum of configurations and types of radiant systems are available for designers, with each having different strengths, capacities, and complexities according to their setup. This presentation will cover some general rules of thumb to consider for radiant systems, as well as provide an overview of the key architectural and engineering design decisions associated with each system configuration.

Presentation Info:

Date:	12/18/2014
Location:	Architecture Organization 3 – Ketchum
Presenter:	Damon Woods

Attendance:

Architect:	15	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	2	Other*:	1
Elec. Engineer:		None Specified:	
Total (In-Person):	**18**		
*Other included:	IPC Customer Rep.		

Evaluations:

		Scale
In general, today's presentation was:	**3.9**	1 Not Useful - 5 Very Useful
Rate organization:	**4.3**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.0**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.8**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.6**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**3.9**	1 Needs Improvement - 5 Excellent
The content of the presentation was:	**3.5**	1 Too Basic - 3 Just Right - 5 Too Advanced

Comments:

Attendee suggested improvements for the instructor:

- Architects need to design with MRT in mind; e.g. cold draft off large windows etc.
- Would like to see more case studies.
- Be more realistic; look at code requirements for fresh air exchange; cost comparisons should take into account both systems. Cost comparisons should also compare radiant to HVAC air systems.
- Specific mechanical unit manufacturers
- Too much info - too little time.
- Slow down and focus on each points, reads on each slide. Add more info and appropriate insulations for radiant systems.

What attendees found most valuable:

- Technical info and controls discussion.
- Too much theory - need more realistic practical situations. Need to get out in the field with architects/engineers.
- Information for radiant cooling.

- Instructor's knowledge
- Forecasting controls.

Professional associations of which attendees are members:

- ASHRAE
- NCARB
- AIA (6)

Other types of training attendees would find useful:

- More of the same.
- Energy Modeling.
- Actual exterior snowmelt installations; insulation options; interior finishes (carpet) examples; loss of efficiency with wood and carpet finishes.
- Innovations in building insulation systems under slab, wall, ceiling/roof.

2.19 Session 20: Benchmarking, Measurement & Verification, and Tool Loan Library (1/29/15)

Due to scheduling conflicts, the final session was pushed into January of 2015. The coordination is complete and the session information is below. Approximately 20 IBOA members are expected to attend.

Title: Benchmarking, Measurement & Verification, and Tool Loan Library

Description: This talk will go in depth on the use of data logging equipment and energy management systems to verify designs, verify equipment performance, establish trend logs and benchmarking at the system and building level. This talk will focus on system and component-level issues, as well as tools to use for benchmarking at the building level. Common data analysis tools and techniques will be presented. It will also discuss the role that the Integrated Design Lab's Tool Loan Library can play in your projects within Idaho Power's Service Territory.

Presentation Info:

Date:	1/29/2015
Location:	Industry Organization 2 – Chubbuck
Presenter:	Brad Acker

Attendance:

Total expected:	Approximately 20

3. Future Work

Feedback was gathered from the 170 Lunch and Learn evaluations received throughout 2014. The comments from these were valuable in defining possible future Lunch and Learn topics and informed the list of suggestions below.

Potential Future Topics:

- Building management (integrated)
  - Benchmarking
  - Training on M&V tools
  - Real-time performance measurements
- Renewables
  - Cogeneration systems and status of the technology
  - Solar
  - Net zero
  - Efficiency strategies for IT
- Client education for moving toward net zero
- Mechanical systems
  - HVAC controls and programming
  - Passive heating/cooling/ventilation
  - Snowmelt (installations, case studies, insulation options, interior finish effects)
- Codes
  - Advances in insulation systems
- IPC incentive training or general presentation
- Modeling/Simulation
  - Details about models programs use (heat transfer models)
  - EnergyPlus, OpenStudio
- Commissioning and balancing
- Lighting/Daylighting
  - LED
  - Residential applications for daylight design in cold climates - cost effectiveness and simple strategies
  - New technologies (glass/lighting) and optical gadgets
  - Daylight calculations process and refresher course

With the Lunch and Learn task, attendance at each session is determined mainly by the size of the firm or organization that is hosting. However, there may still be opportunities for increasing attendance. One suggestion would be to encourage the hosting entity to invite

others who would find the information relevant. With approval by the hosting entity, presentation schedules could be posted on the IDL website or sent to industry organizations such as ASHRAE or AIA so that interested professionals could attend.

4. Appendices

Appendix A: Lunch and Learn 2014 Topics Offered

Design Tools and Methods

Integrated Design Principles (Topic 1401)
The discussion will include a brief overview of the 2030 challenge, the status of current building stock, and its relationship to code. Most of the discussion will be centered on the process of design and the associated inputs of climate, building use, site design, and building design. The creation of loads by the necessary inputs will be addressed as an element to be reduced in order to mitigate system size and energy use. The aim is to provide an example of what can happen when we reduce energy loads through climate and use responsive design. Additionally, the presentation will cover some of the tools and techniques used to help guide decisions in the integrated design process.

Benchmarking and Energy Goal Setting (Topic 1402)
This presentation discusses several methods for establishing energy goals and targets in the pre-design phase as well as the implications for generating ideas to approach serious reductions in usage. Examples will be highlighted to show the progression of early targeting to final performance. The tools presented in this session are widely available and, in most cases, free. The presentation will particularly highlight building performance simulation, including a brief description of what and cannot be expected from a model. It will also describe the array of tools that exist beyond some of the more well-known building physics simulation tools, such as energy and daylight. Measuring the energy performance of existing and new projects is critical to long-term success because you can't improve what you don't measure.

The Importance of Building Performance Modeling for Architects (Topic 1403)
"The architect need not become a technical expert on energy modeling or the myriad software tools currently available. A working understanding of the energy modeling process, its parameters, and benefits, however, is needed to empower us to fold this necessary and valuable capability into our fundamentally integrative work," - The AIA Energy Modeling Working Group. August, 2012. As energy simulation becomes more and more popular for both compliance modeling and design guidance, it is more and more important for architects to understand how this new tool impacts their practice. Furthermore, an understanding of the value added to architecture through evidence-based or evaluative design approaches is also critical. Too often daylight modeling does not occur on projects and designs do not perform adequately. Too often energy modeling is simply a code or, beyond code, compliance strategy and is not used as a design tool. This presentation will provide an overview of building performance simulation and modeling strategies and discuss them in the context of energy savings through the integrated design process. The value of iterative and exploratory simulation will be stressed and several useful examples will be reviewed. It will also highlight an interactive web document that the American Institute of Architects has put together on how to integrate energy modeling into the design process, specifically for architects.

Energy Plus / Open Studio Work Flow (Topic 1404)
As a whole, building simulation software rapidly develops and evolves. Understanding an effective workflow between the tools and disciplines is critical to the integrated design process and resulting energy savings potential. Front-end graphic user interfaces have made powerful simulation engines like EnergyPlus more accessible to both architects and engineers. It has also made the simulation process easier, smoother, and, perhaps most importantly, faster. This presentation will focus on describing the

integrated energy and daylight simulation workflow of OpenStudio, a free graphic user interface developed by the Department of Energy, and its relationship with Radiance and EnergyPlus.

Climate Responsive Design – Tools and Methods (Topic 1405)

Advances in mechanical design and aesthetic ambition have lead modern architecture away from buildings designed to be climate-accepting and towards an often irrational response to place. This can create buildings that reject their climate and, thus, are fundamentally adrift when it comes to rooting their design within their context and location. This session will briefly cover the basics of climatic and passive design strategies, while focusing on several passive design tools that are widely available and free to designers. The presenter will briefly cover the use of the tools and energy and cost implications of their results as well as demonstrate how they can be used in practice. Such tools include: night flush ventilation, balance point calculators, shading, cross and stack ventilation, passive solar, peak cooling, and earth tube design.

Role of Life Cycle Cost Assessment in Integrated Design (Topic 1406)

The process of integrated design can blur the traditional line between the various design trades. People often talk about borrowing budget from the mechanical systems to improve architectural elements that will, in turn, lessen the mechanical needs due to small energy loads. What steps and strategies are involved in putting real numbers to the value of these smaller loads? The session will cover the use of energy modeling and life cycle cost valuing to provide quantifiable data to various strategies in order to understand the feasibility of energy improvements to projects.

Lighting & Daylighting

Daylight in Buildings: Schematic Design Methods (Topic 1408)

High quality daylighting design is a lost art. Several generations of designers and engineers have been trained to rely on electrically-illuminated spaces in order to meet minimum lighting criteria for functional environments occupied by humans. This presentation is the first in a sequence intended to revive the lost art of daylighting design. It teaches concepts of designing in the overcast sky as well as under sunny skies. Additionally, it focuses on how to provide useable workplane illumination and the importance of creating visually comfortable and balanced daylit spaces. This presentation highlights the architectural form generators and interior surface brightness to produce high quality and comfortable daylit spaces, minimizing the reliance on electric lighting.

Daylight in Buildings: Getting the Details Right (Topic 1409)

The second talk in a sequence intended to instruct on the process of creating high quality and comfortable daylit spaces focuses on getting the details right. After the schematic design is formed to appropriately deliver daylight to the important surfaces within a space, there are several details that can make or break the overall success of the project. This presentation discussed several details, ranging from interior surface colors and reflectance, to interior space layouts, furniture design, window details (including glazing specifications), and shading strategies. The presentation introduces concepts of lighting control systems to ensure that energy is saved from the inclusion of daylight.

Daylight Sensing Electric Lighting Controls (Topic 1410)

Daylighting alone does not necessarily save energy. While a good daylighting design will optimize the envelope to minimize unnecessary heat gain and heat loss, the bulk of the energy savings from spaces with the significant inclusion of daylight comes from dimming or switching off electric lighting systems. There have been several examples of successful daylighting-sensing lighting controls systems and even more tough lessons learned from systems that did not perform adequately. The general concepts of various daylight harvesting strategies will be presented. Then, the seven most common

challenges to creating functional daylight-sensing lighting control systems will be reviewed in detail. Finally, several successful examples will be highlighted to promote more successful applications in future projects.

Daylight Performance Metrics for Human Health, Productivity, and Satisfaction (Topic 1411)

Daylight can breathe light and life into our buildings. Daylight can also make our buildings healthier and more energy efficient. However, designing effective, comfortable, and daylit buildings remains outside the capabilities of most designers. This session will discuss the impacts of daylight on humans in the built environment, the metrics associated with effective daylighting, and the tools available for designing daylight spaces with these metrics. It will highlight both the physical and psychological effects of daylight on the human visual and biological system, and what can be feasibly achieved in terms of positive impacts upon worker productivity and improved user satisfaction through high quality daylighting design. It will explain the basis for daylighting metrics and how to utilize them in daylight and lighting design as well as capabilities of simulation tools to generate them, the effect of assumptions about blinds operation, implications for daylight performance and visual comfort, and the limitations of the metrics. Examples from real spaces present us with actionable knowledge about synthesizing the light of place with the specific needs of human activity as well as inform an intuitive understanding of the metrics and corresponding criteria.

Case Studies

Integrated Design Case Studies (Topic 1412)

In this session, the integrated design process will be reviewed and several case study examples will be presented. The case studies highlight both the successes and challenges of executing the integrated design process to create buildings that save significant energy compared to code baseline. Each project will be placed in the context of the 2030 Challenge, with the goal of establishing both the viability and the difficulty of reaching the milestones of the challenge. Most of these projects are regionally and climatically significant to Idaho and the Northwest.

High Performance Classrooms (Topic 1413)

This session will cover a variety of issues facing the design of a healthy, productive, and energy efficient classroom environment. A quick look at the state of the last 50 years of school design will give an introduction to the problems faced by designers. This session will look at several case studies of high performance schools in the Northwest to address daylighting, natural ventilation, and integration of mechanical systems. Each passive strategy will be addressed in detail with regional examples and performance research.

Architectural HVAC Integration Strategies (Topic 1414)

The relationship between architecture and mechanical systems design is often one of neglect, dysfunction, and sometimes even abuse. It has not always been like this, nor does it have to be moving forward. Aesthetic meaning and design concept can be derived from the interdependent relationship between architecture and mechanical engineering, distribution system and interior design, or even equipment and facade expression. Sometimes the most profound architectural moments are deeply informed by their integration with how the building delivers comfort to its occupants. A successful marriage of these concepts can even lead to reduced energy bills, lower capital costs, and, most importantly of all, occupants who love the building. This presentation will focus on breaking down exemplary case studies of architecture's courtship of both passive and active systems.

System Integration

Radiant System Design Considerations (Topic 1407)

Designing for radiant systems and thermally active surfaces represents a key opportunity for integrated design and high performance buildings. While radiant systems can be inherently more energy efficient than air-based systems, their success requires close collaboration between architects and engineers to ensure that the building facade reduces loads to levels achievable by radiant systems. This integration between the disciplines has a direct relationship to the performance of the system and comfort of the building, which is not always so closely related in more typical forced-air systems. Key design decisions must be made early in the design process to ensure the feasibility and performance of radiant systems down the road. A wide spectrum of configurations and types of radiant systems are available for designers, with each having different strengths, capacities, and complexities according to their setup. This presentation will cover some general rules of thumb to consider for radiant systems, as well as provide an overview of the key architectural and engineering design decisions associated with each system configuration.

HVAC 101 and IECC 2012 (Topic 1415)

This talk is aimed at the fundamentals of HVAC systems; their functionality and energy implications. System types and terminology will be explained with emphasis on how they relate to IECC 2012, Section 503-Building Mechanical Systems, and ASHRAE 90.1. Basic and complex systems and concepts will be outlined, such as demand control ventilation, air and water side economizers, two and four pipe hydronic systems, heat pumps, chillers, boilers, cooling towers, and variable air volume systems and terminal devices.

Demand Control Ventilation Technology (Topic 1416)

This presentation is intended for architects and engineers to introduce the energy-saving concept, background, and current standards of Demand Control Ventilation (DCV). ASHRAE 62.1-2010 will be discussed as the current best practice; explained for single- and multi-zone systems, which are then compared to past methods and rules of thumb designers have used. Examples of poor and successful design specification will be presented in addition to how this information is used by testing, adjusting, and balancing (TAB) personal. System interactions, such as sensor placement and DCV interaction with economizer systems, are explained. An example will be presented using the ventilation rate procedure step-by-step as outlined in ASHRAE 62.1-2010.

Right Sizing of Existing HVAC Systems (Topic 1417)

Mechanical engineers are trained to oversize the capacity of HVAC system, and for a good reason. In reality, however, the degree of oversizing can be excessive; way beyond the good reasoning of an engineer's training and resulting in unnecessary energy usage penalties. This session will cover the problem of HVAC system oversizing, particularly the roof-top units (RTUs). The typical HVAC sizing process will be outlined and several potential sources of oversizing will be discussed. This presentation will also summarize the study carried out by the IDL in 2009 on roof-top unit oversizing. The study involves the following: a survey and in-depth interviews with a number of mechanical engineering firms on how they design (i.e. size) the roof-top units (RTU), field measurement on the performance of RTUs during peak design conditions, and the simulations that were conducted to determine the penalties associated with oversizing in terms of energy consumption and peak electricity demand.

Hybrid Cooling Strategies (Topic 1418)

Cooling is one of the greatest electric energy end uses. This presentation explores different ways to bring cooling to the building with less energy. Mechanical cooling should be seen as the last resort, used

only when the cooling load cannot be handled by other means that consume less energy. Natural ventilation can provide cooling during the shoulder seasons. This presentation will discuss simple design techniques to calculate the cross and stack ventilation, and how to combine it with the night ventilation of mass to further reduce peak cooling load. Boise's, as well as most other Idaho cities', climate is conducive for various types of evaporative cooling. The combined use of natural ventilation and evaporative cooling will reduce the demand for mechanical cooling, both in terms of the peak cooling load and the total cooling energy.

Hybrid Ground Source Heat Pump System (Topic 1419)

The initial cost of ground-source heat pump systems can be substantially higher than conventional systems, limiting it as a design option. This presentation will highlight how, with a hybrid GSHP system, it is possible to optimize the overall system life-cycle cost by reducing the initial cost, while still maintaining the low operating cost of a GSHP system. It will discuss how, to reduce initial costs, peak loads should be carefully calculated and minimized during the design phase, the GSHP system should be sized based on coincidental building loads with the use of simulation software, and the system components, including the ground heat exchanger and additional central plant equipment, should be sized to optimize life-cycle costs using appropriate economic assumptions.

Operation and Maintenance

Measurement & Verification + Tool Loan Library (Topic 1420)

This talk will go in depth on the use of data logging equipment and energy management systems to verify designs, verify equipment performance, and establish trend logs. Our Benchmarking and Energy Goal Setting talk explains how to establish building-level energy goals and how to track performance at the building level. This talk will focus on system- and component-level issues, which are not visible at the building level. Common data analysis tools and techniques will be presented. It will also discuss the role that the Integrated Design Lab's Tool Loan Library can play in your projects within Idaho Power's Service Territory. This talk will serve as prerequisite training to check out most of the tools (data loggers) available through the tool loan library.

Holistic Building Commissioning (Topic 1421)

Within this session, the building commissioning process for new and existing spaces will be explained and benefits to owners, occupants, and operators will be presented. The role of the architect and engineer in the process, along with the responsibilities of the commissioning agent, will be explained. Participants will gain an understanding of the major cornerstones of the commissioning process, such as the owner's project requirements, site checklists, issues log, and functional performance testing. Total-building commissioning is becoming more widespread and design professionals should have a basic understanding in order to benefit project outcomes.

Operations and Maintenance Strategies (Topic 1422)

An often overlooked step of the integrated design process, operations and maintenance strategies can make or break the efficiency of a high performance project. Through our existing building research and consulting, the UI-IDL has experienced first-hand how important operations can be on the energy efficiency of all buildings. This Lunch and Llearn topic revolves around presenting the impact of operations on multiple building types and the effect on energy consumption, simulation calibration, and occupant comfort. Local examples from the recent Kilowatt Crackdown competition will be presented. The talk also touches on some free resources developed by Betterbricks to aid building operators in understanding, diagnosing, and maintaining their projects.

HIGH PERFORMANCE RETROFITS (TOPIC 1423)

Our existing building infrastructure consumes tremendous energy resources. This provides an opportunity for conservation on an expansive scale if progress can be made toward identifying a replicable technical and economic template for deep-energy renovations. Fundamentally, this is a question of how today's existing buildings currently operate, and how they will operate a generation from now. This lecture will present interim results of the development phase of an initiative that targets deep energy savings in retrofits of existing buildings into high performance buildings. The session will focus on medium (3-5 stories) buildings, which require a different approach to deep renovation when compared to high-rise buildings. For example, a big chiller replacement that can be used to leverage other energy efficiency measures. This session will discuss the Integrated Measure Packages (IMPs) for medium buildings, which can be used to achieve deep energy savings. Two medium office buildings in the Northwest will be used as platforms for simulation-based investigations of these IMPs. This session will present simulation work for the pilots, examples on how to respond to occupant's complaints, and anecdotal evidence and cost analysis for the renovation projects.

2014 Task 11: Planning and Commissioning for Daylight Harvesting

Summary of Efforts and Outcomes

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_011-01

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DISCLAIMER

While the recommendations in this report have been reviewed for technical accuracy and are believed to be reasonably accurate, the findings are estimates and actual results may vary. All energy savings and cost estimates included in the report are for informational purposes only and are not to be construed as design documents or as guarantees of energy or cost savings. The user of this report, or any information contained in this report, should independently evaluate any information, advice, or direction provided in this report.

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Acronyms and Abbreviations

AIA	American Institute of Architects
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
BSU	Boise State University
DBS	Department of Building Safety
IAEI	International Association of Electrical Inspectors
IBEW	International Brotherhood of Electrical Workers
IBOA	Intermountain Building Operators Association
IDL	Integrated Design Lab
IECC	International Energy Conservation Code
IPC	Idaho Power Company
ME	Mechanical Engineering
NEEA	Northwest Energy Efficiency Alliance
NSPE	National Society of Professional Engineers

1. Class Overview for Daylight Demonstration 2014

The University of Idaho Integrated Design Lab (UI-IDL) is currently equipped with multiple daylight harvesting systems to evaluate various daylight control strategies. Many of the installations were done in 2014; others through work previously funded under IPC 2010-2012 (TASK 1.8 – Daylight Harvesting Lighting Controls Demonstration Suite). The primary objective of the Daylight Demonstration Project was to use the lab as a teaching space to continue education on daylight harvesting control systems similar to those installed in the lab. This training targeted electrical contractors, electricians, designers, engineers, and architects. The daylight photo-control demonstration curriculum was adapted from an existing Northwest Energy Efficiency Alliance (NEEA) project that focused on both best practices and regional code requirements for lighting control systems in commercial buildings. The curriculum covered applications of photo-control systems in both new buildings and in alterations to existing buildings. The intent of the course was to provide background information as well as hands-on training for common photo-control system applications.

1.1 Planning and Commissioning for Daylight Harvesting – Part 1

Presenters: Gunnar Gladics (Hummel Architects) & Katie Leichliter (IDL)

Project Description: The first section of the course was a two-hour lecture on lighting and controls specifically related to daylighting. The session was delivered in a classroom-based format, with a combination of material presentation and discussion. Part 1 focused on the benefits of daylighting controls for energy efficiency in lighting applications, best practices for lighting controls systems, and a review of the current code requirements for lighting energy

efficiency using 2012 International Energy Conservation Code (IECC) and ASHRAE 90.1 2010. Differences between these codes and the previous versions (IECC 2009 and ASHRAE 90.1 – 2007) were highlighted due to the January 1, 2015 Idaho code change.

1.2 Planning and Commissioning for Daylight Harvesting – Part 2: Hands-On

Presenters: Gunnar Gladics (Hummel Architects) & Katie Leichliter (IDL)

Project Description: The second part of the course was also two hours in length, and provided a more interactive approach so attendees could learn commissioning techniques and standards through experience. Course attendees were shown five separate systems using different products and different control methods. These included a lighting control panel using stepped switching, a wireless relay with continuous dimming, a full digital lighting management system with a variety of control options, and two types of fixtures with integral controls.

2. Project Tasks

The 2014 Daylight Demonstration Project was outlined with multiple tasks including project planning, new equipment installation, coordination of marketing, updating of educational materials, session coordination, presenting and recalibrating, travel, and reporting. Deliverables for the project included:

- Installation of one new lighting technology
- Marketing plan for local and regional training sessions
- Attendance logs from training sessions
- Updated commissioning document and training curriculum
- Final report summarizing all session information

Initial planning and preparation included getting all potential instructors approved by the Department of Building Safety (DBS) and getting the courses approved for both DBS and American Institute of Architects (AIA) continuing education units. Substantial effort was put into planning and coordinating the installation of new equipment, as well as marketing to potential attendees. All educational materials were updated, which included major modifications for the IECC 2012 code changes. The Part 2 handouts were also updated to align with the new equipment.

Session coordination and presentation consisted of organizing online and call-in registrations, sending out reminders the week of the classes, and arranging for refreshments. Following each session, the equipment was recalibrated to be functional for regular use. Attendance and evaluation feedback information was submitted to Idaho Power. No travel was necessary in 2014 due to lack of interest in the scheduled sessions at remote locations (Twin Falls, Pocatello, and Ontario): only three total registrations came in for these sites combined.

2.1 New Equipment Installation

The new equipment installed in 2014 included the following:

- An updated lighting control panel for the ”classroom” demonstration space (a model and type frequently observed in field installation)
- Four suspended dimming LED fixtures for the “open office” demonstration space
    - All four were connected to the existing digital lighting management (DLM) system
    - Two were controlled by an existing open-loop photocell
    - Two were a model with an integral photocell to show a simple retrofit application
- Wireless photocell, occupancy sensor, and switch for one of the “private office” demonstration spaces as a retrofit option

- A dimming LED lay-in fixture for the second "private office'' demonstration space. This fixture was equipped with integral photocell and occupancy sensors, again to demonstrate a retrofit option.
- An "up-down" photocell (open and closed loop combination) installed within the existing DLM system

Unfortunately, due to long lead times and the receipt of a damaged fixture, some of the scheduled Part 2 sessions were postponed until the equipment was functional. These sessions are noted in Section 3. of this report.

2.2 Marketing

Multiple marketing tools were used in an attempt to increase course attendance. A webpage was added to the main IDL site where detailed information about the courses and schedule was posted, and an online registration option provided. A postcard mailer was created and sent to over 600 potential attendees: a distribution list of electrical contractors, property managers, and others which was provided by Idaho Power and supplemented with the list of electrical engineers professionally licensed in Idaho. About 300 postcards remained for distribution at IDL and Idaho Power events. The postcard can be seen in the figures below. Slides were also developed to include at Idaho Power and IDL educational events. Course details and registration information were included in all IDL newsletters prior to the final course.

Figure 1: Marketing Materials - Postcard Front

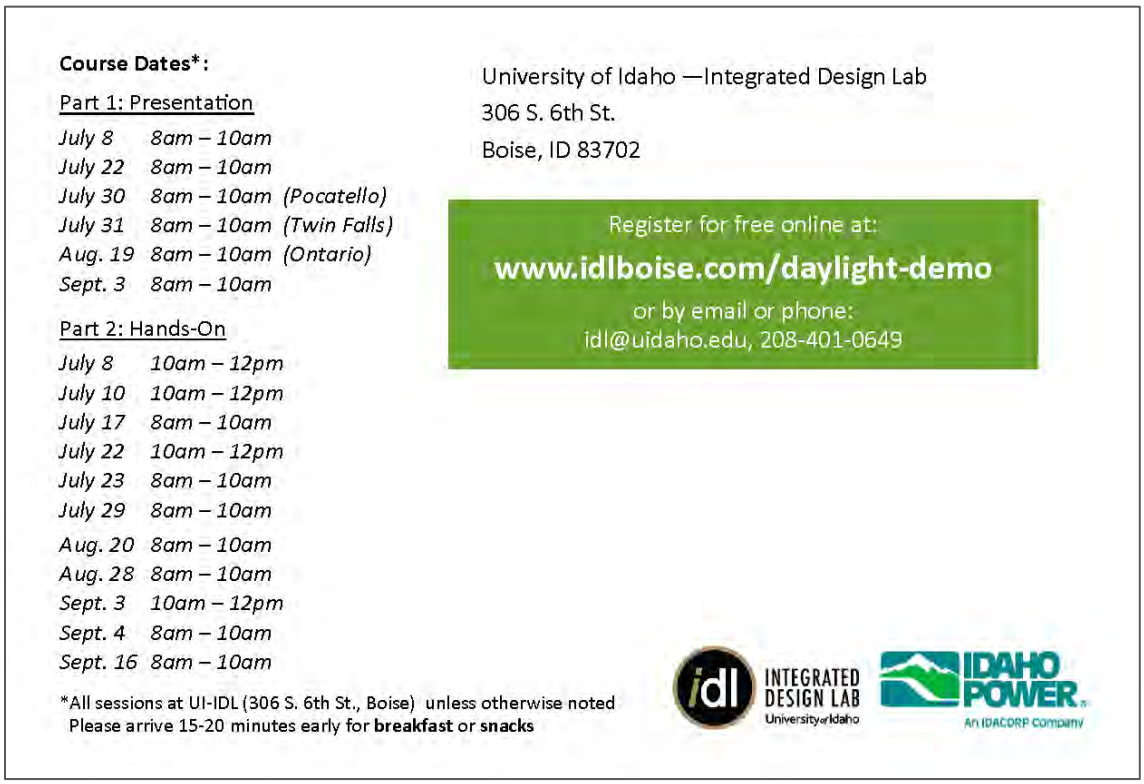


Figure 2: Marketing Materials - Postcard Back

3. Scheduled Sessions

Table 1. Summary of Scheduled Sessions

Date	Session	RSVPs	Attendees	Notes
7/8	Part 1	13	11	Only Part 1 – equipment not ready
7/8	Part 2	3	N/A	Postponed until equipment installed
7/10	Part 2	0	N/A	Postponed until equipment installed
7/17	Part 2	2	N/A	Postponed until equipment installed
7/22	Part 1	12	10	
7/22	Part 2	6	4	
7/23	Part 2	6	6	
7/29	Part 2	2	0	Prepared, but no one attended
7/30	Part 1	1	N/A	Cancelled due to low registrations - Pocatello
7/31	Part 1	2	N/A	Cancelled due to low registrations - Twin Falls
8/19	Part 1	0	N/A	Cancelled due to no registrations - Ontario
8/20	Part 2	0	N/A	Cancelled due to no registrations
8/28	Part 2	4	3	
9/3	Part 1	11	6	
9/3	Part 2	7	2	
9/4	Part 2	5	4	
9/16	Part 2	6	5	
	Total Part 1:		26	
	Total Part 2:		24	
	Total both:		**50**	

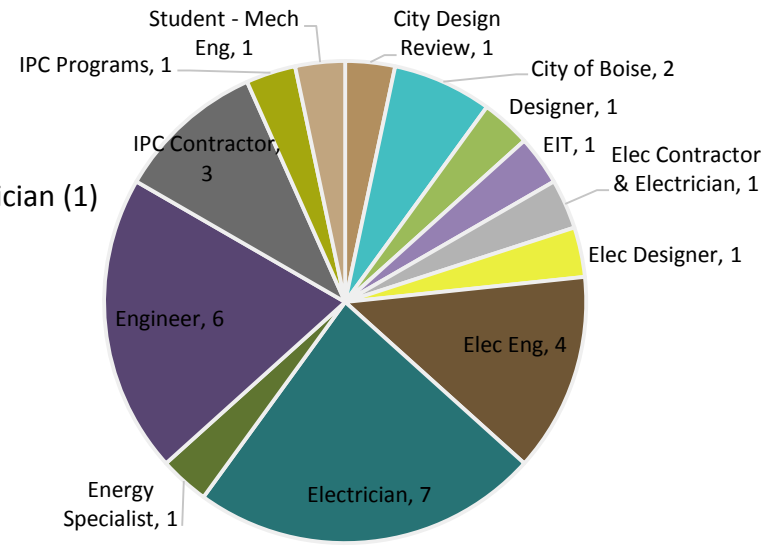
Total Sessions Taught: **9** (**3** Part 1 sessions and **6** Part 2 sessions)

4. Attendance Summary

Total Unique Participants: **29**
Number of Participants – Part 1: **26**
Number of Participants – Part 2: **24**
Total Contact Hours: **102**

Profession of Attendee Responses:

- City Design Review (1)
- City of Boise (2)
- Designer (1)
- EIT (1)
- Electrical Contractor & Electrician (1)
- Electrical Designer (1)
- Electrical Engineer (4)
- Electrician (7)
- Energy Specialist (1)
- Engineer (6)
- IPC Contractor (3)
- IPC Programs (1)
- Student (1)



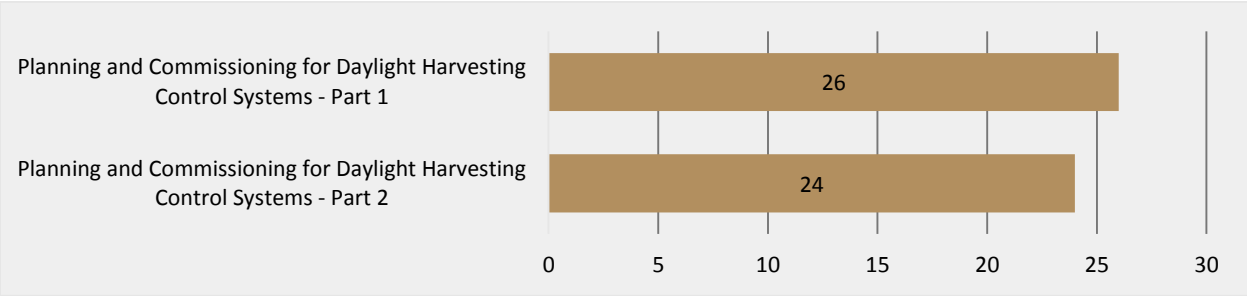


Figure 3: Attendee Count by Course Part

5. Evaluations

Below is the summary of all information collected from evaluation forms.

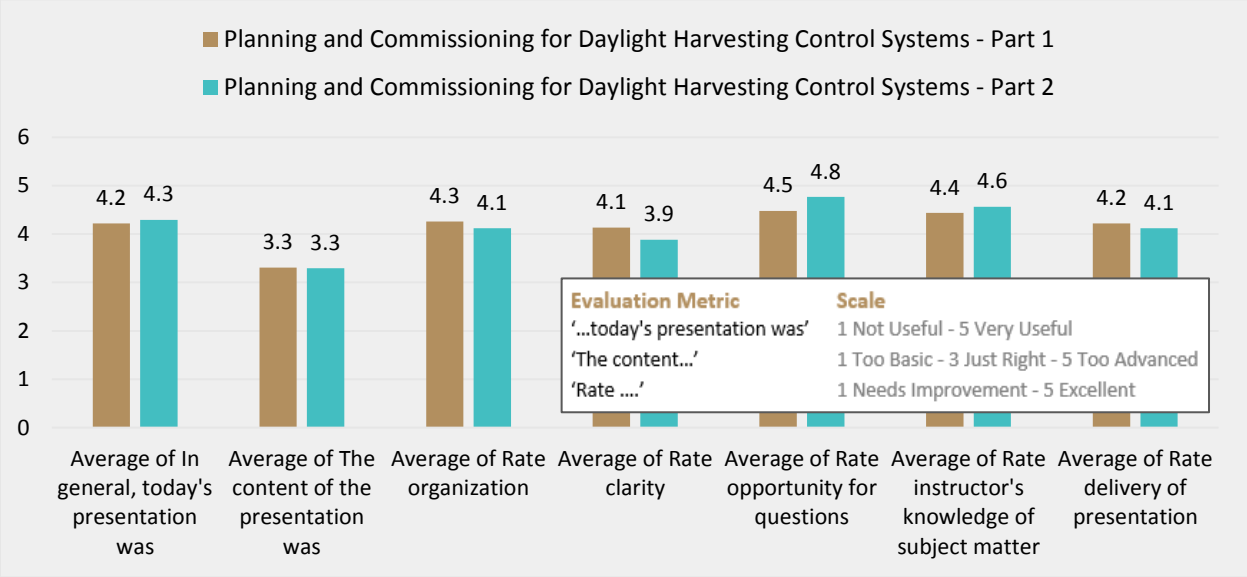


Figure 4: Evaluation Scores by Course Part

5.1 Part 1 Evaluations

Evaluations (total number = 23):

		Scale
In general, today's presentation was:	**4.2**	1 Not Useful - 5 Very Useful
The content of the presentation was:	**3.3**	1 Too Basic - 3 Just Right - 5 Too Advanced
Rate organization:	**4.3**	1 Needs Improvement - 5 Excellent
Rate clarity:	**4.1**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.5**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.4**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.2**	1 Needs Improvement - 5 Excellent

Comments:

Attendee suggested improvements for the instructor:

- The instructor was very good
- Include the example pages from their demonstration in their handout. Offer a condensed model of their presentation in book form for reference guide.
- Should deviate from slides. don't just read verbatim
- Monotone
- Louder, more clear presentation
- The material (slides on wall were difficult to read)
- Maybe a little more background on target audience prior to class (mail?) good instruction

What attendees found most valuable:

- The sensor types and the way of saving energy
- Types of lighting controls
- The different options available.
- Understanding a little of the Arch mind.
- Knowledge of and practice for lighting control
- Application
- Differences in code 2009 to 2012
- Latest IECC requirements
- Code comparisons
- Multi-level controls, code requirements
- Different lighting controls
- Actual case study of facility in Seattle
- Lighting codes
- Layering rules/code changes
- Overview of current codes
- I found that the most valuable part of this course was that Idaho Power is supporting University of Idaho in helping the community complete upgrades.
- New code information
- Case Study
- Overview of how system was integrated into office space
- Code review for 2012

Professional associations of which attendees are members:

- BSU ME student (1)
- IBEW (2)
- Idaho State Elect. (1)
- City of Boise (2)
- IAEI (3)

Other types of training attendees would find useful:

- Practical training for lighting sensors
- Operation of controls themselves
- Explanation & demonstration of different equipment that's offered.
- IECC 2012 requirements needing to be enforced by electrical inspectors.
- Modeling
- HVAC/passive systems, ROI studies
- Hands on product instructions, practical applications
- Technical support on wiring different types of lighting controls
- Additional code information and changes

5.2 Part 2 Evaluations

Evaluations (total number = 17):		Scale
In general, today's presentation was:	**4.3**	1 Not Useful - 5 Very Useful
The content of the presentation was:	**3.3**	1 Too Basic - 3 Just Right - 5 Too Advanced
Rate organization:	**4.1**	1 Needs Improvement - 5 Excellent
Rate clarity:	**3.9**	1 Needs Improvement - 5 Excellent
Rate opportunity for questions:	**4.8**	1 Needs Improvement - 5 Excellent
Rate instructor's knowledge of the subject matter:	**4.6**	1 Needs Improvement - 5 Excellent
Rate delivery of presentation:	**4.1**	1 Needs Improvement - 5 Excellent

Comments:

Attendee suggested improvements for the instructor:

- Preconfigure loads/relays to not be surprised/confused during class
- Well done!
- Presenter 1 - "uhm" cut it out! :)
  Presenter 2 - confidence, you sound timid, which makes you sound unsure
- working examples
- Great job, appreciate the clear overview of the different lighting systems
- Equipment operation

What attendees found most valuable:

- Explained variety of systems
- Demo of multiple types of systems
- Trouble shooting on the fly
- Different controls
- Showing the "How-To" of the session
- Hands on
- The new LED fixture and the control on photocell sensor
- Looking at the equipment, seeing hands on demonstration
- Hands on
- Seeing latest application in daylight harvesting
- Info on LED & photo cells
- Different lights and sensors
- Review of code requirements; review of representative project
- The hands on programming was very interesting. Seeing the different difficulty levels was very helpful.
- Instructor willing to answer questions.

Professional associations of which attendees are members:

- IBEW (1)
- NSPE (1)

Other types of training attendees would find useful:

- The relation between volt and candle heat

6. Improvements for Future Sessions

Based on recommendations from attendees, observations during the sessions, and experience planning and coordinating sessions, some items were identified that may improve future offerings of the course.

- **Plan for earlier equipment installation.** The lead times and damaged equipment caused a delay in some Part 2 sessions in 2014. It may be possible to avoid this scenario by coordinating for new equipment earlier.
- **Install less new equipment at one time.** Installation of the new equipment resulted in great attendee feedback on those new technologies; however, it was difficult to get all equipment functioning properly in the required timeframe. Some of the new equipment was not installed in time to be included in the curriculum before the first session.
- **Plan more back-to-back Part 1 and Part 2 sessions.** It was sometimes difficult for attendees to return for Part 2 at a later date.
- **Force more hands-on time for the participants.** Some groups were more eager than others to take the lead and try the equipment. Participation may be increased in future sessions if individuals are sent to different stations with explicit and detailed instructions while the instructor roams the stations for support.
- **Schedule sessions earlier or later in the year.** Historically, the sessions were held in summer because of more preferred daylight conditions. However, this is a busy time for industry participants. Late spring or early fall dates may result in increased attendance. Sessions may need to be held later in the day than they have been previously.
- **Call more potential participants or firms to get direct contact**. Although mailing marketing materials offered the opportunity to reach a great number of participants, it may be beneficial to make personal phone calls as well. Reminder calls or emails are also recommended.

7. Appendices

Appendix A: Updated Part 2 Worksheets

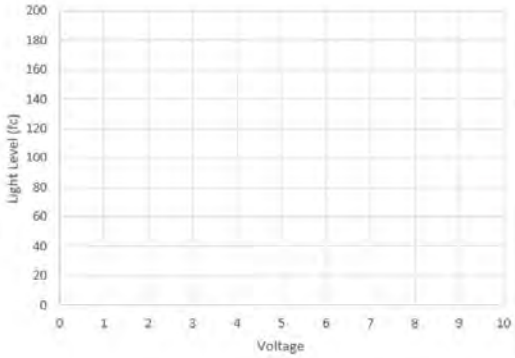
Part 2 Worksheet – Page 1

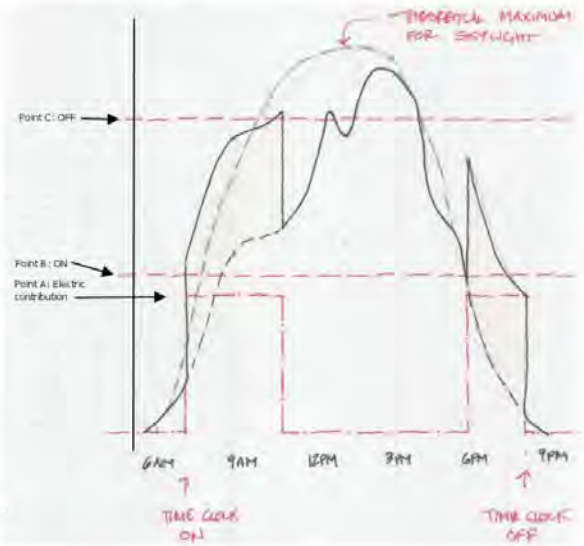
Planning and Commissioning for Daylight Harvesting – Part 2 (hands on)

Classroom

Closed Loop

- Take reading from photocell (lights can be ON or OFF)
  - Turn multimeter on to V (DC)
  - Measure voltage between photocell blue and black wire connections in panel _____V.
- Take light level reading from 'worst case' location in room _____fc.
- Plot the two values above on chart below & draw a straight line between (0, 0) and your plotted values.
- Find electric lighting contribution.
  - Record light level and convert to voltage using the line you drew below:
    - With lights ON _____fc and _____V.
    - With lights OFF _____fc and _____V.
  - Subtract OFF values from ON values: _____fc and _____V. This is the electric contribution (Point A below).
- Choose set-points
  - Point B - ON: _____ V (typically 110%-120% electric lighting contribution for switching)
  - Point C - OFF: _____V (typically about double the ON set-point voltage)

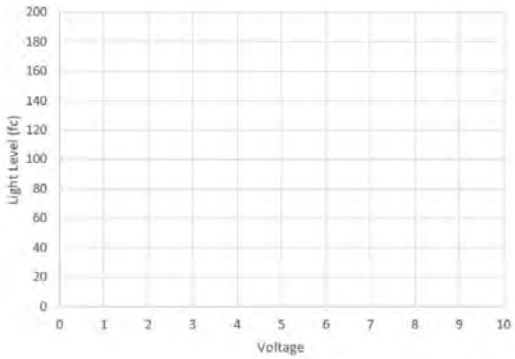


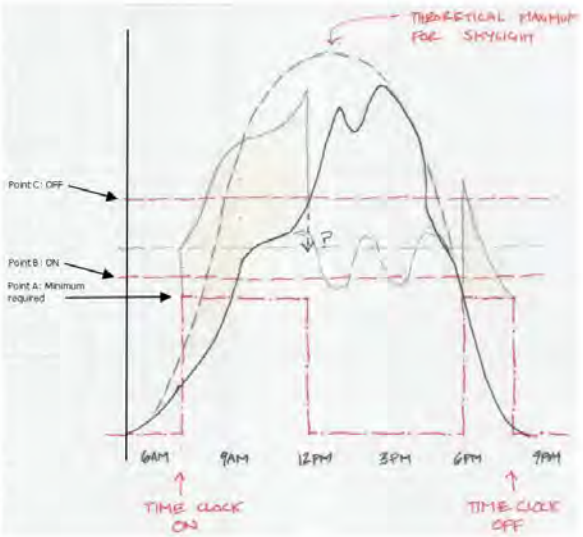


Part 2 Worksheet – Page 2

Open Loop

- Take reading from photocell (lights must be OFF)
  - Turn multimeter on to V (DC)
  - Measure voltage between photocell blue and black wire connections in panel _____V.
- Take light level reading from 'worst case' location in room _____fc.
- Plot the two values above on chart below & draw a straight line between (0, 0) and your plotted values.
- Find Point A:
  - Determine required lighting level from design or 'IES Footcandle Requirements' (attached at end) _____fc.
  - Convert the required lighting level to a voltage using the line you drew below _____V.
- Choose set-points
  - Point B - ON: _____ V (typically 110%-120% electric lighting contribution for switching)
  - Point C - OFF: _____V (typically about 1.5x the ON set-point voltage)





Open Office South (Load 1) – *(2) 47 W LED luminaires with integral daylight sensors*

Luminaires on load 1 share a wall switch but are controlled by individual photocell sensors. Do the following on either of the Load 1 fixtures.

- Twist sensor to provide the most light, record light level _____fc.
- Twist sensor to provide the least light, record light level _____fc.
- Twist sensor to provide the desired light level _____fc.

Open Office North (Load 2) – *(2) luminaires with (2) 32 W T8s each*

Using the handheld remote:

- Select 'Daylighting Config'
- Choose LMLS-400 and find the correct sensor (use 'specific' or 'search' there is only one LMLS-400 on our system)
- Once correct photocell has been selected, chose 'calibration' then 'automatic calibration.'
  - Auto calibrate takes ~4 minutes
  - Using light meter note light level at desk surface _____fc.
- Choose the LMLS-400 sensor again, 'calibration' then 'manual calibration.'
  - Select 'Day' setup
  - Adjust light level to desired set point, note level chosen here _____fc (from light meter).

Open Office South (Load 3) – *(2) 47 W LED luminaires*

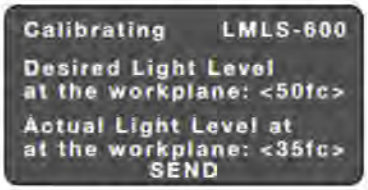
Using the handheld remote:

- Select 'Daylighting Config'
- Choose LMLS-500 and find the correct sensor (use 'specific' or 'search' there is only one LMLS-500 on our system)
- Once correct photocell has been selected, chose 'calibration.'
  - Lights will 'warm up' for 2 minutes
  - Using light meter in the location most likely to have the lowest light level enter light level _____fc at 'full on.'
  - Enter the level at 'all off' _____fc.
  - Lastly choose desired light level set-point _____fc.
- To change the set-point: daylighting config > zone settings >

Part 2 Worksheet – Page 4

Open Office North (Load 4) – *(2) luminaires with (2) 32 W T8s each*

The handheld remote is not working for calibration of the LMLS-600 sensor. It should provide the option for an 'auto calibrate' as well as 'manual.' The 'manual' option allows input of actual light level and desired light level.



Private Office 1 – *54 W LED luminaire with integral daylight and occupancy sensors**

- Twist sensor to provide the most light, record light level _____fc.
- Twist sensor to provide the least light, record light level _____fc.
- Twist sensor to provide the desired light level _____fc.

**Note – one of the knobs is set (default) to setting I which prevents photocell control. For this application, we need the knob set to II to allow the control. Unfortunately, this fixture must be replaced due to the knob being stuck on setting I.*

Private Office 2 – *wireless control system (occupancy sensor, photocell, and switch)***

- Starting light level _____fc.
- With the light meter on the desk surface:
  - Follow the Wireless Programming Quick Reference Guide using the wireless switch to navigate
  - During the 'adjust light level' step, use the light meter and set to desired set-point _____fc.

***NOTE: the wireless photocell control has a default time delay that cannot be adjusted. Adjusted settings may not take effect immediately.*

Part 2 Worksheet – Page 5

IES Footcandle Recommendations

The following selected footcandle ranges represent the Illuminating Engineer Society's (IES) current illuminance recommendations. Indiviudal applications will determing exact foot-candle levels. Please refer to the IES Lighitng Handbook for more detailed evaluation.

Airplane Manufacturing
- Drilling, riveting, screw fastening....75
- Final assemble, hangar....100
- Inspection....50-200
- Welding....50

Assembly
- Rough easy seeing....20-50
- Rough difficult seeing....50-100
- Medium....100-200
- Fine....200-500(a)
- Extra fine....500-1000(a)

Auditoriums
- Social activities....5-10
- Assembly only....10-20
- Exhibitions....10-20

Automobile Manufacturing
- Final assembly, finishing, inspecting....200
- Body & chassis assembly....100
- Body parts manufacturing....100
- Frame assembly....50

Banks
- Lobby general....10-50
- Writing areas....20-70
- Teller stations, posting & keypunch....50-150

Barber Shops
- Beauty Parlors....50-100

Chemical Works....30

Clothing Manufacturer
- Receiving, storing, shipping, winding, measuring....20-50
- Pattern making, trimming....50-100
- Shops, marking....50-200
- Cutting, pressing....100-500(a)
- Sewing, inspection....200-500(a)

Electrical Equipment Manufacturing
- Impregnating....20-50
- Insulating coil winding, testing....50-100

Food Service Facilities
- Dining areas
- Cashier....20-50
- Cleaning....10-20
- Dining....5-20
- Food displays....30-100
- Kitchen....50-100

Foundries
- Annealing furnaces....20-50
- Cleaning....20-50
- Core making....50-200
- Inspection
- Fine....100-500
- Medium....50-100
- Molding....50-200
- Pouring, sorting....50-100

Garages-Motor Vehicles
- Storage....5
- Traffic Lanes
- Parking garage....10
- Service garage....10-20
- Entrances....50
- Repair area....50-100

Gymnasiums
- Assemblies....10
- General exercise & recreation....30
- Exhibitions, matches....50

Hospitals
- Rooms....10-30
- Corridors....5-30
- Emergency rooms....50-100
- Operating rooms....100-200

Hotels
- Bathrooms....20-50
- Bedrooms for reading....20-50
- Corridors, elevators and stairs....10-20
- Front desk....50-100
- Linen room
- Sewing....100-200
- General....10-20
- Lobby
- General lighting....10-20
- Reading and working areas....20-50

Iron & Steel Manufacturing
- Stock, hot top, checker cellar, calcining....10-30
- Building, slag pits, stripping yard....20
- Control platforms, repairs, mixer building....30
- Rolling mills....30-50
- Shearing....50
- Tin plate....50
- Motor room, machine room....30
- Inspection....100

Laundries
- Washing....20-50
- Ironing....20-100

Library
- Ordinary reading, stacks....20-50
- Book repair and binding....20-50
- Study & notes, cataloging, card files, check desk....20-100

Machine Shops
- Rough bench....20-50
- Medium bench, rough grinding, buffing....50-100
- Fine bench and work....200-500(a)

Materials Handling
- Loading trucking....10-20
- Picking stock classifying....20-50
- Wrapping, packing, labeling....20-50

Offices
- Accounting....50-100
- Audio-visual areas....20-50
- Conference areas....20-70
- Corridors, stairways....20(k)
- Drafting....50-200
- General and private offices....50-100
- Lobbies, lounges and reception areas....0-20
- Mail sorting....50-100
- Off-set printing and duplicating area....20-50
- Spaces with VDT's....75

Paint Shop
- Spraying, rubbing, hand art, stencil....20-50
- Fine hand painting & finishing....50-100

Paper Manufacturing
- Beaters, grinding....20-50
- Finishing, cutting....50-100
- Hand couting....50-100
- Paper manchine reel, inspection....100-200
- Rewinder....100-200

Printing
- Photo engraving, etching. blocking....20-50
- Color inspecting....100-200
- Presses....50-100
- Proofreading....100-200
- Composing room....50-100

Schools
- Reading....20-100
- Typing....20-100
- Demonstrations....100-200
- Sewing....20-100

Sheet Metal Works
- General....100
- Tin plate inspection, galvanized, scribing....100-200

Stores
- Circulation area stockroom....10-30
- Merchandising, serviced....30-100
- Merchandising, self-service....200

Textile Mills
- Cotton picking, carding, roving, spinning....50
- Beaming & slashing....150
- Drawing....200
- Others....100

Warehousing, Storage
- Inactive....5-10
- Active
- Rough bulky....10-20
- Medium....20
- Fine....20-50

Welding
- General....20-50

Woodworking
- Rough sawing and bench work....20-50
- Sizing, planing, rough sanding, medium quality machine and bench work, gluing, veneering, cooperage....20-50
- Fine bench and machine work, fine sanding and finishing....50-100

Footnotes:

(a) Obtained with a combination of general light plus specialized supplementary lighting

(k) Or not less than 1/5 the level in adjacent areas

2014 Task 8: Simulation Quality Assurance

Summary of Projects

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_005-01

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Contract Number:
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Acronyms and Abbreviations

ECM	Energy Conservation Measure
IDL	Integrated Design Lab
IPC	Idaho Power Company
M&V	Measurement and Verification
UI	University of Idaho

1. Introduction

The general scope of work for the 2014 Idaho Power Company (IPC) Simulation Quality Assurance task included support to the University of Idaho Integrated Design Lab (UI-IDL) in providing quality assurance with pre- and post-measurement and verification (M&V) work. The goal was to compare modeled vs. realized savings on three to five projects. These projects and their specific scopes of work were determined by IPC. During 2014, the review process was completed for three projects and progress was made on the fourth. A detailed report summarizing the work and findings was provided to IPC for each project once it was completed. This report provides a brief summary of the projects.

2. Project Summary

Facility	Work Completed
Secondary Education Facility	• Coordination with facilities management and controls system service provider to set up trend logs of necessary data. (This review was not completed in 2014).
Office Building 1	• Development of a calibrated EnergyPlus model and a code baseline EnergyPlus model. • Analysis of trend data from controls system. Additional trends necessary for analysis were not previously being logged: these were set up in the controls system. • Installation of, and frequent download from, multiple loggers to capture data not provided by the controls system. • Determination of actual savings compared to code values.
Financial Institution	• Review of eQuest models for two buildings, with five iterations each to capture savings of multiple energy conservation measures (ECMs). • Documentation of detailed differences between models to show how the savings values were achieved. • Review of the findings with both the simulationist and IPC to discuss the findings and possible improvements. • Review of final simulations after edits were made.

Office Building 2	• Review of three eQuest building models, one baseline and two simulations of the proposed ECMs. • Documentation of critical inputs and discrepancies between models for IPC's review. • Discussion of findings and suggestions for improvement with the simulationist and IPC.

2014 Task 7: Tool Loan Library

Summary of Effort and Outcomes

Idaho Power Company Year-End Report

December 31, 2014

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Report Number: 1401_007-05

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Acronyms and Abbreviations

AC	Air Conditioning
AIA	American Institute of Architects
AHU	Air Handling Unit
Amp	Ampere
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
BOMA	Building Owners and Managers Association
BSU	Boise State University
CO2	Carbon Dioxide
CT	Current Transducer
Cx	Commissioning
DCV	Demand Control Ventilation
EE	Energy Efficiency
EEM(s)	Energy Efficiency Measure(s)
fc	Foot-Candle
HVAC	Heating, Ventilation, and Air Conditioning
IAC	Industrial Assessment Center
IBOA	Intermountain Building Operators Association
IDL	Integrated Design Lab
Int.	International
IPC	Idaho Power Company
kW	Kilowatt
kWh	Kilowatt-Hour
M&V	Measurement and Verification
OSA	Outside Air
PG&E	Pacific Gas and Electric Company

PPM	Parts Per Million
RPM	Rotations Per Minute
RTU	Rooftop Unit
TLL	Tool Loan Library
UI	University of Idaho
USGBC	U.S. Green Building Council
Verif.	Verification
VOC	Volatile Organic Compound

1. Introduction

The Tool Loan Library (TLL) is a resource supported by Idaho Power Company (IPC) and managed by the University of Idaho Integrated Design Lab (UI-IDL). The primary goal of the TLL is to help customers with energy efficiency (EE) needs through the use of sensors and loggers deployed in buildings of various types. Loans are provided to individuals or businesses at no charge to the customer. Over 900 individual pieces of equipment are available for loan through the TLL. The equipment is focused on measurement parameters to quantify key factors related to building and equipment energy use, and factors which can affect worker productivity.

The loan process is started when a customer fills out the tool loan proposal form, which is found on the TLL webpage (www.idlboise.com/tool-loan-library). When completing a tool loan proposal, the customer gives basic background information on the customer, project, and data measurement requirements and goals. When a proposal is submitted, UI-IDL staff members are alerted of a pending proposal via email. The customer and a staff member communicate to verify and finalize equipment needs. Tools are picked up at the UI-IDL or shipped at the customer's expense.

The TLL at the UI-IDL is modeled after the Lending Library at the Pacific Energy Center, which is supported by Pacific Gas and Electric (PG&E). Research suggests that the PG&E and the UI-IDL library are the only two public tool-lending libraries in the country.

2. Marketing

Marketing for the TLL was done at various UI-IDL and IPC activities throughout 2014, as well as on the UI-IDL website. Five hundred tool loan flyers were printed in March of 2014 for distribution by IPC and UI-IDL staff. The flyer layout was unchanged from 2013: it is in Figure 1 and Figure 2 below. The TLL was promoted in presentations given by the UI-IDL staff, including the Lunch and Learn series, Fall Lecture Series, and lectures to professional organizations such as American Society of Heating and Refrigeration Engineers (ASHRAE), American Institute of Architects (AIA), International Building Operators Association (IBOA), City of Boise, Building Owners and Operators Association (BOMA), and U.S. Green Building Council (USGBC) events.

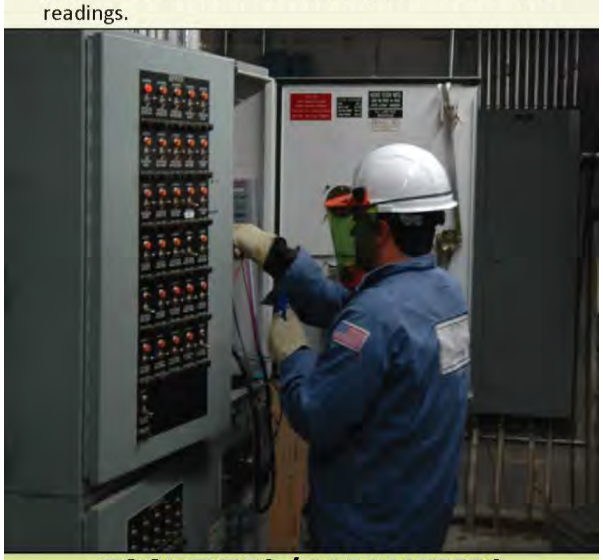
The TLL flyer and program slides point potential users to the TLL website for more information about the library. The main UI-IDL website hosts the TLL portal where customers can submit proposals and request tools, all online. In 2014, the TLL home page had 449 visitors.

INTEGRATED idl DESIGN LAB
University of Idaho

TOOL LOAN LIBRARY

The Tool Loan Library is a free resource managed by the University of Idaho-Integrated Design Lab (UI IDL) available to Idaho Power Company customers to support energy efficiency, demand response, or demand reduction projects. Loans are free of charge for people working on projects in the Idaho Power Company service territory.

The Library has a large variety of tools to capture many parameters for both data logging and on-site spot readings.



TOOL TYPES / PARAMETERS

Power (kW)	Temperature
Energy (kWh)	Relative Humidity
Power Factor	State Logging-Light
Voltage	State Logging-Magnetic
Solar flux (W/m^2)	Air Velocity
Plug loads (120V)	Air Pressure
RPM	Sound Level
Current	Gas-VOC
Flow-liquids	Light Level (lux,fc,ca)
Gas-(CO_2 ppm)	Thermal Imaging Camera
Flow-Natural Gas	Air Balance Equipment
Ultrasonic Leak Detection	

306 S. 6th Street
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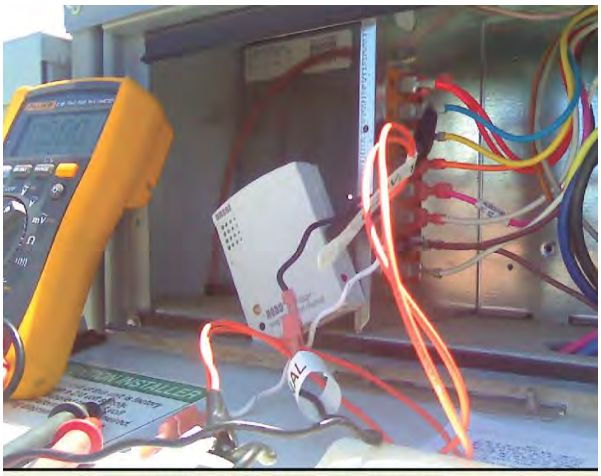
www.idlboise.com
wwwidahopower.com

IDAHO POWER
An IDACORP Company

Figure 1: TLL Flyer Front



TOOL LOAN PROCESS

You will need to have a registered user account to access the tool request form. Creating an account is easy and free. An available tool inventory can be viewed online with information on how specific tools are used.

STEP 1: Access the UI-IDL website at (idlboise.com)
STEP 2: Select the Tool Loan Library tab
STEP 3: Log in, if you don't have an account click the register button on the top right of the IDL website, or follow the prompts to register from the Tool Request Form link.
STEP 4: Select the Tool Request Form link and complete the form.
STEP 5: The form will be sent to staff at the UI-IDL who will determine which tools are best for your application, and will contact you and provide the best equipment available to fulfill your request.

www.idlboise.com/tool-loan-library

Figure 2: TLL Flyer Back

3. 2014 Summary Off Loans

In 2014, loan requests totaled 38 with 36 loans completed. The second quarter had the highest volume of loans with 15. Loans were made to 15 different locations and 23 unique users. A wide range of tools was borrowed, as listed in Figure 8. The majority of tools were borrowed for principle investigations or audits, although loans were also made for determining baselines before EEMs were implemented. Tools were borrowed to verify these EEMs as well. Table 1 and the following figures outline the usage analysis for TLL in 2014.

Table 1: Project and Loan Summary

	Request Date	Location	Project	Type of Loan	# of Tools Loaned
1	1/1/2014	Boise	Commissioning lighting project	Verif. of EEMs	1
2	1/20/2014	Sun Valley	Verify temperature and humidity at	Verif. of EEMs	2
3	1/28/2014	McCall	Residential envelope analysis	Audit	1
4	3/10/2014	Eagle	Residential economizer pre and post analysis	Baseline	1
5	3/12/2014	Boise	Temperature and humidity analysis for moisture content in strawbale walls	Audit	3
6	3/14/2014	Int.	CO2 decay analysis	Audit	1
7	3/24/2014	Ketchum	Energy consumption of equipment at industrial facility	Audit	10
8	3/25/2014	Ogden	Industrial building energy audit	Audit	9
9	3/25/2014	Boise	Daylighting experiment	Audit	1
10	4/1/2014	Missoula	Verification of EEMs	Verif. of EEMs	9
11	4/3/2014	Boise	Log space temperatures for possible set-backs	Audit	5
12	4/3/2014	Idaho Falls	Air compressor analysis at industrial plant	Baseline	8
13	4/4/2014	Boise	Lighting study for class	Audit	1

14	4/8/2014	Boise	Daylighting assessment	Audit	1
15	4/10/2014	Kuna	Residential envelope analysis	Audit	1
16	4/15/2014	Boise	Residential appliance energy audit	Audit	2
17	4/16/2014	Nampa	Industrial building energy audit	Audit	14
18	4/25/2014	Boise	Energy consumption analysis for pre- and post-maintenance of commercial RTUs	Baseline	17
19	4/29/2014	Boise	Energy audit tool introduction to local engineering firm	Audit	7
20	5/6/2014	Boise	OSA analysis for potential DCV installation at a commercial office	Audit	4
21	6/10/2014	Boise	Industrial building energy audit	Audit	5
22	6/16/2014	Boise	Savings verification of commercial office building	Verif. of EEMs	53
23	6/25/2014	Boise	Industrial building energy audit	Audit	15
24	6/26/2014	Boise	ENERGYSTAR® certification of commercial office building	Audit	3
25	8/18/2014	Boise	Energy consumption of equipment at industrial facility	Audit	17
26	8/29/2014	Boise	AHU commissioning at health care facility	Audit	1
27	10/29/2014	Twin Falls	Potential heat recovery inspection	Audit	1
28	10/31/2014	Garden City	End-use analysis at local winery	Audit	1
29	11/6/2014	Pocatello	Power quality and load analysis at industrial facility	Audit	0
30	11/24/2014	Boise	Leak detection on compressed air system and refrigeration load analysis at a brewery	Audit	2
31	11/24/2014	Boise	Computer room AC diagnosis	Audit	10
32	11/25/2014	Boise	Envelope investigation of commercial office	Audit	1
33	11/26/2014	Boise	Hydronic system leak detection commercial office	Audit	1
34	12/3/2014	Undisclosed	Solar thermal system commissioning of production facility	Verif. of EEMs	35
35	12/3/2014	Undisclosed	Solar thermal system commissioning of production facility	Verif. of EEMs	36
36	12/15/2014	Boise	Investigate reflectivity of materials in a design	Audit	1
37	12/16/2014	Boise	Heat pump diagnosis	Audit	6
38	12/23/2014	Boise	HVAC diagnosis at health-care facility	Audit	0
					286

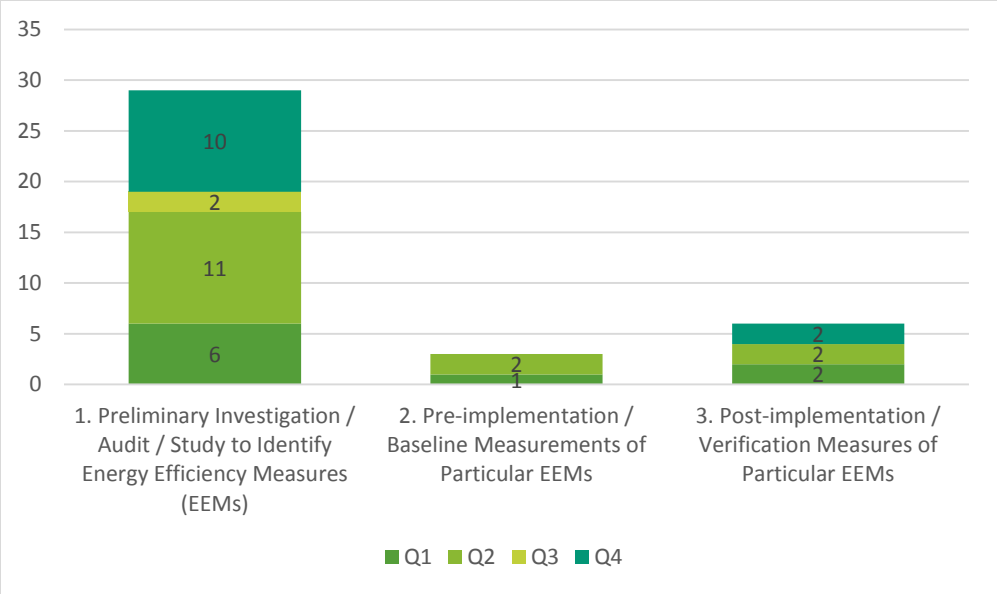


Figure 3: Loans by Type

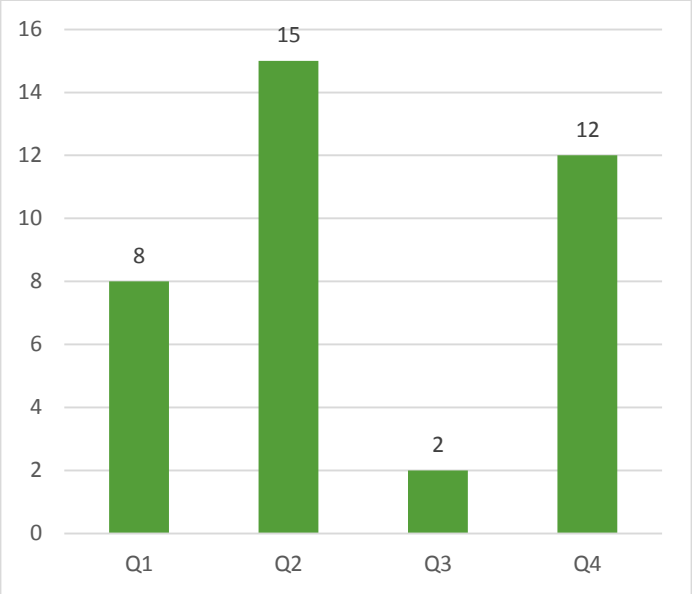


Figure 4: Number of Loans per Quarter

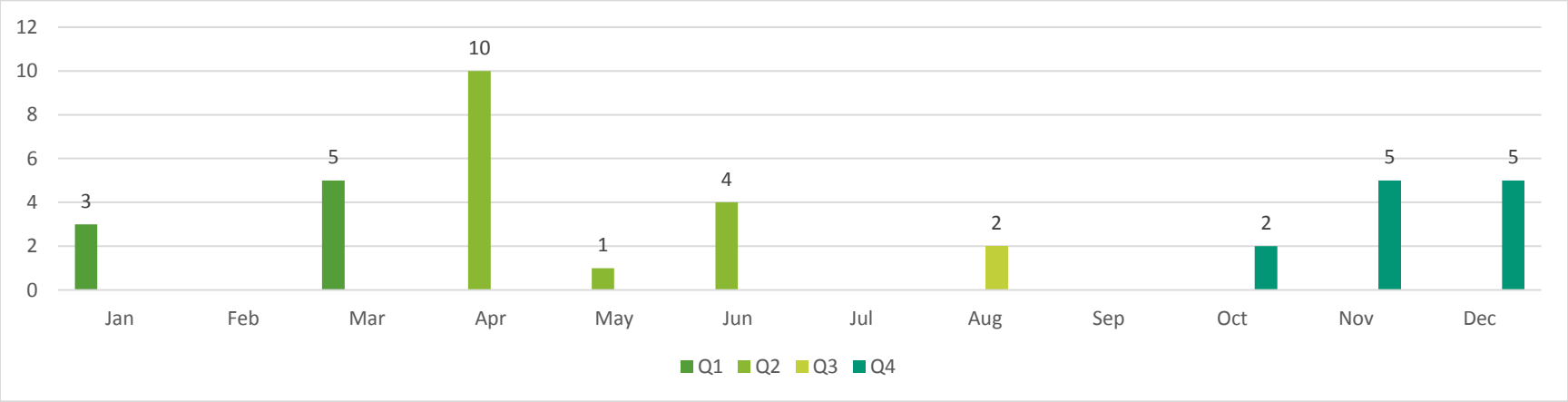


Figure 5: Number of Loans per Month

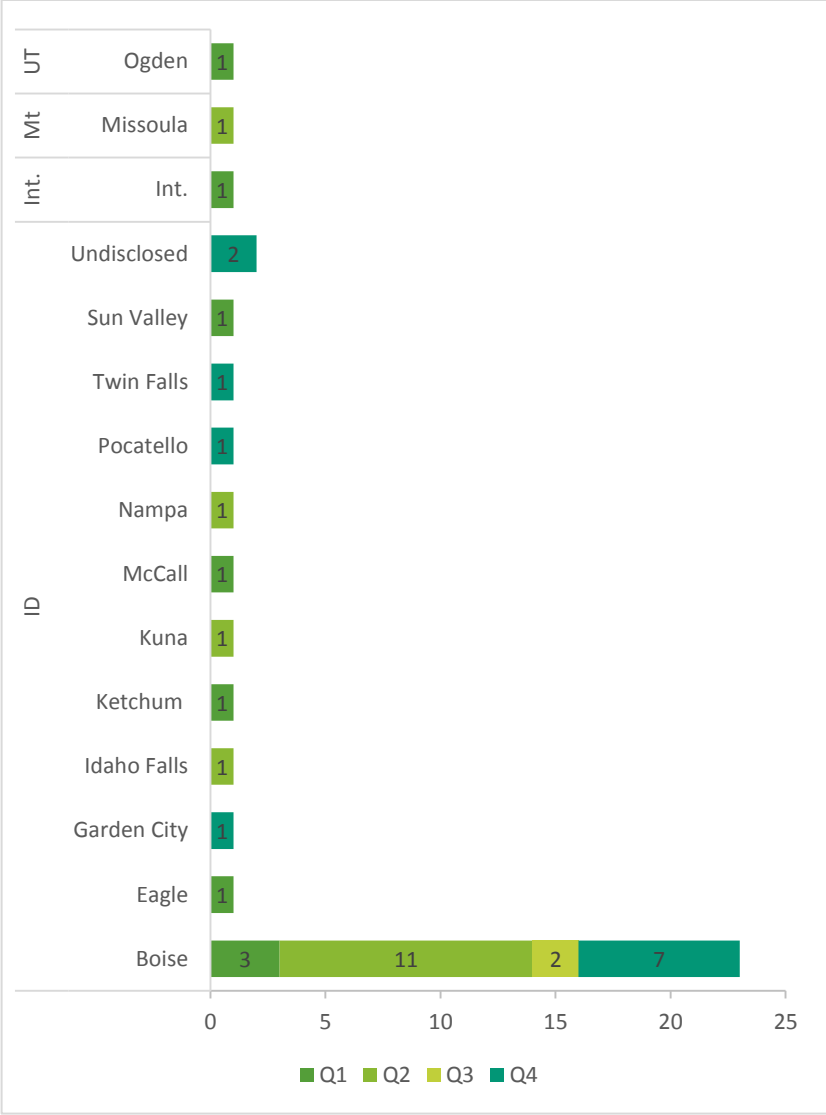


Figure 6: Number of Loans by Location

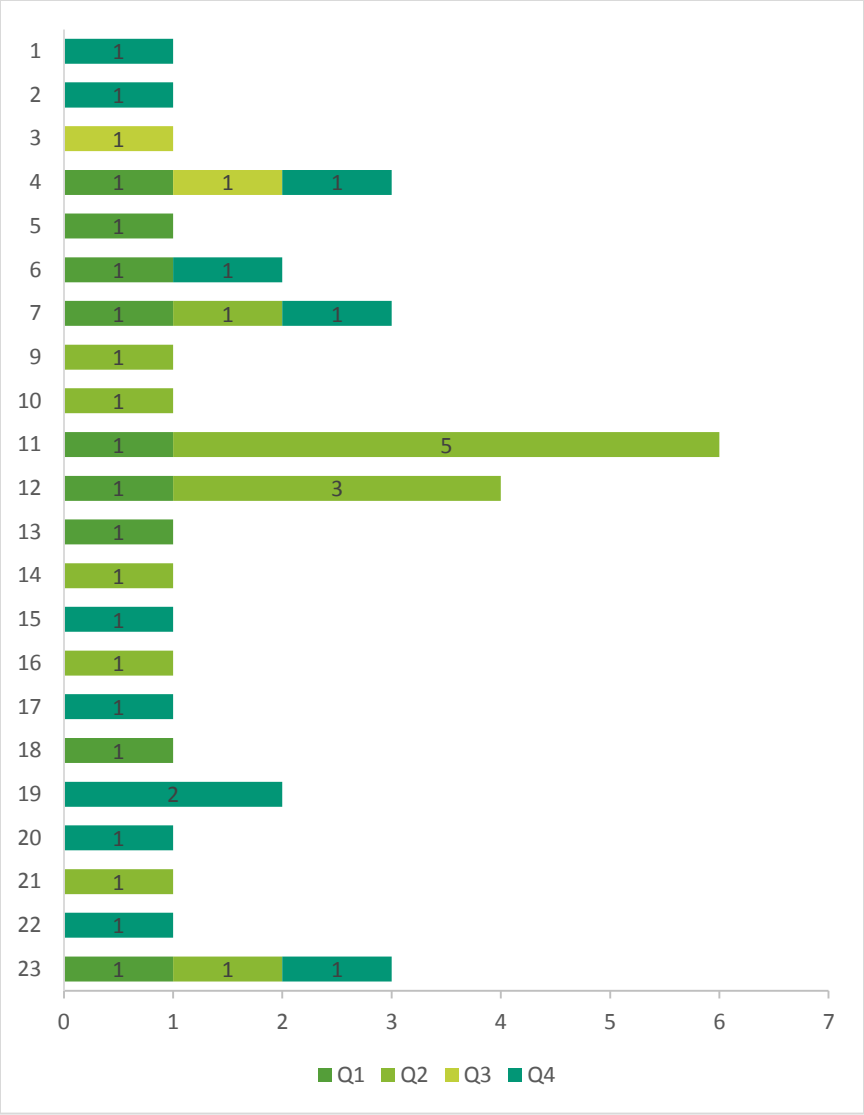


Figure 7: Number of Loans per User

TOTAL TOOLS LOANED: **286** Q1=**29** Q2=**145** Q3=**18** Q4=**94**

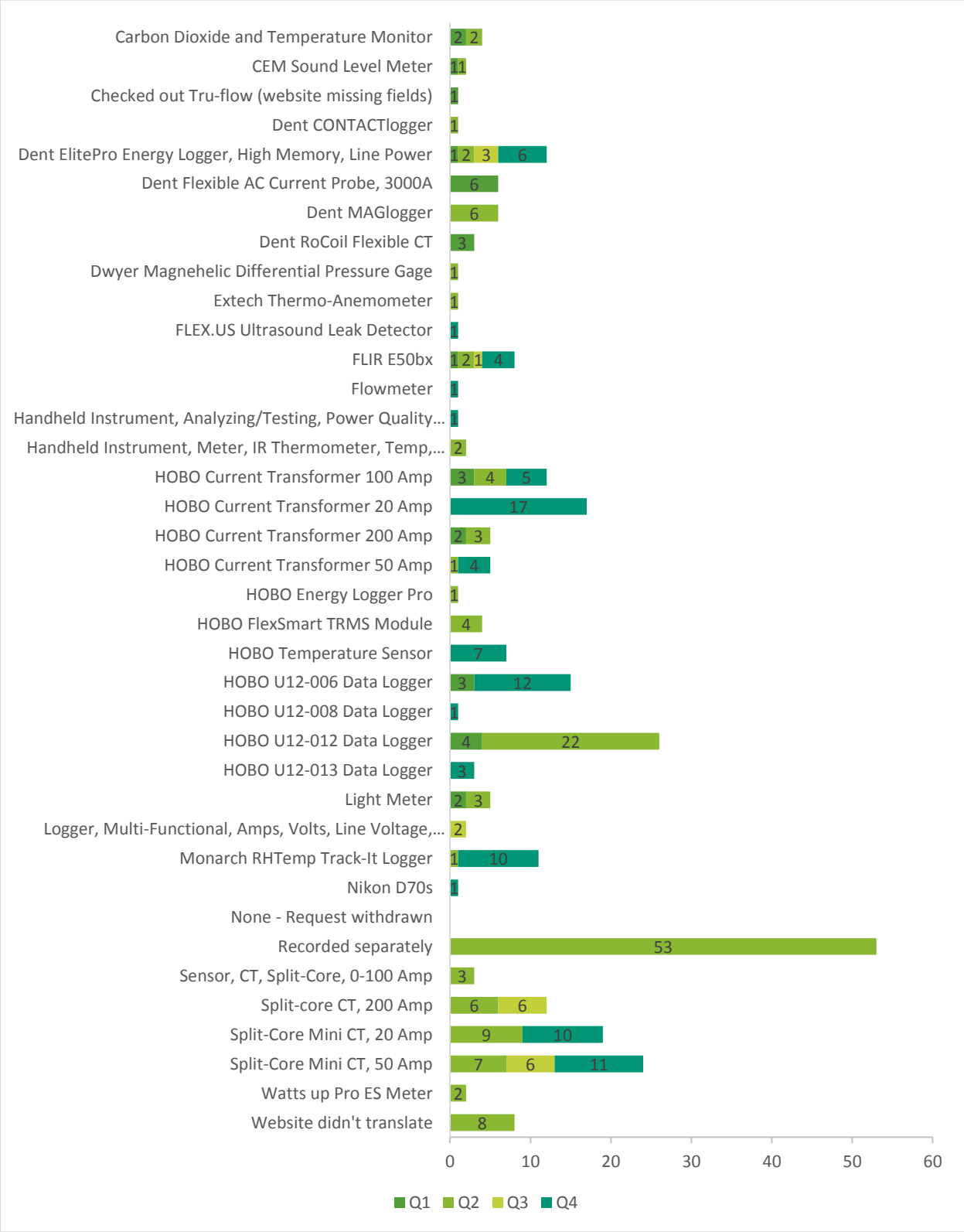


Figure 8: Summary of Tools Loaned

4. Appendices

Appendix A: Equipment List

Manufacturer	Model	Category/Measurement Parameter
Dwyer Instruments	Magnehelic	Guage, Pressure, Differential
Fluke	Fluke PV350	Handheld Instrument Accessories, Multimeter Adapter, Vacuum
Bjornax AB		Handheld Instrument, Analyzing/Testing, Air Current Tester, Smoke Pen
Retrotec		Handheld Instrument, Analyzing/Testing, Air Current Tester, Smoke Pen
Ideal	61-534	Handheld Instrument, Analyzing/Testing, Circuit Breaker Finder
Fluke	Fluke 43B	Handheld Instrument, Analyzing/Testing, Power Quality Analyzer, (Still and Motion)s, Line Voltage, Volts, Ohms
Dwyer Instruments	ASG	Handheld Instrument, Analyzing/Testing, Signal Generator, Analog Signal
Monarch	NOVA-STROBE BB115	Handheld Instrument, Analyzing/Testing, Stroboscope (Battery Powered), Flashes/Min, Rev/Min
Raytek	Raynger PM50, RAYRPM5L3SZU-A84	Handheld Instrument, Logger, IR Thermometer, Temp
CEM	DT-8852	Handheld Instrument, Logger, Sound Level, Decibel
Fluke	Fluke 116	Handheld Instrument, Meter, AC/DC Multimeter, Amps, Line Voltage, Volts, Ohms, Temp
DYNASONICS	UFX	Handheld Instrument, Meter, Flow Meter, Flow Rate
Extech	EA33 with Memory	Handheld Instrument, Meter, Light Meter, Luminance, Illuminance
Extech	461891	Handheld Instrument, Meter, Tachometer (Contact), Rev/In
Extech	HD300	Handheld Instrument, Meter, Thermo-Anemometer, CFM/CMM, Temp
Fluke	Fluke i410	Handheld Instrument, Sensor, AC/DC Adapter-Clamp-On, Amps
Fluke	Fluke 62	Handheld Instrument, Sensor, IR Thermometer, Temp
Raytek	MT2	Handheld Instrument, Sensor, IR Thermometer, Temp
GE Telaire	Telaire 7001 with Onset Cable	Handheld Instrument, Sensor, Monitor, CO2, Temperature
Sylvania	QT 2X32/277 IS	Lighting Accessories, Ballast, Instant Start
Philips	Advance Mark 7 0-10V IZT-2S32-SC	Lighting Accessories, Ballast, Programmed Start, Dimmable
Electronic Educational Devices		Logger, Logger Accessories, UO Cord Sets
Onset Computer Corporation	Voltage Input Leadset	Logger, Logger Accessories, Voltage Input Lead Set
Onset Computer Corporation	Hobo U-Shuttle	Logger, Logger Transporter
Electronic Educational Devices	Watts Up? Pro ES	Logger, Multi-Functional, Amps, Volts, Power Factor, Line Power, Watts, Watt Hours, Cumulative Cost, more
Onset Computer Corporation	Hobo H22-001, Energy Logger Pro	Logger, Multi-Functional, External Channels

Manufacturer	Model	Category/Measurement Parameter
Onset Computer Corporation	Hobo U12-006	Logger, Multi-Functional, External Channels
Onset Computer Corporation	Hobo U12-008	Logger, Multi-Functional, External Channels, Outdoor
Dent Instruments	ElitePro, High Memory	Logger, Multi-Functional, Power, Amps, Volts, Power Factor, Line Voltage
Dent Instruments	ElitePro, Standard Memory (512K)	Logger, Multi-Functional, Power, Amps, Volts, Power Factor, Line Voltage
Dent Instruments	ElitePro SP Power Meter	Logger, Multi-Functional, Power, Amps, Volts, Power Factor, Line Voltage, Watts, Kilowatt Hours, more
Onset Computer Corporation	Hobo U8-003	Logger, Multi-Functional, Temp, RH
Monarch	Track-It Mod #5396-0201	Logger, Multi-Functional, Temp, RH
Onset Computer Corporation	Hobo U12-013	Logger, Multi-Functional, Temp, RH, Extra Channels
Onset Computer Corporation	Hobo U12-012	Logger, Multi-Functional, Temp, RH, Light, Extra Channels
Onset Computer Corporation	Hobo U8-004	Logger, Multi-Functional, Temp, RH, Light, Extra Channels
Dent Instruments	CONTACTlogger	Logger, Single-Functional, Dry Contact
Dent Instruments	MAGlogger	Logger, Single-Functional, Magnetism
Onset Computer Corporation	S-FS-CVIA	Module, Flexsmart Analog, Extra Channels
Onset Computer Corporation	S-FS-TRMSA	Module, Flexsmart TRMS Converter, AC Current, AC Voltage
Onset Computer Corporation	S-FS-TRMSA-D	Module, Flexsmart TRMS Converter, AC Current, AC Voltage
Dent Instruments	ELOG 2004 Software for ElitePro	Office, Computer Software, ElitePro 2004
Dent Instruments	SMARTware Software for all SMARTloggers	Office, Computer Software, SMARTware
Toshiba	Tecra M2V-S330,	Office, Computer, Laptop
Lenovo	ThinkPad T430	Office, Computer, Laptop
Lenovo	X100e	Office, Computer, Laptop
Samsung	TabletGT-P5113TS	Office, Computer, Tablet
Point Grey Camera Omnitech Robotics	ORIVBF1	Photography (Still and Motion), Camera Accessories, Filter.
Nikon	AF Fisheye 10.5 mm	Photography (Still and Motion), Camera Accessories, Lens, Fisheye
Point Grey Camera Omnitech Robotics	ORIFL190-3	Photography (Still and Motion), Camera Accessories, Lens, Fisheye
Nikon	AF-S Nikkor 12-24 mm	Photography (Still and Motion), Camera Accessories, Lens, Nikkor
RODE	VIDEOMICPRO	Photography (Still and Motion), Camera Accessories, Microphone
Manfrotto	Tripod	Photography (Still and Motion), Camera Accessories, Tripod.
Gear	Tripod - "Baby" 14" to 36"	Photography (Still and Motion), Camera Accessories, Tripod.
Heliodon Camera	Heliodon Camera	Photography (Still and Motion), Motion Camera, Heliodon
Olympus	Camedia C-8080	Photography (Still and Motion), Still Camera, DLSR
Nikon	D70S	Photography (Still and Motion), Still Camera, DLSR

Manufacturer	Model	Category/Measurement Parameter
Fuji	FinePix F550EXR 16 mega CMOS	Photography (Still and Motion), Still Camera, DLSR
FLIR	E50BX	Photography (Still and Motion), Still Camera, Thermal Imaging
Dent Instruments	CT-RMV-16-1000 RoCoil	Sensor, CT, Flexible, 1000 Amp (Terminated)
Dent Instruments	CT-FLN	Sensor, CT, Flexible, 3000 Amp (Un-terminated)
Magnelab	SCT-0400-020	Sensor, CT, Mini CT, 0-020 Amp
Dent Instruments	CTHSC-050U	Sensor, CT, Mini CT, 0-050 Amp
Magnelab	SCT-0400-050	Sensor, CT, Mini CT, 0-050 Amp
Continental Control Systems	ACT-0750-005	Sensor, CT, Split-Core, 0-005 Amp
Magnelab	SCT-0750-005	Sensor, CT, Split-Core, 0-005 Amp
Continental Control Systems	ACT-0750-020	Sensor, CT, Split-Core, 0-020 Amp
Onset Computer Corporation	CTV-A	Sensor, CT, Split-Core, 0-020 Amp
Onset Computer Corporation	CTV-B	Sensor, CT, Split-Core, 0-050 Amp
Magnelab	SCT-0750-050	Sensor, CT, Split-Core, 0-050 Amp
Dent Instruments	CT-SCM-0100	Sensor, CT, Split-Core, 0-100 Amp
Dent Instruments	CT-SC-S-0100	Sensor, CT, Split-Core, 0-100 Amp
Onset Computer Corporation	CTV-C	Sensor, CT, Split-Core, 0-100 Amp
Dent Instruments	CT-SCT-0200	Sensor, CT, Split-Core, 0-200 Amp
Onset Computer Corporation	CTV-D	Sensor, CT, Split-Core, 0-200 Amp
Onset Computer Corporation	S-THB-M008	Sensor, Multi-functional, Temp, RH
LI-COR	Mounting and leveling bracket - 6 total	Sensor, Sensor Accessories, Mounting Bracket
LI-COR	Mounting Base #2003S	Sensor, Sensor Accessories, Mounting Bracket
EME Systems	UTA/BNC/hobo-210	Sensor, Sensor Accessories, Transconductance Amplifier (for Hobo), Amps
LI-COR	LI-210SA; Photometric	Sensor, Single-functional, Illuminance
Onset Computer Corporation	S-UCA-M006	Sensor, Single-functional, Pulse Input Adaptor
Onset Computer Corporation	TMC6-HD	Sensor, Single-functional, Temp
LI-COR	LI-200SA; Pyranometer	Sensor, Single-functional, Thermo-Radiation
Veris	Hawkeye H600	Switch, Current, "Go/No Go"
Master Lock	Braided steel cable - 6' x 3/8"	Tools, Lock, Cable
Master Lock	Combo Lock 31-17-35	Tools, Lock, Combo
Continental Control Systems LLC	WNB-3D-480-P	Transducer, WattNode Pulse Output, Watthour, 3 Wires
Continental Control Systems LLC	WNA-3Y-208-P	Transducer, WattNode Pulse Output, Watthour, 4 Wires

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RESEARCH/SURVEYS

Table 3. 2014 Research/Surveys

Report Title	Program or Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
A/C Cool Credit Satisfaction Survey	Residential	Idaho Power	Idaho Power	Participant Satisfaction
Building Efficiency and Easy Upgrades Technical Resource Manual (TRM)	Commercial/Industrial	Idaho Power	Idaho Power	TRM Development
Custom Efficiency Program Research	Commercial/Industrial	MDC Research	Idaho Power	Participant Satisfaction
Energy House Calls Awareness Survey	Residential	Idaho Power	Idaho Power	Non Participant
Energy House Calls Satisfaction Survey	Residential	Idaho Power	Idaho Power	Participant Satisfaction
Energy Wise Program Summary Report	Residential	Resource Action Programs	Idaho Power	Participant
Home Energy Audit Satisfaction Survey	Residential	Idaho Power	Idaho Power	Participant Satisfaction
Idaho Power–CAPAI Easy Savings Survey	Residential	Idaho Power	Idaho Power	Participant
Shade Tree Project Satisfaction Surveys	Residential	Idaho Power	Idaho Power	Participant Satisfaction
THINK! ENERGY Student Energy Efficiency Kit Program Final Report – Version Two Fall 2013	Residential	National Energy Foundation	Idaho Power	Participant
WAQC Satisfaction Survey	Residential	Idaho Power	Idaho Power	Participant Satisfaction
Weatherization Solutions Satisfaction Survey	Residential	Idaho Power	Idaho Power	Participant Satisfaction

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A/C Cool Credit Survey

1. How did you learn about the A/C Cool Credit program? (Check all that apply.)

	Response Percent	Response Count
Newspaper	2.6%	46
Radio	0.7%	12
TV	3.3%	59
Direct mail from Idaho Power	43.8%	781
Idaho Power bill insert	**63.2%**	**1,126**
Idaho Power website	0.7%	12
Friends or family	2.7%	49
Other (please specify)	4.4%	78
	answered question	**1,782**
	skipped question	**28**

2. What was the main reason you participated in the A/C Cool Credit program? (Select one.)

	Response Percent	Response Count
Reduce overall electrical usage on hot summer days	28.1%	470
Earn the credit on my bill	30.1%	502
It seemed like the right thing to do	**38.4%**	**641**
Other (please specify)	3.4%	57
	answered question	**1,670**
	skipped question	**140**

3. How many days would you estimate Idaho Power cycled your air conditioning unit this past summer?

	Response Percent	Response Count
0	2.8%	50
1–5	17.3%	311
6–10	7.1%	127
Greater than 10	8.3%	149
Don't know	**64.6%**	**1,161**
	answered question	**1,798**
	skipped question	**12**

4. How significantly were you impacted by the program this past summer?

	Response Percent	Response Count
Significantly	4.2%	74
Somewhat	14.1%	249
Very little	30.9%	545
Not at all	**50.7%**	**893**
	answered question	**1,761**
	skipped question	**49**

5. Overall, how satisfied are you with the A/C Cool Credit program?

	Response Percent	Response Count
Very dissatisfied	7.5%	131
Somewhat dissatisfied	3.1%	55
Somewhat satisfied	23.4%	410
Very satisfied	**66.0%**	**1,158**
	answered question	**1,754**
	skipped question	**56**

6. What did you find satisfying about the A/C Cool Credit program?

	Response Count
	839
answered question	**839**
skipped question	**971**

7. What did you find dissatisfying about the A/C Cool Credit program?

	Response Count
	116
answered question	**116**
skipped question	**1,694**

8. What did you find satisfying or dissatisfying about the A/C Cool Credit program?

	Response Count
	18
answered question	**18**
skipped question	**1,792**

9. Would you say you received too much, too little, or the right amount of information about this program from Idaho Power (e.g., enrollment brochure, door hanger, letters, etc.)?

	Response Percent	Response Count
Too much information	1.6%	29
Right amount of information	**88.0%**	**1,548**
Too little information	10.3%	182
answered question		**1,759**
skipped question		**51**

10. What is the best way for Idaho Power to provide you information about energy efficiency? (Check all that apply.)

	Response Percent	Response Count
Classes in convenient locations	3.1%	54
Local newspapers	10.5%	180
Idaho Power's website	12.3%	212
Social media	5.6%	97
Newsletters or information directly to homeowners	**80.9%**	**1,391**
Email to homeowners	17.7%	305
Other (please specify)	6.3%	109
	answered question	**1,719**
	skipped question	**91**

11. Provide any additional comments or suggestions you have about the A/C Cool Credit program.

	Response Count
	228
answered question	**228**
skipped question	**1,582**

12. May we use your name and comments in Idaho Power's communication efforts?

	Response Percent	Response Count
Yes	41.5%	626
No	**58.5%**	**884**
	answered question	**1,510**
	skipped question	**300**

13. If yes, please provide your first and last name:

	Response Percent	Response Count
First Name:	**99.8%**	**603**
Last Name:	99.0%	598
	answered question	**604**
	skipped question	**1,206**

14. What is your five-digit zip code?

	Response Count
	1,717
answered question	**1,717**
skipped question	**93**

15. Do you own or rent the residence that participated in the A/C Cool Credit program?

	Response Percent	Response Count
Rent	1.5%	25
Own	**98.5%**	**1,692**
	answered question	**1,717**
	skipped question	**93**

16. Which of the following best describes your age?

	Response Percent	Response Count
Under 18	0.0%	0
18–24	0.1%	2
25–34	3.1%	54
35–44	7.4%	127
45–60	23.6%	407
Over 60	**65.8%**	**1,136**
	answered question	**1,726**
	skipped question	**84**

17. What is the highest level of education you completed?

	Response Percent	Response Count
Less than high school	0.4%	7
Some high school	1.3%	22
High school graduate or equivalent	13.7%	233
Some college	21.2%	362
Two-year associate degree or trade/technical school	12.2%	208
Four-year college degree	**24.5%**	**418**
Some graduate school	8.0%	136
Advanced degree	18.8%	320
	answered question	**1,706**
	skipped question	**104**

18. If you have issues or concerns you would like us to contact you about, please provide your name and contact information:

	Response Percent	Response Count
First Name:	**94.7%**	**160**
Last Name:	**94.7%**	**160**
Phone or email:	**94.7%**	**160**
	answered question	**169**
	skipped question	**1,641**

Technical Reference Manual 1.1

Prepared for

Idaho Power Company

Prepared by:

ADM Associates, Inc.

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1. Overview and Purpose of Deemed Savings Method

This Technical Reference Manual (TRM) is a compilation of stipulated algorithms and values for various energy efficiency measures implemented by Idaho Power Company's commercial demand side management programs and serves the Building Efficiency and Easy Upgrades programs by providing up to date savings estimates for the energy efficiency measures offered by the programs. This manual is intended to facilitate the cost effectiveness screening, planning, tracking, and energy savings reporting for the Building Efficiency and Easy Upgrades Energy Efficiency incentive programs. While the algorithms and stipulated values contained in this TRM are derived using best practices, the stipulated values should be reviewed and revised according to relevant industry research and impact evaluation findings as necessary to ensure that they remain accurate for the Building Efficiency and Easy Upgrades programs. The following sections describe many of the processes and cross-cutting assumptions used to derive the measure level savings estimates found in Section 2.

1.1. Purpose

This manual is intended to facilitate the cost effectiveness screening, planning, tracking, and energy savings reporting for the Building Efficiency and Easy Upgrades energy efficiency incentive programs. This document is intended to be a living document in which the stipulated values are revised according to relevant industry research and impact evaluation findings.

1.2. Methodology and Framework

The algorithms and stipulated values contained in this TRM are derived using current industry standard engineering best practices. Current relevant research, recent impact evaluations, and Technical Reference Manuals developed for other states and/or regions are referenced where appropriate. All energy savings algorithms in this TRM are designed to be applied using the simple engineering formulas defined for each measure in conjunction with the included stipulated values.

Each measure is presented first with a summary of the technology and typical expected (per unit) energy savings, expected useful life, and incremental cost estimates. The ‘typical’ per unit values leverage basic assumptions regarding the geographic distribution of program participants (e.g. weather zone) as well as participant demographics (for example distribution of building types, efficiency of current building stock, etc.). Each measure is accompanied by a spreadsheet calculator containing live formulas and all weights used to derive the typical per-unit estimates. It is expected that as better information is made available regarding program participants, or as program designs are adjusted these numbers will be updated accordingly.

Following the measure summary information, each measure section provides a description of its scope and the spectrum of eligible projects/equipment to which the algorithms and values apply. When applicable, a discussion of code compliance topics (for new construction projects) is included.

1.3. Weather Data Used for *Weather Sensitive* Measures

The service territory for Idaho Power Company covers much of southern Idaho and stretches into eastern Oregon. This is illustrated in Figure 1-1.In order to normalize expected annual energy savings and peak demand reductions for annual variations in weather patterns, all stipulated values for weather sensitive measures were derived using the industry standard Typical Meteorological Year (TMY3) weather data. While there are many weather stations in Idaho for which TMY3 data is available, it was determined that averaging the TMY3 weather across stations in two ASHRAE weather zones (zones 5 and 6) provided sufficient resolution without adding too many separate variations for stipulated values reported in the TRM.

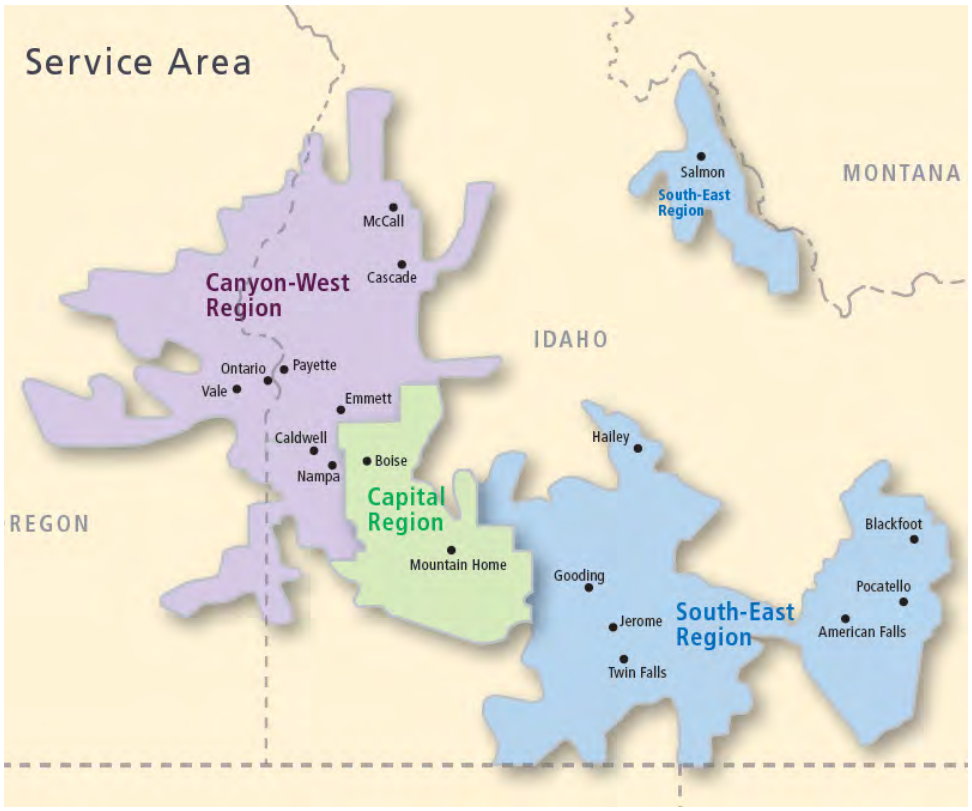

Figure 1-1 Map of Idaho Power Company Service Territory[1]

All stipulated values for weather sensitive measures (e.g. Equivalent Full Load Cooling Hours) are based on 'typical' weather data and provided separately for each of these two weather zones. A map of the ASHRAE weather zones is provided in Figure 1-2. When separate savings estimates are provided for different weather zones, the project location should be used to determine which of the values are applicable. The 'typical' energy savings values reported at the beginning of each measure's section assumes a weighted average between the two weather zones using weights of 80% and 20% for Zones 5 and 6 respectively.

[1] Map represents service territory at the time of this publication.

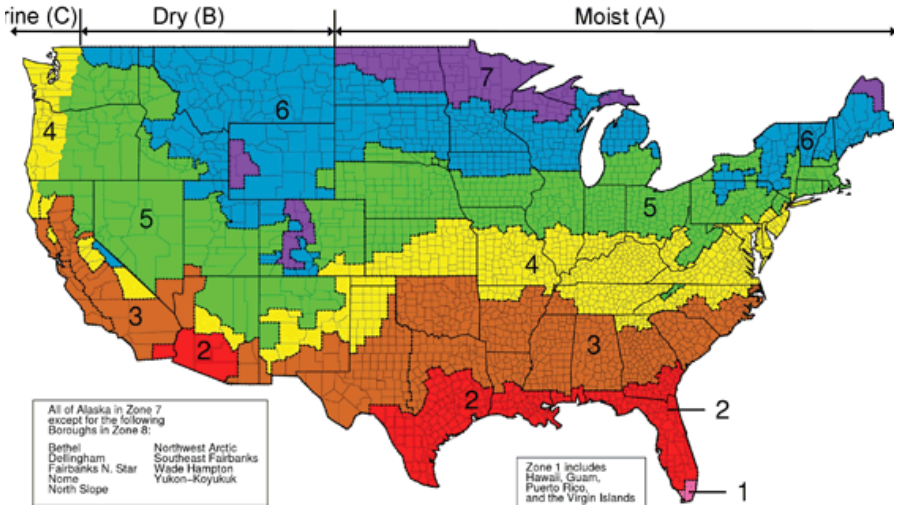

Figure 1-2 Map Illustrating ASHRAE Weather Zones[2]

While reviewing the weather data it was noted that while both weather zones are 'heating dominated' Weather Zone 6 is on average cooler that Weather Zone 5. Therefore, energy conservation measures targeting heating efficiency tend to perform much better in Zone 6. However; measures which result in a heating penalty tend to perform better in Zone 5. Monthly average dry bulb temperatures are compared for both weather zones in

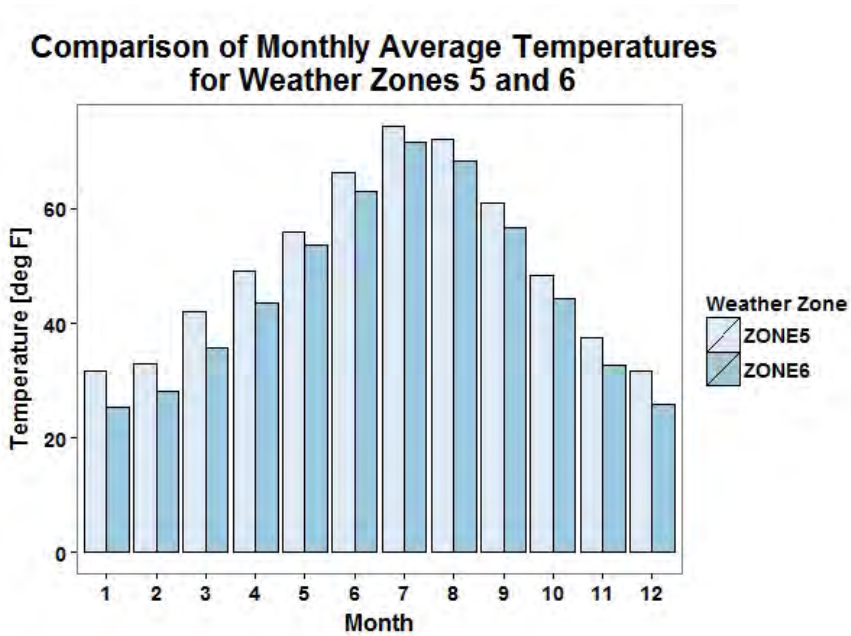

Figure 1-3 Comparison of Monthly Average Temperatures

[2] Note how Idaho is bisected by Zones 5 and 6

1.4. Peak Demand Savings and Peak Demand Window Definition

Where applicable peak demand savings estimates are derived using Idaho Power Company's peak period definition of: *weekdays from 12:00 PM to 8:00 PM, June 1 through August 31*. Hourly savings estimates are averaged over the aforementioned time period to report peak savings.

Coincidence Factors for Lighting

Coincidence factors are defined as the percentage of the demand savings which occur during Idaho Power Company's peak period (defined above). When hourly data are available these are calculated by averaging the hourly demand savings over the peak period definition. This is exemplified in Figure 1-4 which illustrates a hypothetical hourly savings profile. The highlighted region bounds the peak period definition and the CF is calculated by taking the average demand reduction during that period divided by the max demand reduction

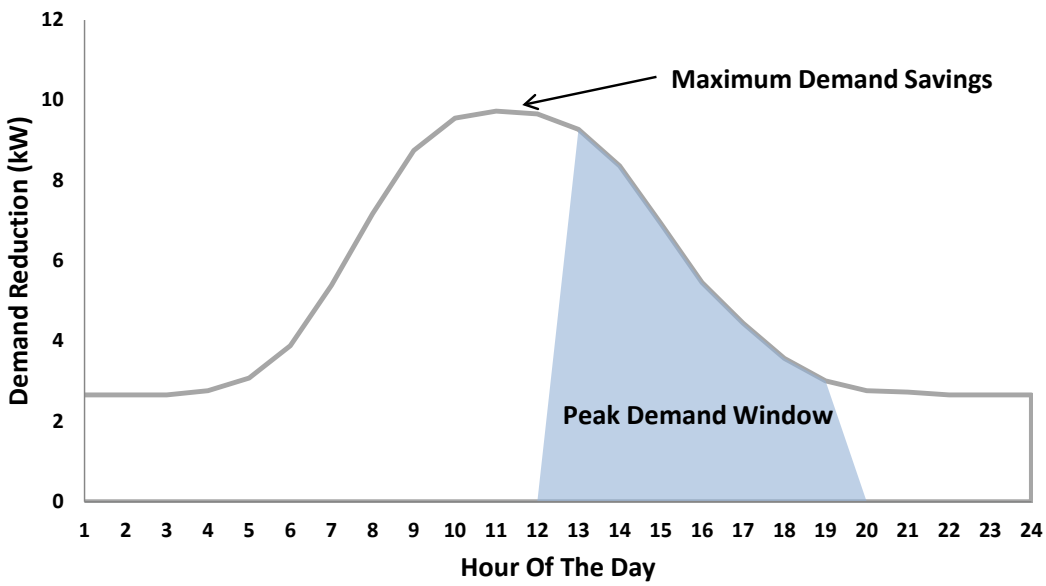

Figure 1-4 Hypothetical Hourly Savings Profile Used to Illustrate Calculation of Coincidence Factor

Thus in the example above let's suppose that the maximum Demand savings are 10 kW and the average kW reduction in the shaded area is 6 kW. The coincidence factor is calculated as follows:

$$Coincidence\ Factor = \frac{Average\ Reduction}{Max\ Reduction} = \frac{6\ kW}{10\ kW} = .6$$

1.5. Description of Prototypical Building Simulation Models

The estimated energy impacts for many of the measures in this TRM were developed using the help of building energy simulation modeling. All of the building simulations were performed using the DOE2.2 simulation software to simulation prototypical building models developed for the Database for Energy Efficiency Resources (DEER). A complete description of these models can be found in the DEER final report – though some aspects will be heighted here as they relate to the TRM.[3]

5 different *vintages* of 23 non-residential prototypical building models were developed for the DEER. These models include the following:

- Assembly,
- Education – Primary School,
- Education – Secondary School,
- Education – Community College,
- Education – University,
- Education – Relocatable Classroom,
- Grocery,
- Health/Medical – Hospital,
- Health/Medical – Nursing Home,
- Lodging – Hotel,
- Lodging – Motel,
- Manufacturing – Bio/Tech,
- Manufacturing – Light Industrial,
- Office – Large,
- Office – Small,
- Restaurant – Sit-Down,
- Restaurant – Fast-Food,
- Retail – 3-Story Large,
- Retail – Single-Story Large,
- Retail – Small,
- Storage – Conditioned,
- Storage – Unconditioned, and
- Storage – Refrigerated Warehouse.

A complete set of these models was pulled from the DEER for use in simulating various weather sensitive measures (including heating and cooling interactive factors for lighting). All simulations were run using the (2) Idaho specific weather data-set described in Section 1.3 for the buildings for which a measure was applicable. The hourly results were then compiled and typically normalized using the building conditioned area (ft^2) or installed cooling/heating capacity (Tons).

[3] Southern California Edision, Database for Energy Efficiency Resources (DEER) Update Study. 2005

Note that the newest vintage of a building type was selected for simulating impacts for *new construction* while the most applicable vintage was selected for retrofit.[4]

1.6. Application of Stacking Effects in the TRM

Often energy conservation projects involve 'packages' of measures implemented together. As measures are 'stacked' on top of one another the each add to the overall project energy savings, however; individual measure impacts are not always directly additive. This is because, unless otherwise noted, the 'typical' savings values reported within this TRM assume that the measure is implemented on its own, and do not presuppose the presence of other measures which may interact with the measure(s) installed (or simply improve the baseline equipment onto which the measure is installed). For example; let's assume that a particular project involved the following energy conservation measures:

Order Implemented	Measure	Expected Savings	End-Use
1	High Efficiency Chiller	10%	Cooling
2	High Efficiency Chilled Water Pumps	3%	Pumps & Auxiliary
3	Water-side economizer	5%	Cooling

The first thing to note is that the first and third measures both impact the same *end-use* (cooling) while the second measure impacts the pumps & auxiliary *end-use*. This is important because measures generally interact with other measures applied to the same *end-use*. Thus, it is often safe to add energy savings for measures impacting different *end-uses* but problematic to add energy savings for measures impacting the same. In our example the waterside economizer interacts directly with the high efficiency chiller but less so with the pumps. When assessing the overall energy impacts for this project we must presuppose the presence of the high efficiency chiller in our baseline for the waterside economizer. This would look something like the following:

$$Energy\ Savings_{Measure1} = kWh_{Baseline} * Sav_{Measure1}$$
$$Energy\ Savings_{Measure2} = kWh_{Pumps\ \&\ Aux\ Baseline} * Sav_{Measure2}$$
$$Energy\ Savings_{Measure3} = (kWh_{Cooling\ Base} * Sav_{Measure1)} * Sav_{Measure3}$$

Notice how the energy savings calculations for Measure 3 (the waterside economizer) subtract out the impacts of Measure 1 (the high efficiency chiller) before applying $Sav_{Measure3}$. This must be done for all interacting measures in a project in order to prevent double counting energy impacts. One thing to note in this example is that had the waterside economizer been installed on a completely separate chiller (and one which was not impacted by the first measure) then the considerations discussed would not be needed as the two measures no longer interact. It is also important to note that while the measures provided in this example only impact a single end-use some measures have non-negligible impacts on multiple *end-uses* that must be considered. An

[4] The specific vintage selected was a function of the expected distribution of buildings of that type in the Idaho Power Service Territory.

example of such a measure is HVAC – Controls. Measures of this nature, where included in this TRM, have been designed to account for their interactions implicitly within the algorithms listed in the measure chapter. Measures for which interactive effects are already accounted are:

1) High efficiency lighting and lighting controls
2) HVAC Controls

All other measures in this TRM have been assigned an *end-use* which represents its primary impact. The user should be cognizant of these *end-uses* and only add measure savings (in projects involving multiple measures) when the *end-uses* are different <u>*or*</u> it is know with certainty that the measures impact totally separate pieces of equipment on that end-use. If *n* measures are identified to be installed and will impact the same equipment on the same *end-use* the following equation shall be used:

$$E_{Sav} = kWh_{Base} * (1 - (1 - Sav_1) * (1 - Sav_2) * \ldots * (1 - Sav_1)$$

Where:

kWh_{Base}	Baseline annual energy use of the affected equipment
$Sav_{1,2,3,\ldots,n}$	The relative savings (% reduction) expected from the energy efficiency measure

If the relative measure savings (% reduction) or the baseline annual energy use is unknown and the above equation cannot be used then the following conservative discount factors should be applied (multiplied) to the savings estimates for each measure according to the order implemented.

Table 1-1 Stacking Effect Discount Factors

Order Implemented	Discount Factor
1	1
2	.85
3	.74
4	.67
5	.62
6	.59

Application of Table 1-1 can be illustrated using the (3) measure example project discussed at the beginning of this section. For this example let's assume that the individual measure savings (as calculated by the TRM chapters) are as follows:

Order	Measure	Relative Savings	End-Use	Individual Energy Savings	Table 1-1 Factor	Stacked Energy Savings
1	High Efficiency Chiller	10%	Cooling	300,000 kWh	1	300,000 kWh
2	High Efficiency Chilled Water Pumps	3%	Pumps & Auxiliary	25,000 kWh	1	25,000 kWh
3	Water-side economizer	5%	Cooling	50,000 kWh	.85	42,500 kWh
					Project Total :	367,500 kWh

2. Commercial and Industrial Deemed Savings Measures

This chapter contains the protocols and stipulated values for commercial and industrial measures covered by this TRM. Spreadsheets were developed for each measure and contain any calculations used to derive stipulated values (or deemed savings estimates). Each measure is presented first with a summary of the technology and typical expected (per unit) energy savings, expected useful life, and incremental cost estimates. The 'typical' per unit values leverage basic assumptions regarding the geographic distribution of program participants (e.g. weather zone) as well as participant demographics (for example distribution of building types, efficiency of current building stock, etc.) and are intended for use in cost effectiveness screening – not as deemed savings estimates (given their generality). Where applicable, deemed savings estimates are provided for various scenario in tables at the end of each measure's section.

Each measure is accompanied by a spreadsheet calculator containing live formulas and all weights used to derive the typical per-unit estimates. It is expected that as better information is made available regarding program participants, or as program designs are adjusted these numbers will be updated accordingly. Following the measure summary information, each measure section provides a description of its scope and the spectrum of eligible projects/equipment to which the algorithms and values apply. When applicable, a discussion of code compliance topics (for new construction projects) is included. It should also be noted that while savings estimates are provided for a multitude of measures (both for retrofit and new construction) a custom engineering analysis should be preferred for significantly large projects when possible. This is particularly true for projects involving VFDs, HVAC controls, and/or large 'packages' of multiple measures.

2.1. Efficient Interior Lighting and Controls (New Construction)

The following algorithms and assumptions are applicable to interior lighting systems installed in commercial and industrial spaces which are more efficient than required by prevailing codes and standards. This measure applies only to projects which represent new construction or major renovations.[5] The following tables summarize the 'typical' expected (per ft^2) energy impacts for lighting power density improvements and controls additions. Typical values are based on the algorithms and stipulated values described below and data from past program participants. [6]

Table 2-1 Typical Savings Estimates for 10% Interior Lighting LPD Improvement (New Construction)

	Retrofit	New Construction
Deemed Savings Unit	n/a	ft^2
Average Unit Energy Savings	n/a	.51 kWh
Average Unit Peak Demand Savings	n/a	.11 W
Expected Useful Life	n/a	14.3 Years
Average Incremental Cost	n/a	$0.26
Stacking Effect End-Use	n/a	

Table 2-2 Typical Savings Estimates for 20% Interior Lighting LPD Improvement

	Retrofit	New Construction
Deemed Savings Unit	n/a	ft^2
Average Unit Energy Savings	n/a	1.03 kWh
Average Unit Peak Demand Savings	n/a	.23 W
Expected Useful Life	n/a	14.3 Years
Average Incremental Cost	n/a	$0.51
Stacking Effect End-Use	n/a	

[5] Major renovations are defined to be any renovation or facility expansion project in which building permits were required and the lighting system had to be demonstrated to comply with a particular code or standard.

[6] See spreadsheet "1-TypicalCalcs_HighEffLight.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Table 2-3 Typical Savings Estimates for >= 30% Interior Lighting LPD Improvement[7]

	Retrofit	New Construction
Deemed Savings Unit	n/a	ft^2
Average Unit Energy Savings	n/a	2.33 kWh
Average Unit Peak Demand Savings	n/a	.52 W
Expected Useful Life	n/a	14.3 Years
Average Incremental Cost	n/a	$0..89
Stacking Effect End-Use	n/a	

Table 2-4 Typical Savings Estimates for Daylighting Controls (New Construction)[8]

	Retrofit	New Construction
Deemed Savings Unit	n/a	ft^2
Average Unit Energy Savings	n/a	.94 kWh
Average Unit Peak Demand Savings	n/a	.24 W
Expected Useful Life	n/a	14.3 Years
Average Incremental Cost	n/a	$0.91
Stacking Effect End-Use	n/a	

Table 2-5 Typical Savings Estimates for Occupancy Sensors (New Construction)[9]

	Retrofit	New Construction
Deemed Savings Unit	n/a	Sensor
Average Unit Energy Savings	n/a	366 kWh
Average Unit Peak Demand Savings	n/a	87 W
Expected Useful Life	n/a	8 Years
Average Incremental Cost	n/a	$38.26
Stacking Effect End-Use	n/a	

[7] Note that the values listed for this measure assume the "typical" improvement in this category is a 45% reduction in interior LPD. This is based on observed lighting load reductions from past program participants. Note that an average % reduction was taken for participants whose LPD reduction fell within this category.

[8] Assumes that the half of the projects will also have a 10% reduction in the lighting power densities which reduce the savings potential for this measure.

[9] See previous footnote

Table 2-6 Typical Savings Estimates for Efficient Exit Signs

	Retrofit	New Construction
Deemed Savings Unit	n/a	Sign
Average Unit Energy Savings	n/a	28 kWh
Average Unit Peak Demand Savings	n/a	3.6 W
Expected Useful Life	n/a	16 Years
Average Incremental Cost	n/a	$10.83
Stacking Effect End-Use	n/a	

2.1.1. Definition of Eligible Equipment

All above-code interior lighting systems (fixtures, lamps, ballasts, etc.) are eligible. Eligibility is determined by calculating the lighting power density (LPD) for the installed system. If the LPD is at least 10% lower than allowed by code (see Section 2.1.2) then the system is eligible. Efficient equipment may include florescent fixtures, LED lamps, LED exit signs, compact florescent light bulbs, high intensity discharge lamps, etc.

In addition to efficient lighting fixtures, lighting controls are eligible under this measure. Eligible controls include: occupancy sensors (wall mounted and fixture mounted), daylighting controls, dimmers, and bi-level switches. Lighting controls are only eligible when not already required by the building code standard to which a project is permitted.

2.1.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the new construction scenario.

Retrofit (Early Replacement)

n/a

New Construction (Includes Major Remodel & Replace on Burn-Out)

Baseline equipment for this measure is defined as an installed lighting system with a maximum allowable LPD. The maximum allowable LPD is defined by the building code according to which the project was permitted. Current applicable standards are defined by ASHRAE 90.1-2004 and 90.1-2007.

Two paths are available for code compliance – the Building Area Method (ASHRAE 90.1, Section 9.5) and the Space-by-Space Method (ASHRAE 90.1, Section 9.6). Either can be used to determine baseline power density provided it is consistent with the method used by the project for code compliance.

Code Compliance Considerations for Lighting Controls

Section 9.4.1 Of the ASHRAE 90.1 Standard specifys mandatory automatic lighting controls for buildings greater than 5000 ft2 and in certain space types (See Section 9.4.1.2). If the building

or space is not exempt from these mandatory provisions then the least efficient mandatory control strategy shall be assumed as baseline equipment. Note that prescriptive lighting control requirements are the same between the 2004 and 2007 versions of Standard 90.1.

2.1.3. Algorithms

Two sets of algorithms are provided for this measure. The first are algorithms for Lighting Power Density (LPD) reductions and/or for the addition of lighting controls. The second set of algorithms are included for high efficiency exit signs (which are treated separately by ASHRAE 90.1):

Algorithm 1 (Lighting Power Density Reduction and Controls Additions):

$$\Delta kWh = kWh_{base} - kWh_{Installed}$$
$$= A_{SF} * [LPD_{base} - LPD_{Installed} * (1 - CSF)] * HOU * HCIF_{Energy}$$
$$\Delta kW = (kW_{base} - kW_{Installed}) * CF$$
$$= ASF * [LPD_{base} - LPD_{Installed} * (1 - CSF)] * HCIF_{Demand} * CF$$
$$kWh/Unit_{Typical} = \Sigma (\Delta kWh/Unit_{building\ i} * W_{building\ i})$$
$$kWh/Unit_{building,\ i} = [LPD_{building\ i,\ base} - LPD_{building\ i,\ Installed} * (1 - CSF)] * HCIF_{Demand}$$

The above equations for *ΔkWh* and *ΔkW* can be simplified the following if a project involves only a lighting power density reduction or lighting controls addition:

Power density reduction only: $\Delta kWh = A_{SF} * [LPD_{base} - LPD_{Installed}] * HOU * HCIF_{Energy}$

Controls installation only: $\Delta kWh = A_{SF} * LPD_{Installed} * CSF * HOU * HCIF_{Energy}$

Algorithm 2 (High Efficiency Exit Signs):

$$\Delta kWh = kWh_{base} - kWh_{Installed}$$
$$= (W_{base} - W_{Installed}) * 8760 * HCIF_{Energy} * N_{Signs}$$
$$\Delta kW = (W_{base} - W_{Installed}) * N_{Signs}$$

2.1.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
HOU	Annual operating hours for the lighting system. Values for various building types are stipulated in Table 2-7. When available, actual system hours of use should be used.
LPD	Lighting power density baseline (base) and installed (meas) systems. This is defined as the total lighting system connected load divided by the lighted area. When using the Building Area method baseline LPD is defined by

	Table 2-8. When using the Space-By-Space method the LPD is defined by Table 2-9 and Table 2-10.
W	Exit Sign *base* and *installed* wattage. Note that the *base* wattage is defined by ASHRAE 90.1 to be 5 watts. See
	Table 2-14 for stipulated wattages.
CF	Peak coincidence factor. Represents the % of the connected load reduction which occurs during Idaho Power's peak period. For Exit signs the coincidence factor is defined to be unity.
HCIF	Heating and Cooling Interactive Factors. These account for the secondary impacts reductions in internal loads effect on HVAC systems by representing the expected "typical' impacts a reduction in the lighting power density will effect on electric space conditioning equipment. These are defined in Table 2-11 for various building types and climate zones.
CSF	Controls Savings Factor. This is defined as the % reduction in system hours of use (HOU) due do installed lighting controls. Stipulated values for this variable are provided in Table 2-13.
$kWh/Unit_{Typical}$	Typical measure savings on a per unit basis.
$kWh/Unit_{building,\ i}$	Typical measure savings for building type i on a per unit basis. Uses the baseline LPD for building type i as defined in
	Table 2-8. Measure LPD for building i is defined as the average installed LPD for past program participants of that building type.
$W_{building,i}$	Population weight for building type i. This is defined to be the square footage of building type i in past program participants divided by the total square footage of past participant building space

2.1.5. Sources

- ASHRAE, Standard 90.1-2004.
- ASHRAE, Standard 90.1-2007.
- Regional Technical Forum, draft Standard Protocol Calculator for Non-Residential Lighting improvements, http://rtf.nwcouncil.org/subcommittees/comlighting/Lighting%20Calculator_version%2012-6-2012.xlsx
- California DEER Prototypical Simulation models (modified), eQUEST-DEER 3-5.[10]
- California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls
- Acker, B., Van Den Wymelenberg, K., 2010. Measurement and Verification of Daylighting Photocontrols; Technical Report 20090205-01, Integrated Design Lab, University of Idaho, Boise, ID.

[10] Prototypical building energy simulations were used to generate Idaho specific Heating and Cooling Interactive Factors and Coincidence factors for various building and heating fuel types.

2.1.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-7 Stipulated Lighting Hours of Use (HOU) by Building Type[11]

Building Type	Hours of Use
Automotive Repair	4,056
College or University	2,300
Exterior 24 Hour Operation	8,760
Hospital	5,000
Industrial Plant with One Shift	2,250
Industrial Plant with Two Shifts	4,500
Industrial Plant with Three Shifts	8,400
Library	3,748
Lodging	3,000
Manufacturing	3,300
Office <20,000 sf	2,600
Office 20,000 to 100,000 sf	3,200
Office >100,000 sf	3,500
Other Health, Nursing, Medical Clinic	3,600
Parking Garage	4,368
Restaurant	4,800
Retail Mini Mart	6,500
Retail Boutique <5,000 sf	3,400
Retail 5,000 to 50,000 sf	3,900
Retail Supermarket	6,500
Retail Big Box >50,000 sf One-Story	4,800
Retail Anchor Store >50,000 sf Multistory	4,000
School K-12	2,200

[11] The values in this table are based on the most recent Regional Technical Forum draft Standard Protocol Calculator for Non-Residential Lighting improvements: http://rtf.nwcouncil.org/subcommittees/comlighting/Lighting%20Calculator_version%2012-6-2012.xlsx

Table 2-8 Baseline Lighting Power Densities By Building Type – Building Area Method[12]

Building Area Type	2004 LPD (W/ft2)	2007 LPD (W/ft2)
Automotive facility	0.9	0.9
Convention center	1.2	1.2
Courthouse	1.2	1.2
Dining: bar lounge/leisure	1.3	1.3
Dining: cafeteria/fast food	1.4	1.4
Dining: family	1.6	1.6
Dormitory	1	1
Exercise center	1	1
Gymnasium	1.1	1.1
Health-care clinic	1	1
Hospital	1.2	1.2
Hotel	1	1
Library	1.3	1.3
Manufacturing facility	1.3	1.3
Motel	1	1
Motion picture theater	1.2	1.2
Multifamily	0.7	0.7
Museum	1.1	1.1
Office	1	1
Parking garage	0.3	0.3
Penitentiary	1	1
Performing arts theater	1.6	1.6
Police/fire station	1	1
Post office	1.1	1.1
Religious building	1.3	1.3
Retail	1.5	1.5
School/university	1.2	1.2
Sports arena	1.1	1.1
Town hall	1.1	1.1
Transportation	1	1
Warehouse	0.8	0.8
Workshop	1.4	1.4

[12] These values are from Tables 9.5.1 in ASHRAE 90.1 for the Building Area method. Note that values for both 2004 and 2007 versions of Standard 90.1 are included.

Table 2-9 Baseline LPD For Common Spaces - Space-by-Space Method

Common Space Type[13]	LPD (W/ft2)
Office-Enclosed	1.1
Office-Open Plan	1.1
Conference/Meeting/Multipurpose	1.3
Classroom/Lecture/Training	1.4
For Penitentiary	1.3
Lobby	1.3
For Hotel	1.1
For Performing Arts Theater	3.3
For Motion Picture Theater	1.1
Audience/Seating Area	0.9
For Gymnasium	0.4
For Exercise Center	0.3
For Convention Center	0.7
For Penitentiary	0.7
For Religious Buildings	1.7
For Sports Arena	0.4
For Performing Arts Theater	2.6
For Motion Picture Theater	1.2
For Transportation	0.5
Atrium—First Three Floors	0.6
Atrium—Each Additional Floor	0.2
Lounge/Recreation	1.2
For Hospital	0.8
Dining Area	0.9
For Penitentiary	1.3
For Hotel	1.3
For Motel	1.2
For Bar Lounge/Leisure Dining	1.4
For Family Dining	2.1
Food Preparation	1.2
Laboratory	1.4
Restrooms	0.9
Dressing/Locker/Fitting Room	0.6
Corridor/Transition	0.5
For Hospital	1
For Manufacturing Facility	0.5
Stairs—Active	0.6
Active Storage	0.8

[13] In cases where both a common space type and a building specific type are listed, the building specific space type shall apply.

Common Space Type[13]	LPD (W/ft2)
For Hospital	0.9
Inactive Storage	0.3
For Museum	0.8
Electrical/Mechanical	1.5
Workshop	1.9
Sales Area	1.7

Table 2-10 Baseline LPD for Specific Spaces - Space-by-Space Method

Building Specific Space Types	LPD (W/ft2)
Playing Area	1.4
Exercise Area	0.9
Courtroom	1.9
Confinement Cells	0.9
Judges Chambers	1.3
Fire Station Engine Room	0.8
Sleeping Quarters	0.3
Post Office-Sorting Area	1.2
Convention Center-Exhibit Space	1.3
Card File and Cataloging	1.1
Stacks	1.7
Reading Area	1.2
Emergency	2.7
Recovery	0.8
Nurse Station	1
Exam/Treatment	1.5
Pharmacy	1.2
Patient Room	0.7
Operating Room	2.2
Nursery	0.6
Medical Supply	1.4
Physical Therapy	0.9
Radiology	0.4
Laundry—Washing	0.6
Automotive—Service/Repair	0.7
Low (<25 ft Floor to Ceiling Height)	1.2
High (>25 ft Floor to Ceiling Height)	1.7
Detailed Manufacturing	2.1
Equipment Room	1.2
Control Room	0.5
Hotel/Motel Guest Rooms	1.1
Dormitory—Living Quarters	1.1
General Exhibition	1
Restoration	1.7
Bank/Office—Banking Activity Area	1.5
Worship Pulpit, Choir	2.4
Fellowship Hall	0.9
Sales Area	1.7
Mall Concourse	1.7
Ring Sports Area	2.7

Building Specific Space Types	LPD (W/ft2)
Court Sports Area	2.3
Indoor Playing Field Area	1.4
Fine Material Storage	1.4
Medium/Bulky Material Storage	0.9
Parking Garage—Garage Area	0.2
Airport—Concourse	0.6
Air/Train/Bus—Baggage Area	1
Terminal—Ticket Counter	1.5

Table 2-11 Heating and Cooling Interactive Factors by Building Type and Weather Zone[14]

Building Type	Weather Zone 5		Weather Zone 6	
	kWh	*kW*	*kWh*	*kW*
Primary School	1.04	1.2	1.03	1.17
Secondary School	1.04	1.14	1.02	1.12
Community College	1.11	1.16	1.08	1.15
University	1.13	1.14	1.14	1.14
Hospital	1.09	1.04	1.08	1.06
Nursing Home	1.09	1.29	1.08	1.26
Hotel	1.15	1.16	1.14	1.15
Motel[15]	0.74	1.29	0.66	1.28
Light Manufacturing	1.05	1.25	1.04	1.23
Small Office	1.06	1.26	1.06	1.24
Large Office	1.08	1.14	1.07	1.14
Full Service Restaurant (Sit-Down)	1.06	1.25	1.05	1.22
Fast Food	1.05	1.2	1.04	1.19
Small Retail	1.07	1.29	1.06	1.25
Large 1-story Retail	1.07	1.3	1.06	1.27
3-story Retail	1.05	1.14	1.05	1.13
Conditioned Storage	1.03	1.09	1.01	1.02
Multi Family	1.03	1.26	1.02	1.24
Other	1.05	1.2	1.04	1.18

[14] Factors generated using DOE2.2 simulations based on the prototypical building models developed for the California Database for Energy Efficiency Resources using weather data based on the two Idaho weather zones. The values in this table make assumptions regarding 'typical' fuel sources and efficiencies for heating and cooling equipment. These numbers represent the expected "typical' impacts a reduction in the lighting power density will effect on electric space conditioning equipment.

[15] Note that these figures assume Motel HVAC systems are either heat-pumps or use electric resistance heating. If it is known that a particular motel uses gas heating then use the values for Hotel instead.

Table 2-12 Peak Demand Coincidence Factors by Building Type[16]

Building Type	CF
Primary School	0.48
Secondary School	0.48
Community College	0.6
University	0.76
Hospital	0.92
Nursing Home	0.9
Hotel	0.89
Motel	0.89
Light Manufacturing	0.98
Small Office	0.71
Large Office	0.85
Full Service Restaurant (Sit-Down)	0.95
Fast Food	0.95
Small Retail	0.47
Large 1-story Retail	0.78
3-story Retail	0.56
Conditioned Storage	0.8
Multi Family	0.43
Other	0.73

[16] Factors generated using prototypical lighting schedules found in the DEER building models and the definition for the Idaho Power Company's peak period (12 pm to 8 pm on weekdays between June 1st and August 31st).

Table 2-13 Controls Savings Factors by Building and Control Type[17]

Space Type	Occupancy Sensor	Daylight Sensor	Bi-level Switching	Dimmers, Wireless on/off Switches	Occupancy & Daylight
Assembly	36%	36%	6%	6%	40%
Break Room	20%	20%	6%	6%	40%
Classroom	18%	68%	6%	6%	34%
Computer Room	35%	18%	6%	6%	34%
Conference	35%	18%	35%	35%	40%
Dining	35%	18%	6%	6%	40%
Gymnasium	35%	35%	6%	6%	40%
Hallway	15%	15%	6%	6%	34%
Hospital Room	45%	63%	6%	6%	35%
Industrial	45%	72%	35%	35%	40%
Kitchen	30%	0%	6%	6%	34%
Library	15%	18%	6%	6%	34%
Lobby	25%	18%	6%	6%	40%
Lodging (Guest Rooms)	45%	0%	35%	35%	40%
Open Office	22%	29%	35%	35%	40%
Parking Garage	15%	18%	35%	0%	0%
Private Office	22%	29%	35%	35%	40%
Process	45%	0%	6%	6%	34%
Public Assembly	36%	36%	6%	6%	40%
Restroom	40%	0%	6%	6%	40%
Retail	15%	29%	6%	6%	34%
Stairs	25%	0%	0%	0%	18%
Storage	45%	0%	6%	6%	40%
Technical Area	35%	18%	6%	6%	34%
Warehouses	31%	31%	35%	35%	40%
Other	7%	18%	6%	6%	34%

[17] The values in this table are based on the most recent Regional Technical Forum draft Standard Protocol Calculator for Non-Residential Lighting improvements: http://rtf.nwcouncil.org/subcommittees/comlighting/Lighting%20Calculator_version%2012-6-2012.xlsx

Table 2-14 Stipulated Fixture Wattages for Various LED Exit Signs

Fixture Description	***Base* Fixture Wattage**	***Installed* Fixture Wattage**
LED Exit Sign, 0.5 Watt Lamp, Single Sided	5 W	0.5 W
LED Exit Sign, 1.5 Watt Lamp, Single Sided	5 W	1.5 W
LED Exit Sign, 2 Watt Lamp, Single Sided	5 W	2 W
LED Exit Sign, 3 Watt Lamp, Single Sided	5 W	3 W
LED Exit Sign, 0.5 Watt Lamp, Double Sided	10 W	1 W
LED Exit Sign, 1.5 Watt Lamp, Double Sided	10 W	3 W
LED Exit Sign, 2 Watt Lamp, Double Sided	10 W	4 W
LED Exit Sign, 3 Watt Lamp, Double Sided	10 W	6 W
Other/Unknown LED	5 W	2 W

2.2. Exterior Lighting Upgrades (New Construction)

The following algorithms and assumptions are applicable to exterior lighting systems installed in commercial and industrial spaces which are more efficient than required by prevailing codes and standards. This measure applies only to projects which represent new construction or major renovations.[18] The following table summarizes the 'typical' expected (per ft^2) energy impacts for lighting power density improvements and controls additions. Typical values are based on the algorithms and stipulated values described below and data from past program participants.[19]

Table 2-15 Typical Savings Estimates for 15% Exterior Lighting LPD Improvement (New Construction)

	Retrofit	New Construction
Deemed Savings Unit	n/a	kW (reduced)
Average Unit Energy Savings	n/a	4,059 kWh
Average Unit Peak Demand Savings	n/a	0 W
Expected Useful Life	n/a	15 Years
Average Material & Labor Cost	n/a	n/a
Average Incremental Cost	n/a	$ 168
Stacking Effect End-Use	Exterior Light	

2.2.1. Definition of Eligible Equipment

All above-code Exterior lighting systems (fixtures, lamps, ballasts, etc.) are eligible. Eligibility is determined by calculating the lighting power density (LPD) for the installed system. If the LPD is at least 15% lower than allowed by code (see Table 2-16 and Table 2-17) then the system is eligible. Efficient equipment may include florescent fixtures, LED lamps, LED exit signs, compact florescent light bulbs, high intensity discharge lamps, etc.

2.2.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the new construction scenario.

Retrofit (Early Replacement)

n/a

New Construction (Includes Major Remodel & Replace on Burn-Out)

Baseline equipment for this measure is defined as an installed lighting system with a maximum allowable LPD. The maximum allowable LPD is defined by the building code according to which

[18] Major renovations are defined to be any renovation or facility expansion project in which building permits were required and the lighting system had to be demonstrated to comply with a particular code or standard.

[19] See spreadsheet "2-TypicalCalcs_ExtLight.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

the project was permitted. Current applicable standards are defined by ASHRAE 90.1-2004 and 90.1-2007.

Code Compliance Considerations for Lighting Controls

Sections 9.4.4 and 9.4.5 of the ASHRAE 90.1 Standard specify energy efficiency and lighting power density requirements for non-exempt exterior lighting. [20] Table 9.4.5 lists the power density requirements for various building exteriors.

2.2.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = kWh_{base} - kWh_{meas}$$

$$= A_{SF} * [LPD_{base} - LPD_{meas} * (1 - CSF)] * HOU$$

$$\Delta kW = 0$$

$$kWh/Unit_{Typical} = \Sigma (\Delta kWh/Unit_{building\ i} * W_{building\ i})$$

2.2.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
HOU	Stipulated to be 4,059 hours.[21]
LPD	Lighting power density baseline (base) and installed (meas) systems. This is defined as the total lighting system connected load divided by the lighted area (or as defined by code). See Table 2-16 and Table 2-17
$kWh/Unit_{Typical}$	Typical measure savings on a per unit basis.
$W_{building,i}$	Population weight for application type *i*. This is defined to be the % of application type *i* in past program participants.

2.2.5. Sources

- ASHRAE, Standard 90.1-2004.
- ASHRAE, Standard 90.1-2007.

2.2.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

[20] Note that both Section 9.1 and Section 9.4.5 list applicable exemptions.

[21] Value is sourced from https://www.idahopower.com/AboutUs/RatesRegulatory/Tariffs/tariffPDF.cfm?id=39

Table 2-16 Baseline Power Densities for Exterior Lighting – Tradable Surfaces[22]

Area Type	Location	LPD	Units
Uncovered Parking Areas	Parking Lots and Drives	0.2	W/Ft^2
Building Grounds	Walkways less than 10 feet wide	1	W/ Linear Foot
	Walkways 10 feet wide or greater	1	W/ Linear Foot
	Plaza areas	0.2	W/Ft^2
	Special Feature Areas	0.2	W/Ft^2
	Stairways	1	W/Ft^2
Building Entrances and Exits	Main entries	30	W/ Linear Foot of Door Width
	Other Doors	20	W/ Linear Foot of Door Width
Canopies and Overhangs	Canopies (free standing and attached and overhangs)	1.3	W/Ft^2
Outdoor Sales	Open Areas (including vehicle sales lots)	0.5	W/Ft^2
	Street frontage for vehicle sales lots in addition to "open area" allowance	20	W/ Linear Foot

Table 2-17 Baseline Power Densities for Exterior Lighting – Non-Tradable Surfaces[23]

Area Type	LPD
Building Facades	0.2 W/ft² for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length
Automated teller machines and night depositories	270 W per location plus 90 W per additional ATM per location
Entrances and gatehouse inspection stations at guarded facilities	1.25 W/ft² of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")
Loading areas for law enforcement, fire, ambulances and other emergency service vehicles	0.5 W/ft² of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")
Drive-up windows at fast food restaurants	400 W per drive-through
Parking near 24-hour retail entrances	800 W per main entry

[22] Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded.

[23] Lighting power density calculations can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowances otherwise permitted in the "Tradable Surfaces" section of this table.

2.3. Efficient Vending Machines

ENERGY STAR qualified new and rebuilt vending machines incorporate more efficient compressors, fan motors, and lighting systems as well as low power mode option that allows the machine to be placed in low-energy lighting and/or low-energy refrigeration states during times of inactivity.

Table 2-18 summarizes the 'typical' expected (per machine) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-18 Typical Savings Estimates for Efficient Vending Machines[24]

	Retrofit	New Construction
Deemed Savings Unit	Machine	Machine
Average Unit Energy Savings	2,299 kWh	217 kWh
Average Unit Peak Demand Savings	2.39 kW	0.22 kW
Expected Useful Life[25]	14 Years	14 Years
Average Material & Labor Cost[26]	$ 3,360	n/a
Average Incremental Cost[27]	n/a	$ 200
Stacking Effect End-Use	Miscellaneous Loads	

2.3.1. Definition of Eligible Equipment

The eligible equipment is a new or rebuilt refrigerated vending machine that meets the ENERGY STAR 3.0 specifications which include low power mode. Each completed ENERGY STAR qualified machine shall receive a "refurbishment label/sticker" that includes the following information to indicate that the machine has been upgraded to ENERGY STAR performance levels:

- A new and discrete model number that is representative of that machine and rebuilding kit combination
- The date of rebuilding
- The ENERGY STAR certification mark

2.3.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

[24] See spreadsheet "3-TypicalCalcs_EffVndMcn.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

[25] ENERGY STAR Calculator: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=VMC

[26] Cadmus Group: http://rtf.nwcouncil.org/meetings/2006/09/RTF%20091806%20-%20Vending%20Final-2.ppt

[27] See previous footnote

The baseline condition for retrofit is a refrigerated beverage vending machine that isn't qualified as Energy Star 3.0.

New Construction (Includes Major Remodel & Replace on Burn-Out)

The baseline condition for new construction is a machine that complies with the Department of Energy's (DOE) energy conservation standards for refrigerated beverage vending machines since 2012.

2.3.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = kWh/Unit * NUnits$$
$$kWh/Unit_{Typical} = \Sigma\ (\Delta kWh/Unit_i * W_i)$$
$$\Delta kW = kW/Unit * NUnits$$
$$kW/Unit_{Typical} = \Sigma\ (\Delta kW/Unit_i * W_i)$$

2.3.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
$kWh/Unit$	Per unit energy savings as stipulated in Table 2-19 and Table 2-20.
$kWh/Unit_{Typical}$	Typical measure savings on a per unit basis.
$\Delta kWh/Unit_i$	Unit savings for combination i of equipment types.
$kW/Unit$	Per unit demand savings as stipulated in Table 2-19 and Table 2-20.
$kW/Unit_{Typical}$	Typical measure demand savings on a per unit basis.
$\Delta kW/Unit_i$	Unit demand savings for combination i of equipment types.
$W_{,i}$	Population weight for each $\Delta kWh/Unit_i$ and $\Delta kW/Unit_i$.
$NUnits$	Number of Units

2.3.5. Sources

1. LBNL 2007: http://enduse.lbl.gov/info/LBNL-62397.pdf
2. Cadmus Energy Star Report: http://rtf.nwcouncil.org/meetings/2006/09/RTF%20091806%20-%20Vending%20Final-2.ppt
3. ENERGY STAR Calculator: http://search.energystar.gov/search?q=cache:4rntJv_yaV8J:www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_Vend_MachBulk.xls+xls&access=p&output=

xml_no_dtd&ie=UTF-8&client=default_frontend&site=default_collection&proxystylesheet=default_frontend&oe=UTF-8&c4d7-9284

2.3.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-19 Unit Energy Savings for Efficient Vending Machines - Retrofit[28]

Vending Machine Capacity (cans)	kWh Savings Per Machine Class A	kW Savings Per Machine Class A	kWh Savings Per Machine Class B	kW Savings Per Machine Class B
<500	1,848	1.677	1,602	1.453
500	2,567	2.765	2,299	2.476
699	2,162	2.101	1,883	1.83
799	2,712	2.833	2,409	2.516
800+	1,909	1.447	1,625	1.232

Table 2-20 Unit Energy Savings for Efficient Vending Machines – New Construction

Vending Machine Capacity (cans)	kWh Savings Per Machine Class A	kW Savings Per Machine Class A	kWh Savings Per Machine Class B	kW Savings Per Machine Class B
<500	66	0.06	168	0.152
500	269	0.289	180	0.194
699	279	0.271	185	0.18
799	304	0.317	199	0.208
800+	284	0.215	188	0.143

[28] See spreadsheet "3-TypicalCalcs_EffVndMcn.xlsx" for assumptions and calculations used to estimate the typical unit energy saving.

2.4. Vending Machine Controls

This measure relates to the installation of new controls on refrigerated beverage vending machines, non-refrigerated snack vending machines, and glass front refrigerated coolers. Controls can significantly reduce the energy consumption of vending machine and refrigeration systems. Qualifying controls must power down these systems during periods of inactivity but, in the case of refrigerated machines, must always maintain a cool product that meets customer expectations. This measure relates to the installation of a new control on a new or existing unit. This measure should not be applied to ENERGY STAR qualified vending machines, as they already have built-in controls.

Table 2-21 through Table 2-23 summarizes the 'typical' expected (per machine controlled) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.[29]

Table 2-21 Summary Deemed Savings Estimates for Beverage Vending Machine Controls

	Retrofit	**New Construction**
Deemed Savings Unit	Machine Controlled	Machine Controlled
Average Unit Energy Savings	519 kWh	222 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	5 Years	5 Years
Average Material & Labor Cost	$ 215.50	n/a
Average Incremental Cost	n/a	$ 180
Stacking Effect End-Use	Miscellaneous Loads	

Table 2-22 Summary Deemed Savings Estimates for Other Cold Product Vending Machine Controls

	Retrofit	**New Construction**
Deemed Savings Unit	Machine Controlled	Machine Controlled
Average Unit Energy Savings	519 kWh	222 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	5 Years	5 Years
Average Material & Labor Cost	$ 215.50	n/a
Average Incremental Cost	n/a	$ 180
Stacking Effect End-Use	Miscellaneous Loads	

[29] The Savings estimates provided in the summary tables are only given for a quick cost effectiveness test. The estimates are based on assumed weights for equipment types. See spreadsheet "4-TypicalCalcs_VndMcnCntrl.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, EUL, and incremental costs.

Table 2-23 Summary Deemed Savings Estimates for Non-Cooled Snack Vending Machine Controls

	Retrofit	New Construction
Deemed Savings Unit	Machine Controlled	Machine Controlled
Average Unit Energy Savings	387 kWh	387 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	5 Years	5 Years
Average Material & Labor Cost	$ 108	n/a
Average Incremental Cost	n/a	$ 75
Stacking Effect End-Use	Miscellaneous Loads	

2.4.1. Definition of Eligible Equipment

The eligible equipment is a non-Energy Star qualified refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity. The controls must be equipped with a passive infrared occupancy sensor, a duplex receptacle, and a power cord for connecting the device to 120V power.

2.4.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

The baseline condition for retrofit is a non-Energy Star qualified refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

New Construction (Includes Major Remodel & Replace on Burn-Out)

The baseline condition for new construction is a machine without a control system that complies with the Department of Energy's (DOE) 2012 energy conservation standards for refrigerated beverage vending machines.

2.4.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$\Delta kWh/Unit_i = kWh_{base} * U_{RR}$$

$$kWh_{base} = \sum (kWh_{base,i} * 365)$$

$$kWh_{code,class\ A} = 0.055 * V + 2.56$$

$$kWh_{code,class\ B} = 0.073 * V + 3.16$$

$$\Delta kW = 0$$

2.4.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment
ΔkWh/Unit	Stipulated per unit energy savings
ΔkW	Defined to be zero for this measure as it is assumed that controls are only effective during off-peak hours.
kWh_{base}	Annual energy consumption of *baseline* equipment for the ith combination of equipment type.
$kWh_{code,\ Class\ A/B}$	Daily energy consumption for new construction (Class A or B) machine
U_{RR}	Usage Reduction Rate
N_{Units}	Number of Machines

2.4.5. Sources

1. DEER2011 EUL Summary http://www.deeresources.com/deer0911planning/downloads/EUL_Summary_10-1-08.xls
2. DEER2011 Cost Data
3. http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValuesAndDocumentation_080530Rev1.zip
4. SCE Work Paper, SCE13CS005: Beverage Merchandise Controller
5. DEER2005 UpdateFinalReport_ItronVersion.pdf
6. LBNL 2007: http://enduse.lbl.gov/info/LBNL-62397.pdf
7. Cadmus Energy Star Report: http://rtf.nwcouncil.org/meetings/2006/09/RTF%20091806%20-%20Vending%20Final-2.ppt

2.4.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-24 Unit Energy Savings for Uncooled Vending Machine Controls[30]

Equipment	kWh Savings Per Machine
Uncooled Vending Machine	387

[30] Applies to both Retrofit and New Construction

Table 2-25 Unit Energy Savings for Retrofit Class A & B Cold Beverage Vending Machine Controls

Vending Machine Capacity (cans)	kWh Savings Per Machine
<500	519
500	653
699	592
799	700
800+	553
Weighted	632

Table 2-26 Unit Energy Savings for New Construction Class A Cold Beverage Vending Machine Controls

Vending Machine Capacity (cans)	kWh Savings Per Machine
<500	222
500	270
699	278
799	298
800+	282
Weighted	134

Table 2-27 Unit Energy Savings for New Construction Class B Cold Beverage Vending Machine Controls

Vending Machine Capacity (cans)	kWh Savings Per Machine
<500	280
500	300
699	309
799	331
800+	314
Weighted	151

Table 2-28 Unit Incremental Cost for Retrofit and New Construction Uncooled Vending Machine Controls

Measure Case Description	Measure Equipment Cost	Measure Labor Cost	Gross Measure Cost
Cold Drink Vending Machine	$180.00	$35.50	$215.50
Uncooled Snack Machine	$75.00	$33.00	$108.00

2.5. Efficient Washing Machines

This protocol discusses the calculation methodology and the assumptions regarding baseline equipment, efficient equipment, and usage patterns used to estimate annual energy savings expected from the replacement of a standard clothes washer with an ENERGY STAR or high efficiency clothes washer.

Table 2-29 summarizes the 'typical' expected (per machine) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-29 Summary Deemed Savings Estimates for Efficient Washing Machines[31]

	Retrofit	New Construction
Deemed Savings Unit	Machine	Machine
Average Unit Energy Savings	1,727 kWh	756 kWh
Average Unit Peak Demand Savings	0.86 kW	0.38 kW
Expected Useful Life[32]	10.7 Years	10.7 Years
Average Material & Labor Cost[33]	$ 1,470	n/a
Average Incremental Cost[34]	n/a	$ 200
Stacking Effect End-Use	Miscellaneous Loads	

2.5.1. Definition of Eligible Equipment

The eligible equipment is clothes washers meeting ENERGY STAR or better efficiency in small commercial applications that have **both** electric water heating (DHW) and electric dryers. The minimum efficiency is Modified Energy Factor (MEF) of ≥2.2 (ft^3/kWh/cycle) and Water Factor (WF) ≤ 4.5 (gal/ft^3/cycle). Currently, only front-loading clothes washers meet the ENERGY STAR standards.

2.5.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

The retrofit baseline condition is a standard efficiency washing machine. The RTF sources the latest CEC database which has non ENERGY STAR machine MEF ranging from 1.26 to 2.45 with an average of 1.63.

[31] See spreadsheet "5-TypicalCalcs_EffWshMcn.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, EUL, and incremental costs. There isn't a difference between new construction and retrofit because RTF specifies the measure for new and existing construction.

[32] ENERGY STAR Calculator: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=VMC

[33] Cadmus Group: http://rtf.nwcouncil.org/meetings/2006/09/RTF%20091806%20-%20Vending%20Final-2.ppt

[34] See previous footnote

New Construction (Includes Major Remodel & Replace on Burn-Out)

For new construction the baseline is the Federal efficiency standard MEF ≥1.60 (ft3/kWh/cycle) and WF ≤ 8.5 (gal/ft^3/cycle) for Top Loading washers and MEF ≥2.0 (ft3/kWh/cycle)/ (kWh) and WF ≤ 5.5 (gal/ft^3/cycle) for Front Loading washers. The RTF designates the baseline using MEF ranging from 1.65 to 2.45 with an average of 2.04 and WF ranging from 3.7 to 8.4 with an average of 5.99.

2.5.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$\Delta kWh/Unit_{Typical} = \sum (\Delta kWh/Unit_i * W_i)$$

$$\Delta kWh/Unit_{i,Intalled} = \Delta kWh_{Dryer} + \Delta kWh_{Water\ heat} + \Delta kWh_{Water\ treatment}$$

$$\Delta kWh_{Water\ heat} = Cap * 0.058 * WF^{1.3593} * C_P * M_{Water} * \Delta T / (\eta_{Elec} * 3{,}412) * N_{Cycles}$$

$$\Delta kWh_{Water\ treatment} = Cap * WF * N_{Cycles} * kWh_{aeration}$$

$$\Delta kW = \Delta kW/Unit * N_{Units}$$

$$\Delta kW/Unit_{Typical} = \sum (\Delta kW/Unit_i * UF * W_i)$$

2.5.4. Definitions

Δ kWh	Expected energy savings between baseline and installed equipment.
Δ kW	Demand energy savings between baseline and installed equipment.
Δ kWh/Unit	Per unit energy savings as stipulated in Table 2-30 and Table 2-31. If retrofit and capacity & WF are known, this can be calculated using the equation for $\Delta kWh/Unit_{i,Installed}$ above.
$\Delta kWh/Unit_{Typical}$	Typical measure energy savings on a per unit basis.
$\Delta kWh/Unit_{i,Installed}$	Calculated energy savings on a per unit basis for retrofit projects.
ΔkW/Unit	Per unit demand savings as stipulated in Table 2-30 and Table 2-31.
$\Delta kW/Unit_{Typical}$	Typical measure demand savings on a per unit basis.
W_i	Population weight for each $\Delta kWh/Unit_i$ and $\Delta kW/Unit_i$. Values used are from DOE's Commercial Clothes Washers Final Rule Technical Support Document
UF	Utilization Factor. This is defined to be 0.000499[35]
N_{Units}	Number of Machines
N_{Cycles}	Number of Cycles
Cap	Compartment Capacity of Washer (ft^3)
WF	Manufacturer rated water factor
kWh_{Dryer}	Dryer energy savings from washer lessening remaining moisture content

[35] See spreadsheet "5-TypicalCalcs_EffWshMcn.xlsx" for assumptions and calculations used to estimate the UF.

$\Delta kWh_{Water\ heat}$	Water heating savings from washer using less hot water
$\Delta kWh_{Water\ treatment}$	Energy savings from reduced wastewater aeration
$\Delta kWh_{Aeration}$	Aeration energy usage = 5.3 kWh/1000gal[36]
C_P	Specific Heat of water = 1 Btu/lb-F
M_{Water}	Mass of water = 8.3149 lbs/gallon
ΔT	Delta temperature. This is defined to be 80 (degree F)
η_{Elec}	Electric Water Heating Efficiency = 98%

2.5.5. Sources

1. Regional Technical Forum measure workbook: http://rtf.nwcouncil.org/measures/com/Com ClothesWasher_v2_0
2. Department of Energy (DOE) Technical Support Document, 2009: http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/46

2.5.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-30 Unit Energy Savings for Laundromat Efficient Washing Machines[37]

Measure	Program Type	kWh/Unit	kW/Unit
Energy Star Commercial Clothes Washer w/MEF 2.2 and higher, WF 4.5 and lower - Electric DHW & Dryer	New Construction	828	0.413
Energy Star Commercial Clothes Washer w/MEF 2.2 and higher, WF 4.5 and lower - Electric DHW & Dryer	Retrofit[38]	1,891	0.944

Table 2-31 Unit Energy Savings for Multifamily Efficient Washing Machines

Measure	Program Type	kWh/Unit	kW/Unit
Energy Star Commercial Clothes Washer w/MEF 2.2 and higher, WF 4.5 and lower - Electric DHW & Dryer	New Construction	469	0.234
Energy Star Commercial Clothes Washer w/MEF 2.2 and higher, WF 4.5 and lower - Electric DHW & Dryer	Retrofit	1072	0.535

[36] From Regional Technical Forum measure workbook

[37] See spreadsheet "5-TypicalCalcs_EffWshMcn.xlsx" for assumptions and calculations used to estimate the typical unit energy savings.

[38] Retrofit refers to early retirement (ER). For replace on burnout (ROB) use New Construction.

2.6. Wall Insulation

The following algorithms and assumptions are applicable to wall insulation installed in commercial spaces which are more efficient than existing insulation or prevailing codes and standards.

Wall insulation is rated by its R-value. An R-value indicates its resistance to heat flow – the higher the R-value, the greater the insulating effectiveness. The R-value depends on the type of insulation including its material, thickness, and density. When calculating the R-value of a multilayered installation, add the R-values of the individual layers.

Table 2-32 and Table 2-33 summarize the 'typical' expected (per insulation ft^2 square foot) energy impacts for this measure for *cooling only* and *cooling + heating* impacts respectively. Typical and deemed values are based on the algorithms and stipulated values described below.[39] The typical and deemed values reported in this chapter are based on a weighted average across multiple building types. The cooling savings assume either DX or Hydronic cooling (depending on what is considered 'typical' for that building type) while the heating component assumes DX air-cooled heat pumps.

Table 2-32 Typical Savings Estimates for Wall Insulation (Cooling Only)

	Retrofit	**New Construction**
Deemed Savings Unit	Insulation ft2	Insulation ft2
Average Unit Energy Savings	0.044 kWh	0.003 kWh
Average Unit Peak Demand Savings	0.028 W	0.002 W
Average Gas Impacts[40]	.022 Therms	.001 Therms
Expected Useful Life	25 Years	25 Years
Average Material & Labor Cost	$ 0.66	n/a
Average Incremental Cost	n/a	$ 0.12
Stacking Effect End-Use	Cooling	

[39] See spreadsheet "6-TypicalCalcs_WallInsul.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs for cooling savings.

[40] Note that the reported gas impacts assume that if savings are being claimed for cooling only the facility is gas heated. If the facility is electrically heated then these gas impacts are not applicable and savings should be based on the following table.

Table 2-33 Typical Savings Estimates for Wall Insulation (Cooling & Heating)

	Retrofit	New Construction
Deemed Savings Unit	Insulation ft2	Insulation ft2
Average Unit Energy Savings	0.414 kWh	0.028 kWh
Average Unit Peak Demand Savings	0.028 W	0.002 W
Expected Useful Life	25 Years	25 Years
Average Material & Labor Cost	$ 0.66	n/a
Average Incremental Cost	n/a	$ 0.12
Stacking Effect End-Use	Heating, Cooling	

2.6.1. Definition of Eligible Equipment

Eligible wall area is limited to the treated wall area of exterior walls (gross wall area, less window and door) where the insulation has been installed to the proposed R-value. Insulation must be installed in buildings, or portions of buildings, with central mechanical air conditioning or PTAC/PTHP systems. Qualifying wall insulation can be rigid foam, fiberglass bat, blown-in fiberglass or cellulose, assuming it meets or exceeds the required R-value. Radiant barriers will not be allowed as a substitute for insulation. The savings estimates for retrofit projects assume the baseline building has no wall insulation (e.g. an empty cavity).

2.6.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction. Note that heating savings are only applicable for facilities with electric heating.

Retrofit (Early Replacement)

If the project is retrofitting pre-existing insulation and the project does not represent a major renovation then the baseline efficiency is defined by the pre-existing insulation.

New Construction (New Construction, Replace on Burnout)

For New Construction, the baseline efficiency is defined as the minimum allowable R-value by the prevailing building energy code or standard according to which the project was permitted. Current applicable standards are defined by ASHRAE 90.1-2004 and 90.1-2007.

2.6.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh_{cool} + \Delta kWh_{heat}$$

$$\Delta kWh_{cool} = A * (CDD * 24)/(SEER * 1000) * (1/R_{base} – 1/R_{meas})$$

$$\Delta kWh_{heat} = A * (HDD * 24)/(HSPF * 3413) * (1/R_{base} – 1/R_{meas})$$

$$\Delta kW_{peak} = \Delta kWh_{cool} / EFLH_{cool} \text{ X } CF$$

2.6.4. Definitions

A	Area of the insulation that was installed in square feet
HDD	Heating degree days, refer to Table 2-38 for typical heating degree days for different buildings. When possible, actual base temperatures should be used to calculate the HDD
CDD	Cooling degree days refer to Table 2-38 for typical cooling degree days for different buildings. When possible, actual base temperatures should be used to calculate the CDD.
R_{base}	The R-value of the insulation and support structure before the additional insulation is installed
R_{meas}	The total measure R-value of all insulation after the additional insulation is installed
EFLH	Annual equivalent full load cooling hours for the air conditioning unit. Values for various building types are stipulated in Table 2-40. When available, actual system hours of use should be used.
SEER	Seasonal Energy efficiency ratio of the air conditioning unit. This is defined as the ratio of the Annual cooling provided by the air conditioner (in BTUs), to the total electrical input (in Watts). Note that the IEER is an appropriate equivalent. If the SEER or IEER are unknown or unavailable use the following formula to estimate from the EER: [41] $SEER = .0507 * EER^2 + .5773 * EER + .4919$
HSPF	Heating Season Performance Factor. This is identical to the SEER (described above) as applied to Heat Pumps in heating mode. If only the heat pump COP is available then use the following: $HSPF = .5651 * COP^2 + .464 * COP + .4873$
CF	Peak coincidence factor. Represents the % of the connected load reduction which occurs during Idaho Power's peak period.
$\Delta kWh/Unit_{Retrofit}$	Typical measure savings on a per unit basis.
$\Delta kWh_{New\ Const}$	Savings reflecting the most efficient unit upgrading to the least efficient qualifying unit representing a conservative savings estimate for the measure.

2.6.5. Sources

1. ASHRAE, Standard 90.1-2004.
2. ASHRAE, Standard 90.1-2007.
3. California DEER Prototypical Simulation models (modified), eQUEST-DEER 3-5.[42]
4. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls[43]

[41] Note that this formula is an approximation and should only be applied to EER values up to 15 EER.

[42] Prototypical building energy simulations were used to generate Idaho specific Heating and Cooling Interactive Factors and Coincidence factors for various building and heating fuel types.

[43] After reviewing the sources feeding into the DEER value of 20 years it was found that the 20 year determination was based on a DEER policy for maximum EUL. Since DEER sources supported a higher EUL the higher EUL is used here.

2.6.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-34 Deemed Energy Savings for Wall Insulation - Retrofit[44]

	W/ft2	kWh/ft^2	Cost/ft^2
R-2.5 to R-11			
Cooling	.028	.044	$0.66
Heating	0	.370	
Cooling & Heating	.028	.414	
R-2.5 to R-19			
Cooling	.032	.050	$0.92
Heating	0	.416	
Cooling & Heating	.032	.465	

Table 2-35 Deemed Energy Savings for Wall Insulation – New Construction[45]

	W/ft2	kWh/ft^2	Cost/ft^2
R-13 to R-19			
Cooling	.002	.003	$0.12
Heating	0	.025	
Cooling & Heating	.002	.028	
R-13 to R-21			
Cooling	.003	.004	$0.16
Heating	0	.030	
Cooling & Heating	.003	.033	

[44] See spreadsheet "6-TypicalCalcs_WallInsul.xlsx" for assumptions and calculations used to estimate the deemed unit energy savings.

[45] See spreadsheet "6-TypicalCalcs_WallInsul.xlsx" for assumptions and calculations used to estimate the deemed unit energy savings.

Table 2-36 Wall Insulation: Code Minimum R-values for Nonresidential Buildings in Zone 5[46]

Climate Zone 5	Opaque Element	ASHRAE 90.1 2004 Insulation Min. R-Value	ASHRAE 90.1 2007 Insulation Min. R-Value
Walls, Above-Grade	Mass	R-7.6 ci	R-11.4 ci
	Metal Building	R-13.0	R-13.0
	Steel-Framed	R-13.0 + R-3.8 ci	R-13.0 + R-7.5 ci
	Wood-Framed and Other	R-13.0	R-13.0 + R-3.8 ci
Wall, Below-Grade	Below-Grade Wall	NR	R-7.5 ci

Table 2-37 Wall Insulation: Code Minimum R-values for Nonresidential Buildings in Zone 6[47]

Climate Zone 6	Opaque Element	ASHRAE 90.1 2004 Insulation Min. R-Value	ASHRAE 90.1 2007 Insulation Min. R-Value
Walls, Above-Grade	Mass	R-9.5 ci	R-13.3 ci
	Metal Building	R-13.0	R-13.0
	Steel-Framed	R-13.0 + R-3.8 ci	R-13.0 + R-7.5 ci
	Wood-Framed and Other	R-13.0	R-13.0 + R-7.5 ci
Wall, Below-Grade	Below-Grade Wall	NR	R-7.5 ci

[46] Values stipulated from Table 5.5-5 ASHRAE 2004 and 2007. c.i. = continuous insulation, NR = no requirement

[47] Values stipulated from Table 5.5-6 in ASHRAE 2004 and 2007. c.i. = continuous insulation, NR = no requirement

Table 2-38 Stipulated Heating and Cooling Degree Days by Building Type[48]

	Zone 5		Zone 6	
Building Type	**HDD**	**CDD**	**HDD**	**CDD**
Assembly	256	104	274	91
Community College	229	116	214	101
Conditioned Storage	256	73	290	72
Fast Food Restaurant	258	103	284	81
Full Service Restaurant	273	88	289	76
High School	253	112	290	75
Hospital	272	93	293	94
Hotel	225	140	268	97
Large Retail 1 Story	240	122	264	101
Large Retail 3 Story	242	103	274	90
Large Office	229	131	247	121
Light Manufacturing	241	121	271	94
Medical Clinic	280	85	293	72
Motel	199	166	285	80
Multi Family	219	121	247	72
Nursing Home	300	65	300	79
Primary School	250	115	286	79
Small Office	226	131	256	106
Small Retail	244	117	271	94
University	229	131	247	109

[48] Values obtained from simulations of the DEER input models using eQuest to obtain typical baseline temperatures for each building. TMY3 weather data was collected and averaged over the ASHRAE weather Zones 5 and 6 to create heating and cooling degree days using the typical baseline temperatures.

Table 2-39 HVAC Coincidence Factors by Building Type

Building Type	Coincidence Factor
Assembly	0.47
Education - Community College	0.54
Education - Primary School	0.1
Education - Secondary School	0.1
Education - University	0.53
Grocery	0.54
Health/Medical - Hospital	0.82
Health/Medical - Nursing Home	0.49
Lodging - Hotel	0.67
Lodging - Motel	0.63
Manufacturing - Light Industrial	0.46
Office - Large	0.58
Office - Small	0.51
Restaurant - Fast-Food	0.48
Restaurant - Sit-Down	0.46
Retail - 3-Story Large	0.66
Retail - Single-Story Large	0.56
Retail - Small	0.49
Storage - Conditioned	0.41

Table 2-40 Heating and Cooling Equivalent Full Load Hours (EFLH) by Building Type[49]

	Zone 5		Zone 6	
Building Type	EFLH Cooling	EFLH Heating	EFLH Cooling	EFLH Heating
Assembly	879	966	758	1059
Education - Primary School	203	299	173	408
Education - Secondary School	230	406	196	514
Education - Community College	556	326	530	456
Education - University	697	341	721	449
Grocery	3437	1825	3762	2011
Health/Medical - Hospital	1616	612	1409	679
Health/Medical - Nursing Home	1049	1399	884	1653
Lodging - Hotel	1121	621	1075	780
Lodging - Motel	978	682	937	796
Manufacturing - Light Industrial	530	699	415	1088
Office - Large	746	204	680	221
Office - Small	607	256	567	360
Restaurant - Sit-Down	811	624	716	709
Restaurant - Fast-Food	850	722	734	796
Retail - 3-Story Large	765	770	644	998
Retail - Single-Story Large	724	855	576	998
Retail - Small	726	886	619	1138
Storage - Conditioned	335	688	242	989

[49] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

2.7. Ceiling Insulation

The following algorithms and assumptions are applicable to ceiling insulation installed in commercial spaces which are more efficient than existing insulation or prevailing codes and standards.

Ceiling insulation is rated by its R-value. An R-value indicates its resistance to heat flow (where a higher the R-value indicates a greater insulating effectiveness). The R-value depends on the type of insulation including its material, thickness, and density. When calculating the R-value of a multilayered installation, add the R-values of the individual layers.

Table 2-41 summarizes the 'typical' expected (per insulation ft^2 square foot) energy impacts for this measure. Table 2-42 summarizes the deemed energy savings for the specific insulation upgrade cited. Typical and deemed values are based on the algorithms and stipulated values described below. The typical and deemed values reported in this chapter are based on a weighted average across multiple building types. The cooling savings assume either DX or Hydronic cooling (depending on what is considered 'typical' for that building type) while the heating component assumes DX air-cooled heat pumps.

Table 2-41 Typical Savings Estimates for Ceiling Insulation (Cooling Only)[50]

	Retrofit	**New Construction**
Deemed Savings Unit	Insulation ft2	Insulation ft2
Average Unit Energy Savings	.006 kWh	.0007 kWh
Average Unit Peak Demand Savings	.005 W	.0005 W
Average Gas Impacts	.003 Therms	0 Therms[51]
Expected Useful Life	25 Years	25 Years
Average Material & Labor Cost	$ 1.38	n/a
Average Incremental Cost	n/a	$ 0.20
Stacking Effect End-Use	Cooling	

[50] See spreadsheet "7-TypicalCalcs_CeilingInsul.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs for cooling savings. Note that the reported gas impacts assume that if savings are being claimed for cooling only the facility is gas heated. If the facility is electrically heated then these gas impacts are not applicable and savings should be based on the following table.

[51] While the therms impact for this measure is technically non-zero it is sufficiently small as to be considered negligible.

Table 2-42 Typical Savings Estimates for Ceiling Insulation (Cooling & Heating)[52]

	Retrofit	New Construction
Deemed Savings Unit	Insulation ft2	Insulation ft2
Average Unit Energy Savings	.035 kWh	.007 kWh
Average Unit Peak Demand Savings	.002 W	.005 W
Expected Useful Life	25 Years	25 Years
Average Material & Labor Cost	$ 1.38	n/a
Average Incremental Cost	n/a	$ 0.20
Stacking Effect End-Use	Heating, Cooling	

2.7.1. Definition of Eligible Equipment

Eligible roof/ceiling area is limited to buildings or potions of buildings with central mechanical air conditioning or PTAC systems. Qualifying ceiling insulation can be rigid foam, fiberglass bat, or blown-in fiberglass or cellulose a long as material is eligible, assuming it meets or exceeds the required R-value. The insulation must upgrade from R11 or less to a minimum of R24 or from R19 or less to a minimum of R38.

2.7.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

If the project is retrofitting pre-existing insulation then the baseline efficiency is defined by the pre-existing insulation.

New Construction (New Construction, Replace on Burnout)

For New Construction, the baseline efficiency is defined as the minimum allowable R-value by the prevailing building energy code or standard according to which the project was permitted. Current applicable standards are defined by ASHRAE 90.1-2004 and 90.1-2007.

2.7.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh_{cool} + \Delta kWh_{heat}$$

$$\Delta kWh_{cool} = A * (CDD * 24)/(SEER * 1000) * (1/R_{base} – 1/R_{meas})$$

$$\Delta kWh_{heat} = A * (HDD * 24)/(HSPF * 3413) * (1/R_{base} – 1/R_{meas})$$

$$\Delta kW_{peak} = \Delta kWh_{cool} / EFLH_{cool} * CF$$

[52] See spreadsheet "7-TypicalCalcs_CeilingInsul.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs for cooling and heating savings.

2.7.4. Definitions

A	Area of the insulation that was installed in square feet
HDD	Heating degree days, refer to Table 2-47 for typical heating degree days for different buildings. When possible, actual base temperatures should be used to calculate the HDD
CDD	Cooling degree days refer to Table 2-47 for typical cooling degree days for different buildings. When possible, actual base temperatures should be used to calculate the CDD.
R_{base}	The R-value of the insulation and support structure before the additional insulation is installed
R_{meas}	The total measure R-value of all insulation after the additional insulation is installed
EFLH	Annual equivalent full load cooling hours for the air conditioning unit. Values for various building types are stipulated in Table 2-49. When available, actual system hours of use should be used.
SEER	Seasonal Energy efficiency ratio of the air conditioning unit. This is defined as the ratio of the Annual cooling provided by the air conditioner (in BTUs), to the total electrical input (in Watts). Note that the IEER is an appropriate equivalent. If the SEER or IEER are unknown or unavailable use the following formula to estimate from the EER: $SEER^{53} = .0507 * EER^2 + .5773 * EER + .4919$
HSPF	Heating Season Performance Factor. This is identical to the SEER (described above) as applied to Heat Pumps in heating mode. If only the heat pump COP is available then use the following: $HSPF = .5651 * COP^2 + .464 * COP + .4873$
CF	Peak coincidence factor. Represents the % of the connected load reduction which occurs during Idaho Power's peak period.
$\Delta kWh/Unit_{Retrofit}$	Typical measure savings on a per unit basis.
$\Delta kWh_{New\ Const}$	Savings reflecting the most efficient unit upgrading to the least efficient qualifying unit representing a conservative savings estimate for the measure.

2.7.5. Sources

1. ASHRAE, Standard 90.1-2004.
2. ASHRAE, Standard 90.1-2007.
3. California DEER Prototypical Simulation models (modified), eQUEST-DEER 3-5.[54]
4. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls[55]

[53] Note that this formula is an approximation and should only be applied to EER values up to 15 EER.

[54] Prototypical building energy simulations were used to generate Idaho specific Heating and Cooling Interactive Factors and Coincidence factors for various building and heating fuel types.

[55] After reviewing the sources feeding into the DEER value of 20 years it was found that the 20 year determination was based on a DEER policy for maximum EUL. Since DEER sources supported a higher EUL the higher EUL is used here.

2.7.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-43 Deemed Energy Savings for Ceiling Insulation - Retrofit[56]

Insulation Values	W/ft2			kWh/ft2		
	Cooling	Heating	Cooling & Heating	Cooling	Heating	Cooling & Heating
R-11 to R-24	0.005	0.000	0.005	0.007	0.059	0.066
R-11 to R-38	0.006	0.000	0.006	0.009	0.077	0.087
R-11 to R-49	0.006	0.000	0.006	0.010	0.084	0.094
R-19 to R-38	0.002	0.000	0.002	0.004	0.032	0.035
R-19 to R-49	0.003	0.000	0.003	0.005	0.039	0.043
Weighted:	0.005	0.000	0.005	0.006	0.053	0.059

Table 2-44 Deemed Energy Savings for Ceiling Insulation – New Construction[57]

	W/ft2	kWh/ft2
R-38 to R-49		
Cooling	.0005	.0007
Heating	0	.006
Cooling & Heating	.0005	.007

[56] See spreadsheet "7-TypicalCalcs_CeilingInsul.xlsx" for assumptions and calculations used to estimate the deemed unit energy savings.

[57] See spreadsheet "7-TypicalCalcs_CeilingInsul.xlsx" for assumptions and calculations used to estimate the deemed unit energy savings.

Table 2-45 ASHRAE Baseline R–values for Nonresidential Buildings in Zone 5[58]

Zone 5	Nonresidential 2004	Nonresidential 2007
Opaque Element	Insulation Min. R-Value	Insulation Min. R-Value
Insulation Entirely above Deck	R-15.0 c.i.	R-20.0 c.i.
Metal Building	R-19.0	R-19.0
Attic and Other	R-30.0	R-38.0

Table 2-46 ASHRAE Baseline R–values for Nonresidential Buildings in Zone 6[59]

Zone 6	Nonresidential 2004	Nonresidential 2007
Opaque Element	Insulation Min. R-Value	Insulation Min. R-Value
Insulation Entirely above Deck	R-15.0 c.i.	R-20.0 c.i.
Metal Building	R-19.0	R-19.0
Attic and Other	R-38.0	R-38.0

[58] Values stipulated from ASHRAE 90.1 2004 and 2007 Table 5.5-5

[59] Values stipulated from ASHRAE 90.1 2004 and 2007 Table 5.5-6

Table 2-47 Base Heating and Cooling Degree Days by Building Type[60]

	Zone 5		Zone 6	
Building Type	HDD	CDD	HDD	CDD
Assembly	256	104	274	91
Community College	229	116	214	101
Conditioned Storage	256	73	290	72
Fast Food Restaurant	258	103	284	81
Full Service Restaurant	273	88	289	76
High School	253	112	290	75
Hospital	272	93	293	94
Hotel	225	140	268	97
Large Retail 1 Story	240	122	264	101
Large Retail 3 Story	242	103	274	90
Large Office	229	131	247	121
Light Manufacturing	241	121	271	94
Medical Clinic	280	85	293	72
Motel	199	166	285	80
Multi Family	219	121	247	72
Nursing Home	300	65	300	79
Primary School	250	115	286	79
Small Office	226	131	256	106
Small Retail	244	117	271	94
University	229	131	247	109

[60] Values obtained from simulations of the DEER input models using eQuest to obtain typical baseline temperatures for each building. TMY3 weather data was collected and averaged over the ASHRAE weather Zones 5 and 6 to create heating and cooling degree days using the typical baseline temperatures.

Table 2-48 HVAC Coincidence Factors by Building Type

Building Type	Coincidence Factor
Assembly	0.47
Education - Community College	0.54
Education - Primary School	0.10
Education - Secondary School	0.10
Education - University	0.53
Grocery	0.54
Health/Medical - Hospital	0.82
Health/Medical - Nursing Home	0.49
Lodging - Hotel	0.67
Lodging - Motel	0.63
Manufacturing - Light Industrial	0.46
Office - Large	0.58
Office - Small	0.51
Restaurant - Fast-Food	0.48
Restaurant - Sit-Down	0.46
Retail - 3-Story Large	0.66
Retail - Single-Story Large	0.56
Retail - Small	0.49
Storage - Conditioned	0.41

Table 2-49 Stipulated Equivalent Full Load Hours (EFLH) by Building Type[61]

	Zone 5		**Zone 6**	
Building Type	EFLH Cooling	EFLH Heating	EFLH Cooling	EFLH Heating
Assembly	879	966	758	1059
Education - Primary School	203	299	173	408
Education - Secondary School	230	406	196	514
Education - Community College	556	326	530	456
Education - University	697	341	721	449
Grocery	3437	1825	3762	2011
Health/Medical - Hospital	1616	612	1409	679
Health/Medical - Nursing Home	1049	1399	884	1653
Lodging - Hotel	1121	621	1075	780
Lodging - Motel	978	682	937	796
Manufacturing - Light Industrial	530	699	415	1088
Office - Large	746	204	680	221
Office - Small	607	256	567	360
Restaurant - Sit-Down	811	624	716	709
Restaurant - Fast-Food	850	722	734	796
Retail - 3-Story Large	765	770	644	998
Retail - Single-Story Large	724	855	576	998
Retail - Small	726	886	619	1138
Storage - Conditioned	335	688	242	989

[61] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

2.8. Reflective Roof

This section covers installation of "cool roof" roofing materials in commercial buildings. Energy and demand saving are realized through reductions in the building cooling loads. The approach utilizes DOE-2.2 simulations on a series of commercial DEER prototypical building models.

Table 2-50 and Table 2-51 summarize the 'typical' expected (per ft^2) e*nergy impacts for this measure.* Typical values are based on the algorithms and stipulated values described below.

Table 2-50 Summary Deemed Savings Estimates for Low-Slope Roof (2:12 or less) Reflective Roof

	Retrofit	New Construction
Deemed Savings Unit	ft^2	ft^2
Average Unit Energy Savings	0.116 kWh	0.116 kWh
Average Unit Peak Demand Savings	0.095 W	0.095 W
Expected Useful Life[62]	15 Years	15 Years
Average Material & Labor Cost[63]	$ 7.84	n/a
Average Incremental Cost[64]	n/a	$ 0.05
Stacking Effect End-Use	Cooling	

Table 2-51 Summary Deemed Savings Estimates for Steep-Slope Roof (>2:12) Reflective Roof

	Retrofit	New Construction
Deemed Savings Unit	ft^2	ft^2
Average Unit Energy Savings	0.021 kWh	0.021 kWh
Average Unit Peak Demand Savings	0.017 W	0.017 W
Expected Useful Life[62]	15 Years	15 Years
Average Material & Labor Cost[63]	$ 7.90	n/a
Average Incremental Cost[64]	n/a	$0.11
Stacking Effect End-Use	Cooling	

2.8.1. Definition of Eligible Equipment

Eligible equipment includes all reflective roofing materials when applied to the roof above a space with central mechanical air conditioning or PTAC systems. The roof treatment must be Energy Star rated or tested through a Cool Roof Rating Council (CRRC) accredited laboratory. For low-slope (2:12 or less) roofs, the roof products must have an solar reflectivity of at least

[62] From 2008 Database for Energy-Efficiency Resources (DEER), Version 2008.2.05, "Effective/Remaining Useful Life Values", California Public Utilities Commission, December 16, 2008

[63] Labor costs from 2005 Database for Energy-Efficiency Resources (DEER), Version 2005.2.01, "Technology and Measure Cost Data", California Public Utilities Commission, October 26, 2005

[64] Material costs from common roof types found in EPA's Reducing Urban Heat Islands: Compendium of Strategies: http://www.epa.gov/heatisld/resources/pdf/CoolRoofsCompendium.pdf

0.70 and thermal emittance of 0.75. For steep slope(greater than 2:12) roofs, minimum solar reflectance is 0.25. Note that facilities with pre-existing cool roofs are not eligible for this measure.

2.8.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction.

Retrofit (Early Replacement)

The baseline equipment for retrofit projects is the pre-existing (non-cool roof) roofing material.

New Construction (Includes Major Remodel & Replace on Burn-Out)

The baseline for new construction projects is established by the constructions and materials typically employed for similar new construction buildings and roof constructions. For the purposes of calculating typical energy savings for this measure it is assumed that the baseline roofing material has a reflectance of 0.15.[65]

2.8.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * A$$

$$\Delta kW = \Delta kW/Unit * A$$

2.8.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
ΔkWh/Unit	Per unit energy savings as stipulated in Table 2-52 and Table 2-53 according to building type and climate zone.
ΔkW/Unit	Per unit demand reduction as stipulated in Table 2-52 and Table 2-53 according to building type and climate zone.
A	Area of cool roofing material installed [ft^2]

2.8.5. Sources

1. ASHRAE, Standard 90.1-2004.
2. ASHRAE, Standard 90.1-2007.
3. California DEER Prototypical Simulation models, eQUEST-DEER 3-5.[66]
4. ASHRAE. 2006. Weather data for building design standards. ANSI/ASHRAE Standard 169-2006.

[65] Value derived using common roof types performance specifications found in the EPA publication Reducing Urban Heat Islands: Compendium of Strategies: http://www.epa.gov/heatisld/resources/pdf/CoolRoofsCompendium.pdf

[66] Prototypical building energy simulation models were used to obtain U-Factor and SHGC values for each building type.

2.8.6. Sources

1. 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study. December 2005
2. 2008 Database for Energy-Efficiency Resources (DEER), Version 2008.2.05, "Effective/Remaining Useful Life Values", California Public Utilities Commission, December 16, 2008
3. 2005 Database for Energy-Efficiency Resources (DEER), Version 2005.2.01, "Technology and Measure Cost Data", California Public Utilities Commission, October 26, 2005

2.8.7. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-52 Unit Energy Savings for Low-Slope (<= 2:12) Reflective Roof[67]

Building Type	Weather Zone 5		Weather Zone 6	
	kWh	W	kWh	W
Primary School	0.082	0.076	0.062	0.059
Secondary School	0.088	0.060	0.052	0.046
Community College	0.392	0.075	0.449	0.068
University	0.148	0.092	0.141	0.083
Hospital	0.086	0.050	0.076	0.052
Nursing Home	0.120	0.096	0.101	0.087
Hotel	0.137	0.054	0.124	0.049
Motel	0.099	0.152	-0.014	0.135
Light Manufacturing	0.078	0.069	0.062	0.062
Small Office	0.102	0.089	0.089	0.083
Large Office	0.202	0.227	0.167	0.183
Full Service Restaurant (Sit-Down)	0.119	0.098	0.092	0.084
Fast Food	0.072	0.046	0.053	0.041
Small Retail	0.117	0.099	0.095	0.084
Large 1-story Retail	0.140	0.112	0.112	0.095
3-story Retail	0.087	0.057	0.098	0.049
Conditioned Storage	0.049	0.051	0.018	0.014

[67] See spreadsheet "8-TypicalCalcs_CoolRoof.xlsx" for assumptions and calculations used to estimate the typical unit energy savings.

Table 2-53 Unit Energy Savings for Steep-Slope (> 2:12) Reflective Roof[68]

Building Type	Weather Zone 5		Weather Zone 6	
	kWh	W	kWh	W
Primary School	0.015	0.014	0.012	0.011
Secondary School	0.015	0.012	0.009	0.009
Community College	0.076	0.013	0.071	0.011
University	0.027	0.016	0.021	0.014
Hospital	0.014	0.008	0.013	0.008
Nursing Home	0.022	0.017	0.019	0.016
Hotel	0.026	0.009	0.028	0.008
Motel	0.017	0.026	-0.002	0.024
Light Manufacturing	0.014	0.012	0.011	0.011
Small Office	0.018	0.016	0.016	0.015
Large Office	0.037	0.038	0.032	0.030
Full Service Restaurant (Sit-Down)	0.021	0.017	0.017	0.015
Fast Food	0.013	0.008	0.010	0.007
Small Retail	0.021	0.018	0.017	0.015
Large 1-story Retail	0.025	0.020	0.020	0.017
3-story Retail	0.013	0.011	0.018	0.009
Conditioned Storage	0.010	0.012	0.006	0.005

[68] See spreadsheet "8-TypicalCalcs_CoolRoof.xlsx" for assumptions and calculations used to estimate the typical unit energy savings.

2.9. Efficient Windows

The following algorithm and assumptions are applicable to efficient windows in commercial spaces which provide a lower U-value than existing windows or prevailing codes and standards. Savings will be realized through reductions in the buildings cooling and heating loads. Note that window films and windows with too low an SHGC value can for many buildings increase the heating loads (unless the building has a significant internal load as is the case for example in hospitals and/or data centers). In a heating dominated climate such as Idaho the increase in heating loads can negate any reduction in the cooling loads. Energy impacts for this measure are largely due to the improved U-Value and care should be taken when selecting windows to ensure that the SHGC values are appropriate for the building and climate.

Table 2-54 and Table 2-55 summarize the 'typical' expected (per window ft^2) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below. [69]

Table 2-54 Typical Savings Estimates for Efficient Windows (Cooling Only)

	Retrofit	**New Construction**
Deemed Savings Unit	ft^2 Window Glass	ft^2 Window Glass
Average Unit Energy Savings	1.51 kWh	n/a
Average Unit Peak Demand Savings	1.11 W	n/a
Average Gas Impacts[70]	0.13 Therms	n/a
Expected Useful Life	25 Years	n/a
Average Material & Labor Cost	$ 20.66	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Cooling	

[69] Average unit energy and peak demand cooling savings are based on a weighted average of electric resistance and heat pump savings only. Average unit energy and peak demand cooling savings are based on a weighted average of chiller and dx cooling only. See spreadsheet "9-TypicalCalcs_Windows.xlsx" for additional assumptions and calculations, EUL, and incremental cost.

[70] Note that the reported gas impacts assume that if savings are being claimed for cooling only the facility is gas heated. If the facility is electrically heated then these gas impacts are not applicable and savings should be based on the following table.

Table 2-55 Typical Savings Estimates for Efficient Windows (Heating and Cooling)

	Retrofit	New Construction
Deemed Savings Unit	ft^2 Window Glass	ft^2 Window Glass
Average Unit Energy Savings	8.47 kWh	n/a
Average Unit Peak Demand Savings	1.11 W	n/a
Expected Useful Life	25 Years	n/a
Average Material & Labor Cost	$ 20.66	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Heating, Cooling	

Table 2-56 Typical Savings Estimates for Premium Windows (Cooling Only)

	Retrofit	New Construction
Deemed Savings Unit	ft^2 Window Glass	ft^2 Window Glass
Average Unit Energy Savings	2.12 kWh	0.40 kWh
Average Unit Peak Demand Savings	1.55 W	0.32 W
Average Gas Impacts[71]	0.16 Therms	0.10 Therms
Expected Useful Life	25 Years	25 Years
Average Material & Labor Cost	$ 22.08	n/a
Average Incremental Cost	n/a	$ 5.92
Stacking Effect End-Use	Cooling	

Table 2-57 Typical Savings Estimates for Premium Windows (Cooling and Heating)

	Retrofit	New Construction
Deemed Savings Unit	ft^2 Window Glass	ft^2 Window Glass
Average Unit Energy Savings	10.6 kWh	5.89 kWh
Average Unit Peak Demand Savings	1.55 W	0.32 W
Expected Useful Life	25 Years	25 Years
Average Material & Labor Cost	$ 22.08	n/a
Average Incremental Cost	n/a	$ 5.92
Stacking Effect End-Use	Heating, Cooling	

[71] Note that the reported gas impacts assume that if savings are being claimed for cooling only the facility is gas heated. If the facility is electrically heated then these gas impacts are not applicable and savings should be based on the following table.

2.9.1. Definition of Eligible Equipment

In order to be considered eligible equipment windows must be independently tested and certified according to the standards established by the National Fenestration Rating Council (NFRC). While the NFRC does provide such testing and certification - any NFRC-licensed independent certification and inspection agency can provide certification. One example of such a body is the American Architectural Manufacturers Association (AAMA). In addition, eligible windows must meet or exceed the following performance ratings:

Efficient Windows:	SHGC = any and U-factor <= 0.42
Premium Windows:	SHGC <= any and U-factor <= 0.3

Window films and shades are not eligible under this measure as they reduce the SHGC without providing an appreciable improvement in the U-Value and in many circumstances their addition would result in an increased heating load which negates or exceeds the reduction in cooling loads.

2.9.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

If the project is retrofitting pre-existing equipment than the baseline efficiency is defined by the pre-existing windows.

New Construction (Includes Major Remodel & Replace on Burn-Out)

For new construction, the baseline efficiency is defined as the minimum allowable window performance in the prevailing building energy code or standard to which the project was permitted. Current standards are defined by ASHRAE 90.1-2004 and 90.1-2007.

2.9.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kW_{Heating} + \Delta kWh_{Cooling}$$
$$= \Delta kW_{Heating} * EFLH_{Heating} + \Delta kW_{Cooling} * EFLH_{cooling}$$
$$\Delta kW_{Heating} = A * (U * (T_{out} - T_{in}) + SHGC * E_{t,Heating}) / COP_{Heating}$$
$$\Delta kW_{Cooling} = A * (U * (T_{out} - T_{in}) + SHGC * E_{t,Cooling}) / COP_{Cooling}$$
$$\Delta kW_{peak} = \Delta kW_{Cooling} * CF$$

2.9.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW_{peak}	Expected demand reduction between baseline and installed equipment.

$\Delta kW_{Heating/Cooling}$	Non-coincident demand reduction for the *Heating* and *Cooling* end-uses.
U	Overall coefficient of heat transfer (U-Factor).
T_{in}	Indoor air temperature.
T_{out}	Outdoor air temperature.
SHGC	Solar heat gain coefficient.
E_t	Incident total irradiance found in Table 2-60.
COP	Coefficient of performance found in Table 2-62. $COP = EER / 3.412$
EFLH	Annual cooling or heating hours for the building. Values for various building types are stipulated in Table 2-63. When available, actual system hours of use should be used.
CF	Peak coincidence factor. Represents the % of the connected load reduction which occurs during Idaho Power's peak period which can be found in Table 2 54

2.9.5. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-58 Retrofit Deemed Savings per Sq. Ft.

Orientation	Savings Type	Premium Windows		Efficient Windows	
		kWh/sq. ft.	kW/sq. ft.	kWh/sq. ft.	kW/sq. ft.
North	Heating	22.25	n/a	16.14	n/a
	Cooling	-2.43	-0.002	-1.52	-0.001
	Heating and Cooling	19.83	-0.002	14.62	-0.001
South	Heating	-5.90	n/a	-2.63	n/a
	Cooling	6.80	0.005	4.63	0.003
	Heating and Cooling	0.89	0.005	1.99	0.003
West	Heating	10.61	n/a	8.38	n/a
	Cooling	2.91	0.003	2.03	0.002
	Heating and Cooling	13.52	0.003	10.41	0.002
East	Heating	6.98	n/a	5.96	n/a
	Cooling	1.19	0.000	0.89	0.000
	Heating and Cooling	8.18	0.000	6.85	0.000
Average	Heating	8.49	n/a	6.96	n/a
	Cooling	2.12	1.55	1.51	1.11
	Heating and Cooling	10.61	1.55	8.47	1.11

Table 2-59 New Construction Deemed Savings per Sq. Ft.

Orientation	Savings Type	Premium Windows	
		kWh/sq. ft.	*kW/sq. ft.*
North	Heating	5.49	n/a
	Cooling	0.40	0.000
	Heating and Cooling	5.89	0.000
South	Heating	5.49	n/a
	Cooling	0.40	0.000
	Heating and Cooling	5.89	0.000
West	Heating	5.49	n/a
	Cooling	0.40	0.000
	Heating and Cooling	5.89	0.000
East	Heating	5.49	n/a
	Cooling	0.40	0.000
	Heating and Cooling	5.89	0.000
Average	Heating	5.49	n/a
	Cooling	0.40	0.32
	Heating and Cooling	5.89	0.32

Table 2-60 Calculated Heating/Cooling E_{ti} for each Building Type[72]

	Weather Zone 5				**Weather Zone 6**			
	Heating		Cooling		Heating		Cooling	
Building Type	Electric Res.	Heat Pump	Chiller	DX	Electric Res.	Heat Pump	Chiller	DX
Assembly	-	43.94	-	128.26	-	44.26	-	134.58
Education - Primary School	-	43.15	-	122.55	-	46.45	-	141.08
Education - Secondary School	-	43.3	-	124.06	-	47.41	-	143.21
Education - Community College	39.09	-	121.6	-	38.38	-	128.99	-
Education - University	39.09	-	112.6	-	40.46	-	124.5	-
Health/Medical - Hospital	44.95	-	131.78	-	48.23	-	133.79	-
Health/Medical - Nursing Home	-	48.44	-	151.3	-	49.27	-	146
Lodging - Hotel	38.36	-	105.48	-	43.19	-	129.7	-
Lodging - Motel	36.76	-	99.9	-	46.21	-	139.43	-
Manufacturing - Light Industrial	41.7	-	119.09	-	44.25	-	132.94	-
Office - Large	39.09	-	112.6	-	40.46	-	116.65	-
Office - Small	-	38.37	-	112	-	41.94	-	125.9
Restaurant - Sit-Down	-	45.16	-	136.04	-	47.41	-	143.21
Restaurant - Fast-Food	-	44.01	-	128.26	-	45.78	-	138.19
Retail - 3-Story Large	41.81	-	128.26	-	44.26	-	135.21	-
Retail - Single-Story Large	41.7	-	117.66	-	42.73	-	128.46	-
Retail - Small	-	42.45	-	121.33	-	44.09	-	132.74
Storage - Conditioned	-	43.94	-	144.43	-	47.41	-	144.24

[72] See spreadsheet "9-TypicalCalcs_Windows.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Table 2-61 Baseline U-Factor and SHGC for Each Building[73]

Building	U-Factor	North Facing SHGC	Non-North Facing SHGC
Assembly	0.81	0.70	0.65
Education - Primary School	0.81	0.70	0.65
Education - Secondary School	0.81	0.70	0.65
Education - Community College	0.81	0.70	0.64
Education - University	1.04	0.83	0.84
Grocery	0.81	0.71	0.70
Health/Medical - Hospital	0.81	0.70	0.65
Health/Medical - Nursing Home	0.81	0.70	0.64
Lodging - Hotel	0.81	0.70	0.64
Lodging - Motel	0.81	0.70	0.64
Manufacturing - Bio/Tech	0.81	0.71	0.70
Manufacturing - Light Industrial	0.81	0.71	0.70
Office - Large	0.81	0.71	0.70
Office - Small	0.81	0.71	0.70
Restaurant - Sit-Down	0.81	0.71	0.70
Restaurant - Fast-Food	0.81	0.71	0.70
Retail - 3-Story Large	0.81	0.71	0.70
Retail - Single-Story Large	0.81	0.71	0.70
Retail - Small	0.81	0.71	0.70
Storage - Conditioned	0.81	0.71	0.70
Storage - Unconditioned	0.81	0.71	0.70
Warehouse - Refrigerated	0.81	0.71	0.70

Table 2-62 Average Heating/Cooling COP[74]

Heating		Cooling	
Electric Resistance	Heat Pump	Chiller	DX
2.6	3.6	5.1	2.9

[73] See spreadsheet "9-TypicalCalcs_Windows.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

[74] Average COP by heating/cooling type stipulated in ASHRAE 90.1 2004 and 2007 code baseline efficiencies.

Table 2-63 Stipulated Equivalent Full Load Hours (EFLH) by Building Type[75]

	Zone 5		***Zone 6***	
Building Type	EFLH Cooling	EFLH Heating	EFLH Cooling	EFLH Heating
Assembly	879	966	758	1059
Education - Primary School	203	299	173	408
Education - Secondary School	230	406	196	514
Education - Community College	556	326	530	456
Education - University	697	341	721	449
Grocery	3437	1825	3762	2011
Health/Medical - Hospital	1616	612	1409	679
Health/Medical - Nursing Home	1049	1399	884	1653
Lodging - Hotel	1121	621	1075	780
Lodging - Motel	978	682	937	796
Manufacturing - Light Industrial	530	699	415	1088
Office - Large	746	204	680	221
Office - Small	607	256	567	360
Restaurant - Sit-Down	811	624	716	709
Restaurant - Fast-Food	850	722	734	796
Retail - 3-Story Large	765	770	644	998
Retail - Single-Story Large	724	855	576	998
Retail - Small	726	886	619	1138
Storage - Conditioned	335	688	242	989

[75] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

Table 2-64 HVAC Coincidence Factors by Building Type

Building Type	CF
Assembly	0.47
Education - Community College	0.54
Education - Primary School	0.1
Education - Secondary School	0.1
Education - University	0.53
Grocery	0.54
Health/Medical - Hospital	0.82
Health/Medical - Nursing Home	0.49
Lodging - Hotel	0.67
Lodging - Motel	0.63
Manufacturing - Light Industrial	0.46
Office - Large	0.58
Office - Small	0.51
Restaurant - Fast-Food	0.48
Restaurant - Sit-Down	0.46
Retail - 3-Story Large	0.66
Retail - Single-Story Large	0.56
Retail - Small	0.49
Storage - Conditioned	0.41

2.10. HVAC Controls

This section covers the implementation of HVAC controls in commercial buildings. HVAC controls include economizers, demand controlled ventilation (DCV), and EMS controls. The discussion of eligible equipment provides more detail regarding the individual measures. HVAC controls garner energy savings by optimizing the algorithms by which HVAC equipment are operated. The approach used in this TRM to estimate energy impacts from such measures is based on DOE-2.2 simulations of prototypical commercial building models.[76]

The controls measures included in this chapter do not encompass equipment optimization, retro-commissioning, or commissioning. Such projects are demonstrated to have significant variance in energy impacts and short measure lives (lack of persistence). They are more suitable for a custom approach and are not included in the TRM. Measures of this nature include temperature set-point and equipment staging optimization, thermostat set-back overrides, and behavioral or maintenance oriented measures.

Table 2-65 though Table 2-67 summarize 'typical' expected (per ton of cooling) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below. [77]

Table 2-65 Typical Savings Estimates for Air-Side Economizer Only (New and Repair)

	Retrofit	**New Construction**
Deemed Savings Unit	Ton of cooling	Ton of cooling
Average Unit Energy Savings	288 kWh	193 kWh
Average Unit Peak Demand Savings	.0140 kW	.0092 kW
Average Unit Gas Savings	0 Therms	0 Therms
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$ 155.01 (New) $ 73.65 (Repair)	n/a
Average Incremental Cost	n/a	$81.36
Stacking Effect End-Use	n/a	

[76] The prototypical building models are sourced from the DEER 2008.

[77] See spreadsheet "10-TypicalCalcs_HVACcntrls.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs. Also note that the savings figures represented in these tables give equal weight to the four HVAC system types discussed later in this chapter

Table 2-66 Typical Savings Estimates for Demand Controlled Ventilation Only

	Retrofit	New Construction
Deemed Savings Unit	CFM of Air Controlled	CFM of Air Controlled
Average Unit Energy Savings	0.80 kWh	0.30 kWh
Average Unit Peak Demand Savings	0.08 W	0.02 W
Average Unit Gas Savings	0.04 Therms	0.02 Therms
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$0.44	n/a
Average Incremental Cost	n/a	$0.30
Stacking Effect End-Use	n/a	

Table 2-67 Typical Deemed Savings Estimates for EMS Controls w/ 2 Strategies Implemented[78]

	Retrofit	New Construction
Deemed Savings Unit	Ton of cooling	Ton of cooling
Average Unit Energy Savings	651 kWh	428 kWh
Average Unit Peak Demand Savings	.11 kW	.07 kW
Average Unit Gas Savings	6 Therms	4 Therms
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$197.98	n/a
Average Incremental Cost	n/a	$162.49
Stacking Effect End-Use	n/a	

Table 2-68 Typical Deemed Savings Estimates for EMS Controls w/ 4 Strategies Implemented[79]

	Retrofit	New Construction
Deemed Savings Unit	Ton of cooling	Ton of cooling
Average Unit Energy Savings	820 kWh	495 kWh
Average Unit Peak Demand Savings	.21 kW	.08 kW
Average Unit Gas Savings	17 Therms	7 Therms
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$197.98	n/a
Average Incremental Cost	n/a	$162.49
Stacking Effect End-Use	n/a	

[78] Assumes that (2) controls measures are implemented on average.

[79] Assumes that (2) controls measures are implemented on average.

2.10.1. Definition of Eligible Equipment

Eligible equipment is based on applicable HVAC system type (note that any building with a system type that isn't included in Table 2-69 should follow a custom path) and appropriately implementing the controls measures listed in Table 2-70. Note that evaporative cooling equipment is not eligible for this measure.

Table 2-69 HVAC System Types

Item	System Type
1	VAV with chilled water coils
2	Packaged Variable Air Volume System (PVAVS)
3	Packaged Variable Air Volume System (PVAVS) Gas Heat
4	Packaged Variable Air Volume System (PVAVS) Electric Reheat
5	Packaged Variable Volume and Temperature (PVVT)
6	Packaged Variable Volume and Temperature (PVVT) Heat Pump
7	Ground Source Heat Pump (GSHP)
8	Packaged Rooftop Unit / Split System
9	Packaged Rooftop Heat Pump Unit

Table 2-70 EMS Measures

Item	Measure
1	Optimum Start/Stop
2	Economizer Controls
3	Demand Controlled Ventilation (DCV)
4	Supply Air Reset
5	Chilled Water Reset
6	Condenser Water Reset

Eligibility requirements for each of the control strategies listed above are as follows:

Optimum Start/Stop	The fan start time is delayed until the fan run time matches that needed to meet the desired zone temperatures. The fan stop time is advanced until the fan run time matches that needed to meet the desired zone temperatures.
Economizer Controls	The economizer is enabled whenever the outside air temperature is below the maximum allowed temperature. Enthalpy control is also allowed.
Demand Controlled Ventilation (DCV)	The minimum outside air fraction is varied based on a DCV sensor.
Supply Air Reset	The air temperature leaving the system cooling coil is reset based on outdoor air temperature.
Chilled Water Reset	The supply chilled water temperature is allowed to rise during low loads.
Condenser Water Reset	The cooling tower temperature floats with the load and wet-bulb temperature

2.10.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

The baseline equipment for retrofit projects is an existing mechanical HVAC system (see list in Table 2-69 for eligible systems) that has not implemented the control strategy (or strategies) claimed in the project. See Table 2-70 for a list of eligible control strategies. Note that evaporative cooling equipment is not eligible for this measure.

New Construction (Includes Major Renovations)

The baseline equipment for new construction projects is an HVAC system (see list in Table 2-69 for eligible systems) that meets the local building energy codes and standards.

Code Compliance Considerations for HVAC Controls

Some of the EMS measures in Table 2-70 are required by code for certain buildings and HVAC systems.

2.10.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/ton * Cap$$

$$\Delta kW = \Delta kW/ton * Cap$$

2.10.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
ΔkWh/ton	Energy savings on a per unit basis as stipulated in Table 2-71 though Table 2-82.
ΔkW/ton	Demand reduction on a per unit basis as stipulated in Table 2-71 though Table 2-82.
Cap	Capacity (in Tons) of the HVAC system on which the HVAC control(s) are installed.

2.10.5. Sources

1. U.S. Bureau of Labor Statistics: http://www.bls.gov/data/inflation_calculator.htm
2. Database for Energy Efficiency Resources (DEER) 2008.

2.10.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-71 Energy Savings for Retrofit EMS Controls Climate Zone 5

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
1	VAV with chilled water coils	514	0.078
2	VAV with chilled water coils	1,190	0.081
3	VAV with chilled water coils	1,758	0.255
4	VAV with chilled water coils	1,783	0.273
5	VAV with chilled water coils	1,851	0.317
6	VAV with chilled water coils	1,872	0.327
1	Packaged Variable Air Volume System (PVAVS)	362	0.155
2	Packaged Variable Air Volume System (PVAVS)	769	0.157
3	Packaged Variable Air Volume System (PVAVS)	810	0.172
4	Packaged Variable Air Volume System (PVAVS)	810	0.172
5	Packaged Variable Air Volume System (PVAVS)	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS)	n/a	n/a
1	Packaged Variable Air Volume System (PVAVS) Gas Heat	227	0.102
2	Packaged Variable Air Volume System (PVAVS) Gas Heat	349	0.103
3	Packaged Variable Air Volume System (PVAVS) Gas Heat	349	0.110
4	Packaged Variable Air Volume System (PVAVS) Gas Heat	349	0.110
5	Packaged Variable Air Volume System (PVAVS) Gas Heat	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS) Gas Heat	n/a	n/a
1	Packaged Variable Air Volume System (PVAVS) Electric Reheat	966	0.101
2	Packaged Variable Air Volume System (PVAVS) Electric Reheat	1,077	0.102
3	Packaged Variable Air Volume System (PVAVS) Electric Reheat	1,642	0.108
4	Packaged Variable Air Volume System (PVAVS) Electric Reheat	1,642	0.108
5	Packaged Variable Air Volume System (PVAVS) Electric Reheat	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS) Electric Reheat	n/a	n/a
1	Packaged Variable Volume and Temperature (PVVT)	225	0.105
2	Packaged Variable Volume and Temperature (PVVT)	417	0.107
3	Packaged Variable Volume and Temperature (PVVT)	421	0.117
4	Packaged Variable Volume and Temperature (PVVT)	421	0.117
5	Packaged Variable Volume and Temperature (PVVT)	n/a	n/a
6	Packaged Variable Volume and Temperature (PVVT)	n/a	n/a
1	Packaged Variable Volume and Temperature (PVVT) Heat Pump	382	0.105

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
2	Packaged Variable Volume and Temperature (PVVT) Heat Pump	575	0.107
3	Packaged Variable Volume and Temperature (PVVT) Heat Pump	694	0.117
4	Packaged Variable Volume and Temperature (PVVT) Heat Pump	694	0.117
5	Packaged Variable Volume and Temperature (PVVT) Heat Pump	n/a	n/a
6	Packaged Variable Volume and Temperature (PVVT) Heat Pump	n/a	n/a
1	Ground Source Heat Pump (GSHP)	239	0.077
2	Ground Source Heat Pump (GSHP)	409	0.080
3	Ground Source Heat Pump (GSHP)	467	0.085
4	Ground Source Heat Pump (GSHP)	467	0.085
5	Ground Source Heat Pump (GSHP)	n/a	n/a
6	Ground Source Heat Pump (GSHP)	n/a	n/a
1	Packaged Rooftop Unit / Split System	232	0.117
2	Packaged Rooftop Unit / Split System	476	0.119
3	Packaged Rooftop Unit / Split System	476	0.119
4	Packaged Rooftop Unit / Split System	476	0.119
5	Packaged Rooftop Unit / Split System	n/a	n/a
6	Packaged Rooftop Unit / Split System	n/a	n/a
1	Packaged Rooftop Heat Pump Unit	401	0.117
2	Packaged Rooftop Heat Pump Unit	626	0.119
3	Packaged Rooftop Heat Pump Unit	758	0.125
4	Packaged Rooftop Heat Pump Unit	758	0.125
5	Packaged Rooftop Heat Pump Unit	n/a	n/a
6	Packaged Rooftop Heat Pump Unit	n/a	n/a

Table 2-72 Energy Savings for New Construction EMS Controls Climate Zone 5

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
1	VAV with chilled water coils	167	0.012
2	VAV with chilled water coils	550	0.013
3	VAV with chilled water coils	580	0.027
4	VAV with chilled water coils	583	0.027
5	VAV with chilled water coils	634	0.064
6	VAV with chilled water coils	660	0.077
1	Packaged Variable Air Volume System (PVAVS)	231	0.099
2	Packaged Variable Air Volume System (PVAVS)	543	0.100
3	Packaged Variable Air Volume System (PVAVS)	592	0.116
4	Packaged Variable Air Volume System (PVAVS)	592	0.116
5	Packaged Variable Air Volume System (PVAVS)	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS)	n/a	n/a
1	Packaged Variable Air Volume System (PVAVS) Gas Heat	179	0.068
2	Packaged Variable Air Volume System (PVAVS) Gas Heat	283	0.069
3	Packaged Variable Air Volume System (PVAVS) Gas Heat	283	0.079
4	Packaged Variable Air Volume System (PVAVS) Gas Heat	283	0.079
5	Packaged Variable Air Volume System (PVAVS) Gas Heat	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS) Gas Heat	n/a	n/a
1	Packaged Variable Air Volume System (PVAVS) Electric Reheat	468	0.068
2	Packaged Variable Air Volume System (PVAVS) Electric Reheat	570	0.069
3	Packaged Variable Air Volume System (PVAVS) Electric Reheat	776	0.069
4	Packaged Variable Air Volume System (PVAVS) Electric Reheat	776	0.069
5	Packaged Variable Air Volume System (PVAVS) Electric Reheat	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS) Electric Reheat	n/a	n/a
1	Packaged Variable Volume and Temperature (PVVT)	137	0.072
2	Packaged Variable Volume and Temperature (PVVT)	306	0.074
3	Packaged Variable Volume and Temperature (PVVT)	311	0.085
4	Packaged Variable Volume and Temperature (PVVT)	311	0.085
5	Packaged Variable Volume and Temperature (PVVT)	n/a	n/a
6	Packaged Variable Volume and Temperature (PVVT)	n/a	n/a
1	Packaged Variable Volume and Temperature (PVVT) Heat Pump	271	0.072
2	Packaged Variable Volume and Temperature (PVVT) Heat Pump	441	0.074
3	Packaged Variable Volume and Temperature (PVVT) Heat Pump	559	0.086
4	Packaged Variable Volume and Temperature (PVVT) Heat Pump	559	0.086
5	Packaged Variable Volume and Temperature (PVVT) Heat Pump	n/a	n/a
6	Packaged Variable Volume and Temperature (PVVT) Heat Pump	n/a	n/a
1	Ground Source Heat Pump (GSHP)	159	0.053

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
2	Ground Source Heat Pump (GSHP)	274	0.054
3	Ground Source Heat Pump (GSHP)	329	0.059
4	Ground Source Heat Pump (GSHP)	329	0.059
5	Ground Source Heat Pump (GSHP)	n/a	n/a
6	Ground Source Heat Pump (GSHP)	n/a	n/a
1	Packaged Rooftop Unit / Split System	190	0.098
2	Packaged Rooftop Unit / Split System	380	0.100
3	Packaged Rooftop Unit / Split System	380	0.100
4	Packaged Rooftop Unit / Split System	380	0.100
5	Packaged Rooftop Unit / Split System	n/a	n/a
6	Packaged Rooftop Unit / Split System	n/a	n/a
1	Packaged Rooftop Heat Pump Unit	358	0.098
2	Packaged Rooftop Heat Pump Unit	549	0.100
3	Packaged Rooftop Heat Pump Unit	654	0.106
4	Packaged Rooftop Heat Pump Unit	654	0.106
5	Packaged Rooftop Heat Pump Unit	n/a	n/a
6	Packaged Rooftop Heat Pump Unit	n/a	n/a

Table 2-73 Energy Savings for Retrofit EMS Controls Climate Zone 6

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
1	VAV with chilled water coils	502	0.076
2	VAV with chilled water coils	1,212	0.085
3	VAV with chilled water coils	1,810	0.269
4	VAV with chilled water coils	1,728	0.259
5	VAV with chilled water coils	1,806	0.302
6	VAV with chilled water coils	1,827	0.313
1	Packaged Variable Air Volume System (PVAVS)	315	0.131
2	Packaged Variable Air Volume System (PVAVS)	677	0.137
3	Packaged Variable Air Volume System (PVAVS)	749	0.151
4	Packaged Variable Air Volume System (PVAVS)	749	0.151
5	Packaged Variable Air Volume System (PVAVS)	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS)	n/a	n/a
1	Packaged Variable Air Volume System (PVAVS) Gas Heat	209	0.078
2	Packaged Variable Air Volume System (PVAVS) Gas Heat	308	0.083
3	Packaged Variable Air Volume System (PVAVS) Gas Heat	308	0.089
4	Packaged Variable Air Volume System (PVAVS) Gas Heat	308	0.089
5	Packaged Variable Air Volume System (PVAVS) Gas Heat	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS) Gas Heat	n/a	n/a
1	Packaged Variable Air Volume System (PVAVS) Electric Reheat	1,051	0.085
2	Packaged Variable Air Volume System (PVAVS) Electric Reheat	1,142	0.091
3	Packaged Variable Air Volume System (PVAVS) Electric Reheat	1,663	0.092
4	Packaged Variable Air Volume System (PVAVS) Electric Reheat	1,663	0.092
5	Packaged Variable Air Volume System (PVAVS) Electric Reheat	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS) Electric Reheat	n/a	n/a
1	Packaged Variable Volume and Temperature (PVVT)	203	0.082
2	Packaged Variable Volume and Temperature (PVVT)	373	0.099
3	Packaged Variable Volume and Temperature (PVVT)	376	0.106
4	Packaged Variable Volume and Temperature (PVVT)	376	0.106
5	Packaged Variable Volume and Temperature (PVVT)	n/a	n/a
6	Packaged Variable Volume and Temperature (PVVT)	n/a	n/a
1	Packaged Variable Volume and Temperature (PVVT) Heat Pump	431	0.082
2	Packaged Variable Volume and Temperature (PVVT) Heat Pump	601	0.099
3	Packaged Variable Volume and Temperature (PVVT) Heat Pump	769	0.106
4	Packaged Variable Volume and Temperature (PVVT) Heat Pump	769	0.106
5	Packaged Variable Volume and Temperature (PVVT) Heat Pump	n/a	n/a

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
6	Packaged Variable Volume and Temperature (PVVT) Heat Pump	n/a	n/a
1	Ground Source Heat Pump (GSHP)	246	0.065
2	VAV with chilled water coils	1,212	0.085
3	VAV with chilled water coils	1,810	0.269
4	VAV with chilled water coils	1,728	0.259
5	VAV with chilled water coils	1,806	0.302
6	VAV with chilled water coils	1,827	0.313
1	Packaged Variable Air Volume (VAV) Unit	553	0.085
2	Packaged Variable Air Volume (VAV) Unit	1,416	0.097
3	Packaged Variable Air Volume (VAV) Unit	2,018	0.309
4	Packaged Variable Air Volume (VAV) Unit	2,027	0.323
5	Packaged Variable Air Volume (VAV) Unit	n/a	n/a
6	Packaged Variable Air Volume (VAV) Unit	n/a	n/a
1	Packaged Rooftop Unit / Split System	190	0.092
2	Packaged Rooftop Unit / Split System	417	0.109
3	Packaged Rooftop Unit / Split System	417	0.109
4	Packaged Rooftop Unit / Split System	417	0.109
5	Packaged Rooftop Unit / Split System	n/a	n/a
6	Packaged Rooftop Unit / Split System	n/a	n/a

Table 2-74 Energy Savings for New Construction EMS Controls Climate Zone 6

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
1	VAV with chilled water coils	166	0.012
2	VAV with chilled water coils	551	0.013
3	VAV with chilled water coils	574	0.027
4	VAV with chilled water coils	577	0.027
5	VAV with chilled water coils	628	0.064
6	VAV with chilled water coils	655	0.077
1	Packaged Variable Air Volume System (PVAVS)	206	0.099
2	Packaged Variable Air Volume System (PVAVS)	480	0.100
3	Packaged Variable Air Volume System (PVAVS)	578	0.116
4	Packaged Variable Air Volume System (PVAVS)	578	0.116
5	Packaged Variable Air Volume System (PVAVS)	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS)	n/a	n/a
1	Packaged Variable Air Volume System (PVAVS) Gas Heat	164	0.068
2	Packaged Variable Air Volume System (PVAVS) Gas Heat	247	0.069
3	Packaged Variable Air Volume System (PVAVS) Gas Heat	247	0.079
4	Packaged Variable Air Volume System (PVAVS) Gas Heat	247	0.079
5	Packaged Variable Air Volume System (PVAVS) Gas Heat	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS) Gas Heat	n/a	n/a
1	Packaged Variable Air Volume System (PVAVS) Electric Reheat	506	0.068
2	Packaged Variable Air Volume System (PVAVS) Electric Reheat	588	0.069
3	Packaged Variable Air Volume System (PVAVS) Electric Reheat	772	0.069
4	Packaged Variable Air Volume System (PVAVS) Electric Reheat	772	0.069
5	Packaged Variable Air Volume System (PVAVS) Electric Reheat	n/a	n/a
6	Packaged Variable Air Volume System (PVAVS) Electric Reheat	n/a	n/a
1	Packaged Variable Volume and Temperature (PVVT)	125	0.072
2	Packaged Variable Volume and Temperature (PVVT)	269	0.074
3	Packaged Variable Volume and Temperature (PVVT)	272	0.085
4	Packaged Variable Volume and Temperature (PVVT)	272	0.085
5	Packaged Variable Volume and Temperature (PVVT)	n/a	n/a
6	Packaged Variable Volume and Temperature (PVVT)	n/a	n/a
1	Packaged Variable Volume and Temperature (PVVT) Heat Pump	300	0.072
2	Packaged Variable Volume and Temperature (PVVT) Heat Pump	444	0.074
3	Packaged Variable Volume and Temperature (PVVT) Heat Pump	607	0.086
4	Packaged Variable Volume and Temperature (PVVT) Heat Pump	607	0.086
5	Packaged Variable Volume and Temperature (PVVT) Heat Pump	n/a	n/a
6	Packaged Variable Volume and Temperature (PVVT) Heat Pump	n/a	n/a
1	Ground Source Heat Pump (GSHP)	164	0.053

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
2	Ground Source Heat Pump (GSHP)	264	0.054
3	Ground Source Heat Pump (GSHP)	331	0.059
4	Ground Source Heat Pump (GSHP)	331	0.059
5	Ground Source Heat Pump (GSHP)	n/a	n/a
6	Ground Source Heat Pump (GSHP)	n/a	n/a
1	Packaged Rooftop Unit / Split System	172	0.098
2	Packaged Rooftop Unit / Split System	342	0.100
3	Packaged Rooftop Unit / Split System	342	0.100
4	Packaged Rooftop Unit / Split System	342	0.100
5	Packaged Rooftop Unit / Split System	n/a	n/a
6	Packaged Rooftop Unit / Split System	n/a	n/a
1	Packaged Rooftop Heat Pump Unit	347	0.098
2	Packaged Rooftop Heat Pump Unit	517	0.100
3	Packaged Rooftop Heat Pump Unit	691	0.106
4	Packaged Rooftop Heat Pump Unit	691	0.106
5	Packaged Rooftop Heat Pump Unit	n/a	n/a
6	Packaged Rooftop Heat Pump Unit	n/a	n/a

Table 2-75 Energy Savings for Retrofit Economizer Controls Only Climate Zone 5

HVAC System Type	kWh/Ton	kW/Ton
VAV with chilled water coils	857	0.0031
Packaged Variable Air Volume System (PVAVS)	462	0.0020
Packaged Variable Air Volume System (PVAVS) Gas Heat	134	0.0020
Packaged Variable Air Volume System (PVAVS) Electric Reheat	125	0.0020
Packaged Variable Volume and Temperature (PVVT)	208	0.0050
Packaged Variable Volume and Temperature (PVVT) Heat Pump	208	0.0050
Ground Source Heat Pump (GSHP)	191	0.0060
Packaged Rooftop Unit / Split System	267	0.0929
Packaged Rooftop Heat Pump Unit	267	0.0055

Table 2-76 Energy Savings for New Construction Economizer Controls Only Climate Zone 5

HVAC System Type	kWh/Ton	kW/Ton
VAV with chilled water coils	448	0.0013
Packaged Variable Air Volume System (PVAVS)	353	0.0020
Packaged Variable Air Volume System (PVAVS) Gas Heat	115	0.0020
Packaged Variable Air Volume System (PVAVS) Electric Reheat	109	0.0020
Packaged Variable Volume and Temperature (PVVT)	171	0.0040
Packaged Variable Volume and Temperature (PVVT) Heat Pump	171	0.0040
Ground Source Heat Pump (GSHP)	127	0.0020
Packaged Rooftop Unit / Split System	194	0.0045
Packaged Rooftop Heat Pump Unit	194	0.0045

Table 2-77 Energy Savings for Retrofit Economizer Controls Only Climate Zone 6

HVAC System Type	kWh/Ton	kW/Ton
VAV with chilled water coils	901	0.0122
Packaged Variable Air Volume System (PVAVS)	415	0.0070
Packaged Variable Air Volume System (PVAVS) Gas Heat	109	0.0070
Packaged Variable Air Volume System (PVAVS) Electric Reheat	104	0.0060
Packaged Variable Volume and Temperature (PVVT)	183	0.0190
Packaged Variable Volume and Temperature (PVVT) Heat Pump	183	0.0190
Ground Source Heat Pump (GSHP)	169	0.0150
Packaged Rooftop Unit / Split System	246	0.0207
Packaged Rooftop Heat Pump Unit	246	0.0207

Table 2-78 Energy Savings for New Construction Economizer Controls Only Climate Zone 6

HVAC System Type	kWh/Ton	kW/Ton
VAV with chilled water coils	453	0.0041
Packaged Variable Air Volume System (PVAVS)	311	0.0070
Packaged Variable Air Volume System (PVAVS) Gas Heat	95	0.0060
Packaged Variable Air Volume System (PVAVS) Electric Reheat	90	0.0060
Packaged Variable Volume and Temperature (PVVT)	148	0.0160
Packaged Variable Volume and Temperature (PVVT) Heat Pump	148	0.0160
Ground Source Heat Pump (GSHP)	110	0.0090
Packaged Rooftop Unit / Split System	174	0.0165
Packaged Rooftop Heat Pump Unit	174	0.0165

Table 2-79 Energy Savings for Retrofit DCV Only Climate Zone 5

HVAC System Type	kWh/CFM	kW/CFM
VAV with chilled water coils	2.75	0.57
Packaged Variable Air Volume System (PVAVS)	0.11	0.07
Packaged Variable Air Volume System (PVAVS) Gas Heat	-0.06	0.03
Packaged Variable Air Volume System (PVAVS) Electric Reheat	2.25	0.01
Packaged Variable Volume and Temperature (PVVT)	0.02	0.03
Packaged Variable Volume and Temperature (PVVT) Heat Pump	0.57	0.03
Ground Source Heat Pump (GSHP)	0.73	0.03
Packaged Rooftop Unit / Split System	-0.10	0.02
Packaged Rooftop Heat Pump Unit	0.65	0.02

Table 2-80 Energy Savings for New Construction DCV Only Climate Zone 5

HVAC System Type	kWh/CFM	kW/CFM
VAV with chilled water coils	0.09	0.035
Packaged Variable Air Volume System (PVAVS)	0.13	0.069
Packaged Variable Air Volume System (PVAVS) Gas Heat	-0.49	0.033
Packaged Variable Air Volume System (PVAVS) Electric Reheat	0.92	-0.011
Packaged Variable Volume and Temperature (PVVT)	0.02	0.035
Packaged Variable Volume and Temperature (PVVT) Heat Pump	0.55	0.036
Ground Source Heat Pump (GSHP)	0.55	0.022
Packaged Rooftop Unit / Split System	-0.09	0.022
Packaged Rooftop Heat Pump Unit	0.64	0.022

Table 2-81 Energy Savings for Retrofit DCV Only Climate Zone 6

HVAC System Type	kWh/CFM	kW/CFM
VAV with chilled water coils	2.79	0.592
Packaged Variable Air Volume System (PVAVS)	0.22	0.060
Packaged Variable Air Volume System (PVAVS) Gas Heat	-0.15	0.019
Packaged Variable Air Volume System (PVAVS) Electric Reheat	2.09	-0.013
Packaged Variable Volume and Temperature (PVVT)	0.004	0.019
Packaged Variable Volume and Temperature (PVVT) Heat Pump	0.80	0.018
Ground Source Heat Pump (GSHP)	0.73	0.029
Packaged Rooftop Unit / Split System	-0.10	0.005
Packaged Rooftop Heat Pump Unit	0.94	0.004

Table 2-82 Unit Energy Savings for New Construction DCV Only Climate Zone 6

HVAC System Type	kWh/CFM	kW/CFM
VAV with chilled water coils	0.05	0.028
Packaged Variable Air Volume System (PVAVS)	0.29	0.052
Packaged Variable Air Volume System (PVAVS) Gas Heat	-0.59	0.019
Packaged Variable Air Volume System (PVAVS) Electric Reheat	0.88	-0.027
Packaged Variable Volume and Temperature (PVVT)	0.004	0.017
Packaged Variable Volume and Temperature (PVVT) Heat Pump	0.73	0.017
Ground Source Heat Pump (GSHP)	0.56	0.026
Packaged Rooftop Unit / Split System	-0.09	0.004
Packaged Rooftop Heat Pump Unit	0.96	0.004

2.11. Hotel/Motel Guestroom Energy Management Systems

The following algorithms and assumptions are applicable to occupancy based Guest Room Energy Management Systems (GREM) installed in motel and hotel guest rooms. These systems use one or more methods to determine whether or not the guest room is occupied. If the room is un-occupied for a predetermined amount of time (typically 15 - 30 min) the thermostat set-point is set-back.

Table 2-83 through Table 2-85 summarize the 'typical' expected (per Ton) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below and data from past program participants.[80]

Table 2-83 Typical Savings Estimates for GREM (w/o Housekeeping Set-Backs)

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	1,095 kWh	965 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	11 Years	11 Years
Average Material & Labor Cost	$150.61	-
Average Incremental Cost	-	$57.50
Stacking Effect End-Use	Heating, Cooling	

Table 2-84 Typical Savings Estimates for GREM (With Housekeeping Set-Backs)

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	235 kWh	196 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	11 Years	11 Years
Average Material & Labor Cost	$150.61	-
Average Incremental Cost	-	$57.50
Stacking Effect End-Use	Heating, Cooling	

[80] See spreadsheet "11-TypicalCalcs_GREM.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs. Note that due to the limited savings available for gas heated facilities the numbers in these tables account only for electric heating fuel system types (e.g. heat-pumps and electric resistance coils).

Table 2-85 Typical Savings Estimates for GREM (Average)[81]

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	430 kWh	384 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	11 Years	11 Years
Average Material & Labor Cost	$150.61	-
Average Incremental Cost	-	$57.50
Stacking Effect End-Use	Heating, Cooling	

2.11.1. Definition of Eligible Equipment

Eligible systems include any occupancy based thermostatic set-back controls controlling an electrically heated system. Systems can be centralized or local controls. Systems must set-back room space temperatures by a minimum of 8 degrees F when the room is determined to be unoccupied. Temperature set-back must occur no longer than 30 minutes after the room is determined unoccupied. Eligible systems include, thermostat based controls, room key-card controls, and system check-in/check-out controls.

2.11.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. However; there are currently no building energy code requirements (as defined in ASHRAE 90.1) which mandate installation of Guestroom Occupancy Control Systems. As such the baseline for retrofit and new construction projects only differ in the efficiency of the existing HVAC systems and building envelope.

Retrofit (Early Replacement)

Baseline equipment for this measure is defined as a non-occupant based room thermostat (either manual or programmable) installed in the existing room.

New Construction (Includes Major Remodel)

Baseline equipment for this measure is defined as a non-occupant based room thermostat (either manual or programmable) installed in the designed room.

2.11.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = kWh/Unit * NUnits$$

[81] The savings represented in this table give equal weight to the two prevailing baseline conditions (e.g. with and without a housekeeping set-back).

$$\Delta kWhUnit_{typical} = \Sigma(\Delta kWh/Unit_i * W_i)$$

2.11.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkWh/Unit	Per unit energy savings as stipulated in Table 2-86 and Table 2-87 according to case temperatures.
$\Delta kWh/Unit_{typical}$	Typical measure savings on a per unit basis.
$\Delta kWh/Unit_i$	Unit savings for combination i of building type (Hotel or Motel), housekeeping practices, weather zone, and heating fuel source.
W_i	Population weight for each ΔkWh/Uniti. Calculated by dividing the expected number of participants with ΔkWh/Uniti by the total number of expected participants.

2.11.5. Sources

1. Prototypical hotel and motel simulation models were developed in EnergyPlus by ADM Associates Inc. for this measure.
2. U.S. Department of Energy Report on PTAC and PTHP energy use in Lodging facilities: http://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/ptac_pthps_tsd_ch7_09-30-08.pdf
3. Kidder Mathews, Real Estate Market Review (Seattle Hotel). 2010

2.11.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.[82]

Table 2-86 Unit Energy Savings for GREM Systems - Retrofit

Housekeeping Setback	***Weather Zone 5***			***Weather Zone 6***		
	Heat-Pump	Gas	Electric Resistance	Heat-Pump	Gas	Electric Resistance
Yes	131	35	398	173	29	498
No	741	200	1,706	875	149	1,930

[82] Savings values are based on an assumed 46% annual average guestroom vacancy rate. This assumption is based on real estate market research for Boise, Idaho Falls, and Post Falls in 2010.

Table 2-87 Unit Energy Savings for GREM Systems – New Construction

Housekeeping Setback	***Weather Zone 5***			***Weather Zone 6***		
	Heat-Pump	Gas	Electric Resistance	Heat-Pump	Gas	Electric Resistance
Yes	97	26	359	131	22	453
No	611	165	1,582	735	125	1,815

2.12. High Efficiency Air Conditioning

The following algorithms and assumptions are applicable to energy efficient air conditioning units installed in commercial spaces. This measure applies to projects which represent either equipment retrofit or new construction (including major renovations).

Table 2-88 and Table 2-89 summarizes the 'typical' expected (per ton) unit energy impacts for this measure.[83] Typical values are based on algorithms and stipulated values described below and data from past program participants. Note that Table 2-89 reports the incremental savings and costs associated with going from CEE Tier 1 to CEE Tier 2 and are therefore additive with those reported in Table 2-88.

Table 2-88 Typical Savings Estimates for High Efficiency Air Conditioning – Base to CEE Tier 1

	Retrofit	New Construction
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	173 kWh	91 kWh
Average Unit Peak Demand Savings	0.11 kW	.06 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$ 959.31	n/a
Average Incremental Cost	n/a	$ 144.49
Stacking Effect End-Use	Cooling	

Table 2-89 Typical Savings Estimates for High Efficiency Air Conditioning – CEE Tier 1 to CEE Tier 2

	Retrofit	New Construction
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	48 kWh	48 kWh
Average Unit Peak Demand Savings	0.03 kW	.03 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	n/a	n/a
Average Incremental Cost	$ 98.54	$ 98.54
Stacking Effect End-Use	Cooling	

2.12.1. Definition of Eligible Equipment

All commercial unitary and split air conditioning system are eligible (This includes Package Terminal Air Conditioners) provided the installed equipment meets or exceeds current Consortium for Energy Efficiency (CEE) Tier 1 efficiencies. High efficiency chillers are not

[83] See spreadsheet "11-TypicalCalcs_GREM.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

eligible under this measure, but are included as a separate measure in this document. Eligibility is determined by calculating the EER, SEER, and/or the IEER for the installed unit.

2.12.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

If the project is retrofitting pre-existing equipment in working condition then the baseline efficiency is defined by the pre-existing equipment. If the equipment being replaced is not in working order, then this is considered “replace on burn-out” and the baseline becomes new construction. Note that units replacing window/wall mounted air-conditioners, room air-conditioners, and/or evaporative cooling are not eligible for early replacement and are considered “New Construction.”

New Construction (Includes Major Remodel & Replace on Burn-Out)

For New Construction, the baseline efficiency is defined as the minimum allowable EER by the prevailing building energy code or standard according to which the project was permitted. Current applicable standards are defined by ASHRAE 90.1-2004 and 90.1-2007. The baseline efficiency for Tier 1 units is CEE Tier 0 while the baseline efficiency for Tier 2 units is CEE Tier 1.

2.12.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = Cap * (1/SEER_{base} - 1/SEER_{Installed}) / 1000 * EFLH$$

$$\Delta kW = Cap * (1/EER_{base} - 1/EER_{Installed}) / 1000 * CF$$

2.12.4. Definitions

ΔkWh Expected energy savings between baseline and installed equipment.

ΔkW_{peak} Expected peak demand savings.

EFLH Equivalent full load cooling hours of. Idaho specific EFLH are by weather zone and building in Table 2-93.

CF Peak coincidence factor. Represents the % of the connected load reduction which occurs during Idaho Power’s peak period.

EER Energy Efficiency Ratio for *base* and *installed* systems. This is defined as the ratio of the cooling capacity of the air conditioner in British Thermal Units per hour, to the total electrical input in watts. Since ASHRAE does not provide EER requirements for air-cooled air conditioners < 65,000 Btu/h, assume the following conversion:

$$EER \approx -0.02 * SEER^2 + 1.12 * SEER$$

SEER Seasonal Energy efficiency ratio of the air conditioning unit. This is defined as the ratio of the Annual cooling provided by the air conditioner (in BTUs), to the total electrical input (in Watts). Note that the IEER is an appropriate equivalent. If the SEER or IEER are unknown or unavailable use the following formula to estimate from the EER: [84]

$$SEER = .0507 * EER^2 + .5773 * EER + .4919$$

Cap Nominal cooling capaity in kBTU/Hr (1 ton = 12,000BTU/Hr)

2.12.5. Sources

1. ASHRAE, Standard 90.1-2004.
2. ASHRAE, Standard 90.1-2007.
3. California DEER Prototypical Simulation models (modified), eQUEST-DEER 3-5.[85]
4. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.California DEER Incremental Cost worksheets: Revised DEER Measure Cost Summary (05_30_2008) Revised (06_02_2008).xls
5. 2012 CEE building efficiency standards

2.12.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

[84] Note that this formula is an approximation and should only be applied to EER values up to 15 EER.

[85] Prototypical building energy simulations were used to generate Idaho specific Heating and Cooling Interactive Factors and Coincidence factors for various building and heating fuel types.

Table 2-90 Deemed Savings for High Efficiency A/C – Retrofit Baseline to CEE Tier 1

Measure Description	Expected Savings [kW/Ton]	Expected Savings [kWh/Ton]	Measure Cost [$/Ton]
Standard 5 ton or less unit – 11.8 SEER	0.05	130.0	$1,390.27
Standard 5-11 ton AC unit – 11.6 EER	0.08	131.7	$845.26
Standard 11-19 ton AC unit – 11.6 EER	0.09	118.6	$745.21
Standard 19-64 ton AC unit – 10.4 EER	0.10	127.8	$847.79
Standard 64 ton or greater unit – 9.8 EER	0.10	171.5	$781.57
Standard 5 ton or less unit – Water Cooled 14 EER	0.12	277.5	$855.23
Standard 5-11 ton AC unit – Water Cooled 13.9 EER	0.15	217.5	$767.93
Standard 11 ton or greater unit – Water Cooled 13.9 EER	0.18	235.4	$1,481.90
Standard All Capacities - PTAC	0.07	93.7	$1,020.09
Standard 5 ton or less VRF - 14 SEER	0.06	130.0	$1,142.71
Standard 5-11 ton VRF - 11.7 EER	0.19	220.2	$644.93
Standard 11-19 ton VRF - 11.7 EER	0.19	214.2	$634.98
Standard 19-64 ton VRF - 10.5 EER	0.20	232.5	$805.76

Table 2-91 Deemed Savings for High Efficiency A/C – New Construction Baseline to CEE Tier 1

Measure Description	Expected Savings [kW/Ton]	Expected Savings [kWh/Ton]	Incremental Cost [$/Ton]
Standard 5 ton or less unit – 11.8 SEER	0.03	50.9	$106.50
Standard 5-11 ton AC unit – 11.6 EER	0.03	47.4	$43.83
Standard 11-19 ton AC unit – 11.6 EER	0.02	31.4	$16.93
Standard 19-64 ton AC unit – 10.4 EER	0.02	30.6	$69.30
Standard 64 ton or greater unit – 9.8 EER	0.04	67.3	$136.63
Standard 5 ton or less unit – Water Cooled 14 EER	0.13	200.9	$207.12
Standard 5-11 ton AC unit – Water Cooled 13.9 EER	0.09	137.5	$278.96
Standard 11 ton or greater unit – Water Cooled 13.9 EER	0.10	148.2	$266.83
Standard All Capacities - PTAC	0.07	93.7	$188.16
Standard 5 ton or less VRF - 14 SEER	0.04	50.9	$271.18
Standard 5-11 ton VRF - 11.7 EER	0.13	137.5	$127.28
Standard 11-19 ton VRF - 11.7 EER	0.13	128.5	$93.51
Standard 19-64 ton VRF - 10.5 EER	0.14	137.2	$180.02

Table 2-92 Deemed Savings for High Efficiency A/C – CEE Tier 1 to CEE Tier 2[86]

Base Description	Expected Savings [kW/Ton]	Expected Savings [kWh/Ton]	Incremental Cost
Standard 5 ton or less unit – 12.3 SEER	0.028	44.1	$106.50
Standard 5-11 ton AC unit – 12.1 EER	0.033	51.6	$54.78
Standard 11-19 ton AC unit – 12.1 EER	0.026	39.9	$23.71
Standard 19-64 ton AC unit – 10.7 EER	0.043	67.7	$173.26
Standard 64 ton or greater unit – 10.3 EER	0.023	36.6	$85.39
Standard 5 ton or less VRF - 14 SEER	0.02	44.1	$285.03

Table 2-93 Stipulated Equivalent Full Load Cooling and Heating Hours (EFLH) by Building Type[87]

	Zone 5		***Zone 6***	
Building Type	*EFLH Cooling*	*EFLH Heating*	*EFLH Cooling*	*EFLH Heating*
Assembly	879	966	758	1059
Education - Primary School	203	299	173	408
Education - Secondary School	230	406	196	514
Education - Community College	556	326	530	456
Education - University	697	341	721	449
Grocery	3437	1825	3762	2011
Health/Medical - Hospital	1616	612	1409	679
Health/Medical - Nursing Home	1049	1399	884	1653
Lodging - Hotel	1121	621	1075	780
Lodging - Motel	978	682	937	796
Manufacturing - Light Industrial	530	699	415	1088
Office - Large	746	204	680	221
Office - Small	607	256	567	360
Restaurant - Sit-Down	811	624	716	709
Restaurant - Fast-Food	850	722	734	796
Retail - 3-Story Large	765	770	644	998
Retail - Single-Story Large	724	855	576	998
Retail - Small	726	886	619	1138

[86] Note that CEE Tier 2 savings are the incremental savings (and cost) between Tier 1 and Tier 2.

[87] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

Table 2-94 HVAC Coincidence Factors by Building Type

Building Type	Coincidence Factor
Assembly	0.47
Education - Community College	0.54
Education - Primary School	0.1
Education - Secondary School	0.1
Education - University	0.53
Grocery	0.54
Health/Medical - Hospital	0.82
Health/Medical - Nursing Home	0.49
Lodging - Hotel	0.67
Lodging - Motel	0.63
Manufacturing - Light Industrial	0.46
Office - Large	0.58
Office - Small	0.51
Restaurant - Fast-Food	0.48
Restaurant - Sit-Down	0.46
Retail - 3-Story Large	0.66
Retail - Single-Story Large	0.56
Retail - Small	0.49
Storage - Conditioned	0.41

Table 2-95 CEE Minimum Efficiencies by Unit Type for All Tiers[88]

Equipment Type	Size Category	Heating Section Type	Subcategory	Tier 0	Tier 1	Tier 2
Air Conditioners, Air Cooled (Cooling Mode)	<65,000 Btu/h	All	Split System	NA	14.0 SEER	15.0 SEER
				NA	12.0 EER	12.5 EER
			Single Package	NA	14.0 SEER	15.0 SEER
				NA	11.6 EER	12.0 EER
	≥65,000 Btu/h and <135,000 Btu/h	Electric Res. Or None	Split System and Single Package	11.7 EER	11.7 EER	12.2 EER
				11.8 IEER	13.0 IEER	14.0 IEER
		All Other	Split System and Single Package	11.5 EER	11.5 EER	12.0 EER
				11.6 IEER	12.8 IEER	13.8 IEER
	≥135,000 Btu/h and <240,000 Btu/h	Electric Res. Or None	Split System and Single Package	11.7 EER	11.7 EER	12.2 EER
				11.8 IEER	12.5 IEER	13.2 IEER
		All Other	Split System and Single Package	11.5 EER	11.5 EER	12.0 EER
				11.6 IEER	12.3 IEER	13.0 IEER
	≥240,000 Btu/h and <760,000 Btu/h	Electric Res. Or None	Split System and Single Package	10.5 EER	10.5 EER	10.8 EER
				10.6 IEER	11.3 IEER	12.3 IEER
		All Other	Split System and Single Package	10.3 ER	10.3 EER	10.6 EER
				10.4 IEER	11.1 IER	12.1 IEER
	≥760,000 Btu/h	Electric Res. Or None	Split System and Single Package	9.9 EER	9.9 EER	10.4 EER
				10.0 IEER	11.1 IEER	11.6 IEER
		All Other	Split System and Single Package	9.7 EER	9.7 EER	10.2 EER
				9.8 IEER	10.9 IEER	11.4 IEER
Air Conditioners, Water Cooled	<65,000 Btu/h	All	Split System and Single Package	NA	14.0 EER	NA*
	≥65,000 Btu/h and <135,000 Btu/h	Electric Res. Or None	Split System and Single Package	NA	14.0 EER	NA*
				NA	15.3 IEER	NA*
		All Other	Split System and Single Package	NA	13.8 EER	NA*
				NA	15.1 IEER	NA*
	≥135,000 Btu/h	Electric Res. Or None	Split System and Single Package	NA	14.0 EER	NA*
				NA	14.8 IEER	NA*
		All Other	Split System and Single Package	NA	13.8 EER	NA*
				NA	14.6 IEER	NA*
VRF Air Cooled (Cooling Mode)	<65,000 Btu/h	All	Multisplit System	NA	14.0 SEER 12.0 EER	15.0 SEER 12.5 EER
	≥65,000 Btu/h and <135,000 Btu/h	Electric Res. Or None	Multisplit System	NA	11.7 EER 14.9 IEER	NA

[88] Values obtained from 2012 CEE building efficiency standards for unitary air conditioning units.

Equipment Type	Size Category	Heating Section Type	Subcategory	Tier 0	Tier 1	Tier 2
	≥135,000 Btu/h and <240,000 Btu/h	Electric Res. Or None	Multisplit System	NA	11.7 EER 14.4 IEER	NA
	≥240,000 Btu/h	Electric Res. Or None	Multisplit System	NA	10.5 EER 13.0 IEER	NA

*At this time, CEE is not establishing higher tier levels for this equipment size due to limited availability

2.13. High Efficiency Heat Pumps

The following algorithms and assumptions are applicable to energy efficient heat pump units installed in commercial spaces. This measure applies to projects which represent either equipment retrofit or new construction (including major renovations).

Table 2-96 through Table 2-98 summarize the 'typical' expected (per ton) unit energy impacts for this measure. Typical values are based on algorithms and stipulated values described below and data from past program participants. [89] Note that the values listed the tables below are averaged across each of the system efficiency and tonnage categories offered by the program. Table 2-102 through Table 2-107 at the end of this section provide individual savings and materials/labor costs.

Table 2-96 Typical Savings Estimates for High Efficiency Heat Pumps - Base to CEE Tier 1 (Cooling Only)

	Retrofit	**New Construction**
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	165 kWh	79 kWh
Average Unit Peak Demand Savings	0.12 kW	.06 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$ 1,103	n/a
Average Incremental Cost	n/a	$ 339
Stacking Effect End-Use	Cooling	

Table 2-97 Typical Savings Estimates for High Efficiency Heat Pumps - Base to CEE Tier 1 (Heating Only)

	Retrofit	**New Construction**
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	938 kWh	685 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$ 1,103	n/a
Average Incremental Cost	n/a	$ 339
Stacking Effect End-Use	Heating	

[89] See spreadsheet "14-TypicalCalcs_HeatPumps_v2.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Table 2-98 Typical Savings Estimates for High Efficiency Heat Pumps - Base to CEE Tier 1 (Heating And Cooling)

	Retrofit	New Construction
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	1,103 kWh	765 kWh
Average Unit Peak Demand Savings	.12 kW	.06 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$ 1,103	n/a
Average Incremental Cost	n/a	$ 339
Stacking Effect End-Use	Heating, Cooling	

Table 2-99 Typical Savings Estimates for High Efficiency Heat Pumps - CEE Tier 1 to Tier 2 (Cooling Only)

	Retrofit	New Construction
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	44 kWh	44 kWh
Average Unit Peak Demand Savings	.03 kW	.03 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	n/a	n/a
Average Incremental Cost	$ 83	$ 83
Stacking Effect End-Use	Cooling	

Table 2-100 Typical Savings Estimates for High Efficiency Heat Pumps - CEE Tier 1 to Tier 2 (Heating Only)

	Retrofit	New Construction
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	60 kWh	60 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	n/a	n/a
Average Incremental Cost	$ 83	$ 83
Stacking Effect End-Use	Heating	

Table 2-101 Typical Savings Estimates for High Efficiency Heat Pumps - CEE Tier 1 to Tier 2 (Heating and Cooling)

	Retrofit	New Construction
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	104 kWh	104 kWh
Average Unit Peak Demand Savings	.03 kW	.03 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	n/a	n/a
Average Incremental Cost	$ 83	$ 83
Stacking Effect End-Use	Cooling, Heating	

2.13.1. Definition of Eligible Equipment

All heat pump systems are eligible provided the installed equipment meets or exceeds current Consortium for Energy Efficiency (CEE) Tier 1 efficiencies. Eligibility is determined by calculating the EER, SEER, IEER, and/or HSPF as appropriate for the installed unit.

2.13.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or New construction.

Retrofit (Early Replacement)

If the project is retrofitting pre-existing equipment in working condition then the baseline efficiency is defined by the pre-existing equipment. If the equipment being replaced is not in working order, then this is considered “replace on burn-out” and the baseline becomes new construction.

New Construction (Includes Major Remodel & Replace on Burn-Out)

For New Construction, the baseline efficiency is defined as the minimum allowable EER by the prevailing building energy code or standard according to which the project was permitted. Current applicable standards are defined by ASHRAE 90.1-2004 and 90.1-2007.

2.13.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh_{Cool} + \Delta kWh_{Heat}$$

$$= Cap * (1/EER_{base,\ cool} - 1/SEER_{Installed,\ cool}) / 1000 * EFLH_{Cool} + Cap * (1/EER_{base,\ Heat} - 1/HSPF_{Installed,\ Heat}) / 1000 * EFLH_{Heat}$$

$$\Delta kW_{peak} = Cap * (1/EER_{base,\ cool} - 1/EER_{Installed,\ cool}) / 1000 * CF$$

2.13.4. Definitions

ΔkWh Expected energy savings between baseline and installed equipment.

ΔkW_{peak} Expected peak demand savings.

EFLH Equivalent full load cooling hours of. Idaho specific EFLH are by weather zone and building in Table 2-105.

CF Peak coincidence factor. Represents the % of the connected load reduction which occurs during Idaho Power's peak period.

EER Energy Efficiency Ratio for *base* and *installed* systems in *cooling* and *heating* modes. This is defined as the ratio of the cooling capacity of the air conditioner in British Thermal Units per hour, to the total electrical input in watts. Since ASHRAE does not provide EER requirements for air-cooled air conditioners < 65,000 Btu/h, assume the following conversion:

$$EER \approx -0.02 * SEER^2 + 1.12 * SEER$$

SEER Seasonal Energy efficiency ratio of the air conditioning unit. This is defined as the ratio of the Annual cooling provided by the air conditioner (in BTUs), to the total electrical input (in Watts). Note that the IEER is an appropriate equivalent. If the SEER or IEER are unknown or unavailable use the following formula to estimate from the EER: [90]

$$SEER = .0507 * EER^2 + .5773 * EER + .4919$$

HSPF Heating Season Performance Factor. This is identical to the SEER (described above) as applied to Heat Pumps in heating mode. If only the heat pump COP is available then use the following:

$$HSPF = .5651 * COP^2 + .464 * COP + .4873$$

Cap Nominal cooling capaity in kBTU/Hr (1 ton = 12,000BTU/Hr)

2.13.5. Sources

1. ASHRAE, Standard 90.1-2004.
2. ASHRAE, Standard 90.1-2007.
3. California DEER Prototypical Simulation models (modified), eQUEST-DEER 3-5.[91]

[90] Note that this formula is an approximation and should only be applied to EER values up to 15 EER.

[91] Prototypical building energy simulations were used to generate Idaho specific Heating and Cooling Interactive Factors and Coincidence factors for various building and heating fuel types.

4. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.California DEER Incremental Cost worksheets: Revised DEER Measure Cost Summary (05_30_2008) Revised (06_02_2008).xls

2.13.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-102 Deemed Energy Savings for Efficient Heat Pumps – Retrofit base to CEE Tier 1[92]

Measure Description	Demand Savings - Cooling [kW/Ton]	Energy Savings - Cooling [kWh/Ton]	Energy Savings - Heating [kWh/Ton]	Energy Savings - All [kWh/Ton]	Measure Cost
Standard 5 ton or less unit – 14 SEER	0.10	130	200	330	$1,365
Standard 5-11 ton HP unit – 11.1 EER	0.08	108	1,390	1,498	$810
Standard 11-19 ton HP unit – 10.7 EER	0.08	116	1,637	1,753	$734
Standard 19-64 ton HP unit – 10.1 EER	0.12	175	1,637	1,812	$669
Standard 1.5 ton or less Water Source HP - 14 EER	0.16	230	529	759	$1,056
Standard 1.5-5 ton Water Source HP - 14 EER	0.13	175	629	805	$1,056
Standard 5-11 ton Water Source HP - 14 EER	0.13	175	723	898	$1,056
Groundwater-source HP Less than 11 Tons - 16 EER	0.25	322	731	1,053	$1,622
Groundsource HP Less than 11 Tons - 13 EER	0.17	277	1,385	1,662	$5,381
Package Terminal Heat Pump - 10.8 EER	0.06	84	247	331	$1,449
Standard 5 ton or less VRF - 14 SEER	0.12	135	175	309	$1,471
Standard 5-11 ton VRF - 11.2 EER	0.08	221	611	832	$879
Standard 11-19 ton VRF - 10.8 EER	0.08	227	558	785	$805
Standard greater than 19 ton VRF - 10.2 EER	0.13	294	558	852	$736

[92] Heating COP was assumed to be 15% less efficient than the cooling EER after converting. The value was obtained from comparing ASHRAE code standards for heating and cooling efficiencies. See spreadsheet "14-TypicalCalcs_HeatPumps_v3.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Table 2-103 Deemed Energy Savings for Efficient Heat Pumps – New Construction base to CEE Tier 1

Measure Description	Demand Savings - Cooling [kW/Ton]	Energy Savings - Cooling [kWh/Ton]	Energy Savings - Heating [kWh/Ton]	Energy Savings - All [kWh/Ton]	Incr.Cost
Standard 5 ton or less unit – 14 SEER	0.04	51	74	125	$90
Standard 5-11 ton HP unit – 11.1 EER	0.01	19	1,038	1,058	$16
Standard 11-19 ton HP unit – 10.7 EER	0.02	21	1,245	1,266	$10
Standard 19-64 ton HP unit – 10.1 EER	0.05	70	1,245	1,315	$139
Standard 1.5 ton or less Water Source HP - 14 EER	0.11	145	345	490	$455
Standard 1.5-5 ton Water Source HP - 14 EER	0.07	96	430	526	$455
Standard 5-11 ton Water Source HP - 14 EER	0.07	96	510	606	$455
Groundwater-source HP Less than 11 Tons - 16 EER	0.18	238	539	777	$443
Groundsource HP Less than 11 Tons - 13 EER	0.11	185	1,014	1,199	$4,441
Package Terminal Heat Pump - 10.8 EER	n/a	n/a	n/a	n/a	n/a
Standard 5 ton or less VRF - 14 SEER	0.06	56	61	117	$216
Standard 5-11 ton VRF - 11.2 EER	0.02	133	259	391	$85
Standard 11-19 ton VRF - 10.8 EER	0.02	131	166	298	$81
Standard greater than 19 ton VRF - 10.2 EER	0.06	188	166	355	$206

Table 2-104 Deemed Energy Savings for Efficient Heat Pumps – CEE Tier 1 to Tier 2

Measure Description	Demand Savings - Cooling [kW/Ton]	Energy Savings - Cooling [kWh/Ton]	Energy Savings - Heating [kWh/Ton]	Energy Savings - All [kWh/Ton]	Incr. Cost
Standard 5 ton or less unit – 14 SEER	0.028	44.1	60.4	104.5	$75
Standard 5 ton or less VRF - 14 SEER	0.02	39.4	56.8	96.2	$236

Table 2-105 Stipulated Equivalent Full Load Hours (EFLH) by Building Type[93]

Building Type	Zone 5		Zone 6	
	EFLH Cooling	**EFLH Heating**	**EFLH Cooling**	**EFLH Heating**
Assembly	879	966	758	1059
Education - Primary School	203	299	173	408
Education - Secondary School	230	406	196	514
Education - Community College	556	326	530	456
Education - University	697	341	721	449
Grocery	3437	1825	3762	2011
Health/Medical - Hospital	1616	612	1409	679
Health/Medical - Nursing Home	1049	1399	884	1653
Lodging - Hotel	1121	621	1075	780
Lodging - Motel	978	682	937	796
Manufacturing - Light Industrial	530	699	415	1088
Office - Large	746	204	680	221
Office - Small	607	256	567	360
Restaurant - Sit-Down	811	624	716	709
Restaurant - Fast-Food	850	722	734	796
Retail - 3-Story Large	765	770	644	998
Retail - Single-Story Large	724	855	576	998
Retail - Small	726	886	619	1138
Storage - Conditioned	335	688	242	989

[93] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

Table 2-106 HVAC Coincidence Factors by Building Type

Building Type	Coincidence Factor
Assembly	0.47
Education - Community College	0.54
Education - Primary School	0.1
Education - Secondary School	0.1
Education - University	0.53
Grocery	0.54
Health/Medical - Hospital	0.82
Health/Medical - Nursing Home	0.49
Lodging - Hotel	0.67
Lodging - Motel	0.63
Manufacturing - Light Industrial	0.46
Office - Large	0.58
Office - Small	0.51
Restaurant - Fast-Food	0.48
Restaurant - Sit-Down	0.46
Retail - 3-Story Large	0.66
Retail - Single-Story Large	0.56
Retail - Small	0.49
Storage - Conditioned	0.41

Table 2-107 CEE Baseline Efficiency by Unit Type[94]

Equipment Type	Size Category	Heating Section Type	Subcategory	Tier 0	Tier 1	Tier 2
Air Conditioners, Air Cooled (Cooling Mode)	<65,000 Btu/h	All	Split System	NA	14.0 SEER 12.0 EER	15.0 SEER 12.5 EER
			Single Package	NA	14.0 SEER 11.6 EER	15.0 SEER 12.0 EER
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.3 EER 11.4 IEER	11.3 EER 12.3 IEER	NA* NA*
		All Other	Split System and Single Package	11.1 EER 11.2 IEER	11.1 EER 12.1 IEER	NA* NA*
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.9 EER 11.0 IEER	10.9 EER 11.9 IEER	NA* NA*
		All Other	Split System and Single Package	10.7 EER 10.8 IEER	10.7 EER 11.7 IEER	NA* NA*
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.3 EER 10.4 IEER	10.3 EER 10.9 IEER	NA* NA*
		All Other	Split System and Single Package	10.1 EER 10.2 IEER	10.1 EER 10.7 IEER	NA* NA*
Air Cooled (Heating Mode)	<65,000 Btu/h	-	Split System	NA	8.5 HSPF	9.0 HSPF
		-	Single Package	NA	8.0 HSPF	8.5 HSPF
	≥65,000 Btu/h and <135,000 Btu/h	-	47oF db/43oF wb Outdoor Air	NA	3.4 COP	NA*
		-	17oF db/15oF wb Outdoor Air	NA	2.4 COP	NA*
	≥135,000 Btu/h	-	47oF db/43oF wb Outdoor Air	NA	3.2 COP	NA*
		-	17oF db/15oF wb Outdoor Air	No Spec.	2.1 COP	NA*
Water Source (Cooling Mode)	<135,000 Btu/h	All	86oF Entering Water	No Spec.	14.0 EER	NA*
Water Source (Heating Mode)	<135,000 Btu/h	-	68oF Entering Water	No Spec.	4.6 COP	NA*

[94] These values are from 2012 CEE

2.14. High Efficiency Chillers

The following algorithms and assumptions are applicable to Electric Chillers installed in commercial spaces. This measure applies to projects which represent either equipment retrofit or new construction (including major renovations).

Table 2-108 summarizes the 'typical' expected unit energy impacts for this measure. Typical values are based on algorithms and stipulated values described below and data from past program participants. Note that the values listed in the table below are averaged across each of the system efficiency and tonnage categories offered by the program. Table 2-109 through Table 2-114 at the end of this section provide individual savings and materials/labor costs.

Table 2-108 Typical Savings Estimates for High Efficiency Chillers[95]

	Retrofit	New Construction
Deemed Savings Unit	Tons	Tons
Average Unit Energy Savings	340 kWh	250 kWh
Average Unit Peak Demand Savings	0.14 kW	0.10 kW
Expected Useful Life	20 Years	20 Years
Average Material & Labor Cost	$ 600.70	n/a
Average Incremental Cost	n/a	$ 45.58
Stacking Effect End-Use	Cooling	

2.14.1. Definition of Eligible Equipment

All commercial chiller units are eligible provided the installed equipment meets or exceeds current federal minimum efficiencies. Eligibility is determined by calculating the Integrated Part Load Value (IPLV) for the installed unit. The algorithms and stipulated assumptions stipulated for High Efficiency Chillers apply only to like-for-like chiller replacements and are not suited for addition of variable speed drives (VSDs) or plant optimization.

Only primary chillers will qualify. Chillers intended for backup service only are not eligible. Air-cooled chiller efficiencies must include condenser-fan energy consumption. Efficiency ratings for IPLV must be based on ARI standard rating conditions per ARI-550-98 & ARI-590-98.

2.14.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

If the project is retrofitting pre-existing equipment in working condition then the baseline efficiency is defined by the pre-existing equipment. If the equipment being replaced is not in

[95] See spreadsheet "11-TypicalCalcs_GREM.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

working order, then this is considered “replace on burn-out” and the baseline becomes new construction.

New Construction (Includes Major Remodel & Replace on Burn-Out)

For New Construction, the baseline efficiency is defined as the minimum allowable COP and IPLV by the prevailing building energy code or standard according to which the project was permitted. Current applicable standards are defined by ASHRAE 90.1-2004 and 90.1-2007.

2.14.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = Cap * (IPLVbase - IPLVmeas) * EFLH$$

$$\Delta kW = Cap * (IPLVbase - IPLVmeas) * CF$$

$$\Delta kWh/Unit_i = (IPLVbase - IPLVmeas) * EFLHi$$

2.14.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected peak demand savings.
IPLV[96]	Efficiency of high efficiency equipment expressed as Integrated Part Load Value in units of kW/Ton
Cap	Chiller nominal cooling capacity in units of Tons
CF	Peak coincidence factor. Represents the % of the connected load reduction which occurs during Idaho Power’s peak period.
EFLH	Annual Equivalent Full Load cooling hours for chiller. Values for various building types are stipulated in Table 2-112. When available, actual system hours of use should be used.
$\Delta kWh/Unit_i$	Typical measure savings on a per unit basis per kBTU/hr.

2.14.5. Sources

1. ASHRAE, Standard 90.1-2004.
2. ASHRAE, Standard 90.1-2007.
3. California DEER Prototypical Simulation models (modified), eQUEST-DEER 3-5.[97]

[96] Integrated Part Load Value is a seasonal average efficiency rating calculated in accordance with ARI Standard 550/590. It may be presented using one of several sets of units: EER, kW/ton, or COP.

[97] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

4. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls
5. California DEER Incremental Cost worksheets: Revised DEER Measure Cost Summary (05_30_2008) Revised (06_02_2008).xls

2.14.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-109 Deemed Measure Savings for Retrofit

Deemed Savings		kW/Ton	kWh/Ton	Measure Cost [$/Ton]
Air Cooled, with Condenser, Electronically Operated	All Sizes	0.258	622.26	$571.57
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	≤150 Tons	0.173	416.73	$608.20
	>150 and ≤299 Tons	0.148	357.28	$582.74
	>300 Tons	0.106	254.55	$582.74
Water Cooled, Electrically Operated, Centrifugal	≤150 Tons	0.126	302.66	$626.09
	>150 and ≤299 Tons	0.088	211.2	$626.09
	>300 Tons	0.091	219.73	$607.45

Table 2-110 Deemed Measure Savings for New Construction

Deemed Savings		kW/Ton	kWh/Ton	Incremental Cost [$/Ton]
Air Cooled, with Condenser, Electronically Operated	All Sizes	0.196	472.44	$86.12
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	≤150 Tons	0.134	322.46	$58.78
	>150 and ≤299 Tons	0.113	271.67	$49.52
	>300 Tons	0.074	178.27	$32.50
Water Cooled, Electrically Operated, Centrifugal	≤150 Tons	0.091	218.76	$39.88
	>150 and ≤299 Tons	0.056	135.62	$24.72
	>300 Tons	0.063	150.96	$27.52

Table 2-111 Minimum Efficiency Requirements

Equipment Type	Size Category	Minimum Efficiency
Air-Cooled Chiller with Condenser	< 150 Tons	IPLV: 14.0 EER or higher
	≥ 150 Tons	IPLV: 14.0 EER or higher
Water Cooled Chiller electronically operated, reciprocating & positive displacement	< 75 Tons	IPLV: 0.52 or less (kW/ton)
	≥ 75 and < 150 Tons	IPLV: 0.52 or less (kW/ton)
	≥ 150 and < 300 Tons	IPLV: 0.49 or less (kW/ton)
	≥ 300 Tons	IPLV: 0.49 or less (kW/ton)
Water Cooled Chiller electronically operated, centrifugal	< 150 Tons	IPLV: 0.52 or less (kW/ton)
	≥ 150 and < 300 Tons	IPLV: 0.52 or less (kW/ton)
	≥ 300 and < 600 Tons	IPLV: 0.45 or less (kW/ton)

Table 2-112 Stipulated Equivalent Full Load Hours (EFLH) by Building Type[98]

	Zone 5		Zone 6	
Assembly	879	966	758	1059
Education - Primary School	203	299	173	408
Education - Secondary School	230	406	196	514
Education - Community College	556	326	530	456
Education - University	697	341	721	449
Grocery	3437	1825	3762	2011
Health/Medical - Hospital	1616	612	1409	679
Health/Medical - Nursing Home	1049	1399	884	1653
Lodging - Hotel	1121	621	1075	780
Lodging - Motel	978	682	937	796
Manufacturing - Light Industrial	530	699	415	1088
Office - Large	746	204	680	221
Office - Small	607	256	567	360
Restaurant - Sit-Down	811	624	716	709
Restaurant - Fast-Food	850	722	734	796
Retail - 3-Story Large	765	770	644	998
Retail - Single-Story Large	724	855	576	998
Retail - Small	726	886	619	1138
Storage - Conditioned	335	688	242	989
Warehouse - Refrigerated	5096	79	5049	71

[98] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

Table 2-113 HVAC Coincidence Factors by Building Type

Building Type	Coincidence Factor
Assembly	0.47
Education - Community College	0.54
Education - Primary School	0.10
Education - Secondary School	0.10
Education - University	0.53
Grocery	0.54
Health/Medical - Hospital	0.82
Health/Medical - Nursing Home	0.49
Lodging - Hotel	0.67
Lodging - Motel	0.63
Manufacturing - Light Industrial	0.46
Office - Large	0.58
Office - Small	0.51
Restaurant - Fast-Food	0.48
Restaurant - Sit-Down	0.46
Retail - 3-Story Large	0.66
Retail - Single-Story Large	0.56
Retail - Small	0.49
Storage - Conditioned	0.41

Table 2-114 Code Baseline COP and IPLV by Unit Type [99]

Equipment Type	Size	Minimum Efficiency 2004	Minimum Efficiency 2007
Air Cooled, with Condenser, Electronically Operated	All Capacities	2.80 COP 3.05 IPLV[100]	2.80 COP 3.05 IPLV
Air Cooled, without Condenser, Electronically Operated	All Capacities	3.10 COP 3.45 IPLV	3.10 COP 3.45 IPLV
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	All Capacities	4.20 COP 5.05 IPLV	4.20 COP 5.05 IPLV
Water Cooled, Electrically Operated, Positive Displacement (Rotary and Scroll)	< 150 tons	4.45 COP 5.20 IPLV	4.45 COP 5.20 IPLV
	≥ 150 tons and < 300 tons	4.90 COP 5.60 IPLV	4.90 COP 5.60 IPLV
	≥ 300 tons	5.50 COP 6.15 IPLV	5.50 COP 6.15 IPLV
Water Cooled, Electrically Operated, Centrifugal	< 150 tons	5.00 COP 5.25 IPLV	5.00 COP 5.25 IPLV
	≥ 150 tons and < 300 tons	5.55 COP 5.90 IPLV	5.55 COP 5.90 IPLV
	≥ 300 tons	6.10 COP 6.40 IPLV	6.10 COP 6.40 IPLV
Air-Cooled Absorption Single Effect	All Capacities	0.60 COP	0.60 COP
Water-Cooled Absorption Single Effect	All Capacities	0.70 COP	0.70 COP
Absorption Double Effect, Indirect-Fired	All Capacities	1.00 COP 1.05 IPLV	1.00 COP 1.05 IPLV
Absorption Double Effect, Direct-Fired	All Capacities	1.00 COP 1.00 IPLV	1.00 COP 1.00 IPLV
Equipment Type	Size	Minimum Efficiency 2004	Minimum Efficiency 2007
Air Cooled, with Condenser, Electronically Operated	All Capacities	2.80 COP 3.05 IPLV	2.80 COP 3.05 IPLV
Air Cooled, without Condenser, Electronically Operated	All Capacities	3.10 COP 3.45 IPLV	3.10 COP 3.45 IPLV

[99] These values are from Tables 6.8.1 in ASHRAE 90.1 for the unit type method. Note that values for both 2004 and 2007 versions of Standard 90.1 are included. The chiller equipment requirements do not apply for chillers in low-temperature applications where the design leaving fluid temperature is < 40oF. COP refers to the full load efficiency and IPLV refers to the part time load efficiency.

[100] Note that all IPLV values are in units of COP which need to be converted to kW/Ton using the following formula: kW/Ton = 12/(COP*3.412)

2.15. Evaporative Coolers (Direct and Indirect)

Evaporative coolers provide an effective space cooling alternative to direct expansion units in dry climates such as found in Idaho. Evaporative coolers can be designed in direct and indirect configurations.

A direct evaporative cooler represents the simplest and most efficient approach by pulling air directly through a wetted media to cool the air before dispersing it into the space. A direct evaporative cooler will also humidify the incoming air which, depending on the ambient conditions, can lead to high indoor humidity levels.

Indirect evaporative coolers employ heat exchangers to cool dry outside air on one side with evaporatively cooled moist air on the other. The two air streams are kept separate and the moist air exhausted outside while the dry cool air is supplied indoors. These systems are more complex and often much larger than direct systems because they require more space for heat large exchangers. However; indirect coolers do not increase the indoor humidity levels.[101]

Table 2-115 through Table 2-117 summarize the 'typical' expected unit energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-115 Typical Savings Estimates for Evaporative Coolers (All)[102]

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	392 kWh	353 kWh
Average Unit Peak Demand Savings	0.28 kW	0.26 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$1,654	-
Average Incremental Cost	-	$840
Stacking Effect End-Use	Cooling	

[101] Except by the normal relationship between temperature and relative humidity.

[102] Note that these figures assume a weighted average between direct and indirect evaporative coolers in both weather zones. See spreadsheet "16-TypicalCalcs_EvapDirectIndirect.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Table 2-116 Typical Savings Estimates for Evaporative Coolers (Direct)[103]

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	443 kWh	399 kWh
Average Unit Peak Demand Savings	0.32 kW	0.29 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$1,178	-
Average Incremental Cost	-	$364
Stacking Effect End-Use	Cooling	

Table 2-117 Typical Savings Estimates for Evaporative Coolers (Indirect)[104]

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	316 kWh	285 kWh
Average Unit Peak Demand Savings	0.23 kW	0.21 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$2,367	-
Average Incremental Cost	-	$1,553
Stacking Effect End-Use	Cooling	

2.15.1. Definition of Eligible Equipment

Eligible equipment includes any direct or indirect evaporative cooler systems used to supplant direct expansion (DX) system of equivalent size (or greater). Evaporatively pre-cooled DX systems do not qualify under this measure.

2.15.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

Baseline equipment for retrofit projects is the pre-existing DX system.

New Construction (Includes Major Remodel)

Baseline equipment for New Construction projects is a new DX system meeting federal or local building energy code (whichever is applicable) minimum efficiency requirements.

[103] Ibid. Note that these values are for Direct Evaporative units only.

[104] Ibid. Note that these values are for Indirect Evaporative units only.

2.15.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = kWh/Unit * Cap$$

$$\Delta kW = kW/Unit * Cap$$

2.15.4. Definitions

ΔkWh Expected energy savings between baseline and installed equipment.

ΔkW Expected peak demand savings between baseline and installed equipment.

Cap Nominal capacity (in Tons) of the air-cooled equipment

kWh/Unit Per unit energy savings as stipulated in Table 2-118 and Table 2-119.

kW/Unit Per unit demand savings as stipulated in Table 2-118 and Table 2-119.

2.15.5. Sources

1. California Energy Commission. Advanced Evaporative Cooling White Paper. 2004
2. Southwest Energy Efficiency Project & UC Davis Western Cooling Efficiency Center. SWEEP / WCEC Workshop On Modern Evaporative Cooling Technologies. 2007
3. 3012-14 Non-DEER Ex Ante measure work papers submitted by Southern California Edison and Pacific Gas and Electric. http://www.deeresources.com/

2.15.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-118 Unit Energy Savings for Evaporative Coolers – Weather Zone 5

	Retrofit		*New Construction*	
Measure	kWh per Unit Savings	kW per Unit Savings	kWh per Unit Savings	kW per Unit Savings
Direct Evaporative Cooler	456 kWh	0.32 kW	410 kWh	0.29 kW
Indirect Evaporative Cooler	316 kWh	0.23 kW	285 kWh	0.21 kW

Table 2-119 Unit Energy Savings for Evaporative Coolers – Weather Zone 6

	Retrofit		*New Construction*	
Measure	kWh per Unit Savings	kW per Unit Savings	kWh per Unit Savings	kW per Unit Savings
Direct Evaporative Cooler	391 kWh	0.32 kW	352 kWh	0.29 kW
Indirect Evaporative Cooler	279 kWh	0..23 kW	251 kWh	0.21 kW

2.16. Evaporative Pre-Cooler (For Air-Cooled Condensers)

Evaporative pre-coolers, when added to an air-cooled condenser coil, can improve both equipment capacity and energy efficiency. The algorithms and assumptions for this measure are applicable to retrofits in which a separate evaporative cooling system is added onto an air-cooled condenser. Such systems include saturated media, water nozzles (and associated water piping), and a rigid frame. The additional equipment is used to evaporatively pre-cool ambient air before it reaches the air-cooled condenser. This not a replacement of an air-cooled condenser with an evaporative condenser. Typical applications include refrigeration systems and air-cooled chillers.

The tables below summarize the 'typical' expected unit energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-120 Typical Savings Estimates for Evaporative Pre-Cooler (Installed on Chillers)[105]

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	62 kWh	n/a
Average Unit Peak Demand Savings	.05 kW	n/a
Expected Useful Life	15 Years	n/a
Average Material & Labor Cost	$ 173	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Cooling	

Table 2-121 Typical Savings Estimates for Evaporative Pre-Cooler (Installed on Refrigeration Systems)[106]

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	108 kWh	n/a
Average Unit Peak Demand Savings	.09 kW	n/a
Expected Useful Life	15 Years	n/a
Average Material & Labor Cost	$ 173	n/a
Average Incremental Cost	n/a	n/a

[105] See spreadsheet "17-TypicalCalcs_EvapPreCool.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

[106] See spreadsheet "17-TypicalCalcs_EvapPreCool.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

2.16.1. Definition of Eligible Equipment

Eligible equipment includes any retrofit in which equipment is added to an existing air-cooled condenser to evaporatively cool the ambient air temperature before reaching the condenser coils. Self-contained evaporative condensing coils are not eligible as part of this measure. Eligible systems must be purchased and installed by a qualified contractor.

2.16.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

The baseline equipment for retrofit projects is the existing air-cooled condenser coil in a properly working and maintained condition.

New Construction (Includes Major Remodel & Replace on Burn-Out)

The baseline equipment for new construction projects is defined to be a properly working and maintained air-cooled condenser coil with all required fan and head pressure controls as defined by the local energy codes and standards.

2.16.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = kWh/Unit * Cap$$

$$\Delta kW = kW/Unit * Cap$$

2.16.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected peak demand savings between baseline and installed equipment.
Cap	Nominal capacity (in Tons) of the air-cooled equipment
kWh/Unit	Per unit energy savings as stipulated in Table 2-122.
kW/Unit	Per unit demand savings as stipulated in Table 2-122.

2.16.5. Sources

8. Bisbee, Dave & Mort, Dan. Evaporative Precooling System: Customer Advanced Technologies Program Report Technology Evaluation Report. 2010[107]

[107] https://www.smud.org/en/business/save-energy/energy-management-solutions/documents/evapercool-tech-aug10.pdf

9. One other internal monitoring study was referenced when deriving savings values for this measure; however, has not been made public.

2.16.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-122 Unit Energy Savings for Evaporative Pre-Cooler (For Air-Cooled Condensers)

Measure	kWh per Unit Savings	kW per Unit Savings
Evaporative Pre-Cooler (Installed on Chillers)	62	0.05
Evaporative Pre-Cooler (Refrigeration Systems)	108	0.09

2.17. Variable Frequency Drives (For HVAC Applications)

The following algorithms and assumptions are applicable to Variable Frequency Drives (VFDs) on HVAC fans and pumps installed in commercial spaces. This measure applies to projects which represent either equipment retrofit or new construction (including major renovations).

Table 2-123 summarizes the 'typical' expected unit energy impacts for this measure. Typical values are based on algorithms and stipulated values described below and data from past program participants.

Table 2-123 Summary Deemed Savings Estimates for VFDs Installed on Chilled Water Pumps, Condensing Water Pumps, and Cooling Tower Fans

	Retrofit	New Construction
Deemed Savings Unit	HP	HP
Average Unit Energy Savings	286 kWh	268 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$ 194.28	n/a
Average Incremental Cost	n/a	$ 165.33
Stacking Effect End-Use	Cooling	

Table 2-124 Summary Deemed Savings Estimates for VFDs Installed on Fans & Hot Water Pumps

	Retrofit	New Construction
Deemed Savings Unit	HP	HP
Average Unit Energy Savings	1,065 kWh	996 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$ 174.82	n/a
Average Incremental Cost	n/a	$ 142.05
Stacking Effect End-Use	Cooling	

2.17.1. Definition of Eligible Equipment

Only VFDs installed on variably loaded motors, from 5 to 300 horsepower, in HVAC applications are eligible under this measure. Note that systems of motors which are individually less than 5 horsepower are eligible provided that: 1) they are controlled by a common VFD, and 2) the aggregate horsepower of motors controlled by a single VFD is greater than 5 HP. New construction projects must meet or exceeds current federal minimum requirements and must not be required by the applicable building codes. Retrofit projects must remove or permanently disable any pre-existing throttling or flow control device(s), and cannot replace a pre-existing VFD.

2.17.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit or new construction.

Retrofit (Early Replacement)

If the project is retrofitting pre-existing equipment with a variable frequency drive then the baseline control strategy is defined by the pre-existing control strategy.

New Construction (Includes Major Remodel & Replace on Burn-Out)

For facilities that are installing VFDs during a new construction project the minimum HVAC fan/pump controls strategy is dictated by the prevailing building energy code or standard according to which the project was permitted. Current applicable control standards are defined by ASHRAE 90.1-2004 and 90.1-2007.

Code Compliance Considerations for HVAC VFDs

Section 6.5.3 Of the ASHRAE 90.1 Standard specifies horsepower threshold in which VFDs must be installed on individual fans in VAV air-side delivery systems. Section 6.5.4 specifies a horsepower threshold for pumps in hydronic variable flow systems. Note that the is the system has less than three control valves then it is exempt from the VFD requirement. Section 6.5.5 specifies a horsepower threshold for heat rejections fans such as cooling tower fans. Note that the threshold for VAV fans does changes between the 2004 and 2007 versions of Standard 90.1.

2.17.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = .746 * HP * LF / \eta_{motor} * HRS * ESF$$

$$\Delta kW = 0$$

2.17.4. Definitions

ΔkWh Expected energy savings between baseline and installed equipment.

ΔkW Peak demand savings are defined to be zero for this measure.

HP Manufacturer name plate rated horsepower of the motor.

LF Load Factor. Ratio between the actual load and the rated load. Motor efficiency curves typically result in motors being most efficient at approximately 75% of the rated load. The default value is 0.75.

η_{motor} Manufacturer name plate efficiency of the motor at full load.

HRS Annual operating hours of VFD. Values for various building types and end uses are stipulated in Table 2-125.

ESF Energy Savings Factor. Percent of baseline energy consumption saved by installing a VFD. The appropriate ESF can be found in Table 2-126.

2.17.5. Sources

1. ASHRAE, Standard 90.1-2004.
2. ASHRAE, Standard 90.1-2007.
3. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls
4. California DEER Incremental Cost worksheets: Revised DEER Measure Cost Summary (05_30_2008) Revised (06_02_2008).xls

2.17.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-125 Stipulated Hours of Use for Commercial HVAC Motors

Building Type	Motor Usage Group	Zone 5	Zone 6
Assembly	Chilled Water Pump	2,111	1,877
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	2,111	1,877
	HVAC Fan	6,132	1,753
	Cooling Tower Fan	1,050	851
Education – Primary School	Chilled Water Pump	649	584
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	649	584
	HVAC Fan	3,454	1,752
	Cooling Tower Fan	711	559
Education – Secondary School	Chilled Water Pump	649	584
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	649	584
	HVAC Fan	3,454	1,752
	Cooling Tower Fan	711	559
Education – Community College	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,861	1,694
	HVAC Fan	4,795	1,752
	Cooling Tower Fan	1,050	851
Education – University	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,861	1,694
	HVAC Fan	4,795	1,752
	Cooling Tower Fan	1,050	851
Grocery	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,861	1,694
	HVAC Fan	5,423	1,752
	Cooling Tower Fan	1,050	851
Health/Medical – Hospital	Chilled Water Pump	2,485	2,028
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	2,485	2,028
	HVAC Fan	8,760	1,753
	Cooling Tower Fan	1,050	851
Health/Medical – Nursing Home	Chilled Water Pump	2,485	2,028
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	2,485	2,028
	HVAC Fan	8,760	1,753
	Cooling Tower Fan	1,050	851

Building Type	Motor Usage Group	Zone 5	Zone 6
Lodging – Hotel	Chilled Water Pump	2,485	2,028
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	2,485	2,028
	HVAC Fan	8,760	1,753
	Cooling Tower Fan	1,050	851
Lodging – Motel	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,861	1,694
	HVAC Fan	5,423	1,752
	Cooling Tower Fan	1,050	851
Manufacturing – Light Industrial	Chilled Water Pump	1,418	1,306
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,418	1,306
	HVAC Fan	4,672	1,752
	Cooling Tower Fan	1,050	851
Office – Large	Chilled Water Pump	1,612	1,472
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,612	1,472
	HVAC Fan	5,047	1,752
	Cooling Tower Fan	1,050	851
Office – Small	Chilled Water Pump	1,612	1,472
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,612	1,472
	HVAC Fan	5,047	1,752
	Cooling Tower Fan	1,050	851
Restaurant – Sit Down	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,861	1,694
	HVAC Fan	5,423	1,752
	Cooling Tower Fan	1,050	851
Restaurant – Fast Food	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,861	1,694
	HVAC Fan	5,423	1,752
	Cooling Tower Fan	1,050	851
Retail – 3 Story	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,861	1,694
	HVAC Fan	5,423	1,752
	Cooling Tower Fan	1,050	851
Retail – Single Story	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610

Building Type	Motor Usage Group	Zone 5	Zone 6
	Condenser Water Pump	1,861	1,694
	HVAC Fan	5,423	1,752
	Cooling Tower Fan	1,050	851
Retail – Small	Chilled Water Pump	1,861	1,694
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,861	1,694
	HVAC Fan	5,423	1,752
	Cooling Tower Fan	1,050	851
Storage – Conditioned	Chilled Water Pump	1,418	1,306
	Heating Hot Water Pump	6,133	6,610
	Condenser Water Pump	1,418	1,306
	HVAC Fan	4,672	1,752
	Cooling Tower Fan	1,050	851

Table 2-126 Stipulated Energy Savings Factors (ESF) for Commercial HVAC VFD Installations

Building Type	Motor Usage Group	Zone 5	Zone 6
Assembly	Chilled Water Pump	0.313	0.300
	Heating Hot Water Pump	0.411	0.401
	Condenser Water Pump	0.313	0.300
	HVAC Fan	0.297	0.284
	Cooling Tower Fan	0.301	0.278
Education – Primary School	Chilled Water Pump	0.363	0.357
	Heating Hot Water Pump	0.301	0.384
	Condenser Water Pump	0.363	0.357
	HVAC Fan	0.258	0.254
	Cooling Tower Fan	0.324	0.311
Education – Secondary School	Chilled Water Pump	0.363	0.357
	Heating Hot Water Pump	0.301	0.384
	Condenser Water Pump	0.363	0.357
	HVAC Fan	0.258	0.254
	Cooling Tower Fan	0.324	0.311
Education – Community College	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Education – University	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Grocery	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Health/Medical – Hospital	Chilled Water Pump	0.294	0.285
	Heating Hot Water Pump	0.331	0.429
	Condenser Water Pump	0.294	0.285
	HVAC Fan	0.278	0.269
	Cooling Tower Fan	0.279	0.268
Health/Medical – Nursing Home	Chilled Water Pump	0.294	0.285
	Heating Hot Water Pump	0.331	0.429
	Condenser Water Pump	0.294	0.285
	HVAC Fan	0.278	0.269
	Cooling Tower Fan	0.279	0.268

Building Type	Motor Usage Group	Zone 5	Zone 6
Lodging – Hotel	Chilled Water Pump	0.294	0.285
	Heating Hot Water Pump	0.331	0.429
	Condenser Water Pump	0.294	0.285
	HVAC Fan	0.278	0.269
	Cooling Tower Fan	0.279	0.268
Lodging – Motel	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Manufacturing – Light Industrial	Chilled Water Pump	0.317	0.303
	Heating Hot Water Pump	0.307	0.396
	Condenser Water Pump	0.317	0.303
	HVAC Fan	0.300	0.287
	Cooling Tower Fan	0.307	0.280
Office – Large	Chilled Water Pump	0.319	0.305
	Heating Hot Water Pump	0.307	0.395
	Condenser Water Pump	0.319	0.305
	HVAC Fan	0.302	0.289
	Cooling Tower Fan	0.309	0.285
Office – Small	Chilled Water Pump	0.319	0.305
	Heating Hot Water Pump	0.307	0.395
	Condenser Water Pump	0.319	0.305
	HVAC Fan	0.302	0.289
	Cooling Tower Fan	0.309	0.285
Restaurant – Sit Down	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Restaurant – Fast Food	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Retail – 3 Story	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Retail – Single Story	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395

Building Type	Motor Usage Group	Zone 5	Zone 6
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Retail – Small	Chilled Water Pump	0.319	0.306
	Heating Hot Water Pump	0.309	0.395
	Condenser Water Pump	0.319	0.306
	HVAC Fan	0.303	0.289
	Cooling Tower Fan	0.310	0.286
Storage – Conditioned	Chilled Water Pump	0.317	0.303
	Heating Hot Water Pump	0.307	0.396
	Condenser Water Pump	0.317	0.303
	HVAC Fan	0.300	0.287
	Cooling Tower Fan	0.307	0.280

2.18. Water-Side Economizers

The following algorithms and assumptions are applicable to energy efficient air conditioning units installed in commercial spaces. This measure applies to projects which represent either equipment retrofit or new construction (including major renovations).

Table 2-127 summarizes the 'typical' expected (per combined chillers tonnage) unit energy impacts for this measure. Typical values are based on algorithms and stipulated values described below and data from past program participants.

Table 2-127 Typical Savings Estimates for Water-Side Economizers

	Retrofit	New Construction
Deemed Savings Unit	Ton (Chillers)	Ton (Chillers)
Average Unit Energy Savings	184 kWh	154 kWh
Average Unit Peak Demand Savings	0 kW	0 kW
Expected Useful Life	10 Years	10 Years
Average Material & Labor Cost	$ 462.69	n/a
Average Incremental Cost	n/a	$ 462.69
Stacking Effect End-Use	Cooling	

2.18.1. Definition of Eligible Equipment

Eligibility is determined by the installed cooling system. A water cooled chilled water plant must be present and a separate cooling tower installed dedicated to providing free cooling to the chilled water loop.

2.18.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction. For both cases the assumed baseline is a water cooled chilled water plant with no waterside free cooling capabilities.

Retrofit (Early Replacement)

If the project is adding waterside economizing capabilities to a pre-existing chilled water system then it is considered a retrofit except when the project involves an expansion of capacity of the chilled water plant.

New Construction (Includes Major Remodel & Replace on Burn-Out)

Waterside economizer additions on new chilled water plants and on pre-existing plants undergoing expansion are considered new construction for the purposes of this measure.

2.18.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = Cap_{supplanted} * \Delta kWh/Ton$$

2.18.4. Definitions

ΔkWh Expected energy savings between baseline and installed equipment.

ΔkWh/Ton Per unit energy savings as stipulated by weather zone.

$Cap_{supplanted}$ The combined rated capacities of all the chillers supplanted by the waterside economizer.

2.18.5. Sources

10. California DEER Prototypical Simulation models (modified), eQUEST-DEER 3-5002E[108]

2.18.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-128 Water Side Economizer Savings[109]

Zone	Retrofit Savings (ΔkWh/Ton)	New Construction Savings (ΔkWh/Ton)
5	183	153
6	186	155

[108] Prototypical building energy simulations were used to generate Idaho specific kWh savings for various buildings.

[109] See "19-TypicalCalcs_WaterEcono.xlsx" for assumptions and calculations used to estimate the typical unit energy savings.

2.19. Kitchen: Refrigerators/Freezers

The following algorithms and assumptions are applicable to the installation of a new reach-in commercial refrigerator, or freezer meeting ENERGY STAR 2.0 efficiency standards. ENERGY STAR labeled commercial refrigerators and freezers are more energy efficient because they are designed with components such as ECM evaporator and condenser fan motors, hot gas anti-sweat heaters, and/or high-efficiency compressors, which will significantly reduce energy consumption.

Table 2-129 and Table 2-130 summarize 'typical' expected (per unit) energy impacts for this measure can be found. Typical values are based on the algorithms and stipulated values described below.[110]

Table 2-129 Typical Savings Estimates for ENERGY STAR Refrigerators (< 30 ft^3)[111]

	Retrofit	New Construction
Deemed Savings Unit	Refrigerator	Refrigerator
Average Unit Energy Savings	6.2 kWh	6.2 kWh
Average Unit Peak Demand Savings	0.66 W	0.66 W
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$ 7,626	n/a
Average Incremental Cost	n/a	$ 108
Stacking Effect End-Use	Refrigeration	

Table 2-130 Typical Savings Estimates for ENERGY STAR Refrigerators (30 to 50 ft^3)

	Retrofit	New Construction
Deemed Savings Unit	Refrigerator	Refrigerator
Average Unit Energy Savings	5.4 kWh	5.4 kWh
Average Unit Peak Demand Savings	0.58 W	0.58 W
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$ 12,133	n/a
Average Incremental Cost	n/a	$ 135
Stacking Effect End-Use	Refrigeration	

[110] See spreadsheet "20-TypicalCalcs_KitchFrigFrzrIce.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, EUL, and incremental costs.

There isn't a difference between new construction and retrofit because the retrofit baseline is at least as efficient as that required by federal equipment standards.

[111] These numbers do not include chest refrigerators. Inclusion of chest refrigerators would increase the 'typical' savings estimates.

Table 2-131 Typical Savings Estimates for ENERGY STAR Freezers (< 30 ft^3)

	Retrofit	New Construction
Deemed Savings Unit	Freezer	Freezer
Average Unit Energy Savings	28 kWh	28 kWh
Average Unit Peak Demand Savings	3.0 W	3.0 W
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$ 11,052	n/a
Average Incremental Cost	n/a	$ 163
Stacking Effect End-Use	Refrigeration	

Table 2-132 Typical Savings Estimates for ENERGY STAR Freezers (30 to 50 ft^3)

	Retrofit	New Construction
Deemed Savings Unit	Freezer	Freezer
Average Unit Energy Savings	75 kWh	75 kWh
Average Unit Peak Demand Savings	8.0 W	8.0 W
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$ 12,806	n/a
Average Incremental Cost	n/a	$ 35
Stacking Effect End-Use	Refrigeration	

2.19.1. Definition of Eligible Equipment

The eligible equipment is a new commercial vertical solid, glass door refrigerator or freezer, or vertical chest freezer meeting the minimum ENERGY STAR 2.0 efficiency level standards.

2.19.2. Definition of Baseline Equipment

The baseline equipment used to establish energy savings estimates for this measure is established by the Regional Technical Forum (RTF). The RTF uses an existing solid or glass door refrigerator or freezer meeting the minimum federal manufacturing standards as specified by the Energy Policy Act of 2005. The RTF sources a market potential study for and uses a baseline that is more efficient than *code*. Consequently, there is no distinction between baselines for new construction and retrofit projects

Retrofit (Early Replacement)

See explanation above

New Construction (Includes Major Remodel & Replace on Burn-Out)

See explanation above

2.19.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$\Delta kW = \Delta kW/Unit * N_{units}$$

$$= \Delta kWh/Unit * CF / Hours$$

2.19.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Demand energy savings between baseline and installed equipment.
kWh/Unit	Per unit energy savings as stipulated in Table 2-133 and Table 2-134.
kW/Unit	Per unit demand savings.
$\Delta kW/Unit_i$	Unit demand savings for combination i of type, harvest rate, and/or volume.
CF	Coincidence Factor = 0.937
Hours	Annual operating hours = 8760
N_{Units}	Number of refrigerators or freezers

2.19.5. Sources

11. Regional Technical Forum measure workbooks:
    http://rtf.nwcouncil.org/measures/com/ComFreezer_v3.xlsm &
    http://rtf.nwcouncil.org/measures/com/ComRefrigerator_v3.xlsm
12. Illinois Technical Reference Manual

2.19.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-133 Unit Energy and Demand Savings for Units 15 to 30 cu.ft[112]

Measure Category	Energy Savings (kWh/yr)	Peak Reduction (W)
Solid Door Refrigerator	4.8	0.52
Glass Door Refrigerator	7.5	0.8
Chest Refrigerator (Solid)	29	3.1
Chest Refrigerator (Glass)	181	19.4
Solid Door Freezers	9.9	1.06
Glass Door Freezers	46.2	4.94
Chest Freezer (Solid)	0.0	0.0
Chest Freezer (Glass)	7.8	0.84

Table 2-134 Unit Energy and Demand Savings for Units 30 to 50 cu.ft.[113]

Measure Category	Energy Savings (kWh/yr)	Peak Reduction (W)
Solid Door Refrigerator	5.3	0.57
Glass Door Refrigerator	5.5	0.59
Chest Refrigerator (Solid)	29	3.1
Chest Refrigerator (Glass)	181	19.4
Solid Door Freezers	3.9	0.42
Glass Door Freezers	146	15.6
Chest Freezer (Solid)	0.0	0.0
Chest Freezer (Glass)	7.8	0.84

[112] See spreadsheet "20-TypicalCalcs_KitchFrigFrzrIce.xlsx" for assumptions and calculations used to estimate the typical unit energy saving.

[113] See spreadsheet "20-TypicalCalcs_KitchFrigFrzrIce.xlsx" for assumptions and calculations used to estimate the typical unit energy saving.

Table 2-135 List of Incremental Cost Data For Refrigerators and Freezers.[114]

Type	Size Category	Incremental Cost	Average Cost
Solid Door Freezers	0 to 15 cu.ft.	n/a	$25
	15 to 30 cu.ft.	($118)	
	30 to 50 cu.ft.	$38	
	50 + cu.ft.	$153	
Glass Door Freezers	0 to 15 cu.ft.	n/a	$256
	15 to 30 cu.ft.	$443	
	30 to 50 cu.ft.	$32	
	50 + cu.ft.	$293	
Chest Freezer (Solid or Glass)	-	($517)	($517)
Solid Door Refrigerators	0 to 15 cu.ft.	($115)	($30)
	15 to 30 cu.ft.	$16	
	30 to 50 cu.ft.	$52	
	50 + cu.ft.	($73)	
Glass Door Refrigerators	0 to 15 cu.ft.	($16)	$158
	15 to 30 cu.ft.	$199	
	30 to 50 cu.ft.	$219	
	50 + cu.ft.	$229	
Chest Refrigerator	-	$1	$1

[114] From RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComFreezer_v3.xlsm

Table 2-136 List of Materials Cost Data for Refrigerators and Freezers.[115]

Size Category	Qualifying Products Average List Price
Solid Door Refrigerators	
0<V<15	$ 3,484.00
15<=V<30	$ 6,513.17
30<=V<50	$ 12,111.17
50<=V	$ 17,694.20
Glass Door Refrigerators	
0<V<15	$ 3,181.67
15<=V<30	$ 8,739.33
30<=V<50	$ 12,155.60
50<=V	$ 16,747.75
Chest Refrigerators (Solid and Glass)	
All Sizes	$ 4,097.38
Solid Door Freezers	
0<V<15	n/a
15<=V<30	$ 7,204.67
30<=V<50	$ 13,033.33
50<=V	$ 18,738.25
Glass Door Freezers	
0<V<15	n/a
15<=V<30	$ 14,899.00
30<=V<50	$ 12,578.50
50<=V	$ 19,299.00
Chest Freezers (Solid and Glass)	
All Sizes	$ 1,487.70

[115] From RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComFreezer_v3.xlsm

2.20. Kitchen: Ice Machines

The following algorithms and assumptions are applicable to the installation of a new commercial ice machine meeting ENERGY STAR 2.0 efficiency standards. The ENERGY STAR label is applied to air-cooled, cube-type ice machines including ice-making head, self-contained, and remote-condensing units.

Table 2-137 and Table 2-138 summarize the 'typical' expected (per unit) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below. [116]

Table 2-137 Typical Savings Estimates for Ice Machines (<200 lbs/day)

	Retrofit	New Construction
Deemed Savings Unit	Machine	Machine
Average Unit Energy Savings	336 kWh	336 kWh
Average Unit Peak Demand Savings	.07 kW	.07 kW
Expected Useful Life	10 Years	10 Years
Average Material & Labor Cost	$ 2,165	n/a
Average Incremental Cost	n/a	$ 189
Stacking Effect End-Use	Refrigeration	

Table 2-138 Typical Savings Estimates for Ice Machines (>200 lbs/day)

	Retrofit	New Construction
Deemed Savings Unit	Machine	Machine
Average Unit Energy Savings	341 kWh	341 kWh
Average Unit Peak Demand Savings	.07 kW	.07 kW
Expected Useful Life	10 Years	10 Years
Average Material & Labor Cost	$ 4,800	n/a
Average Incremental Cost	n/a	$ 480
Stacking Effect End-Use	Refrigeration	

2.20.1. Definition of Eligible Equipment

The eligible equipment is a new commercial ice machine meeting the minimum ENERGY STAR 2.0 efficiency level standards.

[116] See spreadsheet "21-TypicalCalcs_KitchIceMcn.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, EUL, and incremental costs.

There isn't a difference between new construction and retrofit because the retrofit baseline is at least as efficient as that required by federal equipment standards.

2.20.2. Definition of Baseline Equipment

The baseline condition for retrofit and new construction is established by the RTF. The RTF uses a commercial ice machine meeting federal equipment standards established January 1, 2010. The RTF sources a market potential study for and uses a baseline that is more efficient than *code*. Consequently, there is no distinction between baselines for new construction and retrofit projects

Retrofit (Early Replacement)

See explanation above

New Construction (Includes Major Remodel & Replace on Burn-Out)

See explanation above

2.20.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$= [(kWh_{base} - kWh_{Installed}) * H * Hours/(24*100) + \Delta kWh_{wastewater}]* N_{Units}$$

$$\Delta kW = \Delta kW/Unit * N_{Units}$$

$$= \Delta kWh/Unit_{i,ice} * CF / Hours$$

2.20.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Demand energy savings between baseline and installed equipment.
ΔkWh/Unit	Per unit energy savings as stipulated in Table 2-139.
ΔkW/Unit	Per unit demand savings as stipulated in Table 2-139.
$kWh_{base/Installed}$	Daily energy usage of *base* (baseline) or *installed* ice machines.
$\Delta kWh_{wastewater}$	Annual savings from reduced water usage.
CF	Coincidence Factor = 0.937[117]
H	Harvest Rate (pounds of ice made per day)
Hours	Annual operating hours = 4400

[117] From Illinois TRM

N_{Units} Number of refrigerators or freezers

2.20.5. Sources

13. Regional Technical Forum measure workbooks:
14. http://rtf.nwcouncil.org/measures/com/ComIceMaker_v1_1.xlsx
15. SDG&E Work Paper: WPSDGENRCC0004, “Commercial Ice Machines”
16. Illinois Technical Reference Manual

2.20.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-139 Unit Energy Savings for Ice Machine[118]

Measure	kWh per Unit Savings	kW per Unit Savings
Energy Star Air Cooled Ice Making Head Unit <=200 lbs/day ice	297	0.063
Energy Star Air Cooled Ice Making Head Unit >200 lbs/day ice	1,153	0.246
Energy Star Air Cooled Self-Contained Unit <=200 lbs/day ice	184	0.039
Energy Star Air Cooled Self-Contained Unit >200 lbs/day ice	450	0.096
Energy Star Air Cooled Remote Condensing Unit <=200 lbs/day ice	394	0.084
Energy Star Air Cooled Remote Condensing Unit >200 lbs/day ice	1,082	0.231
CEE Tier 2 Water Cooled Ice Making Head Unit <=200 lbs/day ice	232	0.049
CEE Tier 2 Water Cooled Ice Making Head Unit >200 lbs/day ice	744	0.158
CEE Tier 2 Water Cooled Self-Contained Unit <=200 lbs/day ice	137	0.029
CEE Tier 2 Water Cooled Self-Contained Unit >200 lbs/day ice	343	0.073
CEE Tier 3 Air Cooled Ice Making Head Unit <=200 lbs/day ice	448	0.095
CEE Tier 3 Air Cooled Ice Making Head Unit >200 lbs/day ice	1,587	0.338
CEE Tier 3 Water Cooled Ice Making Head Unit <=200 lbs/day ice	357	0.076
CEE Tier 3 Water Cooled Ice Making Head Unit >200 lbs/day ice	1,371	0.292
CEE Tier 3 Air Cooled Self-Contained Unit <=200 lbs/day ice	385	0.082
CEE Tier 3 Air Cooled Self-Contained Unit >200 lbs/day ice	950	0.202
CEE Tier 3 Water Cooled Self-Contained Unit <=200 lbs/day ice	292	0.062
CEE Tier 3 Water Cooled Self-Contained Unit >200 lbs/day ice	734	0.156
CEE Tier 3 Air Cooled Remote Condensing Unit <=200 lbs/day ice	636	0.135
CEE Tier 3 Air Cooled Remote Condensing Unit >200 lbs/day ice	1,747	0.372

[118] Values given are based on assumed weights for harvest rates. Savings vary significantly between harvest rates.

Table 2-140 Unit Incremental Cost for Ice Machines

Harvest Rate (H)	New Construction & ROB	Retrofit - ER
100-200 lb ice machine	$189	$2,165
201-300 lb ice machine	$818	$3,260
301-400 lb ice machine	$281	$2,740
401-500 lb ice machine	$63	$2,646
501-1000 lb ice machine	$233	$3,728
1001-1500 lb ice machine	$550	$5,301
>1500 lb ice machine	$866	$7,668

2.21. Kitchen: Efficient Dishwashers

The following algorithms and assumptions are applicable to the installation of new high and low temp under counter, single tank door type, single tank conveyor, and multiple tank conveyor dishwashers installed in a commercial kitchen meeting ENERGY STAR efficiency standards. ENERGY STAR dishwashers save energy in four categories: reduction in wastewater processing, building water heating, booster water heating, and idle energy. Building water heating and booster water heating can be either electric or natural gas.

Table 2-141 and Table 2-142 summarize the 'typical' expected (per machine) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below. [119]

Table 2-141 Typical Savings Estimates for Efficient Commercial Dishwashers (All Electric)

	Retrofit	New Construction
Deemed Savings Unit	Machine	Machine
Average Unit Energy Savings	5,561 kWh	5,561 kWh
Average Unit Peak Demand Savings	0.41 kW	0.41 kW
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$ 3,978	n/a
Average Incremental Cost	Machine	$ 3, 978
Stacking Effect End-Use	Miscellaneous Loads	

Table 2-142 Typical Savings Estimates for Efficient Commercial Dishwashers (Gas Heater with Electric Booster)

	Retrofit	New Construction
Deemed Savings Unit	Machine	Machine
Average Unit Energy Savings	1,761 kWh	1,761 kWh
Average Unit Peak Demand Savings	0.23 kW	0.23 kW
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$ 3,978	n/a
Average Incremental Cost	Machine	$ 3,978
Stacking Effect End-Use	Miscellaneous Loads	

[119] Savings estimates are only given for a quick cost effectiveness test. The estimates are based on assumed weights for equipment types. See spreadsheet "22-TypicalCalcs_KitchDshWshr.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, expected useful life, coincidence factor, and incremental costs. Note that there isn't a difference between new construction and retrofit because code doesn't constrain commercial dishwasher efficiencies. The baseline used in the RTF is conservative.

Table 2-143 Typical Savings Estimates for Efficient Residential Dishwashers (All Electric)

	Retrofit	New Construction
Deemed Savings Unit	Machine	Machine
Average Unit Energy Savings	2,210 kWh	2,210 kWh
Average Unit Peak Demand Savings	0.19 kW	0.19 kW
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$ 232	n/a
Average Incremental Cost	Machine	$ 232
Stacking Effect End-Use	Miscellaneous Loads	

Table 2-144 Typical Savings Estimates for Efficient Residential Dishwashers (Gas Heater with Electric Booster)

	Retrofit	New Construction
Deemed Savings Unit	Machine	Machine
Average Unit Energy Savings	821 kWh	821 kWh
Average Unit Peak Demand Savings	0.10 kW	0.10 kW
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$ 232	n/a
Average Incremental Cost	Machine	$ 232
Stacking Effect End-Use	Miscellaneous Loads	

2.21.1. Definition of Eligible Equipment

The eligible equipment is an ENERGY STAR certified dishwasher meeting the thresholds for idle energy rate (kW) and water consumption (gallons/rack) limits listed in the tables below. Maximum idle rates are determined by both machine type and sanitation approach (chemical/low temp versus high temp). Dishwashers installed with both gas hot water and gas booster water heating are not eligible. However; dishwashers installed with electric booster water heating are eligible in buildings using gas hot water heating.

Table 2-145 Idle Rate Requirements for Low Temperature Dishwashers

	Post Condition	
Type	Idle Energy Rate (kW)	Water Consumption (GPR)
Undercounter	0.20	0.95
Door type	0.40	0.87
Single tank conveyor	0.55	0.56
Multiple tank conveyor	0.96	0.386

Table 2-146 Idle Rate Requirements for High Temperature Dishwashers

	Post Condition	
Type	Idle Energy Rate (kW)	Water Consumption (GPR)
Undercounter	0.38	0.74
Door type	0.55	0.68
Single tank conveyor	1.45	0.39
Multiple tank conveyor	1.84	0.35

2.21.2. Definition of Baseline Equipment

The baseline condition is a dishwasher that's not ENERGY STAR certified and doesn't meet the efficiency thresholds for idle energy rate (kW) and water consumption (gallons/rack).

2.21.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$\Delta kW = \Delta kW/Unit * N_{Units}$$

$$\Delta kW/Unit = (\Delta kWh/Unit / Hrs_{Idle}) * CF$$

2.21.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
kWh/Unit	Per unit energy savings as stipulated in Table 2-148and Table 2-149.
kW/Unit	Per unit demand savings as stipulated in Table 2-148and Table 2-149.
CF	Coincidence Factor[120]
NUnits	Number of dishwashers
Hrs_{Idle}	Annual Idle Hours. Values for this input are stipulated in Table 2-148 and Table 2-149.

[120] From Illinois TRM

2.21.5. Sources

17. Regional Technical Forum measure workbook: http://rtf.nwcouncil.org/measures/com/ComDishwasher_v1_2.xlsm
18. Illinois Technical Reference Manual

2.21.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-147 Coincidence Factor for Kitchen: Efficient Dishwashers 118[121]

Location	CF
Fast Food Limited Menu	0.32
Fast Food Expanded Menu	0.41
Pizza	0.46
Full Service Limited Menu	0.51
Full Service Expanded Menu	0.36
Cafeteria	0.36

Table 2-148 Unit Energy Savings and Incremental Costs for All Electric Kitchen: Efficient Dishwashers[122]

Equipment Type	Electric Savings (kWh)	Demand Savings (kW)	Idle Hours	Inc. Cost - Retrofit	Inc. Cost - New Construction
Low Temp Under Counter	3,271	0.283	3375	$232.00	$232
Low Temp Door Type	3,684	0.135	1632	$2,659	$2,659
Low Temp Single Tank Conveyor	3,067	0.281	3600	$5,882	$5,882
Low Temp Multi Tank Conveyor	6,864	0.588	3600	$3,394	$3,394
High Temp Under Counter	1,150	0.103	3375	$232	$232
High Temp Door Type	4,586	0.269	1632	$2,659	$2,659
High Temp Single Tank Conveyor	7,265	0.540	3600	$5,882	$5,882
High Temp Multi Tank Conveyor	7,897	0.658	3600	$3,394	$3,394

[121] From Illinois TRM

[122] See spreadsheet “22-TypicalCalcs_KitchDshWshr.xlsx” for assumptions and calculations used to estimate the typical unit energy savings.

Table 2-149 Unit Energy Savings and Incremental Costs for Gas Heater with Electric Booster Kitchen: Efficient Dishwashers

Equipment Type	Electric Savings (kWh)	Demand Savings (kW)	Idle Hours	Inc. Cost - Retrofit	Inc. Cost - New Construction
Low Temp Under Counter	975	0.116	3375	$2,297	$232
Low Temp Door Type	-352	-0.087	1632	$2,297	$2,659
Low Temp Single Tank Conveyor	1,337	0.150	3600	$2,297	$5,882
Low Temp Multi Tank Conveyor	1,862	0.209	3600	$2,297	$3,394
High Temp Under Counter	668	0.080	3375	$2,297	$232
High Temp Door Type	1,684	0.416	1632	$2,297	$2,659
High Temp Single Tank Conveyor	2,275	0.255	3600	$2,297	$5,882
High Temp Multi Tank Conveyor	3,761	0.421	3600	$2,297	$3,394

2.22. Refrigeration: Efficient Refrigerated Cases

This protocol estimates savings for installing high efficiency refrigerated cases. Efficient cases have low- or no-heat glass doors, efficient fan motors, efficient lighting, and efficient evaporators.

Table 2-150 summarizes the 'typical' expected (per linear foot) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-150 Typical Savings Estimates for Efficient Refrigerated Cases [123]

	Retrofit	New Construction
Deemed Savings Unit	Linear ft.	n/a
Average Unit Energy Savings	Table 2-151	n/a
Average Unit Peak Demand Savings	Table 2-151	n/a
Expected Useful Life	12 Years	n/a
Average Material & Labor Cost	$906.27	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

2.22.1. Definition of Eligible Equipment

Efficient cases with doors must have low- or no-heat glass doors, efficient fan motors, efficient lighting, and evaporators that raise the suction temperature set point by at least 3° F. Efficient cases without doors must the same features excluding door requirements. Savings for cases that don't satisfy all requirements must be treated under their corresponding measure chapters (e.g. efficient lighting, evaporator fans, and/or low-no-heat glass).

2.22.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario. For purposes of the energy savings estimates open cases are assumed to utilize night covers for 6 hours at night.

Retrofit (Early Replacement)

The baseline condition is assumed to be a standard refrigerated case. A standard case is defined as any refrigerated case without any of the following equipment:

1) Low- or no-heat door glass (applies only to fixtures with doors)
2) ECM fan motors
3) LED case lighting
4) Evaporator controls which raise the suction temperature set-point by at least 3° F

New Construction (Includes Major Remodel & Replace on Burn-Out)

[123] See spreadsheet "23-TypicalCalcs_EffCases.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, EUL, and incremental cost.

New construction is not eligible for this measure as this measure is assumed to be standard practice.

2.22.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$\Delta kW = \Delta kW/Unit * N_{Units}$$

2.22.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
ΔkWh/Unit	The unit annual energy savings. Stipulated values for this input are listed by weather zone in Table 2-151.
ΔkW/Unit	The unit peak reduction. Stipulated values for this input are listed by weather zone in Table 2-151.
N_{Units}	Number of linear feet of refrigerated case

2.22.5. Sources

19. DEER Measure Cost Summary: http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValuesAndDocumentation_080530Rev1.zip
20. DEER EUL/RUL Values: http://www.deeresources.com/deer0911planning/downloads/EUL_Summary_10-1-08.xls

2.22.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-151 Unit Energy Savings for Efficient Refrigerated Cases

Case Type (Std. to Eff.)	*Climate Zone 5*		*Climate Zone 6*	
	Per Unit kWh Savings	Per Unit kW Savings	Per Unit kWh Savings	Per Unit kW Savings
Med-Temp Open to Med-Temp Open	65.6	0.019	64.8	0.015
Med-Temp Open to Med-Temp w/doors	322.7	0.047	357.8	-0.002
Low-Temp w/doors to Low-Temp w/doors	38.2	0.003	38.2	0.003
Low-Temp Open to Low-Temp w/doors	772.1	0.034	797.8	0.048
Low-Temp Coffin to Low-Temp w/doors	85.9	-0.047	120.7	-0.041

2.23. Refrigeration: ASH Controls

Anti-sweat heater (ASH) controls turn off door heaters when there is little or no risk of condensation. There are two commercially available control strategies that achieve "on-off" control of door heaters based on either: (1) the relative humidity of the air in the store or (2) the "conductivity" of the door (which drops when condensation appears). In the first strategy, the system activates door heaters when the relative humidity in a store rises above a specific set-point and turns them off when the relative humidity falls below that set-point. In the second strategy, the sensor activates the door heaters when the door conductivity falls below a certain set-point and turns them off when the conductivity rises above that set-point. Without controls, anti-sweat heaters run continuously whether they are necessary or not. Savings are realized from the reduction in energy used by not having the heaters running at all times. In addition, secondary savings result from reduced cooling load on the refrigeration unit when the heaters are off.

The following algorithms and assumptions are applicable to ASH controls installed on commercial glass door coolers and freezers.

Table 2-152 summarizes the 'typical' expected (per linear ft. of case) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-152 Typical Savings Estimates for ASH Controls[124]

	Retrofit	New Construction
Deemed Savings Unit	linear ft. of case	n/a
Average Unit Energy Savings	208 kWh	n/a
Average Unit Peak Demand Savings	23.7 W	n/a
Expected Useful Life	8 Years	n/a
Average Material & Labor Cost	$ 40.00[125]	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

2.23.1. Definition of Eligible Equipment

The eligible equipment is assumed to be a door heater control on a commercial glass door cooler or refrigerator utilizing humidity or conductivity control. This does not apply to special doors with low/no anti-sweat heat.

2.23.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario.

[124] See spreadsheet "24-TypicalCalcs_ASH.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, expected useful life, and incremental costs.

[125] The cost is based on the most recent Regional Technical Forum Measure Workbook for this measure:

http://rtf.nwcouncil.org/measures/Com/ComGroceryAntiSweatHeaters_v1_0.xlsm

Retrofit (Early Replacement)

The baseline condition is assumed to be a commercial glass door cooler or refrigerator with a standard heated door with no controls installed.

New Construction (Includes Major Remodel & Replace on Burn-Out)

n/a

2.23.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = W_{Installed} * 8760(1 + F_{waste} / (EER * DF)) * (1 – F_{Sav}) / 1000$$

$$\Delta kW = \Delta kWh / 8760$$

2.23.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
$W_{Installed}$	Connected load (kW) for typical reach-in refrigerator or freezer door and frame with a heater.
L	Length of the cases in linear feet.
EER	Energy Efficiency Ratio for the annual average refrigeration system.
DF	Degradation Factor accounts for the refrigeration and HVAC systems ages, condenser cleanliness and condition, and evaporative or air cooled condenser.
F_{waste}	Waste Heat Factor. Defined as the percentage of ASH energy use that is converted into heat in the case and must be removed by the refrigeration system. Stipulated values for this figure are provided in Table 2-153.
F_{Sav}	ASH run-time reduction Factor. Stipulated values for this figure are provided in Table 2-153.

2.23.5. Sources

21. June 2001 edition of ASHRAE Journal
22. Regional Technical Forum, Measure Workbooks
    http://rtf.nwcouncil.org/measures/Com/ComGroceryAntiSweatHeaters_v1_0.xlsm
23. http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm

2.23.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-153 Connected Load for Typical Reach-In Case[126]

Case Type	kW_{Base}	EER	DF	F_{waste}	F_{Sav}	ΔW/linear ft. case	ΔkWh/linear ft. case
Low Temperature	72	5.12	0.98	0.35	0.5	38.7	339
Medium Temperature	43	11.2	0.98	0.35	0.8	8.8	76.8
Average	57	8.2	0.98	0.35	0.65	23.7	208

[126] The values are based on the most recent Regional Technical Forum Measure Workbook for this measure. http://rtf.nwcouncil.org/measures/Com/ComGroceryAntiSweatHeaters_v1_0.xlsm

2.24. Refrigeration: Auto-Closer

Auto-closers on freezers and coolers can reduce the amount of time that doors are open, thereby reducing infiltration and refrigeration loads.

The following algorithms and assumptions are applicable to auto-closers installed on reach-in and walk-in coolers and freezers.

Table 2-154 through Table 2-157 summarize the 'typical' expected (per door) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below. [127]

Table 2-154 Typical Savings Estimates for Auto-Closers (Walk-In, Low-Temp)

	Retrofit	New Construction
Deemed Savings Unit	Door	n/a
Average Unit Energy Savings	2,547 kWh	n/a
Average Unit Peak Demand Savings	0.27 kW	n/a
Expected Useful Life	8 Years	n/a
Average Material & Labor Cost	$ 139.32	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

Table 2-155 Typical Savings Estimates for Auto-Closers (Walk-In, Med-Temp)

	Retrofit	New Construction
Deemed Savings Unit	Door	n/a
Average Unit Energy Savings	575 kWh	n/a
Average Unit Peak Demand Savings	0.14 kW	n/a
Expected Useful Life	8 Years	n/a
Average Material & Labor Cost	$ 139.32	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

[127] See spreadsheet "25-TypicalCalcs_AutoCloser_v2.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Table 2-156 Typical Savings Estimates for Auto-Closers (Reach-In, Low-Temp)

	Retrofit	New Construction
Deemed Savings Unit	Door	n/a
Average Unit Energy Savings	560 kWh	n/a
Average Unit Peak Demand Savings	0.07 kW	n/a
Expected Useful Life	8 Years	n/a
Average Material & Labor Cost	$ 139.32	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

Table 2-157 Typical Savings Estimates for Auto-Closers (Reach-In, Med-Temp)

	Retrofit	New Construction
Deemed Savings Unit	Door	n/a
Average Unit Energy Savings	373 kWh	n/a
Average Unit Peak Demand Savings	0.06 kW	n/a
Expected Useful Life	8 Years	n/a
Average Material & Labor Cost	$ 139.32	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

2.24.1. Definition of Eligible Equipment

The eligible equipment is an auto-closer that must be able to firmly close the door when it is within one inch of full closure.

2.24.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario.

Retrofit (Early Replacement)

The baseline equipment is doors not previously equipped with functioning auto-closers and assumes the walk-in doors have strip curtains.

New Construction (Includes Major Remodel & Replace on Burn-Out)

n/a

2.24.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$\Delta kW = \Delta kW/Unit * N_{Units}$$

2.24.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
ΔkWh/Unit	Unit energy savings estimates. Stipulated values for this input are provided in Table 2-158 based on case type and temperature.
ΔkW/Unit	Unit demand savings estimates. Stipulated values for this input are provided in Table 2-158 based on case type and temperature.
N_{Units}	Number of doors onto which this measure is installed.

2.24.5. Sources

24. Regional Technical Forum, Measure Workbooks http://rtf.nwcouncil.org/measures/com/ComGroceryAutoCloser_v1_0.xlsm
25. http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm
26. Workpaper PGECOREF110.1 – Auto-Closers for Main Cooler or Freezer Doors
27. DEER Measure Cost Summary: http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValuesAndDocumentation_080530Rev1.zip

2.24.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-158 Unit Energy and Demand Savings Estimates

Case Temperature	ΔkWh/Unit	ΔkW/Unit
Low Temperature (Reach-in)	560	0.07
Medium Temperature (Reach-in)	373	0.06
Low Temperature (Walk-in)	2,547	0.27
Medium Temperature (Walk-in)	575	0.14

2.25. Refrigeration: Condensers

The following algorithms and assumptions are applicable to efficient air and evaporative cooled refrigeration condensers. Condensers can be oversized in order to take maximum advantage of low ambient dry-bulb (for air-cooled) or wet-bulb (for evaporative cooled) temperatures.

Table 2-159 summarizes the 'typical' expected (per ton) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-159 Summary Deemed Savings Estimates for Efficient Refrigeration Condenser

	Retrofit	New Construction
Deemed Savings Unit	Ton	ton
Average Unit Energy Savings	120 kWh	114 kWh
Average Unit Peak Demand Savings	0.118 kW	0.112 kW
Expected Useful Life	15 Years	15 Years
Average Material & Labor Cost	$ 695.56[128]	n/a
Average Incremental Cost	n/a	$ 35.00[129]
Stacking Effect End-Use	Refrigeration	

2.25.1. Definition of Eligible Equipment

Efficient condenser retrofits must have floating head pressure controls, staged or VSD controlled fans, must operate with subcooling of 5°F or more at design conditions and have a TD of 8°F of less for low-temp systems, 13°F or less for med-temp systems and 18°F or less for evaporative condensers.

2.25.2. Definition of Baseline Equipment

Baseline equipment for this measure is determined by the nature of the project. There are two possible scenarios: retrofit (early replacement) or new construction.

Retrofit (Early Replacement)

The baseline equipment for retrofit projects is the existing condenser coil in a properly working and maintained condition.

New Construction (Includes Major Remodel & Replace on Burn-Out)

The baseline equipment for new construction projects is defined to be a properly working and maintained condenser coil with all required fan and head pressure controls as defined by the local energy codes and standards.

2.25.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

[128] From DEER 2005 Database

[129] From Ameren TRM

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$\Delta kW = \Delta kW/Unit * N_{units}$$

2.25.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
ΔkWh/Unit	Per unit energy savings as stipulated in Table 2-160.
ΔkW/Unit	Per unit demand savings as stipulated in Table 2-160.
N_{units}	Number of condensers installed on individual systems

2.25.5. Sources

28. Ameren Missouri Technical Resource Manual

2.25.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-160 Unit Energy Savings for Efficient Refrigeration Condenser[130]

Measure	kWh/Ton	kW/Ton
Energy Efficient Condenser - Retrofit	120	0.118
Energy Efficient Condenser – New Construction	114	0.112

[130] From Ameren Missouri Technical Resource Manual

2.26. Refrigeration: Controls

Floating-head pressure controls take advantage of low outside air temperatures to reduce the amount of work for the compressor by allowing the head pressure to drop and rise along with outdoor conditions. Dropping the head pressure during low outdoor ambient temperature conditions (less than 70 degrees F) reduces compressor energy consumption and overall runtime. Floating suction pressure requires controls to reset refrigeration system target suction temperature based on refrigerated display case or walk-in temperature, rather than operating at a fixed suction temperature set-point. This also reduces compressor energy consumption and overall runtime.

Table 2-161 Typical Savings Estimates for Floating Suction Pressure Controls (Only)

	Retrofit	New Construction
Deemed Savings Unit	HP	HP
Average Unit Energy Savings	104 kWh	77 kWh
Average Unit Peak Demand Savings	19 W	10 W
Expected Useful Life	16 Years	16 Years
Average Material & Labor Cost	$86.91	n/a
Average Incremental Cost	n/a	$53.75
Stacking Effect End-Use	Refrigeration	

Table 2-162 Typical Savings Estimates for Floating Head Pressure Controls (Only)

	Retrofit	New Construction
Deemed Savings Unit	HP	HP
Average Unit Energy Savings	440 kWh	225 kWh
Average Unit Peak Demand Savings	17 W	11 W
Expected Useful Life	16 Years	16 Years
Average Material & Labor Cost	$272.60	n/a
Average Incremental Cost	n/a	$166.60
Stacking Effect End-Use	Refrigeration	

Table 2-163 summarizes the ‘typical’ expected (per unit) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-161 Typical Savings Estimates for Floating Suction Pressure Controls (Only)

	Retrofit	New Construction
Deemed Savings Unit	HP	HP
Average Unit Energy Savings	104 kWh	77 kWh
Average Unit Peak Demand Savings	19 W	10 W
Expected Useful Life	16 Years	16 Years
Average Material & Labor Cost	$86.91	n/a
Average Incremental Cost	n/a	$53.75
Stacking Effect End-Use	Refrigeration	

Table 2-162 Typical Savings Estimates for Floating Head Pressure Controls (Only)

	Retrofit	New Construction
Deemed Savings Unit	HP	HP
Average Unit Energy Savings	440 kWh	225 kWh
Average Unit Peak Demand Savings	17 W	11 W
Expected Useful Life	16 Years	16 Years
Average Material & Labor Cost	$272.60	n/a
Average Incremental Cost	n/a	$166.60
Stacking Effect End-Use	Refrigeration	

Table 2-163 Typical Savings Estimates for Floating Head and Suction Pressure Controls

	Retrofit	New Construction
Deemed Savings Unit	HP	HP
Average Unit Energy Savings	544 kWh	302 kWh
Average Unit Peak Demand Savings	36 W	21 W
Expected Useful Life	16 Years	16 Years
Average Material & Labor Cost	$359.51	n/a
Average Incremental Cost	n/a	$220.35
Stacking Effect End-Use	Refrigeration	

2.26.1. Definition of Eligible Equipment

Refrigeration systems having compressors with motors rated 1 horsepower or larger are eligible. A head pressure control valve (flood-back control valve) must be installed to lower minimum condensing head pressure from fixed position (180 psig for R-22; 210 psig for R-404a) to a saturated pressure equivalent to 70 degrees F or less. Either a balanced-port or electronic expansion valve that is sized to meet the load requirement at a 70 degree condensing temperature must be installed. Alternatively, a device may be installed to supplement refrigeration feed to each evaporator attached to condenser that is reducing head pressure.

2.26.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction.

Retrofit (Early Replacement)

The baseline equipment for retrofit projects is the existing refrigeration system without floating head and/or suction pressure controls.

New Construction (Includes Major Remodel & Replace on Burn-Out)

The baseline equipment for New Construction projects is a refrigeration system meeting current federal energy efficiency requirements and without floating head and/or suction pressure controls.

2.26.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * Cap$$

$$\Delta kW = \Delta kW/Unit * Cap$$

2.26.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
ΔkWh/Unit	Per unit energy savings as stipulated in Table 2-164 and Table 2-165 according to building type, building vintage, and baseline refrigeration system type.
ΔW/Unit	Per unit demand savings (in Watts) as stipulated in Table 2-164 and Table 2-165 according to building type, building vintage, and baseline refrigeration system type.
Cap	The capacity (in Tons) of the refrigeration system(s) onto which controls are being installed.

2.26.5. Sources

29. DEER Database for Energy-Efficient Resources. Version 2011 4.01
30. DEER Measure Cost Summary: http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValuesAndDocumentation_080530Rev1.zip
31. Regional Technical Forum UES workbook for Floating Head Pressure Controls: http://rtf.nwcouncil.org/measures/com/ComGroceryFHPCSingleCompressor_v1_1.xls

2.26.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-164 Unit Energy and Demand Savings estimates for Retrofit Projects

Measure Description	ΔkWh/HP	ΔW/HP
Grocery, Floating Suction Pressure	104	17.27
Grocery, Floating Head Pressure, Fixed Setpoint (air-cooled)	325	-0.81
Grocery, Floating Head Pressure, Fixed Setpoint (evap-cooled)	466	4.59
Grocery, Floating Head Pressure, Variable Setpoint (air-cooled)	345	9.05
Grocery, Floating Head Pressure, Variable Setpoint (evap-cooled)	484	26.89
Grocery, Floating Head Pressure, Variable Setpt & Speed (air-cooled)	520	21.90
Grocery, Floating Head Pressure, Variable Setpt & Speed (evap-cooled)	515	30.85
Ref Warehse, Floating Suction Pressure	115	57.89
Ref Warehse, Floating Head Pressure, Fixed Setpoint (evap-cooled)	351	45.10
Ref Warehse, Floating Head Pressure, Variable Setpoint (evap-cooled)	351	45.10
Ref Warehse, Floating Head Pressure, Variable Setpt & Speed (evap-cooled)	467	45.10

Table 2-165 Unit Energy and Demand Savings estimates for New Construction Projects

Measure Description	ΔkWh/HP	ΔW/HP
Grocery, Floating Suction Pressure	78	9.62
Grocery, Floating Head Pressure, Fixed Setpoint (air-cooled)	120	0.00
Grocery, Floating Head Pressure, Fixed Setpoint (evap-cooled)	184	-23.55
Grocery, Floating Head Pressure, Variable Setpoint (air-cooled)	169	16.24
Grocery, Floating Head Pressure, Variable Setpoint (evap-cooled)	190	0.62
Grocery, Floating Head Pressure, Variable Setpt & Speed (air-cooled)	411	63.16
Grocery, Floating Head Pressure, Variable Setpt & Speed (evap-cooled)	226	4.96
Ref Warehse, Floating Suction Pressure	70	12.31
Ref Warehse, Floating Head Pressure, Fixed Setpoint (evap-cooled)	352	28.06
Ref Warehse, Floating Head Pressure, Variable Setpoint (evap-cooled)	352	28.06
Ref Warehse, Floating Head Pressure, Variable Setpt & Speed (evap-cooled)	438	28.06

2.27. Refrigeration: Door Gasket

Tight fitting gaskets inhibit infiltration of warm, moist air into the cold refrigerated space, thereby reducing the cooling load. Aside from the direct reduction in cooling load, the associated decrease in moisture entering the refrigerated space also helps prevent frost on the cooling coils. Frost build-up adversely impacts the coil's, heat transfer effectiveness, reduces air passage (lowering heat transfer efficiency), and increases energy use during the defrost cycle. Therefore, replacing defective door gaskets reduces compressor run time and improves the overall effectiveness of heat removal from a refrigerated cabinet.

The following algorithms and assumptions are applicable to door gaskets installed on reach-in and walk-in coolers and freezers.

Table 2-166 summarizes the 'typical' expected (per linear ft. of gasket) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-166 Typical Savings Estimates for Door Gaskets

	Retrofit	New Construction
Deemed Savings Unit	linear ft. of gasket	n/a
Average Unit Energy Savings	2.4 kWh	n/a
Average Unit Peak Demand Savings	0.27 W	n/a
Expected Useful Life	4 Years	n/a
Average Material & Labor Cost	$ 9.61[131]	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

2.27.1. Definition of Eligible Equipment

The eligible equipment is a new door gasket and must replace a worn or damaged gasket on the main insulated solid door of a walk-in cooler. Replacement gaskets must meet the manufacturer's specifications regarding dimensions, materials, attachment method, style, compression, and magnetism.

2.27.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario.

Retrofit (Early Replacement)

The baseline equipment is a door gasket that has a tear that is at least large enough for a hand to pass through (6 inches).

New Construction (Includes Major Remodel & Replace on Burn-Out)

[131] Weighted Cost from DEER Measure Cost Summary

n/a

2.27.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh_{unit} * L$$

$$\Delta W = \Delta W_{unit} * L$$

2.27.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔW	Expected demand reduction (in Watts) between baseline and installed equipment.
ΔkWh_{unit}	Deemed kWh savings stipulated in Table 2-167.
ΔW_{unit}	Deemed kW savings stipulated in Table 2-167.
L	Length of gasket replaced in feet.

2.27.5. Sources

32. CPUC Reports of Strip Curtains and Gaskets
    http://rtf.nwcouncil.org/subcommittees/grocery/CPUC%20Strip&Gasket%202010.zip
33. Regional Technical Forum, Measure Workbooks
    http://rtf.nwcouncil.org/measures/com/ComGroceryDoorGasketReplacement_v1_0.xlsm
    http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm
    http://rtf.nwcouncil.org/measures/com/ComGroceryWalkinECM_v1_1.xlsm
34. DEER Measure Cost Summary:
    http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValuesAndDocumentation_080530Rev1.zip

2.27.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-167 Unit Energy Savings for Door Gaskets[132]

Case Type	ΔkWh_{unit}	ΔW_{unit}
Reach-In (Low-Temp)	*3.16*	*0.36*
Reach-In (Med-Temp)	0.53	0.06
Walk-In (Low-Temp)	5.10	0.58
Walk-In (Med-Temp)	0.70	0.08

[132] Walk-in values obtained from CPUC reports. Reach-in values referenced by using a similar reach-in to walk-in ratio as RTF

2.28. Refrigerator: Evaporator Fans

Existing standard efficiency evaporator fan motors in reach-in and walk-in freezers and coolers can be retrofitted with high-efficiency motors and/or controllers. These measures save energy by reducing fan usage, refrigeration load (due to heat from motors), and compressor energy (from electronic temperature control).The following algorithms and assumptions are applicable to reach-in and walk-in evaporator fans.

Table 2-168 through Table 2-170 summarize the 'typical' expected (per motor) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described on the next page. [133]

Table 2-168 Typical Savings Estimates for Reach-in and Walk-in Evaporator Fan Controls

	Retrofit	New Construction
Deemed Savings Unit	Motor	n/a
Average Unit Energy Savings	408 kWh	n/a
Average Unit Peak Demand Savings	42 W	n/a
Expected Useful Life	15 Years	n/a
Average Material & Labor Cost	$ 161.74	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

Table 2-169 Typical Savings Estimates for Walk-in Evaporator Fan Motors

	Retrofit	New Construction
Deemed Savings Unit	Motor	n/a
Average Unit Energy Savings	593 kWh	n/a
Average Unit Peak Demand Savings	61 W	n/a
Expected Useful Life	15 Years	n/a
Average Material & Labor Cost	$ 296.78	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

[133] See spreadsheet "29-TypicalCalcs_EvapFans.xlsx" for assumptions and calculations.

Table 2-170 Typical Savings Estimates for Reach-in Evaporator Fan Motors

	Retrofit	New Construction
Deemed Savings Unit	Motor	n/a
Average Unit Energy Savings	318 kWh	n/a
Average Unit Peak Demand Savings	44 W	n/a
Expected Useful Life	15 Years	n/a
Average Material & Labor Cost	$ 84.45	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

2.28.1. Definition of Eligible Equipment

The eligible equipment for high-efficiency evaporator fan motors is Electronically Commutated (ECM) or Permanent Split Capacitor (PSC) motors. PSC motors can only replace shaded pole (SP) motors, and ECM motors can replace either SP or PSC motors. Eligible fan motor controls can either be 2 speed (hi/low) or cycle the fans (on/off). Controls must cut fan motor power by at least 75 percent during the compressor “off” cycle.

2.28.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario.

Retrofit (Early Replacement)

The baseline equipment for high-efficiency evaporator fan motors is SP or PSC evaporator fan motors in reach-in and walk-in freezers and coolers. SP motors can be retrofitted with either ECMs or PSCs. Existing PSC motors can only be retrofitted with ECMs. The baseline for controls is a fan that operated continuously and at full speed prior.

New Construction (Includes Major Remodel & Replace on Burn-Out)

n/a

2.28.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = N_{Units} * [(kWh_{Fan}) + (kWh_{Fan} * 3.413) / EER]$$

$$\Delta kW = N_{Units} * kWh_{Fan} * CF / Hours$$

$$kWh_{Fan,\ motor} = (kW_{motor,\ base} - kW_{motor,\ Installed}) * Hours$$

$$kWh_{Fan,\ control} = (kWh_{control,\ base} - kWh_{control,\ Installed})$$

$$kW_{motor,\ base} = Watts_{base} / (\eta_{base} * 1000)$$

$$kW_{motor,\ Installed} = Watts_{Installed} / (\eta_{Installed} * 1000)$$

$$kWh_{control,\ base} = Watts_{base} * Hours / (\eta_{base} * 1000)$$

$$kWh_{control,\ Installed} = kWh_{fullspeed} + kWh_{lowspeed}$$

$$kWh_{fullspeed} = kWh_{control,\ base} * Run\ Time\ \%$$

$$kWh_{lowspeed} = \%\ Speed^{2.5} * kWh_{contro,\ base} * Run\ Time\ \%$$

2.28.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
N_{Units}	Number of fans
Hours	Annual operating hours
CF	Coincidence Factor
$kW_{motor,\ i}$	Connected load of the *base* and *installed* motors
$Watts_{base/Installed}$	Baseline motor output wattage - If unknown, see Table 2-172 and Table 2-175.
$\eta_{base/Installed}$	Efficiency of baseline (*base*) or *installed* motor(s) - If unknown, see Table 2-172 and Table 2-175.
$kWh_{control,\ i}$	Fan annual energy usage before (*base*) and after (*Installed*) controls
kWh_{Fan}	Fan motor annual energy usage
$kWh_{fullspeed}$	Fan annual energy usage at full speed
$kWh_{lowspeed}$	Fan annual energy usage at low speed
Run Time %	Run Time % - Percent of time that fan is at corresponding speed see Table 2-177.
% Speed	Ratio of low speed to full speed in a percent = 35% see Table 2-177.

2.28.5. Sources

35. Regional Technical Forum, Measure Workbooks
http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm
http://rtf.nwcouncil.org/measures/com/ComGroceryWalkinEvapFanECMController_v1_1.xls

http://rtf.nwcouncil.org/measures/com/ComGroceryWalkinECM_v1_1.xlsm
36. EnergySmart Grocer Invoice Data
37. AHRI Standard 1200 – 2006
38. Federal Rulemaking for Commercial Refrigeration Equipment, Technical Support Document. 2009
39. Pennsylvania TRM

2.28.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-171 Evaporator Fan Motor Output and Input Power for Reach-ins

Motor Output[134] (watts)	SP Input (watts)	ECM Input (watts)	PSC Input (watts)	ECM Efficiency[135]	PSC Efficiency[135]	SP Efficiency[135]
9	45	14	31	66%	29%	20%
19.5	97.5	29.5	67.2	66%	29%	20%
37	185	56	128	66%	29%	20%

[134] From RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm

[135] Values from AHRI Standard 1200 - 2006

Table 2-172 Un-Weighted Baseline kWh Savings for Reach-ins[136]

Retrofit Type	Base Power (Watts)	Installed Power (Watts)	Annual Hours	EER	Energy Savings (kWh/motor)
Med Temp Shaded Pole to ECM - 9 Watt Output	45	14	8,760	9	379
Med Temp Shaded Pole to ECM - 19.5 Watt Output	98	30	8,760	9	821
Med Temp Shaded Pole to ECM - 37 Watt Output (1/20 HP)	185	56	8,760	9	1,558
Low Temp Shaded Pole to ECM - 9 Watt Output	45	14	8,030	5	424
Low Temp Shaded Pole to ECM in display case - 19.5 Watt Output	98	30	8,030	5	918
Low Temp Shaded Pole to ECM - 37 Watt Output (1/20 HP)	185	56	8,030	5	1,742
Med Temp Shaded Pole to PSC - 9 Watt Output	45	31	8,760	9	169
Med Temp Shaded Pole to PSC - 19.5 Watt Output	98	67	8,760	9	366
Med Temp Shaded Pole to PSC - 37 Watt Output (1/20 HP)	185	128	8,760	9	694
Low Temp Shaded Pole to PSC - 9 Watt Output	45	31	8,030	5	189
Low Temp Shaded Pole to PSC in display case - 19.5 Watt Output	98	67	8,030	5	409
Low Temp Shaded Pole to PSC - 37 Watt Output (1/20 HP)	185	128	8,030	5	776
Med Temp PSC to ECM - 9 Watt Output	31	14	8,760	9	210
Med Temp PSC to ECM - 19.5 Watt Output	67	30	8,760	9	455
Med Temp PSC to ECM - 37 Watt Output (1/20 HP)	128	56	8,760	9	864
Low Temp PSC to ECM - 9 Watt Output	31	14	8,030	5	235
Low Temp PSC to ECM in display case - 19.5 Watt Output	67	30	8,030	5	509
Low Temp PSC to ECM - 37 Watt Output (1/20 HP)	128	56	8,030	5	966

Table 2-173 Average Savings and Incremental Cost by Evaporator Fan Motor Type for Reach-ins

Retrofit Type	kWh Savings	kW Savings	Incremental Cost
SP to ECM	477	0.049	$84.45
SP to PSC	212	0.022	$84.45
PSC to ECM	265	0.027	$84.45

[136] kWh algorithms from RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm

Table 2-174 Evaporator Fan Motor Output and Input Power for Walk-ins[137]

Motor Output (watts)	SP Input (watts)	ECM Input (watts)	PSC Input (watts)	ECM Efficiency	PSC Efficiency[138]	SP Efficiency
16-23	75	30	48	66%	41%	26%
37	142	56	90	66%	41%	26%
49.7	191	75	121	66%	41%	26%

[137] All values except PSC Efficiency are from RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryWalkinEvapFanECMController_v1_1.xls

[138] PSC Efficiency from Pennsylvania TRM

Table 2-175 Un-Weighted Baseline kWh Savings for Walk-ins[139]

Retrofit Type	Base Power (Watts)	Installed Power (Watts)	Annual Hours	EER	Total Energy Savings (kWh/motor)
Med Temp Shaded Pole to ECM - 16-23 Watt Output	75	30	8,760	11.16	520
Med Temp Shaded Pole to ECM - 37 Watt Output (1/20 HP)	142	56	8,760	11.16	987
Med Temp Shaded Pole to ECM - 49.7 Watt Output (1/15 HP)	191	75	8,760	11.16	1325
Low Temp Shaded Pole to ECM - 16-23 Watt Output	75	30	8,760	5.12	664
Low Temp Shaded Pole to - 37 Watt Output (1/20 HP)	142	56	8,760	5.12	1259
Low Temp Shaded Pole to ECM - 49.7 Watt Output (1/15 HP)	191	75	8,760	5.12	1691
Med Temp Shaded Pole to PSC - 16-23 Watt Output	75	48	8,760	11.16	314
Med Temp Shaded Pole to PSC - 37 Watt Output (1/20 HP)	142	90	8,760	11.16	596
Med Temp Shaded Pole to PSC - 49.7 Watt Output (1/15 HP)	191	121	8,760	11.16	800
Low Temp Shaded Pole to PSC - 16-23 Watt Output	75	48	8,760	5.12	401
Low Temp Shaded Pole to - 37 Watt Output (1/20 HP)	142	90	8,760	5.12	760
Low Temp Shaded Pole to PSC - 49.7 Watt Output (1/15 HP)	191	121	8,760	5.12	1021
Med Temp PSC to ECM - 16-23 Watt Output	48	30	8,760	11.16	206
Med Temp PSC to ECM - 37 Watt Output (1/20 HP)	90	56	8,760	11.16	391
Med Temp PSC to ECM - 49.7 Watt Output (1/15 HP)	121	75	8,760	11.16	525
Low Temp PSC to ECM - 16-23 Watt Output	48	30	8,760	5.12	263
Low Temp PSC to - 37 Watt Output (1/20 HP)	90	56	8,760	5.12	499
Low Temp PSC to ECM	121	75	8,760	5.12	670
- 49.7 Watt Output (1/15 HP)					

[139] kWh algorithms are based on RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryWalkinECM_v1_1.xlsm

Table 2-176 Average Savings and Incremental Cost by Evaporator Fan Motor Type for Walk-ins

Retrofit Type	kWh Savings	kW Savings	Incremental Cost
SP to ECM	659	0.068	$304.58
SP to PSC	398	0.041	$226.53
PSC to ECM	261	0.027	$304.58

Table 2-177 Un-Weighted Baseline kWh Savings for Walk-in Evaporator Fan Controls

Baseline Fan							Evap Fan Controls					Energy Savings		
							Full Speed		Low Speed					
Walk-in Temp	Motor Type	Output Power (Watts)	EER	Input Power (Watts)	Annual Hours	Annual Energy (kWh)	Run Time %	Annual Energy (kWh)	Run Time %	% Speed	Annual Energy (kWh)	Direct (kWh)	Refrig. (kWh)	Total (kWh)
Med	SP	16-23	11.16	75	8,760	657	52%	342	48%	35%	23	293	89	382
Med	SP	37 (1/20 hp)	11.16	142	8,760	1247	52%	648	48%	35%	43	555	170	725
Med	SP	49.7 (1/15 hp)	11.16	191	8,760	1675	52%	871	48%	35%	58	746	228	974
Low	SP	16-23	5.12	75	8,760	657	68%	447	32%	35%	15	195	130	325
Low	SP	37 (1/20 hp)	5.12	142	8,760	1247	68%	848	32%	35%	29	370	247	617
Low	SP	49.7 (1/15 hp)	5.12	191	8,760	1675	68%	1139	32%	35%	39	497	331	828
Med	PSC	16-23	11.16	48	8,760	417	52%	217	48%	35%	14	185	57	242
Med	PSC	37 (1/20 hp)	11.16	90	8,760	791	52%	411	48%	35%	28	352	108	460
Med	PSC	49.7 (1/15 hp)	11.16	121	8,760	1062	52%	552	48%	35%	37	473	145	617
Low	PSC	16-23	5.12	48	8,760	417	68%	283	32%	35%	10	124	82	206
Low	PSC	37 (1/20 hp)	5.12	90	8,760	791	68%	538	32%	35%	18	235	156	391
Low	PSC	49.7 (1/15 hp)	5.12	121	8,760	1062	68%	722	32%	35%	25	315	210	525
Med	ECM	16-23	11.16	30	8,760	259	52%	135	48%	35%	9	115	35	150
Med	ECM	37 (1/20 hp)	11.16	56	8,760	491	52%	255	48%	35%	17	219	67	286
Med	ECM	49.7 (1/15 hp)	11.16	75	8,760	660	52%	343	48%	35%	23	294	90	384
Low	ECM	16-23	5.12	30	8,760	259	68%	176	32%	35%	6	77	51	128

		Baseline Fan					Evap Fan Controls					Energy Savings		
Low	ECM	37 (1/20 hp)	5.12	56	8,760	491	68%	334	32%	35%	11	146	97	243
Low	ECM	49.7 (1/15 hp)	5.12	75	8,760	660	68%	449	32%	35%	15	196	131	326

Table 2-178 Average Savings and Incremental Cost by Evaporator Fan Motor Type for Walk-in Evaporator Fan Controls

Motor Type	kWh Savings	kW Savings	Incremental Cost
SP	452	0.046	$161.74
PSC	285	0.029	$161.74
ECM	178	0.018	$161.74

2.29. Refrigeration: Insulation

This measure applies to installation of insulation on existing bare suction lines (the larger diameter lines that run from the evaporator to the compressor) that are located outside of the refrigerated space. Insulation impedes heat transfer from the ambient air to the suction lines, thereby reducing undesirable system superheat. This decreases the load on the compressor, resulting in decreased compressor operating hours, and energy savings. Table 2-179 and Table 2-180 summarize the 'typical' expected (per foot) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-179 Typical Savings Estimates for Suction Line Insulation for Medium-Temperature Coolers

	Retrofit	New Construction
Deemed Savings Unit	Linear Foot	n/a
Average Unit Energy Savings	7.5 kWh	n/a
Average Unit Peak Demand Savings	1.6 W	n/a
Expected Useful Life	11 Years	n/a
Average Material & Labor Cost	$ 4.46[140]	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

Table 2-180 Typical Savings Estimates for Suction Line Insulation for Low-Temperature Freezers

	Retrofit	New Construction
Deemed Savings Unit	Linear Foot	n/a
Average Unit Energy Savings	12 kWh	n/a
Average Unit Peak Demand Savings	2.3 W	n/a
Expected Useful Life	11 Years	n/a
Average Material & Labor Cost	$ 4.46[141]	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

2.29.1. Definition of Eligible Equipment

Insulation must insulate bare refrigeration suction lines of 2-1/4 inches in diameter or less on existing equipment only. Medium temperature lines require 3/4 inch of flexible, closed-cell, nitrite rubber or an equivalent insulation. Low temperature lines require 1-inch of insulation that is in compliance with the specifications above. Insulation exposed to the outdoors must be protected from the weather (i.e. jacketed with a medium-gauge aluminum jacket).

[140] From SCE Work Paper: WPSCNRRN0003.1

[141] From SCE Work Paper: WPSCNRRN0003.1

2.29.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario.

Retrofit (Early Replacement)

The baseline condition is an un-insulated (bare) refrigeration suction line.

New Construction (Includes Major Remodel & Replace on Burn-Out)

New construction is not eligible since installation of insulation on refrigerant suction line is standard practice.

2.29.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * L$$

$$\Delta kW = \Delta kW/Unit * L$$

2.29.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
ΔkWh/Unit	Unit energy savings. Stipulated values for this input are listed in Table 2-181.
ΔkW/Unit	Unit demand savings. Stipulated values for this input are listed in Table 2-181.
L	Length of insulation installed.

2.29.5. Sources

40. Southern California Edison Company, "Insulation of Bare Refrigeration Suction Lines", Work Paper WPSCNRRN0003.1
41. Pennsylvania Technical Reference Manual

2.29.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-181 Unit Energy Savings for Suction Line Insulation[142]

Case Type	***ΔkW/ft***	***ΔkWh/ft***
Medium-Temperature Coolers	0.001548	7.5
Low-Temperature Freezers	0.00233	12

[142] See spreadsheet "30-TypicalCalcs_RefIns.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs. Unit energy savings are referenced from the DEER for California climate zone 16 (which exhibits the most similar weather to Idaho). Note that these savings do not exhibit significant sensitivity to outdoor weather.

2.30. Refrigeration: Night Covers

Night covers are deployed during facility unoccupied hours in order to reduce refrigeration energy consumption. These types of display cases can be found in small and medium to large size grocery stores. The air temperature inside low-temperature display cases is below 0°F and between 0°F to 30°F for medium-temperature and between 35°F to 55°F for high-temperature display cases. The main benefit of using night covers on open display cases is a reduction of infiltration and radiation cooling loads. It is recommended that these covers have small, perforated holes to decrease moisture buildup. The following algorithms and assumptions are applicable to night covers installed on existing open-type refrigerated display cases.

Table 2-182 summarizes the 'typical' expected (per ft. of the opening width) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-182 Typical Savings Estimates for Night Covers

	Retrofit	New Construction
Deemed Savings Unit	ft. of case	n/a
Average Unit Energy Savings	29 kWh	n/a
Average Unit Peak Demand Savings	0.0 kW	n/a
Expected Useful Life	5 Years	n/a
Average Material & Labor Cost	$ 42.20[143]	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

2.30.1. Definition of Eligible Equipment

The eligible equipment is assumed to be a refrigerated case with a continuous cover deployed during overnight periods. Characterization assumes covers are deployed for six hours daily.

2.30.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario.

Retrofit (Early Replacement)

The baseline equipment is assumed to be an open refrigerated case with no continuous covering deployed during overnight periods.

New Construction (Includes Major Remodel & Replace on Burn-Out)

n/a

143

2.30.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * L$$

$$\Delta kW = 0$$

2.30.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Defined to be zero for this measure. Demand savings are zero because it is assumed that the covers aren't used during the peak period.
ΔkWh/Unit	Per unit energy savings as stipulated in Table 2-183 according to case temperature and climate zone.

2.30.5. Sources

42. SCE Workpaper: "Night Covers for Open Vertical and Horizontal LT and Open Vertical MT Display Cases," SCE13RN005.0
43. RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm
44. DEER Measure Cost Summary: http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValuesAndDocumentation_080530Rev1.zip

2.30.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-183 Unit Energy Savings for Refrigeration: Night Covers

CZ	Case Type	Savings (kWh/ft)
5	Low Temperature	66.67
5	Medium Temperature	28.99
6	Low Temperature	75
6	Medium Temperature	30.43

2.31. Refrigeration: No-Heat Glass

New low heat/no heat door designs incorporate heat reflective coatings on the glass, gas inserted between the panes, non-metallic spacers to separate the glass panes, and/or non-metallic frames (such as fiberglass). This protocol documents the energy savings attributed to the installation of special glass doors with low/no anti-sweat heaters for low temp cases. Table summarizes the 'typical' expected (per door) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-184 Typical Savings Estimates for Low/No Heat Doors[144]

	Retrofit	New Construction
Deemed Savings Unit	Door	Door
Average Unit Energy Savings	281 kWh	253 kWh
Average Unit Peak Demand Savings	0.17 kW	0.15 kW
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$472	n/a
Average Incremental Cost	n/a	$386
Stacking Effect End-Use	Refrigeration	

2.31.1. Definition of Eligible Equipment

The eligible equipment is a no-heat/low-heat clear glass on an upright display case. It is limited to door heights of 57 inches or more. Doors must have either heat reflective treated glass, be gas filled, or both. This measure applies to low temperature cases only—those with a case temperature below 0°F. Doors must have 3 or more panes. Total door rail, glass, and frame heater wattage cannot exceed 54 Watts per door for low temperature display cases.

2.31.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario.

Retrofit (Early Replacement)

The baseline condition is assumed to be a commercial glass door that consists of two-pane glass, aluminum doorframes and door rails, and door and frame heaters. For the purposes of calculating typical energy savings for this measure it is assumed that the baseline door and frame heaters consume 214 Watts per door.

New Construction (Includes Major Remodel & Replace on Burn-Out)

n/a

[144] See spreadsheet "32-TypicalCalcs_NoHeatGlass.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, EUL, and incremental cost.

2.31.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$

$$\Delta kW = \Delta kW/Unit * N_{Units}$$

2.31.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
ΔkWh/Unit	Per unit energy savings. Stipulated values for this input can be found in Table […].
ΔkW/Unit	Per unit peak reduction. Stipulated values for this input can be found in Table […].
N_{Units}	Total number of doors installed.

2.31.5. Sources

45. Southern California Edison. Low ASH Display Doors Work Paper: SCE13RN018.0
46. DEER EUL/RUL Values: http://www.deeresources.com/deer0911planning/downloads/EUL_Summary_10-1-08.xls

2.31.6. Stipulated Valies

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-185 Stipulated Energy and Demand Savings Estimates for "No-Heat Glass"

	ΔkWh/Unit	**ΔkW/Unit**
Weather Zone 5	295.4	0.175
Weather Zone 6	223.9	0.14

2.32. PC Management Software

This measure relates to the installation of a centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power mode states. Savings come from an increase in the rate of time spent in the "Off" state due to the ability of the network application to shut the computer down when not in prolonged use. The shift in hours from idle state to off state is based on empirical studies of power management installations. Savings vary by building type according to HVAC interaction factor.

Table 2-186 summarizes the 'typical' expected (per machine controlled) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-186 Typical Savings Estimates for PC Power Management Software

	Retrofit	New Construction
Deemed Savings Unit	Machine Controlled	n/a
Average Unit Energy Savings	135 kWh	n/a
Average Unit Peak Demand Savings	6 W	n/a
Expected Useful Life	4 Years	n/a
Average Material & Labor Cost	$12	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Miscellaneous Loads	

2.32.1. Definition of Eligible Equipment

The eligible equipment is a network of standard desktop computers and monitors, with no centralized power management software. Eligible software must allow IT administrators to control desktop power consumption within the network from a central location and include a reporting feature to enable monitoring and validation of the energy savings. Reports must also provide a catalog of systems (and their locations) under management.

2.32.2. Definition of Baseline Equipment

There are two possible project baseline scenarios – retrofit and new construction. This measure currently only addresses the retrofit scenario.

Retrofit (Early Replacement)

The baseline condition is a network of standard desktop computers and monitors, with no centralized power management software. Baseline desktop usage is derived as a weighted mix of Energy Star compliant and non-compliant models, and a mix of desktop categories. Baseline duty cycle is drawn from empirical studies, taking into account the enabled built-in power management of computers and monitors before applying the effects of a centralized power management control.

New Construction (Includes Major Remodel & Replace on Burn-Out)

n/a

2.32.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = \Delta kWh/Unit * N_{Units}$$
$$\Delta kW = \Delta kW/Unit * N_{Units}$$

2.32.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkWh/Unit	Per unit energy savings as stipulated in Table **2-187**.
ΔkW/Unit	Per unit demand savings as stipulated in Table **2-187**.
N_{Units}	Total number of computers controlled.

2.32.5. Sources

47. Regional Technical Forum, Measure Workbooks http://rtf.nwcouncil.org/measures/measure.asp?id=95/ NonResNetCompPwrMgt_v3_0.xls

2.32.6. Stipulated Values

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-187 Unit Energy Savings for PC Power Management Software[145]

Building	HVAC System	ΔkWh/Unit	ΔkW/Unit
K-12 School	Electric Heat	83.9	0.003
K-12 School	Heat Pump	124.4	0.004
K-12 School	Gas Heat	159.2	0.006
Large Office/Central HVAC	Electric Heat	131.4	0.006
Large Office/Central HVAC	Heat Pump	147.6	0.007
Large Office/Central HVAC	Gas Heat	160.6	0.008
Other/Packaged HVAC	Electric Heat	98.7	0.005
Other/Packaged HVAC	Heat Pump	138.2	0.007
Other/Packaged HVAC	Gas Heat	172.2	0.008

[145] See spreadsheet "33-NonResNetCompPwrMgt_v3_0.xlsx" for assumptions and calculations used to estimate the typical unit energy and peak demand savings.

2.33. Variable Frequency Drives (Process Applications)

Variable Frequency drives can provide energy efficient operation for fans and pumps used in processes applications. The savings potential for Variable Frequency Drives in process applications is highly variable and dependent upon its application. For this reason it is best for the energy impacts for such projects to be determined via a custom path. The method below can be used to assess energy impacts for projects in which a VFD is installed on either a fan or centrifugal pump serving a process application.

Table 2-188 summarizes the 'typical' expected energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-188 Variable Frequency Drives (Process Applications)[146]

	Retrofit	New Construction
Deemed Savings Unit	HP	HP
Average Unit Energy Savings	1,377 kWh	1,319 kWh
Average Unit Peak Demand Savings	0.16 kW	0.16 kW
Expected Useful Life	12 Years	12 Years
Average Material & Labor Cost	$332	n/a
Average Incremental Cost	n/a	$332
Stacking Effect End-Use	Process	

2.33.1. Definition of Eligible Equipment

Only VFDs installed on variably loaded motors, from 5 to 300 horsepower, in process applications are eligible under this measure.[147] Note that systems of motors which are individually less than 5 horsepower are eligible provided that: 1) they are controlled by a common VFD, and 2) the aggregate horsepower of motors controlled by a single VFD is greater than 5 HP. Eligible applications are limited to fans and centrifugal pumps serving a process load. Examples of such loads include (but are not limited to) wastewater effluent pumping, ventilation fans for agricultural sheds, and dairy vacuum pumps. Fans and pumps used for Heating, Ventilation and Air-Conditioning in occupant comfort applications are not eligible under this measure.

2.33.2. Definition of Baseline Equipment

When electing to use an engineering calculation approach (Algorithm 2 below) the reported savings estimates must be *production neutral*. Since the impact of facility production rates is implicit in the motor load profile care should be taken to ensure that the *baseline* and *measure* motor load profiles developed for each site are based on a facility 'typical' production. In cases where the project constitutes an expansion due to increased production (or new construction)

[146] See spreadsheet "34-TypicalCalcs_ProcessVFD.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

[147] The term "process" here denotes any industrial or agricultural VFD driven application which does not serve space conditioning equipment for occupant comfort.

the most reliable production estimates should be used. There are two possible project baseline scenarios - retrofit and new construction.

Retrofit (Early Replacement)

In early replacement retrofit scenarios the baseline equipment is the pre-existing pump/fan, motor, and flow control strategy. Production levels (to the extent that they impact equipment energy use) are assumed to be 'typical' for the facility.

New Construction (Includes Major Remodel & Replace on Burn-Out)

Baseline equipment for new construction projects (including retrofits that result in an expansion of equipment capacity) is defined by the "industry standard" for affected processes. If no industry standard can be identified then the facility (or others operated by the same company) should be explored to identify whether or not *older* and similar production lines can be used to define baseline equipment. If none of the above are present (or applicable) then the baseline equipment is assumed to be the least efficient variant of what is installed. Production levels (to the extent that they impact equipment energy use) are assumed to be the most reliable estimate of 'typical' production rates for the facility.

2.33.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

Algorithm 1: Deemed

$$\Delta kWh_{Deemed} = kWh/Unit * P_{Nominal}$$

$$\Delta kW_{Deemed} = kW/Unit * P_{Nominal}$$

Algorithm 2: Engineering Formulas[148]

$$\Delta\ kWh_{Eng} = \sum P_{motor} * Hr_i * (F_{base,\ i} - F_{meas,\ i})$$

$$\Delta\ kW_{Eng} = P_{motor} * (F_{base,\ i} - F_{meas,\ i}) * CF$$

$$P_{motor} = .745 * P_{Nominal} * LF / \eta$$

$$F_i = \beta_1 + \beta_2 * Spd_i + \beta_3 * Spdi^2 + \beta_4 * Spdi^3$$

2.33.4. Definitions

ΔkWh	Expected energy savings between baseline and installed equipment.
ΔkW	Expected demand reduction between baseline and installed equipment.
P_{motor}	The electrical power draw of the motor at pump design conditions.
$P_{nominal}$	The nominal horsepower of the motor
LF	The load factor for the motor when operating at pump design conditions.

[148] TCFhese formulas are applied in the workbook titled “34-TypicalCalcs_ProcessVFD.xlsx”. The spreadsheet titled “Site Specific Calculator” can be used to estimate project energy impacts using the engineering formula based approach.

η	Motor nameplate efficiency.
F_i	The motor process loading factor at motor % Speed *i*. This is calculated using the curve-fit coefficients β_1 through β_4 found in Table 2-190. The appropriate factors are selected based on the flow control type for the baseline. Coefficients for flow control VFD are selected for the measure factors ($F_{meas,\ i}$). For any project, it must first be determined how often the motor/VFD will operate at different speeds.
SPD_i	Motor percent speed (e.g. 10% = 10)
Hr_i	The time spent (in units of hours) at speed *i*
CF	The coincidence factor. If unknown for the project a value of .77 should be used.

2.33.5. Sources

48. Regional Technical Forum Unit Energy Savings calculator for Agricultural: Variable Frequency Drives – Dairy (http://rtf.nwcouncil.org/measures/ag/AgDairyVFD_v1_2.xls)
49. Regional Technical Forum Unit Energy Savings calculator for Agricultural: Variable Frequency Drives - Potato/Onion Shed

    (http://rtf.nwcouncil.org/measures/ag/AgPotatoOnionShedVFD_v1_3.xls)
50. Evaluation Results from 2011 Easy Upgrades, 2011 Building Efficiency, and 2010 Custom Efficiency Incentive Programs.

The following tables stipulate allowable values for each of the variables in the energy and demand savings algorithms for this measure.

Table 2-189 Deemed Per/HP savings values

Measure	Energy Savings [kWh/HP]	Peak Demand Savings [kW/HP]
Process VFD	1,377	0.16

Table 2-190 Coefficients for Process Loading Factors (F^i) Curve-Fits

Flow Control Type	β1	β2	β3	β4
Throttling Valve	55.2124	0.637	-0.0019	0
Eddy Current Clutch	16.39683	-0.05647	0.01237	-3 x 10-5
Mechanical (Torque Converter)	13.51137	0.34467	0.01269	-7 x 10-5
Bypass, Recirculation Valve	102	0	0	0
VFD	27.44751	-1.00853	0.01762	0

Table 2-191 Coincidence Factors

Application	CF
Site Specific	As Measured
Other	.77

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Idaho Power

Custom Efficiency Program Research

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Research Objectives

- This research, designed as a collaborative effort between MDC Research (MDC) and Idaho Power Company (IPC), serves to provide a deeper understanding of customer engagement with the Custom Efficiency program.

- By engaging with program participants from commercial and industrial businesses, as well as representatives from eligible businesses who have not participated in the program, MDC moderators were able to gain insight into the following:
  - ✓ Awareness and understanding of the program offering and benefits
  - ✓ General program satisfaction
  - ✓ Satisfaction with the equipment installed as part of the program
  - ✓ Overall satisfaction with the program process
  - ✓ Participant recommendations for program changes or improvements
  - ✓ Desired channels for program information and marketing
  - ✓ Perceived barriers to program participation
  - ✓ Unmet needs under the current program structure

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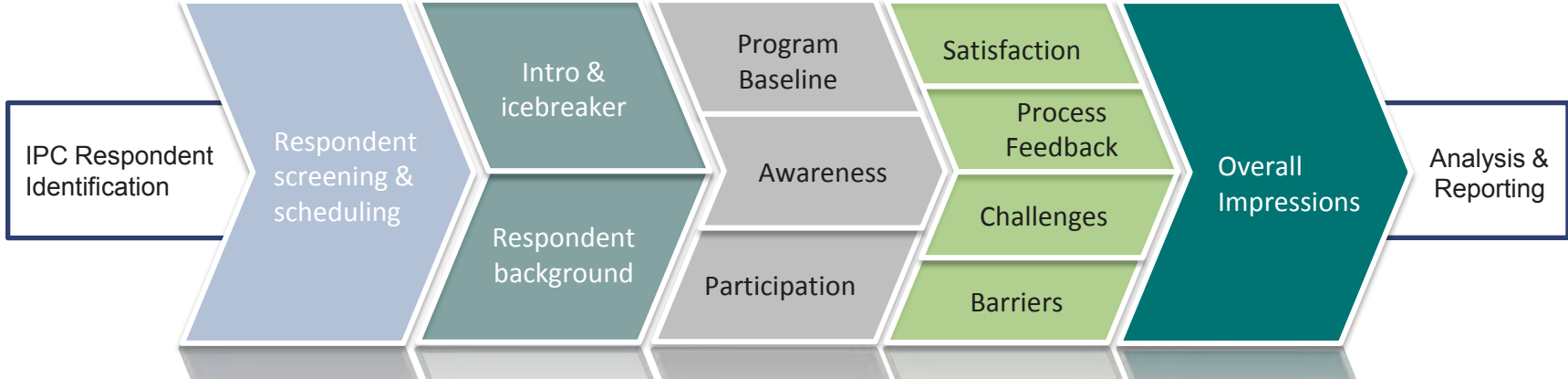
Methodology

- Feedback was collected using in-depth one on one telephone interviews.
  - ✓ MDC conducted a total of 36 interviews with energy decision-makers
- Following IPC's identification of target respondents, MDC recruiters screened the majority of them to ensure they were the appropriate contact for the research.
  - ✓ Industrial customers were invited to participate through direct contact from their IPC reps

Research Process



Key Take-Aways

1

Drive outreach for participation

Even when first time participants had a fairly immediate or pressing need for upgrades or greater efficiency, most did not seek out the program on their own.

2

For marketing outreach and collateral, highlight all program benefits

While ROI/savings is universally attractive, it is not the main driver for every company. Some place equal or more importance on "green" aspects or having better equipment; others, typically with less capital, find the subsidization of a needed project to be more attractive than down-the-road savings.

3

Specifically Address Rising Energy Concerns

Organizations are well aware that their energy costs are rising, and most have already made some form of internal changes. Some non-participants don't typically think of power companies as a resource to help them save energy.

Key Take-Aways (continued)

4

Provide knowledge and resources to those curious about the program

With many first-time participants "pleasantly surprised" with how the program worked for them, and non-participants eager for more information about energy savings, IPC serves to benefit from further spreading their vast energy efficiency knowledge. Some find contact with informed IPC reps to be a benefit in and of itself.

5

Ensure independent contractors meet and exceed IPC standards

Program satisfaction is often directly correlated to the contractors' performance, or even earlier promises. Many smaller-scale customers don't readily distinguish between their contractor's performance and IPC's, or feel that IPC has responsibility in ensuring contractors are up to par.

6

If possible, provide support or tips for forecasting kWh savings

Of the entire process, this is typically the most commonly stated pain point. Those left to their own devices to calculate this (often an important component of internal approval processes), voiced struggles with these calculations.

Factors for Program Engagement

Program Engagement

When it comes to their initial engagement with the Custom Efficiency program, respondents fall into three broad categories:

1. Outside Sales

- Typically involves business decision-maker being approached by a contractor, who leverages the Custom Efficiency program as a sales deal.
- More common among commercial customers, especially those of a smaller size/with less direct contact with Idaho Power.
- Customer satisfaction is largely dependent on how well the contractor presents the program qualifications, and how well their performance meets the preset expectations.

2. IPC Relationship

- Company has a dedicated IPC rep, who keeps them informed of program offerings, qualifications, etc.
- At times, customer may approach rep about additional program opportunities.
- Common among larger industrial customers, who tend to have more ongoing, direct contact with Idaho Power.
- The majority of those who agreed to participate in this research speak highly of their rep and are satisfied with their relationship with Idaho Power.

3. Prior Experience

- Some participants cite having worked with the program at a previous company, whether directly (“it was my role in my previous position”) or indirectly (“I know that my last company took advantage of this program”).
- It is typically a positive prior experience that drives the participant to seek out the program in their newer role.
- Many mention the cost savings as something that stuck in their mind when pursuing the program in their new role.

Program Engagement: Outside Sales

- This process was typically mentioned by respondents from small to midsize commercial businesses, and accounted for over half of the participant interviews.
- Though an outside contractor was the catalyst for engagement, most were already considering some sort of improvement or upgrade.
- With savings/ROI being the main "sell" for these contractors, respondents in this category have a tendency to be highly aware of their IPC bill, and whether bill reductions are inline with what was originally pitched.

How Can Idaho Power Improve this Process?

- More thorough vetting of all "approved" contractors—they're working as an extension of IPC, and when cost savings or equipment policy is not as promised, it reflects poorly on the program, or even on the company as a whole. Some felt the engagements were overly "sales-y," an especially common sentiment among those who are approached frequently by multiple contractors.
- Work with contractors to better position the Custom Efficiency program—many customers were aware of the savings opportunity, but were not necessarily aware of the program by name.

"We had four other contractors also approach us within a 30-day period, during which everyone explained the Custom Efficiency program in a different way."

Program Engagement: IPC Relationship

- Mentioned primarily by respondents from larger industrial businesses, who by nature tend to have more ongoing contact with IPC reps.
- Most research participants are highly satisfied with their rep, and with the process as a whole.
- A few of the larger industrial customers feel as though their "stature" as a key IPC customer should earn them greater bargaining power when working through program qualifications.

How Can Idaho Power Improve this Process?

- This process represents the smallest area for IPC improvement, as most respondents are highly satisfied with both their IPC rep and the program as whole. It should be noted, however, that those who are more satisfied/engaged with IPC may be more likely to participate in this research.
- Suggestions for improvement center around more ability to customize or tailor projects to larger companies, or less "red tape" in the approval process; these recommendations only came up in a small handful of interviews.

"The program is not very cut and dry for industrial customers; it *feels* more suited to commercial customers."

Program Engagement: Prior Experience

- This process was mentioned by a small handful of respondents from a variety of business types.
- Prior satisfaction/savings is a common driver, though some participants note a diminishing return on more recent engagements. Some mention they recall the program savings being more significant, with a shorter ROI timeframe.
- As these respondents profess to have prior experience, they tend to be highly aware of a wider range of program specifics (as opposed to more recent participants, who may have only had exposure to certain components from engagement through a contractor).

"I had a prior relationship with Idaho Power from my previous position at ___. They'd had good success with the program there."

Drivers for Engagement

Program participants report three key motivators for engagement; for many, their final driver was some combination of the three.

"ROI was absolutely the deciding factor."

Future ROI/savings

As this is the main benefit touted by outside contractors (and often by IPC), this aspect comes up frequently in participant interviews.

The company's overarching objective to save energy or "be green."

Often mentioned by larger, regulated businesses who typically have a government directive to be green.

Those who make this decision independently tend to highly promote or advertise this aspect of their business.

(from the homepage of a participant's website)

"We can't waste resources. We have to be green."

Subsidizing a needed upgrade

For some, especially those from smaller businesses, the capital to begin an upgrade or improvement was their primary driver, especially when equipment is outdated. For these, the IPC incentive was an important component of their decision.

ROI: An In-depth Look

- Though not always the #1 driver, ROI is nearly always a consideration.
  - ✓ It may be that those placing less importance on this factor are less directly tied to company profits.
- Acceptable ROI periods vary, and can be dependent on the size and scope of a project; however, 5 years is frequently mentioned as a threshold many would not be comfortable moving past.
  - ✓ Participants who are more ROI-driven tend to only find smaller periods acceptable, and may not even consider projects with more than a 2 or 3 year payback period.
- Those who are ROI-driven tend to watch their power bills closely. Some note that any ROI has been essentially negated by what they describe as IPC rate increases during the time they were engaging with the program.

"If the ROI period is more than 2-3 years, I don't even bother. It won't be approved."

"Custom Efficiency can take an energy efficiency project with a 4-5 year ROI, and bring it down to less. This is key, as our internal requirement is 2 years."

"We ended up with about a 25% savings… but then Idaho Power had a 25% rate increase. It pretty much washed it out to even."

Typical Process

The **process** for engaging with the program is largely dependent on the company's size and structure.

Smaller

Mostly single location;
Smaller square footage

In these scenarios the energy "decision-maker" is typically the owner/operator, or another high-ranking associate. They tend to work alongside IPC and contractors throughout the process. Upgrades typically are smaller in scope, and the initiation process is usually considered to be simple and straightforward.

Medium

Multi-location facilities, typically with ops needs that go beyond lighting

Companies of this size/structure tend to fall into two main categories: either the energy decision-maker reports to higher ranking executive staff, or they are directly involved with group executive decisions. In either case, there is considerably more collaborative discussion than in the smaller companies.

Large

Larger industrial customers with complex operations

Larger organizations inherently have more bureaucracy, including executive sign-offs, energy decision teams, or shareholder approval. The decision-making process to engage with the program is a lot more in-depth and formalized—many will only "bother" initiating for projects with more immediate benefits or returns.

Participation Concerns

Concerns about engaging with the program again vary by company size and structure

For smaller commercial companies, the main concern is the potential shutdown of business (lost revenue).

- ✓ Most are happy to report that their concerns were alleviated.

For medium commercial businesses, concerns are significantly greater, with upgrades naturally being a bit larger in scope, and/or affecting crucial operational components (refrigeration units, heat pumps, compression systems, etc.).

- ✓ In these cases there is a stronger correlation between contractor success and diminished concerns.

Surprisingly, those from the largest industrial organizations voiced less concern; this likely is a result of longstanding (typically positive) relationships with IPC, or in some cases, the fact that their position is less tied to company profit.

Feedback on Program Processes

Program Process Overview

- Program participants were asked, in detail, to evaluate six individual steps of the program:

1. Determining how the electrical process could be more energy efficient
2. Obtaining a cost estimate to modify or install equipment
3. Completing a Custom Efficiency application and agreement
4. IPC application review and pre-approval
5. Equipment installation
6. IPC or third-party equipment inspection

- Despite this breakdown of components, many found it challenging to look at the process as individual steps; rather they are generally viewed as three broad categories: paperwork and inspections leading up to the install, the installation itself, and then the final inspections and payouts.

Overall Satisfaction with Processes

- For the most part, participants are highly satisfied with the Custom Efficiency process in its entirety—from initial engagement to final inspection of a completed project.
  - ✓ Dissatisfaction tends to center around contractor experience. The small number of unhappy participants tied this to the installation process, with complaints including low-quality equipment, missed deadlines, or ROI/savings that were less than promised.
  - ✓ Participants are aware that these are contractor issues, but still associate them with IPC (with the assertion that IPC is/should be vetting all contractors who promote their programs).
  - ✓ Some call for more direct access to an IPC rep in situations where things go wrong.
- Some participants cite their internal processes as being much more difficult to navigate than IPC's program steps.
- Except for installation challenges, satisfaction/experience does not tend to waiver across components.

"When problems happen, I think it's a good idea for Idaho Power to be more involved…send out a rep to see where the project is at. I think there should be more supervision."

Process Feedback

- The vast majority of those working directly with an IPC rep are highly satisfied, in some cases even calling out their representative by name.
  - ✓ There is a general consensus that when an IPC rep is involved, they tend to fully drive the process. Most in these situations were not involved in the intricacies of each step (i.e., “I’m not sure about that stage of the process. My rep just handled it.”).
- Those working with contractors cite similar scenarios where the process was driven without their day-to-day involvement. However, first-time participants (who typically had less trust in their contractor), tended to push for more transparency/involvement.
- The one pain point stated from this process is calculated kWh savings. Some note this is integral to get a project to move forward, and can be difficult to do if left to their own devices.
- Overall, the majority of participants had good things to say about the end result of their program engagement.

“It’s nice having a program that gets us retrofitted with more modern technology”

“As far as working with Idaho Power, it was pretty easy. Idaho Power…they pretty much took care of everything for us.”

Feedback from Non-Participants

Viewpoints on Energy Efficiency

- Over half of the non-participant respondents currently have plans to upgrade to more energy efficient equipment.
- Respondents report a strong perception of energy costs rising, and believe equipment changes will be necessary to keep expenses down.
- There are three primary inhibitors to making energy efficient upgrades:

1. **Upfront costs** - High upfront cost can be difficult to justify.
2. **Uncertain ROI** - Some non-participants find ROI calculations difficult and can potentially overestimate long-term savings.
3. **Quality of the equipment** - Industrial companies with heavy machinery report skepticism to the quality of energy efficient equipment.

"Energy costs just keep rising"

1 "I don't have this mass amount of money to put into a project upfront"

2 "The savings [on an energy efficient project] were not as great as the district or public thought it would be when we put it in"

3 "Will a more efficient motor do the work we want and need to do? Will the bearings hold up?"

Program Awareness

- Only 3 of the 10 non-participants were aware of Idaho Power's Custom Efficiency Program before the interview.
  - ✓ Two were aware in name only.
  - ✓ The other knew IPC offered a "program to upgrade existing equipment," but has only used Building Efficiency and Easy Upgrades.

- Most participants unaware of the specific program are aware of incentives offered by Idaho Power.
  - ✓ None have done extensive research on programs OR recalled being contacted directly by IPC.
  - ✓ All non-participants report interest in learning more about the program.

"I was aware that they offered a variety programs, I was not aware of them in detail."

Program Appeal

- After hearing a basic description of the program, respondents gave the appeal of the program an average rating of 8 out of 10.
- ROI is the primary factor non-participants will consider before participating.
  - ✓ While respondents value more factors than ROI, the justification to corporate or bureaucratic decision-makers centers on that investment return.
- Respondents familiar with energy efficient incentives feel the Custom Efficiency program is competitive.
  - ✓ One respondent suggested a peak-demand hour incentive. The peak-demand rate would be adjusted once a project is complete.

"We would want to know the data and costs. The savings…we would look at it strictly on a financial basis."

- The expected payback period is consistent with participant findings; most look for a 1 to 2 year payback period, but 5 years is justifiable if it augments other aspects of the business (more efficient equipment, better lighting, etc.).

Engagement

- All non-participants believe they would be at least somewhat likely to participate in the Custom Efficiency program in the future.
  - ✓ It is more of a “when,” not “if” situation.
- Engagement is inhibited by awareness.
  - ✓ Very few have specific projects in mind for the program
    - Lighting is the most common upgrade mentioned.
    - They are not sure which equipment may qualify.
  - ✓ They are open to direct contact from IPC to learn more about the program and other services.
    - Idaho Power’s knowledge is seen by some as an incentive in itself.
- Non-participants have less interaction with contractors, who are a primary driver of the program.
  - ✓ Some non-participants report a more difficult decision process with conflicting priorities. It is difficult to see any project to fruition without an external force driving the project.

“I would participate in this program if I had the knowledge upfront… It’s something I could be sold on”

The Future of Custom Efficiency

Ideal IPC Outreach

- Respondents are fairly mixed when it comes to “ideal” outreach. While a few (typically from smaller companies) claim they would closely review an email or bill insert, it is generally agreed that these contact methods are usually overlooked.
  - ✓ Those from larger companies report they would not be the ones opening/reading bills, or receiving B2B email outreach from IPC
  - ✓ One participant reported he would be much more likely to notice something like this in his residential bill/email

“Unless they want to start doing regular television advertising…there’s not much [else] they can do.”

- Most admit they would pay the most attention to an in-person visit from IPC. With that in mind, IPC would have to be careful to differentiate themselves from contractor outreach, which is seen as an annoyance (or a sales pitch) to some.

Engagement Strategies

Increase Awareness

- Explain qualified equipment and answer questions
- Explain probable ROI
- Explain probable upfront cost

+

Increase Motivation

- Reach out regularly to stay relevant
- Promote energy audit services

→

Increased Participation

"I would say guidance [can drive projects]. Come out and tell us how to improve our equipment"

Participant Profile

Respondent Profile

- MDC interviewed a total of 36 energy decision-makers on their viewpoints on energy efficiency and the custom efficiency program.
  - 20 Large Commercial Custom Efficiency Participants
  - 6 Industrial Custom Efficiency Participants
  - 9 Large Custom Efficiency Non-Participants
  - 1 Industrial Custom Efficiency Non-Participant
- Respondents were recruited from a variety of industries including services, manufacturing, and retail.

Industry	Total	Participant	Non-Participant
Services	11	7	4
Manufacturing	10	7	3
Transportation, Communications, Electric, Gas, & Sanitary Service	5	4	1
Retail Trade	4	4	0
Wholesale Trade	2	2	0
Agriculture, Forestry, & Fishing	2	2	0
Mining	1	0	1
Finance, Insurance, and Real Estate	1	0	1
Total	36	26	10

Idaho Power Customer Survey

SurveyMonkey

1. Do you live in an electrically heated manufactured or mobile home?

	Response Percent	Response Count
Yes	**99.1%**	**537**
No	0.9%	5
	answered question	**542**
	skipped question	**0**

2. Do you live in a manufactured or mobile home park or on private land?

	Response Percent	Response Count
Manufactured or mobile park	32.5%	172
Private land	**66.0%**	**349**
Not sure	1.5%	8
	answered question	**529**
	skipped question	**13**

3. Do you own or rent the home you live in?

	Response Percent	Response Count
Own	**87.2%**	**463**
Rent	12.8%	68
	answered question	**531**
	skipped question	**11**

4. Approximately when was your home originally built? (Select when the building was originally constructed, not when it was remodeled, added to, or converted.)

	Response Percent	Response Count
Before 1980	**33.4%**	**153**
1980–1989	21.0%	96
1990–1999	27.9%	128
2000–2006	9.8%	45
2007–2013	4.1%	19
Not sure	3.7%	17
	answered question	**458**
	skipped question	**84**

5. What is the primary heating system used to heat this home? (Mark one)

	Response Percent	Response Count
Central furnace with ducts	**74.2%**	**395**
Space/wall heater	4.5%	24
Stove, fireplace, or fireplace insert	3.8%	20
Heat pump	13.7%	73
Other (please specify)	3.8%	20
	answered question	**532**
	skipped question	**10**

6. Prior to receiving this survey, were you aware of Idaho Power's Energy House Calls program which provides free duct sealing for electrically heated manufactured/mobile homes?

	Response Percent	Response Count
Yes	36.6%	196
No	**63.4%**	**339**
	answered question	**535**
	skipped question	**7**

7. How did you learn about the Energy House Calls program provided? (Check all that apply)

	Response Percent	Response Count
Letter/postcard from Idaho Power	**53.1%**	**103**
Door hanger/flyer from Idaho Power	3.1%	6
Promotional material in Idaho Power bill	36.6%	71
Idaho Power website	2.6%	5
Idaho Power employee	3.6%	7
Heating and cooling specialist	3.1%	6
Church/senior center	3.6%	7
Facebook/social media	0.0%	0
Not sure	7.7%	15
Other (please specify)	7.2%	14
	answered question	**194**
	skipped question	**348**

8. What were your reasons for not participating in Idaho Power's Energy House Calls program? (Check all that apply)

	Response Percent	Response Count
Did not see the benefit of doing so	11.5%	20
Landlord declined	1.1%	2
Planned to move	2.9%	5
Was not offered the service	9.2%	16
Did not fully understand the program	24.7%	43
Not eligible for the program	6.9%	12
Did not know it was free	26.4%	46
Other (please specify)	**38.5%**	**67**
	answered question	**174**
	skipped question	**368**

9. How would you prefer Idaho Power communicate with you about programs and issues impacting your bill? (Check all that apply)

	Response Percent	Response Count
Community events	1.8%	9
Promotional material in Idaho Power bill	48.2%	248
Newsletter	23.2%	119
Letter or postcard in the mail	**60.9%**	**313**
Website	4.7%	24
Newspaper advertisement	1.9%	10
Social media (Facebook and Twitter)	2.7%	14
Other (please specify)	4.9%	25
	answered question	**514**
	skipped question	**28**

10. Based on what you know of the program, how likely would you be to participate in the Energy House Calls program?

	Response Percent	Response Count
Very likely	**50.1%**	**241**
Somewhat likely	33.5%	161
Somewhat unlikely	6.4%	31
Very unlikely	10.0%	48
	answered question	**481**
	skipped question	**61**

11. Using a scale of 1 to 5 where "1" means Not Very Motivating and "5" means Very Motivating, rate the following items based on their ability to motivate you to participate in the Energy House Calls program or any other energy efficiency program.

	Not Very Motivating 1	2	3	4	Very Motivating 5	Rating Count
Lower energy costs	3.4% (17)	1.4% (7)	4.3% (22)	9.5% (48)	**81.5% (413)**	507
Increased comfort	2.9% (14)	2.9% (14)	10.0% (49)	17.3% (85)	**67.0% (329)**	491
Reduced maintenance	2.9% (14)	3.5% (17)	10.4% (50)	16.9% (81)	**66.3% (318)**	480
No/Low cost to participate	3.1% (15)	3.1% (15)	4.1% (20)	12.4% (60)	**77.2% (372)**	482
Safer home environment	3.5% (17)	3.3% (16)	8.6% (42)	14.0% (68)	**70.6% (343)**	486
					answered question	**510**
					skipped question	**32**

12. Which of the following best describes your age?

		Response Percent	Response Count
Under 18		0.0%	0
18–24		0.8%	4
25–34		5.8%	31
35–44		9.8%	52
45–60		26.6%	141
Over 60		**57.1%**	**303**
		answered question	**531**
		skipped question	**11**

13. What is the highest level of education you have completed?

	Response Percent	Response Count
Less than high school	10.4%	54
High school or equivalent	30.4%	158
Some college/technical school	**43.5%**	**226**
4-year college degree	8.7%	45
Some graduate courses	2.9%	15
Graduate degree	4.2%	22
	answered question	**520**
	skipped question	**22**

14. Please provide any additional comments you have about Idaho Power's Energy House Calls program.

	Response Count
	147
answered question	**147**
skipped question	**395**

ENERGY HOUSE CALLS Survey

1. How did you learn about the Energy House Calls program provided by Idaho Power? (Check all that apply)

	Response Percent	Response Count
Letter/postcard from Idaho Power	**35.7%**	**51**
Door hanger/flyer from Idaho Power	2.8%	4
Promotional material in Idaho Power bill	30.1%	43
Idaho Power website	4.9%	7
Idaho Power employee	11.9%	17
Heating and cooling specialist	5.6%	8
Church/senior center	2.1%	3
Facebook/social media	0.7%	1
Not sure	2.1%	3
Other (please specify)	13.3%	19
	answered question	**143**
	skipped question	**0**

2. What were your reasons for participating in Idaho Power's Energy House Calls program? (Check all that apply)

	Response Percent	Response Count
Landlord suggested participation	4.2%	6
Reduce energy costs	**92.3%**	**131**
Receive free duct sealing	44.4%	63
Improve comfort	40.8%	58
Other (please specify)	2.1%	3
	answered question	**142**
	skipped question	**1**

3. Have you noticed any change in the comfort of your home since participating in the Energy House Calls program?

	Response Percent	Response Count
Yes	**57.4%**	**81**
No	20.6%	29
Not sure	22.0%	31
	answered question	**141**
	skipped question	**2**

4. How has the comfort of your home changed since you participated in the Energy House Calls program?

	Response Percent	Response Count
Much better	**53.1%**	**43**
Somewhat better	44.4%	36
Somewhat worse	2.5%	2
Much worse	0.0%	0
	answered question	**81**
	skipped question	**62**

5. What company provided the service to your home? (Name can be found on the furnace sticker)

	Response Percent	Response Count
Gale Insulation	**53.3%**	**72**
HEET	11.1%	15
Not sure	31.1%	42
Other (please specify)	4.4%	6
	answered question	**135**
	skipped question	**8**

6. Please rate the service specialist that completed the work in your home on the following statements using a scale of 1 to 5 where "1" means you Strongly Disagree with the statement and "5" means you Strongly Agree with the statement.

	Strongly Disagree 1	2	3	4	Strongly Agree 5	Rating Count
Arrived at scheduled time	4.9% (7)	2.1% (3)	2.1% (3)	12.7% (18)	**78.2% (111)**	142
Was courteous	6.3% (9)	0.7% (1)	0.7% (1)	10.6% (15)	**81.7% (116)**	142
Was professional	7.1% (10)	0.7% (1)	0.0% (0)	12.1% (17)	**80.0% (112)**	140
Did a thorough job	6.4% (9)	2.8% (4)	2.8% (4)	13.5% (19)	**74.5% (105)**	141
Left property in condition expected	7.7% (11)	1.4% (2)	1.4% (2)	13.4% (19)	**76.1% (108)**	142
Explained the work being done	4.3% (6)	2.8% (4)	2.8% (4)	12.8% (18)	**77.3% (109)**	141
					answered question	**143**
					skipped question	**0**

7. How useful was the Idaho Power informational material the contractor left behind?

		Response Percent	Response Count
Very useful		31.6%	42
Somewhat useful		**49.6%**	**66**
Not very useful		5.3%	7
Not useful at all		4.5%	6
Contractor did not leave any information		9.0%	12
		answered question	**133**
		skipped question	**10**

8. How easy was it for you to participate in Idaho Power's Energy House Calls program?

	Response Percent	Response Count
Very easy	**85.7%**	**120**
Somewhat easy	11.4%	16
Somewhat difficult	2.1%	3
Very difficult	0.7%	1
	answered question	**140**
	skipped question	**3**

9. How satisfied are you with your overall experience with the Energy House Calls program?

	Response Percent	Response Count
Very satisfied	**81.3%**	**113**
Somewhat satisfied	11.5%	16
Somewhat dissatisfied	3.6%	5
Very dissatisfied	3.6%	5
	answered question	**139**
	skipped question	**4**

10. How likely would you be to recommend the Energy House Calls program to friends or family members?

	Response Percent	Response Count
Very likely	**87.8%**	**122**
Somewhat likely	7.9%	11
Somewhat unlikely	2.9%	4
Very unlikely	1.4%	2
	answered question	**139**
	skipped question	**4**

11. Do you live in a manufactured or mobile home park or on private land?

	Response Percent	Response Count
Manufactured or mobile park	30.0%	42
Private land	**68.6%**	**96**
Not sure	1.4%	2
	answered question	**140**
	skipped question	**3**

12. Do you own or rent the home you live in?

	Response Percent	Response Count
Own	**88.5%**	**123**
Rent	11.5%	16
	answered question	**139**
	skipped question	**4**

13. Which of the following best describes your age?

	Response Percent	Response Count
Under 18	0.0%	0
18–24	0.7%	1
25–34	8.5%	12
35–44	13.5%	19
45–60	22.0%	31
Over 60	**55.3%**	**78**
	answered question	**141**
	skipped question	**2**

14. What is the highest level of education you have completed?

	Response Percent	Response Count
Less than high school	10.0%	14
High school or equivalent	27.9%	39
Some college/technical school	**42.1%**	**59**
4-year college degree	12.9%	18
Some graduate courses	2.9%	4
Graduate degree	4.3%	6
	answered question	**140**
	skipped question	**3**

15. Please provide any additional comments about Idaho Power's Energy House Calls program.

	Response Count
	65
answered question	**65**
skipped question	**78**

SPRING 2014

IDAHO POWER
ENERGY WISE® PROGRAM SUMMARY REPORT

SUBMITTED BY:
RESOURCE ACTION PROGRAMS®

RESOURCEACTION
PROGRAMS

Idaho Power Energy Wise®
Program Summary Report
Spring 2014

Made possible by:

IDAHO POWER®

An IDACORP Company

Submitted by:

RESOURCEACTION PROGRAMS

July 2014

"I enjoyed seeing my students interact and brainstorm ways they could change behaviors at home. This was a great tie in with Earth Day!"

Jen Bollinger, Teacher
Teed Elementary

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"I appreciated having a student guide for every student. We were able to practice highlighting and note taking strategies. The program provided a variety of strategies to try."

Charise Balmer, Teacher
Indian Hills Elementary

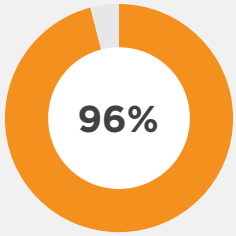
Executive Summary

Resource Action Programs (RAP) is pleased to present this Program Summary Report to Idaho Power which summarizes the Spring 2014 Idaho Power Energy Wise® Program. The program was implemented in the Idaho Power service area in the state of Idaho by 3,822 teachers, students, and their families.

The following pages provide an overview of the program and materials, outline of program implementation, introduction to the program team, description of program enhancements, impact of the program, and summary of results from the home activities. In addition to this information, evaluations, letters, and comments are provided for a glimpse into actual participant feedback. Lastly, projected savings from the individual measures found within the Energy Wise Kit are also included.

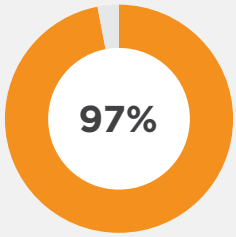
Participant Satisfaction

A successful program excites and engages participants. Students, parents, and teachers are asked to evaluate the program and provide personal comments. A sample of the feedback is given in the margin. ›



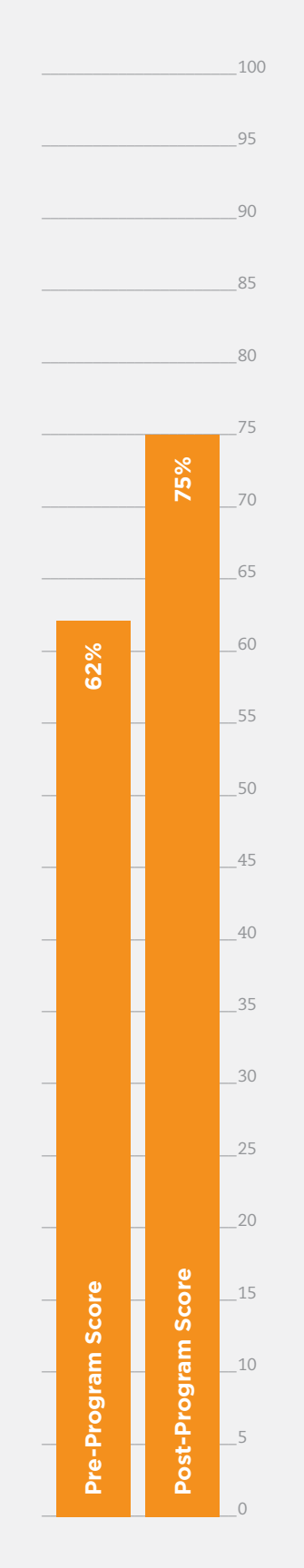
Teachers who indicated parents supported the program.

Teachers who indicated they would recommend this program to other colleagues.



Teachers who indicated they would conduct this program again.

A summary of responses can be found in Appendix D.



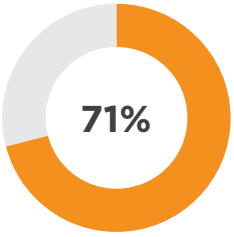
Knowledge Gained

Identical tests were administered to the students prior to the program and again upon program completion to measure knowledge gained. Scores and subject knowledge improved from **62%** to **75%**.

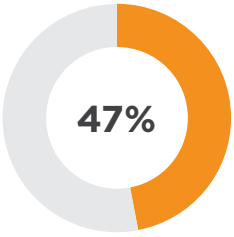
Data Obtained

Home surveys were taken by students and their families, which collected household demographic and consumption data along with program participation information.

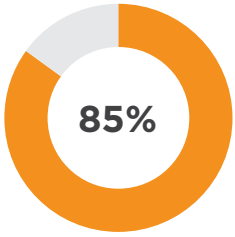
A summary of responses can be found in Appendix B.



Students who reported that their family home is owned.



Students who reported that their water is heated by electricity.

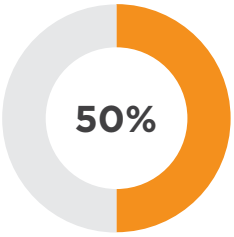


Students who reported that their home has a dishwasher.

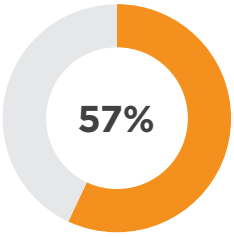
Measures Installed

Students completed take-home activities as part of the program and reported on the kit measures they installed in their homes.

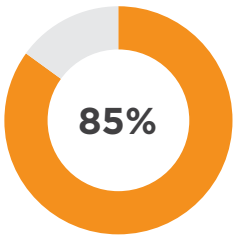
A summary of responses can be found in Appendix B.



Students who reported they installed the High-Efficiency Showerhead.



Students who reported they installed the 13-watt CFL.



Students who reported they installed the LED Night Light.

Energy and Water Savings Results

In addition to educating students and their parents, a primary program goal is to generate cost-effective energy and water savings. Student home surveys not only provided the data used in the savings projections, but also reinforced the learning benefits.

Projected Resource Savings

A list of assumptions and formulas used for these calculations can be found in Appendix A.

PROJECTED ANNUAL SAVINGS	
6,835,242	gallons of water saved
855,443	kWh of electricity saved
28,094	therms of gas saved
6,835,242	gallons of wastewater saved

PROJECTED TEN YEAR SAVINGS	
68,352,424	gallons of water saved
8,490,862	kWh of electricity saved
280,940	therms of gas saved
68,352,424	gallons of wastewater saved

PROJECTED ANNUAL SAVINGS PER HOME	
1,788	gallons of water saved
224	kWh of electricity saved
7	therms of gas saved
1,788	gallons of wastewater saved

PROJECTED TEN YEAR SAVINGS PER HOME	
17,884	gallons of water saved
2,222	kWh of electricity saved
74	therms of gas saved
17,884	gallons of wastewater saved

"The program was successful and I liked the discussions that occurred when reading the material. The students learned a lot about conserving energy."

Kate Van Tassel, Teacher
Snake River Elementary

Community Education Representatives

Liz Haugee, Russ Weedon, Pam Compton, Andie Falconburg and Claudia Tremelling

Program Overview

The Idaho Power Energy Wise® Program, a school-based energy efficiency education program, is designed to generate immediate and long-term resource savings by bringing interactive, real-world education home to students and their families. The Spring 2014 program was taught in grades 4, 5 and 6 in the Idaho Power service area.

The Idaho Power program team identifies and enrolls students and teachers within the designated service area. The program physically begins with classroom discussions in a Student Guide that provide the foundations of using energy and water efficiently, followed by hands-on, creative, problem solving activities led by the classroom teacher.

All program materials support state and national academic standards to allow the program to fit easily into a teacher's existing curriculum and requirements. The participating classroom teachers follow the Teacher Book and lesson plan. Information is given to guide lessons throughout the program in order to satisfy each student's individual needs, whether they are visual, auditory, or kinesthetic learners.

The Energy Wise Kit and Student Workbook comprise the take-home portion of the program. Students receive a kit containing high-efficiency measures they use to install within their homes. With the help of their parents/guardians, students install the kit measures and complete a home survey. The act of installing and monitoring new energy efficiency devices in their homes allows students to put their learning into practice. Here, participants and their parents/guardians realize actual energy savings within their home, benefitting two generations.

A critical element of RAP program design is the use of new knowledge through reporting. At the end of the program, the Idaho Power program team tabulates all participant responses—including home survey information, teacher responses, student letters, and parent feedback—and generates this Program Summary Report.

"It is good to get kids involved at such a young age, they are the power consumers of our future."

Hilary Helter, Parent
Fruitland Elementary School

Program Materials

Each participant in the Idaho Power Energy Wise® Program receives classroom materials and energy efficiency kits containing high-efficiency measures to perform the program's take-home activities. Program materials for students, parents/guardians, and teachers are outlined below.

Each Student/Teacher Receives

Student Guide

Student Workbook

Parent Letter/Pledge Form*

Student Survey Form

Certificate of Achievement

Energy Wise Kit containing:

- High-Efficiency Showerhead*
- 13-watt Compact Fluorescent Lamp
- 18-watt Compact Fluorescent Lamp
- 23-watt Compact Fluorescent Lamp
- Shower Timer
- Digital Thermometer*
- FilterTone® Alarm*
- LED Night Light
- Flow Rate Test Bag
- Natural Resource Fact Chart
- Parent/Guardian Program Evaluation

Idaho Power "Get Wise" Wristband

Website Access at:

http://www.idahopower.com/wise

Toll-Free HELP Line

Each Teacher/Classroom Receives

Teacher Book

Step-by-Step Program Checklist

Lesson Plans

Idaho State and National Academic Standards Chart

Extra Activities

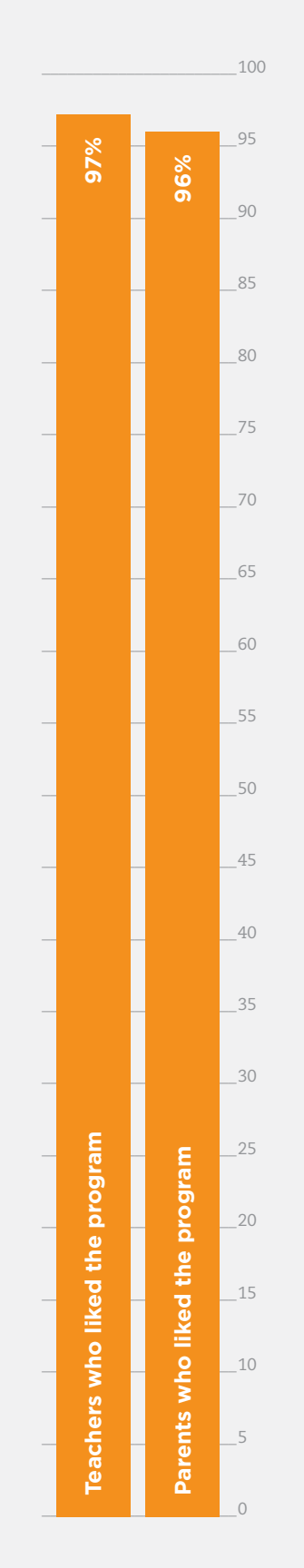
Teacher Program Evaluation

Pre/Post Student Survey Answer Keys

Electricity Generation Poster

Self-Addressed Postage-Paid Envelope

** Materials / Installation Instructions provided in English and Spanish*



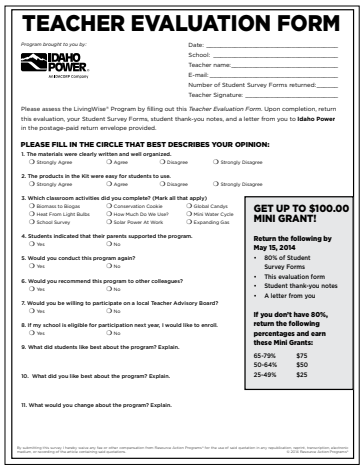
Custom Branding

In addition to increasing resource awareness and efficiency, the program has been designed to strengthen bonds between Idaho Power and the community. One of the steps taken to ensure the greatest possible exposure is to feature Idaho Power branding with custom design and color scheme in each Energy Wise Kit. The Student Guide, Student Workbook, Teacher Book, Teacher Program Evaluation, Parent/Guardian Program Introduction Letter, Installation DVD, Quick Start Guide, and Certificate of Achievement also feature Idaho Power custom branding. In addition to the program materials, a custom website was also created to help increase interest, interactivity, and implementation of the Idaho Power Energy Wise Program. As an added benefit to Idaho Power, a cross-marketing Residential Energy Efficiency Handout was created to help promote other Idaho Power energy-efficiency programs.

Website

Residential Energy Efficiency Handout

Program Materials



TEACHER EVALUATION FORM

Program brought to you by:

IDAHO POWER. An IDACORP Company

Date: _____
School: _____
Teacher name: _____
E-mail: _____
Number of Student Survey Forms returned: _____
Teacher Signature: _____

Please assess the LivingWise® Program by filling out this *Teacher Evaluation Form*. Upon completion, return this evaluation, your Student Survey Forms, student thank-you notes, and a letter from you to **Idaho Power** in the postage-paid return envelope provided.

PLEASE FILL IN THE CIRCLE THAT BEST DESCRIBES YOUR OPINION:

1. The materials were clearly written and well organized.
❍ Strongly Agree ❍ Agree ❍ Disagree ❍ Strongly Disagree

2. The products in the Kit were easy for students to use.
❍ Strongly Agree ❍ Agree ❍ Disagree ❍ Strongly Disagree

3. Which classroom activities did you complete? (Mark all that apply)
❍ Biomass to Biogas ❍ Conservation Cookie ❍ Global Candyo
❍ Heat From Light Bulbs ❍ How Much Do We Use? ❍ Mini Water Cycle
❍ School Survey ❍ Solar Power At Work ❍ Expanding Gas

4. Students indicated that their parents supported the program.
❍ Yes ❍ No

5. Would you conduct this program again?
❍ Yes ❍ No

6. Would you recommend this program to other colleagues?
❍ Yes ❍ No

7. Would you be willing to participate on a local Teacher Advisory Board?
❍ Yes ❍ No

8. If my school is eligible for participation next year, I would like to enroll.
❍ Yes ❍ No

9. What did students like best about the program? Explain.

10. What did you like best about the program? Explain.

11. What would you change about the program? Explain.

GET UP TO $100.00 MINI GRANT!

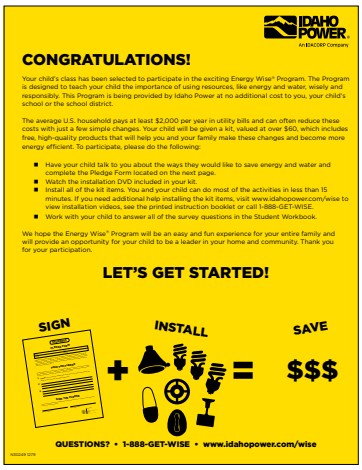
Return the following by May 15, 2014
- 80% of Student Survey Forms
- This evaluation form
- Student thank-you notes
- A letter from you

If you don't have 80%, return the following percentages and earn these Mini Grants:

65-79%	$75
50-64%	$50
25-49%	$25

By submitting this survey I hereby waive any fee or other compensation from Resource Action Programs® for the use of said quotation in any republication, reprint, transcription, electronic medium, or recording of this article, including said quotation. © 2014 Resource Action Programs®

Teacher Evaluation Form



IDAHO POWER. An IDACORP Company

CONGRATULATIONS!

Your child's class has been selected to participate in the exciting Energy Wise® Program. The Program is designed to teach your child the importance of using resources, like energy and water, wisely and responsibly. This Program is being provided by Idaho Power at no additional cost to you, your child's school or the school district.

The average U.S. household pays at least $2,000 per year in utility bills and can often reduce these costs with just a few simple changes. Your child will be given a kit, valued at over $60, which includes free, high-quality products that will help you and your family make these changes and become more energy efficient. To participate, please do the following:

- Have your child talk to you about the ways they would like to save energy and water and complete the Pledge Form located on the next page.
- Watch the installation DVD included in your kit.
- Install all of the kit items. You and your child can do most of the activities in less than 15 minutes. If you need additional help installing the kit items, visit www.idahopower.com/wise to view installation videos, see the printed instruction booklet or call 1-888-GET-WISE.
- Work with your child to answer all of the survey questions in the Student Workbook.

We hope the Energy Wise® Program will be an easy and fun experience for your entire family and will provide an opportunity for your child to be a leader in your home and community. Thank you for your participation.

LET'S GET STARTED!

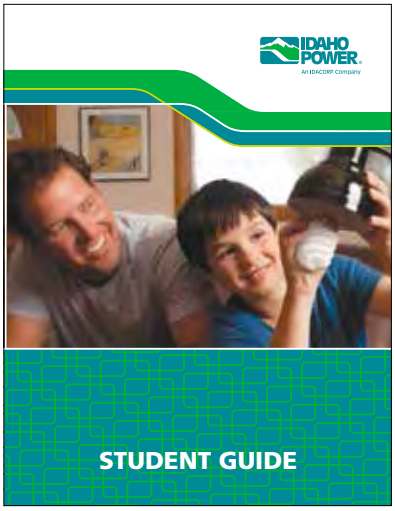
SIGN INSTALL SAVE

$$$

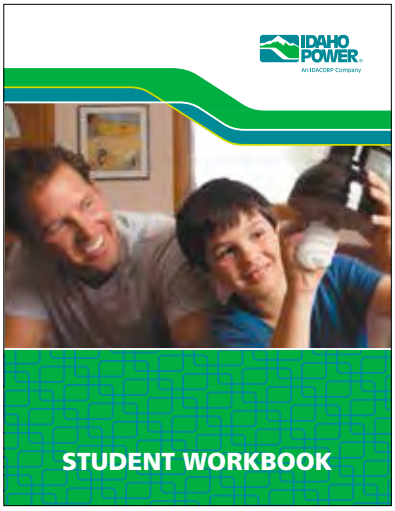
QUESTIONS? • 1-888-GET-WISE • www.idahopower.com/wise

Parent Letter

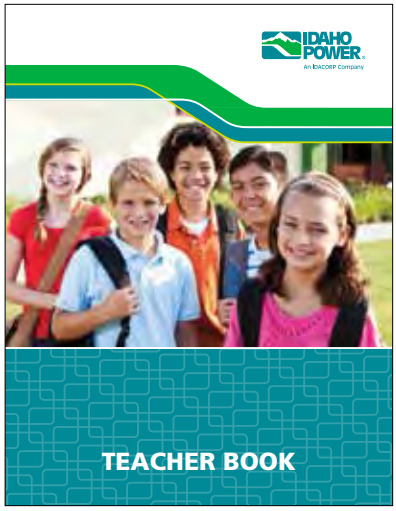
Teacher Incentive Flier



Student Guide



Student Workbook



Teacher Book

Certificate of Achievement

Kit Box

"Exposure! They had no idea about any of it!"

Rebecca Franks, Teacher
Endeavor School

Program Implementation

The Spring 2014 Idaho Power Energy Wise® Program followed this comprehensive implementation schedule:

1. Identification of Idaho state and national academic standards & benchmarks
2. Curriculum development and refinement (completed annually)
3. Curriculum correlation to Idaho state and national academic standards & benchmarks
4. Materials modification to incorporate Idaho Power branding
5. Incentive program development
6. Teacher/school identification—with Idaho Power approval
7. Teacher outreach and program introduction
8. Teachers enrolled in the program individually
9. Implementation dates scheduled with teachers
10. Program material delivered to coincide with desired implementation date
11. Delivery confirmation
12. Periodic contact to ensure implementation and teacher satisfaction
13. Program completion incentive offered
14. Results collection
15. Program completion incentive delivered to qualifying participants
16. Thank-you cards sent to participating teachers
17. Data analysis
18. Program Summary Report generated and distributed

Participating teachers are free to implement the program to coincide with their lesson plans and class schedules. Appendix C provides a comprehensive list of classrooms in grades 4, 5 and 6 that participated during the Spring Semester of the 2013-2014 school year.

For more than 20 years, Resource Action Programs (RAP) has designed and implemented Measure Based Education℠ programs that inspire change in household energy and water use while delivering significant, measurable resource savings. All RAP programs feature a proven blend of innovative education, comprehensive implementation services, and hands-on activities to put efficiency knowledge to work in students' homes.

RAP has a strong reputation for providing a high level of client service as part of a wide range of energy efficiency education solutions for utilities, municipalities, states, community agencies, corporations, and more. In 2013, RAP was the only conservation services provider honored by the American Council for an Energy-Efficient Economy (ACEEE) and the Alliance for Water Efficiency (AWE) as one of 12 top programs that provides sustained achievement. RAP was honored for market penetration, innovative design, and its ability to achieve substantial/sustained energy and water savings.

ACEEE
American Council for an Energy-Efficient Economy

Alliance for Water Efficiency

Program Team

RAP implements nearly 300 individual programs that serve more than 550,000 households each year. All-inclusive program delivery occurs in its 80,000 square-foot Nevada Program Center where implementation teams and support departments work together to provide:

- 1:1 teacher support
- Curriculum development
- Customized materials
- Data tracking and reporting
- Energy and water efficiency measures
- Graphic and web design
- Kit assembly
- Marketing communications
- Shipping
- Printing
- Program management
- Participant enrollment
- Warehousing

The Implementation Team

For the Idaho Power Energy Wise Program, RAP assigned a specific implementation team to Idaho Power made up of a PMP®-designated Program Manager; CEM®-designated energy analyst, graphic designer, outreach personnel, educator, and administrative staff. This team immersed themselves into the Idaho Power brand, and handled all program implementation for Idaho Power. Idaho Power also received the benefit of fully staffed support departments which worked with the implementation team to define success for Idaho Power. These departments include education, marketing, information technology, and warehouse/logistics.

Continuous Improvement

In addition to successful implementation of the Idaho Power Energy Wise Program, RAP engages in continuous program improvement, as well as enhancements to educational materials, with modifications based on emerging technology, industry trends, and EM&V findings.

As part of this plan, RAP utilizes an extensive network of educators for program feedback. This feedback ensures that educational components meet the changing needs of educators, keep information relevant to students, and, in turn, provide increased energy literacy amongst program participants.

"They liked working with their families. Several students got to do things they haven't done before such as change light bulbs, showerheads, etc."

Kris Carte, Teacher
Greenhurst Elementary School

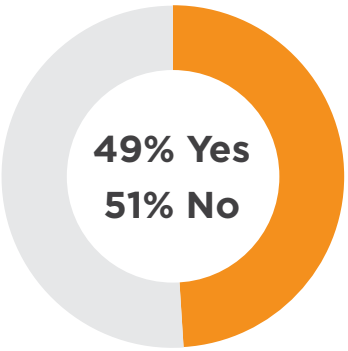
Program Impact

The Idaho Power Energy Wise® Program has had a significant impact within the community. As illustrated below, the program successfully educated participants about energy and water efficiency while generating resource savings through the installation of efficiency measures in homes. Home survey information was collected to track projected savings and provide household consumption and demographic data. Program evaluations and comments were collected from teachers, students and parents. The following program elements were used to collect this data:

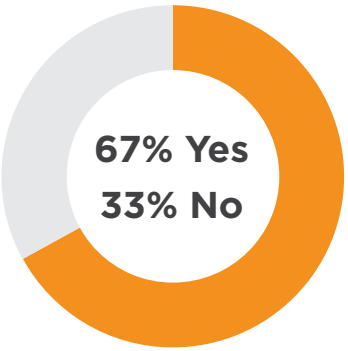
A. Home Survey

Upon completion of the program, participating families are asked to complete a home survey to assess their resource use, verify product installation, provide demographic information and measure participation rates. A few samples of questions asked are below while a complete summary of all responses is included in the appendices.

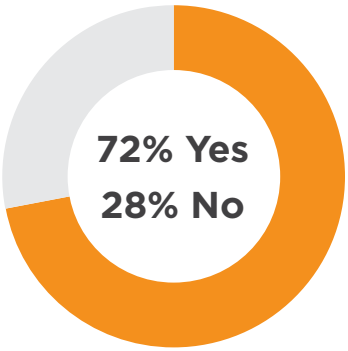
Did your family install the 18-watt Compact Fluorescent Lamp (CFL)?	**Yes - 57%**
Did your family change the way they use water?	**Yes - 72%**
Did your family change the way they use energy?	**Yes - 67%**



Students who indicated they installed the 18-watt Compact Flourescent Lamp (CFL).



Students who indicated their family changed the way they use water.

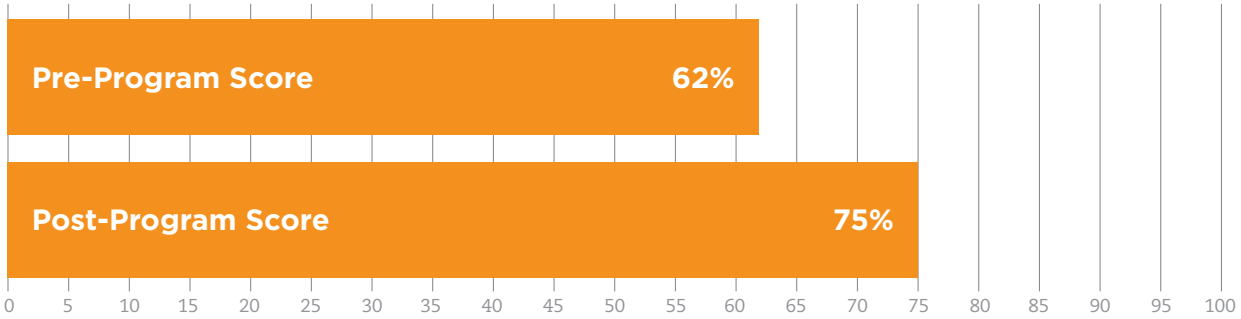


Students who indicated their family changed the way they use energy.

B. Pre-Program and Post-Program Tests

Students were asked to complete a 10-question test before the program was introduced, and then again after it was completed to determine the knowledge gained through the program. The average student answered **6.2** questions correctly prior to being involved in the program and then improved to answer **7.5** questions correctly following participation.

Scores improved from 62% to 75%



C. Home Activities

As part of the program, parents and students installed resource efficiency measures in their homes. They also measured the pre-existing devices to calculate savings that they generated. Using the family habits collected from the home survey as the basis for this calculation, 3,822 households are expected to save the following resource totals. Savings from these actions and new behaviors will continue for many years to come.

Projected Resource Savings

A list of assumptions and formulas used for these calculations can be found in Appendix A.

Number of Participants:	**3,822**		
	Annual	**Lifetime**	
Projected reduction from Showerhead retrofit:	**6,835,242**	**68,352,424**	gallons
Product Life: **10 years**	**422,131**	**4,221,309**	kWh
	23,801	**238,010**	therms
Projected reduction from **13** Watt Compact Fluorescent Lamp (CFL):	**100,147**	**976,422**	kWh
Product Life: **10,000 hours**			
Projected reduction from **18** Watt Compact Fluorescent Lamp (CFL):	**81,174**	**791,437**	kWh
Product Life: **10,000 hours**			
Projected reduction from **23** Watt Compact Fluorescent Lamp (CFL):	**72,856**	**710,342**	kWh
Product Life: **10,000 hours**			
Projected reduction from LED Night Light retrofit:	**92,490**	**924,905**	kWh
Product Life: **10,000 hours**			
Projected reduction from FilterTone® installation:	**86,645**	**866,448**	kWh
Product Life: **10 years**	**4,293**	**42,930**	therms
TOTAL PROGRAM SAVINGS:	**6,835,242**	**68,352,424**	gallons
	855,443	**8,490,862**	kWh
	28,094	**280,940**	therms
TOTAL PROGRAM SAVINGS PER HOUSEHOLD:	**1,788**	**17,884**	gallons
	224	**2,222**	kWh
	7	**74**	therms

D. Teacher Program Evaluation

Program improvements are based on participant feedback received. One of the types of feedback obtained is from participating teachers via a Teacher Program Evaluation Form. They are asked to evaluate relevant aspects of the program, and each response is reviewed for pertinent information. The following is feedback from the Teacher Program Evaluation for the Idaho Power Energy Wise Program.

Teacher Response

(A summary of responses can be found in Appendix D)

97% of participating teachers indicated they would conduct the program again given the opportunity.

100% of participating teachers indicated they would recommend the program to their colleagues.

In my opinion, the thing the students like best about the program/materials is:

"That it was about them. They could see that these were subjects that affect them."
Theresa Giery, Emmett Middle School

"They liked working with their families. Several students got to do things they haven't done before such as change light bulbs, showerheads, etc."
Kris Carte, Greenhurst Elementary School

"The loved getting the kits. Many this year were excited about a 'nice' showerhead."
Tricia Hemsley, Claude A. Wilcox Elementary School

"The surprise and finding out how much money they can help their parents save."
Steve Thompson, Ustick Elementary School

"Students don't get to do a lot of science so they loved that there were experiments for home and school."
Erin Ewalt, Sacajawea Elementary School

"They enjoyed installing the shower head because people got wet. They were able to work with their parents."
Carole Harshman, Emmett Middle School

"Completing a project as a family."
Kris Pfaff, Ponderosa Elementary School

"Installing and using the student workbook to see how much they save."
Jami Rushing, Owyhee Elementary

"To help our families save energy and money. The kit and working with family."
Stormi McCarthy, Hagerman Elementary School

"Having actual items to install at home — the hands on activities."
Kathy Pound, Valley View Elementary School

Teacher Response

(A summary of responses can be found in Appendix D)

In the future, one thing I would like to change would be:

"Can't think of any changes."
Ron Cowman, Amity Elementary School

"Two separate student survey forms — one for school and one for home."
Amanda Puckett, Owyhee Elementary

"I like it as is."
Gena Chaney, Lewis & Clark Elementary

"The student forms have to be taken home in the beginning and the end. It's challenging to get them back after they've already received their kits. Maybe just a different strategy?"
Kristy Simpson, Sacajawea Elementary School

"I was just very pleased with the program. However, earlier in the school year would work better for teaching this unit."
Linda Langley, Fruitland Elementary School

As a teacher, the aspect of the program/materials I liked best was:

"I appreciated having a student guide for every student. We were able to practice highlighting and note taking strategies. The program provided a variety of strategies to try."
Charise Balmer, Indian Hills Elementary

"How it explained everything in detail at school and home. The extra sheet (correlations) explaining all the common core areas being taught."
Stormi McCarthy, Hagerman Elementary School

"Exposure! They had no idea about any of it!"
Rebecca Franks, Endeavor School

"I enjoyed seeing my students interact and brainstorm ways they could change behaviors at home. This was a great tie in with Earth Day!"
Jen Bollinger, Teed Elementary

"Awareness for students' real life application of conservation teaching."
Kiley Crill, Crimson Point Elementary

"I loved the reinforcement activities and experiments! Time for some science!"
Aimee Stocks, Sacajawea Elementary School

"I like using the student guide as a consumable that kids can be taught study skills in such as highlighting main ideas."
Tricia Hemsley, Claude A. Wilcox Elementary School

E. Parent/Guardian Program Evaluation

Parent involvement with program activities and their children is of paramount interest to both utilities and teachers in the program. When parents take an active role in their child's education it helps the schools and strengthens the educational process considerably. When students successfully engage their families in retrofit, installation, and home energy efficiency projects, efficiency messages have been powerfully delivered to two generations in the same household. The program is a catalyst for this family interaction, which is demonstrated by feedback from Parent/Guardian Program Evaluations in each program. The following is feedback from the Parent/Guardian Program Evaluations for the Idaho Power Energy Wise Program.

Parent Response

(A summary of responses can be found in Appendix E)

100% of participating parents indicated that the program was easy to use.

100% of participating parents indicated they would continue to use the kit items after the completion of the program.

97% of participating parents indicated they would like to see this program continued in local schools.

As a parent, which aspect of the Program did you like best?

"Going through how you can be more energy efficient by just changing a few small things, like light bulbs or shower heads."
Carol Szews, Fruitland Elementary School

"The shower head, flow bag, shower timer, and night light. Items that our child uses personally so changes hit home."
Charity Mullenaux, Fruitland Elementary School

"All the tools and gadgets that helped calculate energy and save on energy."
Marc and Michelle French, Fruitland Elementary School

"I love the fact that you are teaching kids to be more efficient."
Rhonda Jimenez, Fruitland Elementary School

"Doing small projects with my daughter and seeing her face light-up and hearing her say 'this is kinda fun.'"
April Smith, Greenhurst Elementary School

"Kids were able to visualize just how quickly water usage adds up. They know they can make a difference."
Kay Ramsey, Leadore School

"Son's new found enthusiasm to be a part of the solution."
Leslie M. Krause, North Star Charter School

"I like that the program taught my child to be more aware of energy use, it did it better than listening to me."
Katie Kent, Stoddard Elementary School

Parent Response

(A summary of responses can be found in Appendix E)

"A fun project to do with your child. Good dialogue about energy use and waste."
Magnuson, Amity Elementary School

"How excited my child was to use and try everything in the kit."
Amber Bridgewater, Fruitland Elementary School

"That my daughter was excited to talk to her family about what she learned."
Andria and Sam Hainey, Fruitland Elementary School

"The fact that the children were able to be actively involved. My child was very excited."
Christi Garman, Fruitland Elementary School

"How excited my child got about saving energy. He now sleeps with the night light in the hallway instead of having the bathroom light on all night."
Hilary Helter, Fruitland Elementary School

"I liked that my daughter was excited about the kit and wanted us to use them to save money."
Kathy Boyd, Fruitland Elementary School

"The shower timer, because children don't realize how much water and power is being used."
kelly Frates, Fruitland Elementary School

"I liked that it educated the kids about energy conservation and that it also taught them about conserving water."
Tisha Presher, Fruitland Elementary School

"Liked that someone else was teaching the children to reduce and conserve. They get tired of mom and dad."
Kim Cato, Hagerman Elementary School

"The fridge and freezer temperature. We found out that our fridge was broken."
Kermit Bunde, Indian Hills Elementary

"The hands on experience — user friendly and informative."
Michelle Brack, Longfellow Elementary School

Are there any comments you would like to express to your child's Program Sponsor?

"Good to get kids involved at such a young age, they are the power consumers of our future."
Hilary Helter, Fruitland Elementary School

"This program is an excellent way to teach our children and the parents to be aware of wasteful habits and become energy efficient! Thanks again!"
Melissa Hinkey, Fruitland Elementary School

F. Teacher Letters

(A summary of responses can be found in Appendix F)

To Whom It May Concern:
Idaho Power, Power Wise Program 2014

Thank you for the opportunity to expand our students' understanding and exposure to the need to be "energy wise." As an educator I have a front row seat to both experientially and philosophically facilitating a future citizenry that will be equipped with the knowledge and experience to leave our country and planet better that they received it. I think this facilitation was accomplished well through our recent completion of the Idaho Power's Energy Wise program.

The students shared both their likes and dislikes with me; therefore, I would like the opportunity to provide feedback that will hopefully help improve the effort to impart knowledge in a lasting way for this program. When asked what they liked, they were quickly came to light the common thread of the activities being the most influential component. Whether it was the Shower Head activity giving them the feel of an engineer in testing or the simple shower timer drawing light on their overuse of water, the activities where the catalyst for much of their learning. Some of the students mentioned that they did not like the dime start nature of the energy efficient bulbs. Although, this was a good opportunity for a discussion as to why they were designed with that feature, they were less likely to want to use a bulb with a dim start function. Finally, the students stated that the activity book was easy to follow and the mathematics steps were simple to calculate.

Overall the positives outweighed the negatives in this programs and I would highly recommend its future implementation in order to impart energy wise ideals to our Nation's future.

Sincerely,

Nick Channer
Willow Creek Elementary
Nampa School District

Teacher Letters

(A summary of responses can be found in Appendix F)

Krista Campos
5th Grade
Wilcox Elementary
427 Lark Lane
Pocatello, ID 83201

Idaho Power
Get Wise Resource Action Programs
976 United Circle
Sparks, NV 89431

Re: Idaho Power Energy Wise Student Kits

To whom it may concern:

Thank you for providing the Idaho Power Kits for our classroom learning this year. Once the students began working in the student guide, they were excited to receive the workbook and kit and begin implementing the program at home. Our class took four weeks to work and study through the program. Students were especially excited to share as they installed the new shower head and the night light.

The information provided in the study guide is well organized. Our class focused on the skill of main idea and detail as we highlighted text and summarized information. The four student worksheet pages are a good assessment of the key concepts in each chapter. The "Conservation Cookie" was a fun activity for students to see the importance of using resources wisely.

This program is a benefit to our school curriculum. As a first year participant in the program, I would definitely like to participate again, and would recommend it to other teachers as well.

Again, thank you for providing this resource to our class and for supporting student education and knowledge.

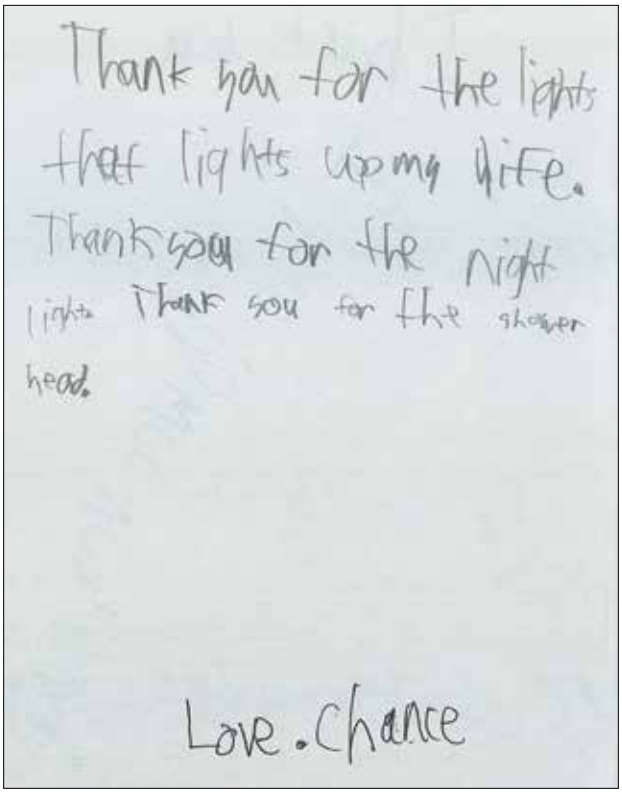
Sincerely,

Krista Campos

Krista Campos

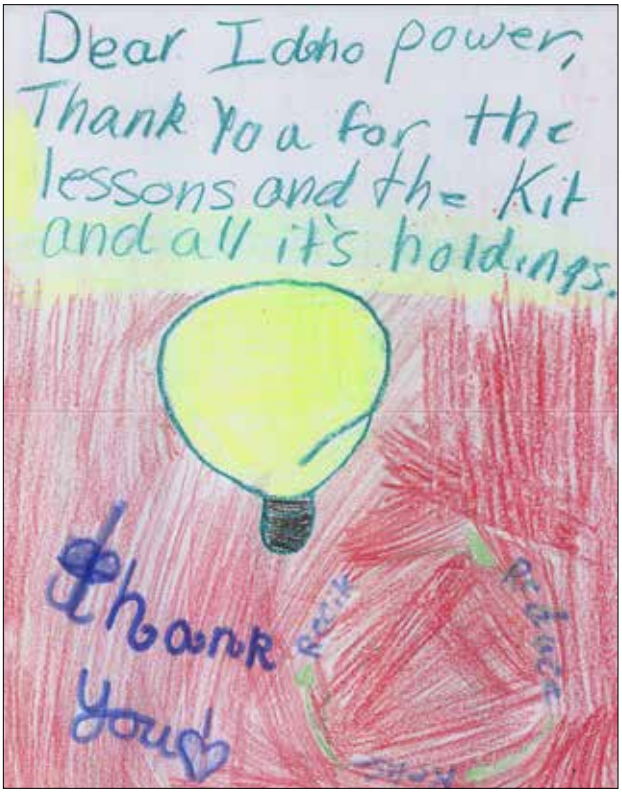
G. Student Letters

(A summary of responses can be found in Appendix G)

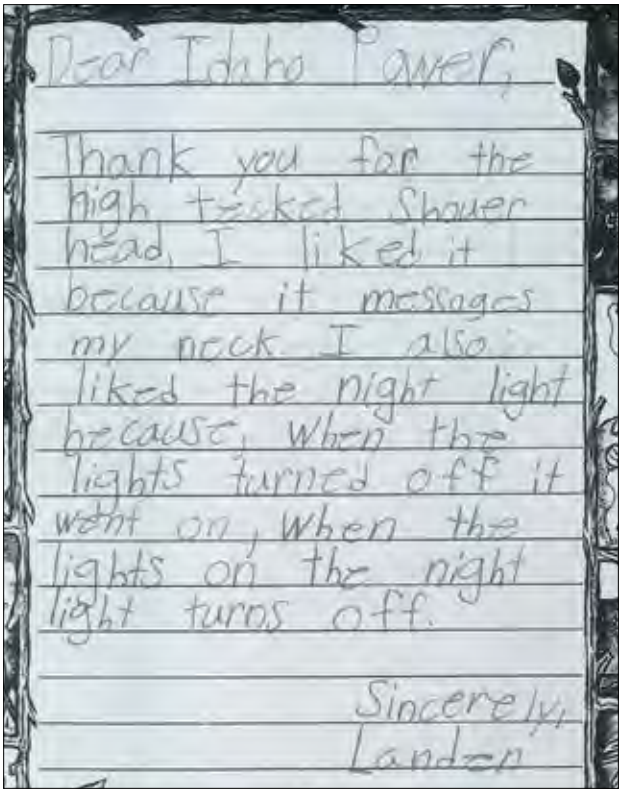

Thank you for the lights that lights up my life. Thank you for the night lights Thank you for the shower head.

Love. Chance

Thank you, I Idaho Power!


Dear Idaho power, Thank you for the lessons and the Kit and all it's holdings.

Thank You!


Dear Idaho Power,

Thank you for the high tecked Shower head, I liked it because it messages my neck. I also liked the night light because, when the lights turned off it went on, when the lights on the night light turns off.

Sincerely,
Landen

Student Letters

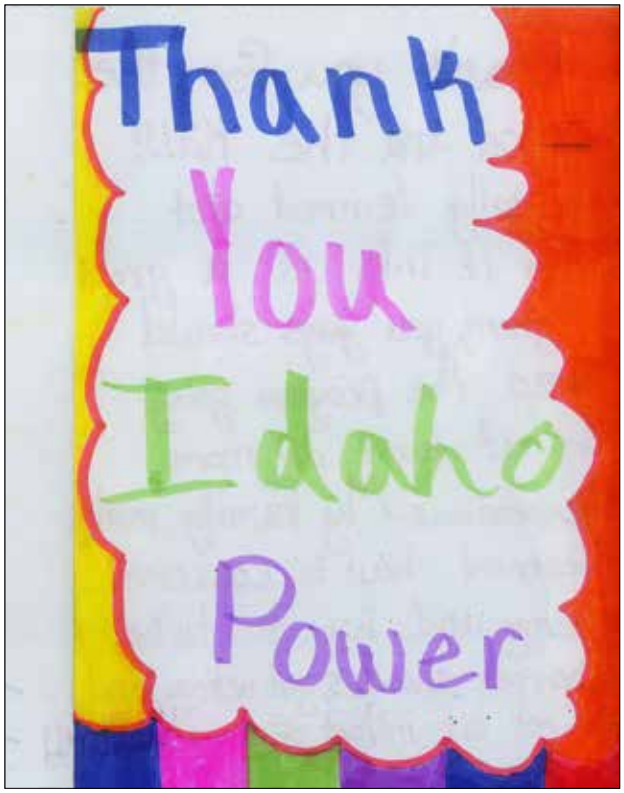
(A summary of responses can be found in Appendix G)

Josceline

Hi im Josceline. It was so fun with the kit. the shower timer I use it all the time! the Led night light lit up my Hole Bedroom. the shower Head was cugn cooler! my old shower Head was Bad it feel gusing at me like gallons of water on your head! But the new shower head was perfect! it flows right throw my hair like mash mellows. the CD was helpful to my mom my Dad. well thats it. I hope you do this next year. Bye! =^)

Your friend

Josceline



Dear, Idaho Power

Idaho Power, thank you for the kit. I really like the kit. I'm pretty sure it will save us alot of money. And thank you for giving us the robot handbook. And for letting us know about nonrenewable and renewable resources. And thank you for the showerhead we really needed. And for telling us how to use energy wisely.

Sincerely,

Reynaldo

Student Letters

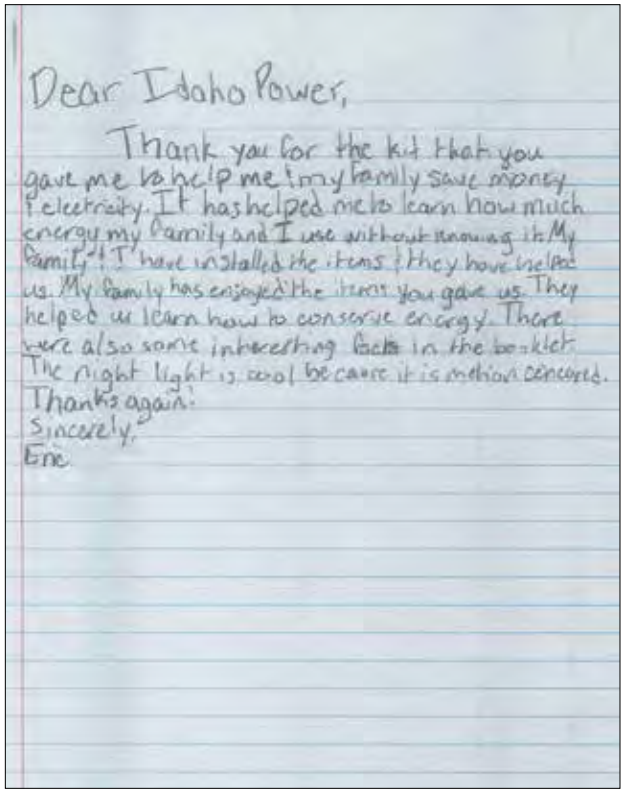
(A summary of responses can be found in Appendix G)

Idaho Power,
Thank you!
you've helped my family save so much money now my parents can actually can pay buy treats for us! ☺ your kits are made to help save energy and save money. The thing I liked the most was the shower head it made the water pressure slower which used less energy and less water. The night light was very useful to my mom every night. She can't see when she gets up with the twins. The night light helped my mom. Another thing I liked out of the kits was the lights. They were dimmer but they saved energy. Thanks again!

Sincerely,

Jade

Bold Lexie



Dear Idaho Power,

Thank you for the kit that you gave me to help me & my family save money & electricity. It has helped me to learn how much energy my family and I use without knowing it. My family & I have installed the items & they have helped us. My family has enjoyed the items you gave us. They helped us learn how to conserve energy. There were also some interesting facts in the booklet. The night light is cool because it is motion concered. Thanks again.
Sincerely,
Eric

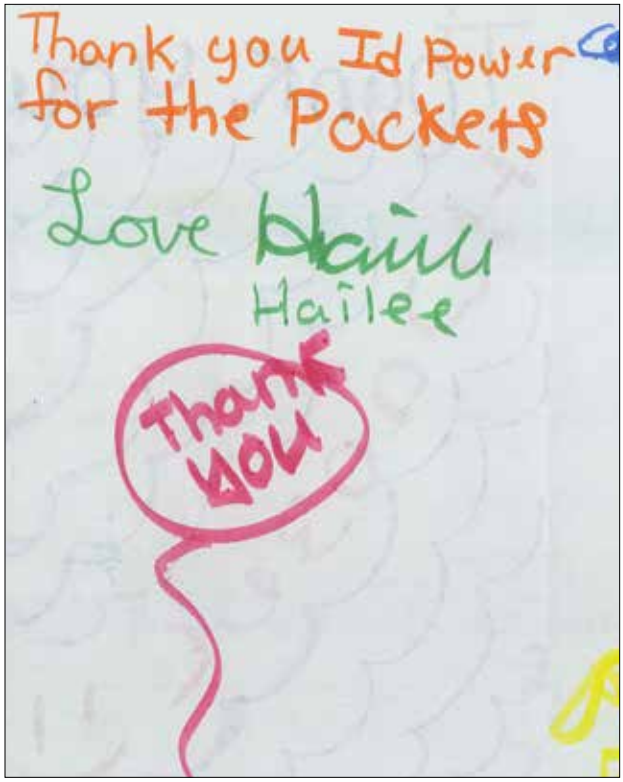
Student Letters

(A summary of responses can be found in Appendix G)

Dear Idaho power,

Thank you for the kits they rocked! They are very helpful and I will use them. My family will use it too. We will save alot from this. I hope other families will use the kit too. I also learned a lot about conserving resorces, being energy wise, and why that's important. I'm having fun trying out the activities in the kit. I hope other kids year after year get a kit too. They can start conserving.

Sincerely,
Chiba



Dear Idaho Power

Thank you for sending those kit for us they were cool and awsome. And I'm glad that you're helping us and every body on this state. These are the kit that I like that I like inside of that box, EVERYTHING. Those are the writtings that I wrote. And have a good time. Keep up the good work ... YOU ROCK

Sincerly
Moises

"Students don't get to do a lot of science so they loved that there were experiments for home and school."

Erin Ewalt, Teacher
Sacajawea Elementary School

Appendices

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Projected Savings from Showerhead Retrofit

Showerhead retrofit inputs and assumptions:

Average household size:	**5.15**	people[1]
Average number of full bathrooms per home:	**2.05**	full bathrooms per home[1]
% of water heated by gas:	**53%**	[1]
% of water heated by electricity:	**47%**	[1]
Installation / participation rate of:	**50%**	[1]
Average Showerhead has a flow rate of:	**1.98**	gallons per minute[1]
Retrofit Showerhead has flow rate of:	**1.27**	gallons per minute[1]
Number of Participants:	**3,822**	[1]
Shower duration:	**8.20**	minutes per day[2]
Showers per day per person:	**0.67**	showers per day[2]
Product life:	**10**	years[3]

Projected Water Savings:

Showerhead retrofit projects an **annual** reduction of:	**6,835,242**	gallons[4]
Showerhead retrofit projects a **lifetime** reduction of:	**68,352,424**	gallons[5]
Projected Electricity Savings:		
Showerhead retrofit projects an **annual** reduction of:	**422,131**	kWh[2,6]
Showerhead retrofit projects a **lifetime** reduction of:	**4,221,309**	kWh[2,7]

Projected Natural Gas Savings:

Showerhead retrofit projects an **annual** reduction of:	**23,801**	therms[2,8]
Showerhead retrofit projects a **lifetime** reduction of:	**238,010**	therms[2,9]

1 Data Reported by Program Participants.

2 (March 4, 2010). EPA WaterSense® Specification for Showerheads Supporting Statement. Retrived from http://www.epa.gov/WaterSense/docs/showerheads_finalsuppstat508.pdf

3 Provided by manufacturer.

4 [(Average Household Size x Shower Duration x Showers per Day per Person) ÷ Average Number of Full Bathrooms per Home] x (Average Showerhead Flow Rate - Retrofit Showerhead Flow Rate) x Number of Participants x Installation Rate x 365 days

5 [(Average Household Size x Shower Duration x Showers per Day per Person) ÷ Average Number of Full Bathrooms per Home] x (Average Showerhead Flow Rate - Retrofit Showerhead Flow Rate) x Number of Participants x Installation Rate x 365 days x Product Life

6 Projected Annual Water Savings x Percent of Water that is Hot Water x 0.18 kWh/gal x % of Water Heated by Electricity

7 Projected Annual Water Savings x Percent of Water that is Hot Water x 0.18 kWh/gal x % of Water Heated by Electricity x Product Life

8 Projected Annual Water Savings x Percent of Water that is Hot Water x 0.009 Therms/gal x % of Water Heated by Natural Gas

9 Projected Annual Water Savings x Percent of Water that is Hot Water x 0.009 Therms/gal x % of Water Heated by Natural Gas x Product Life

Projected Savings from FilterTone® Alarm Installation

FilterTone® installation inputs and assumptions:

Annual energy (electricity) use by a central air conditioner:	**4,467**	kWh[1]
Annual energy (natural gas) use by a central space heating or furnace:	**421**	therms[1]
Projected increase in efficiency (electricity):	**1.75%**	[2]
Projected increase in efficiency (natural gas):	**0.92%**	[2]
Product life:	**10**	years[3]
Installation / participation rate of:	**29%**	[4]
Number of participants:	**3,822**	[4]

Projected Electricity Savings:

The FilterTone installation projects an **annual** reduction of:	**86,645**	kWh[5]
The FilterTone installation projects a **lifetime** reduction of:	**866,448**	kWh[6]

Projected Natural Gas Savings:

The FilterTone installation projects an **annual** reduction of:	**4,293**	therms[7]
The FilterTone installation projects a **lifetime** reduction of:	**42,930**	therms[8]

1 U.S. Department of Energy, Energy Information Administration 2005 Residential Energy Consumption Web site for Mountain West States: http://www.eia.gov/consumption/residential/data/2005/

2 Reichmuth P.E., Howard. (1999). Engineering Review and Savings Estimates for the 'Filtertone' Filter Restriction Alarm.

3 Provided by manufacturer.

4 Data reported by program participants.

5 Annual energy (electricity) use by a central air conditioner, heat pump or furnace x Projected increase in efficiency (electricity) x Installation rate x Number of participants

6 Annual energy (electricity) use by a central air conditioner, heat pump or furnace x Projected increase in efficiency (electricity) x Installation rate x Number of participants x Product life

7 Annual energy (natural gas) use by a central air conditioner, heat pump or furnace x Projected increase in efficiency (natural gas) x Installation rate x Number of participants

8 Annual energy (natural gas) use by a central air conditioner, heat pump or furnace x Projected increase in efficiency (natural gas) x Installation rate x Number of participants x Product life

Projected Savings from 13-Watt CFL Retrofit

CFL retrofit inputs and assumptions:

Product life:	**10,000**	hours[1]
Watts used by the compact fluorescent light bulb:	**13**	watts[1]
Hours of operation per day:	**2.81**	hours per day[2]
Watts used by the replaced incandescent light bulb:	**57.82**	watts
Installation / participation rate of:	**57%**	[3]
Number of Participants:	**3,822**	[3]

Projected Electricity Savings:

The CFL retrofit projects an **annual** reduction of:	**100,147**	kWh[2,4]
The CFL retrofit projects a **lifetime** reduction of:	**976,422**	kWh[2,5]

1 Provided by manufacturer.

2 Frontier Associates. (2011). Oncor's LivingWise Program: Measurement & Verification Update.

3 Data reported by program participants.

4 {[(Wattage of incandescent light bulb replaced - Wattage of compact fluorescent light bulb) x Hours of operation per day x 365 Days] ÷ 1,000} x Number of participants x Installation rate

5 {[(Wattage of incandescent light bulb replaced - Wattage of compact fluorescent light bulb) x Product Life] ÷ 1,000} x Number of participants x Installation rate

Projected Savings from 18-Watt CFL Retrofit

CFL retrofit inputs and assumptions:

Product life:	**10,000**	hours[1]
Watts used by the compact fluorescent light bulb:	**18**	watts[1]
Hours of operation per day:	**2.81**	hours per day[2]
Watts used by the replaced incandescent light bulb:	**60.26**	watts
Installation / participation rate of:	**49%**	[3]
Number of Participants:	**3,822**	[3]

Projected Electricity Savings:

The CFL retrofit projects an **annual** reduction of:	**81,174**	kWh[2,4]
The CFL retrofit projects a **lifetime** reduction of:	**791,437**	kWh[2,5]

1 Provided by manufacturer.

2 Frontier Associates. (2011). Oncor's LivingWise Program: Measurement & Verification Update.

3 Data reported by program participants.

4 {[(Wattage of incandescent light bulb replaced - Wattage of compact fluorescent light bulb) x Hours of operation per day x 365 Days] ÷ 1,000} x Number of participants x Installation rate

5 {[(Wattage of incandescent light bulb replaced - Wattage of compact fluorescent light bulb) x Product Life] ÷ 1,000} x Number of participants x Installation rate

Projected Savings from 23-Watt CFL Retrofit

CFL retrofit inputs and assumptions:

Product life:	**10,000**	hours[1]
Watts used by the compact fluorescent light bulb:	**23**	watts[1]
Hours of operation per day:	**2.81**	hours per day[2]
Watts used by the replaced incandescent light bulb:	**65.24**	watts
Installation / participation rate of:	**44%**	[3]
Number of Participants:	**3,822**	[3]

Projected Electricity Savings:

The CFL retrofit projects an **annual** reduction of:	**72,856**	kWh[2,4]
The CFL retrofit projects a **lifetime** reduction of:	**710,342**	kWh[2,5]

1 Provided by manufacturer.

2 Frontier Associates. (2011). Oncor's LivingWise Program: Measurement & Verification Update.

3 Data reported by program participants.

4 {[(Wattage of incandescent light bulb replaced - Wattage of compact fluorescent light bulb) x Hours of operation per day x 365 Days] ÷ 1,000} x Number of participants x Installation rate

5 {[(Wattage of incandescent light bulb replaced - Wattage of compact fluorescent light bulb) x Product Life] ÷ 1,000} x Number of participants x Installation rate

Projected Savings from LED Night Light Retrofit

Energy Efficient Night Light retrofit inputs and assumptions:

Average length of use:	**4,380**	hours per year[1]
Average night light uses:	**7**	watts
Retrofit night light uses:	**0.5**	watts
Product life:	**10**	years[2]
Energy saved per year:	**28**	kWh per year
Energy saved over life expectancy:	**285**	kWh
Installation / participation rate of:	**85%**	[3]
Number of Participants:	**3,822**	[3]

Projected Electricity Savings:

The Energy Efficient Night Light retrofit projects an **annual** reduction of:	**92,490**	kWh
The Energy Efficient Night Light retrofit projects a **lifetime** reduction of:	**924,905**	kWh

1 Assumption (12 hours per day)

2 Product life provided by manufacturer

3 Data reported by program participants

Home Check-Up

1 What type of home do you live in?

Single Family Home (Mobile)	8%
Single Family Home (Manufactured)	9%
Single Family Home (Built)	68%
Multi-Family (2-4 units)	10%
Multi-Family (5-20 units)	4%
Multi-Family (21+ units)	1%

2 Was your home built before 1992?

Yes	40%
No	60%

3 Is your home owned or rented?

Owned	71%
Rented	29%

4 How many kids live in your home (age 0-17)?

1	10%
2	31%
3	27%
4	17%
5+	15%

5 How many adults live in your home (age 18+)?

1	10%
2	71%
3	12%
4	5%
5+	2%

6 Does your home have a programmable outdoor sprinkler system?

Yes	64%
No	36%

7 Does your home have a programmable thermostat?

Yes	73%
No	27%

Due to rounding of numbers, percentages may not add up to 100%

Home Check-Up

(continued)

8 What is the main source of heating in your home?

Natural Gas	47%
Electric Heater	37%
Propane	4%
Heating Oil	1%
Wood	7%
Other	4%

9 What type of air conditioning unit do you have?

Central Air Conditioner	70%
Evaporative Cooler	6%
Room Unit	13%
Don't Have One	10%

10 Does your home have a Dishwasher?

Yes	85%
No	15%

11 How many half-bathrooms are in your home?

0	61%
1	31%
2	5%
3	2%
4+	1%

12 How many full bathrooms are in your home?

1	21%
2	58%
3	16%
4	4%
5+	1%

13 How many toilets are in your home?

1	15%
2	45%
3	31%
4	7%
5+	3%

14 How is your water heated?

Natural Gas	53%
Electricity	47%

Due to rounding of numbers, percentages may not add up to 100%

Home Activities

1 What is the flow rate of your old showerhead?

0 - 1.0 GPM	12%
1.1 - 1.5 GPM	18%
1.6 - 2.0 GPM	24%
2.1 - 2.5 GPM	22%
2.6 - 3.0 GPM	16%
3.1+ GPM	9%

2 Did you install the new High-Efficiency Showerhead?

Yes	50%
No	50%

3 If you answered "yes" to question 2, what is the flow rate of your new showerhead?

0 - 1.0 GPM	25%
1.1 - 1.5 GPM	41%
1.6 - 2.0 GPM	34%

4 Did you use the Shower Timer?

Yes	79%
No	21%

5 Did your family install the 13-watt Compact Fluorescent Lamp (CFL)?

Yes	57%
No	43%

6 If you answered "yes" to question 5, what is the wattage of the incandescent bulb you replaced?

40-watt	22%
60-watt	42%
75-watt	13%
100-watt	8%
Other	15%

7 Did your family install the 18-watt Compact Fluorescent Lamp (CFL)?

Yes	49%
No	51%

8 If you answered "yes" to question 7, what is the wattage of the incandescent bulb you replaced?

40-watt	15%
60-watt	37%
75-watt	25%
100-watt	7%
Other	17%

Due to rounding of numbers, percentages may not add up to 100%

Home Activities

(continued)

9 Did your family install the 23-watt Compact Fluorescent Lamp (CFL)?

Yes	44%
No	56%

10 If you answered "yes" to question 9, what is the wattage of the incandescent bulb you replaced?

40-watt	13%
60-watt	28%
75-watt	20%
100-watt	21%
Other	18%

11 Did your family install the FilterTone® Alarm?

Yes	29%
No	71%

12 How much did your family turn down the thermostat in winter for heating?

1 - 2 Degrees	15%
3 - 4 Degrees	20%
5+ Degrees	15%
Didn't Adjust Thermostat	50%

13 How much did your family turn up the thermostat in summer for cooling?

1 - 2 Degrees	16%
3 - 4 Degrees	17%
5+ Degrees	16%
Didn't Adjust Thermostat	52%

14 Did you install the LED Night Light?

Yes	85%
No	15%

15 Did your family lower your water heater settings?

Yes	27%
No	73%

16 Did your family raise the temperature on your refrigerator?

Yes	16%
No	84%

17 Did you complete the optional online energy use activity?

All of it	5%
Some of it	17%
None	78%

18 Did you work with your family on this Program?

Yes	72%
No	28%

Home Activities

(continued)

19 Did your family change the way they use water?

Yes	67%
No	33%

20 Did your family change the way they use energy?

Yes	72%
No	28%

21 How would you rate the Idaho Power Energy Wise® Program?

Great	47%
Pretty Good	33%
Okay	17%
Not So Good	3%

Participant List

SCHOOL	TEACHER	T	S
American Falls Intermediate School	Kristen Jensen	1	6
Amity Elementary School	Sharon Shaw	1	40
Amity Elementary School	Ron Cowman	1	29
Amity Elementary School	Susie Cox	1	30
Barbara Morgan STEM Academy	Melissa Webb	1	27
Barbara Morgan STEM Academy	Ricky Clark	1	27
Barbara Morgan STEM Academy	Wendy Fortner	1	23
Central Elementary School	John Harlan	1	60
Claude A. Wilcox Elementary School	Tricia Hemsley	1	21
Claude A. Wilcox Elementary School	Hailey Herron	1	20
Claude A. Wilcox Elementary School	Kyle Crawford	1	22
Claude A. Wilcox Elementary School	Krista Campos	1	20
Council Elementary School	Courtney Fisher	1	54
Crimson Point Elementary	Becky Sobolewski	1	24
Crimson Point Elementary	Rochelle Killett	1	25
Crimson Point Elementary	Kiley Crill	1	26
Crimson Point Elementary	Mickie Barrett	1	27
Crimson Point Elementary	Michael Pletcher	1	28
Edahow Elementary School	Jodi Carlson	1	25
Edahow Elementary School	Patty Nystrom	1	24
Ellis Elementary School	Aaron Hall	1	26
Ellis Elementary School	Sherry VanEvery	1	24
Ellis Elementary School	Mike Gornichec	1	24

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

SCHOOL	TEACHER	T	S
Emmett Middle School	Theresa Giery	1	62
Emmett Middle School	Carole Harshman	1	58
Emmett Middle School	Wendy Garz	1	62
Endeavor School	Rebecca Franks	1	102
Frontier Elementary	Amanda Jermann	1	32
Frontier Elementary	Mary Koch	1	33
Fruitland Elementary School	Linda Langley	1	32
Fruitland Elementary School	Stacy Wescott	1	28
Fruitland Elementary School	Teresa Wilson	1	28
Fruitland Elementary School	Heather Heitz	1	32
Fruitland Elementary School	Darlene Ingebritsen	1	30
Galileo STEM Academy	Jolene Gunn	1	30
Galileo STEM Academy	Jennifer Sebesta	1	28
Galileo STEM Academy	Beth Bivens	1	30
Greenhurst Elementary School	Kris Carte	1	30
Greenhurst Elementary School	Tami Ashley	1	29
Hagerman Elementary School	Stormi McCarthy	1	16
Homedale Middle School	David Hann	1	91
Horseshoe Bend Elementary School	Suzette Womack	1	22
I.B. Perrine Elementary School	Paula Schreiner	1	30
Indian Hills Elementary	Mark Bowman	1	28
Indian Hills Elementary	Joyce Pearson	1	28
Indian Hills Elementary	Bridget Durante	1	28

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

SCHOOL	TEACHER	T	S
Indian Hills Elementary	Charise Balmer	1	28
Iowa Elementary	Thea Marie	1	31
Iowa Elementary	Carrie Goldsmith	1	33
Iowa Elementary	Jill Noble	1	33
Lake Ridge Elementary School	Deanna Menssen	1	35
Lake Ridge Elementary School	James Bright	1	35
Lake Ridge Elementary School	Laura Crawford	1	33
Lakevue Elementary School	Brenda Maggard	1	25
Lakevue Elementary School	Debbie Vermaat	1	25
Lakevue Elementary School	Kimberly Reinecker	1	22
Lakevue Elementary School	Heather Stanton	1	22
Leadore School	Melody Kauer	1	13
Lewis & Clark Elementary	Kim Silveria	1	33
Lewis & Clark Elementary	Gena Chaney	1	15
Longfellow Elementary School	Michelle Fluckiger	1	22
Longfellow Elementary School	Emily Hammond	1	22
Marsing Middle School	Shontel Jarvis	1	74
Midvale Elementary School	Tonya Holmes	1	16
Midvale Elementary School	Vickie Warren	1	25
North Star Charter School	Joan Rosenbaum	1	35
North Star Charter School	Julie Handyside	1	34
North Star Charter School	Casey Hawkins	1	36
Ola Elementary School	Amy McBryde	1	9

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

SCHOOL	TEACHER	T	S
Oregon Trail Elementary School	Julie Delia	1	25
Oregon Trail Elementary School	Sherie Keyt	1	22
Oregon Trail Elementary School	Tammy Holmes	1	25
Oregon Trail Elementary School	Amanda Busby	1	25
Owyhee Elementary	Jami Rushing	1	28
Owyhee Elementary	Amanda Puckett	1	28
Owyhee Elementary	Ellie Elli	1	28
Ponderosa Elementary School	Kris Pfaff	1	28
Ponderosa Elementary School	Maribeth Yeates	1	28
Ponderosa Elementary School	Kelli Lemken	1	28
Ponderosa Elementary School	Elizabeth Lejardi	1	28
Purple Sage Elementary School	Brad Fackrell	1	27
Reed Elementary	Cindy Berg	1	30
Reed Elementary	Michaele Fonnesbeck	1	30
Reed Elementary	Arielle Jensen	1	28
Reed Elementary	Susan Hoiland	1	15
Sacajawea Elementary School	Kristy Simpson	1	25
Sacajawea Elementary School	Aimee Stocks	1	25
Sacajawea Elementary School	Melissa Binford	1	25
Sacajawea Elementary School	Erin Ewalt	1	26
Sacajawea Elementary School	Debbie Olsen	1	27
Sacajawea Elementary School	Lisa Smith	1	26
Salmon Middle School	Krystal Smith	1	23

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

SCHOOL	TEACHER	T	S
Salmon Middle School	Jean Hadlock	1	23
Silver Trail Elementary School	Justin Burgess	1	31
Silver Trail Elementary School	Dan Blitman	1	30
Silver Trail Elementary School	Dan Hoehne	1	30
Snake River Elementary	Kelly Langford	1	25
Snake River Elementary	Stephanie Lothrop	1	26
Snake River Elementary	Kate Van Tassel	1	25
Snake River Elementary	Suzan Racchetto-Madrigal	1	28
St. Joseph's Catholic School	Kelly Weaver	1	15
St. Joseph's Catholic School	Carolynne Joy	1	16
Stoddard Elementary School	Kimberly Buck	1	28
Stoddard Elementary School	Kristin Barrus	1	28
Stoddard Elementary School	Jay Miles	1	29
Teed Elementary	Brandy Roberts	1	22
Teed Elementary	Tessa Libby	1	23
Teed Elementary	Amber Healey	1	22
Teed Elementary	RaNae Jones	1	33
Teed Elementary	Jen Bollinger	1	33
Teed Elementary	Jerri Amendola	1	33
Ustick Elementary School	Steve Thompson	1	28
Ustick Elementary School	Lori Murphy	1	27
Ustick Elementary School	Amy Hirsch	1	27
Valley View Elementary School	Kathy Pound	1	25

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

SCHOOL	TEACHER	T	S
Valley View Elementary School	Joan Harrie	1	26
Washington Elementary School	Heather Hahn	1	25
Washington Elementary School	Jan Damron	1	21
Washington Elementary School	Teresa O'Toole	1	22
West Canyon Elementary	Amy Mattei	1	29
West Canyon Elementary	Brenda Carrier	1	30
West Canyon Elementary	Sally VanderVeen	1	30
West Canyon Elementary	Michelle Claverie	1	30
Willow Creek Elementary School	Nick Channer	1	33
Willow Creek Elementary School	Kim Chierici	1	33
Willow Creek Elementary School	Andrea Koenig	1	33
	TOTALS	126	3696
	TOTAL PARTICIPANTS	3822	

Teacher Program Evaluation Data

1 The materials were clearly written and well organized.

Strongly Agree	69%
Agree	31%
Disagree	0%
Strongly Disagree	0%

2 The products in the Kit were easy for students to use.

Strongly Agree	45%
Agree	51%
Disagree	4%
Strongly Disagree	0%

3 Students indicated that their parents supported the program.

Yes	96%
No	4%

4 Would you conduct this Program again?

Yes	97%
No	3%

5 Would you recommend this program to other colleagues?

Yes	100%
No	0%

6 If my school is eligible for participation next year, I would like to enroll.

Yes	97%
No	3%

Due to rounding of numbers, percentages may not add up to 100%

Teacher Comment Data

(continued from page 22)

In my opinion, the thing the students like best about the program/materials is:

"The students enjoyed the classroom activities because they could participate in the activities and were better able to understand."
Kate Van Tassel, Snake River Elementary

"They liked the kits! They were excited to take them home and use the items. They enjoyed the interaction with their parents."
Joan Harrie, Valley View Elementary School

"They liked the activities that we did. They also liked the work scramble and the crossword puzzle."
Joyce Pearson, Indian Hills Elementary

"Students enjoyed the student guide along with the activity about the information"
Stacy Wescott, Fruitland Elementary School

"They loved the products they received and they liked comparing the new ones to the old ones."
Kim Chierici, Willow Creek Elementary School

"Testing each new item supplied in their kit. I had several students come back telling me how long their showers were."
Jen Bollinger, Teed Elementary

"They liked taking home the kits and sharing with their parents."
Laura Crawford, Lake Ridge Elementary School

"Receiving the materials!"
Amanda Jermann, Frontier Elementary

"The kit! Always exciting."
Deanna Menssen, Lake Ridge Elementary School

"They love helping their parents save money."
Jolene Gunn, Galileo STEM Academy

"The hands-on application."
Michaele Fonnesbeck, Reed Elementary

"The students loved learning how to save water."
Jennifer Sebesta, Galileo STEM Academy

"Materials."
Mary Koch, Frontier Elementary

Teacher Comment Data

(continued)

"They enjoyed the free materials and the labs."
Mickie Barrett, Crimson Point Elementary

"The kit for home, especially the night light and shower timer."
Kiley Crill, Crimson Point Elementary

"Everything!"
Aimee Stocks, Sacajawea Elementary School

"The students were very excited about the content of the student workbooks and the kits."
Melissa Binford, Sacajawea Elementary School

"Learning about the savings while using the lights and shower head."
David Hann, Homedale Middle School

"The students enjoyed installing the kit items and working well with their families."
Beth Bivens, Galileo STEM Academy

"Getting the box of goodies."
Tami Ashley, Greenhurst Elementary School

"They liked taking home the kits."
James Bright, Lake Ridge Elementary School

"They loved taking home the kits and working with parents to install."
Kimberly Reinecker, Lakevue Elementary School

"Receiving the kits and participating in the 'Conservation Cookie.'"
Krista Campos, Claude A. Wilcox Elementary School

"The loved all the goodies in the kit, especially the shower head and timer."
Maribeth Yeates, Ponderosa Elementary School

"Noticing the energy saving, the shower head, timer, and night light."
John Harlan, Central Elementary School

"They loved installing many items including showerhead and night light."
Ellie Elli, Owyhee Elementary

"The kits. They enjoyed installing the kit items at home with their parents."
Shontel Jarvis, Marsing Middle School

Teacher Comment Data

(continued)

In the future, one thing I would like to change would be:

"Nothing."
Deanna Menssen, Lake Ridge Elementary School

"The student guide was advanced for my students! They were fine, just had to simplify the wording."
Jami Rushing, Owyhee Elementary

"The hard words and the depth as they introduce the chapters. A little over 4th grader's knowledge."
Stormi McCarthy, Hagerman Elementary School

"Nuclear energy is hard to teach. Some parents feel CFL's are dangerous. Several thermometers did not work."
Jennifer Sebesta, Galileo STEM Academy

"Suggest video links support to topics such as conservation. If we were given links to Discovery Network it would be very helpful. All Idaho teachers have access already."
Kris Carte, Greenhurst Elementary School

"Put the practice worksheets with each chapter at the end of the chapter."
Mickie Barrett, Crimson Point Elementary

"I think it is very well done."
Melissa Binford, Sacajawea Elementary School

"Perhaps more of the supplies to perform experiments could be provided."
Tricia Hemsley, Claude A. Wilcox Elementary School

"I think the survey could be a little more parent friendly. I think many weren't returned because parents/guardians found part of the survey hard."
Maribeth Yeates, Ponderosa Elementary School

"Perhaps make it more clear to parents (on kit or on yellow paper) that this program is FREE. They don't always read carefully."
Ellie Elli, Owyhee Elementary

"More classroom activities."
Amy Mattei, West Canyon Elementary

"I'm seeing more and more families that are involved with saving energy anyway they can. We also have a great recycle program in our community. We fill four canisters per week at our school. Energy Wise is a great program."
Mark Bowman, Indian Hills Elementary

Teacher Comment Data

(continued)

As a teacher, the aspect of the program/materials I liked best was:

"How organized it was, so complete down to the last detail. Easy to put to use in the classroom, and the value/importance of subject matter."
Linda Langley, Fruitland Elementary School

"The activities which provided a great bridge between theory and application."
Nick Channer, Willow Creek Elementary School

"I like the 10 day teach plan."
Melody Kauer, Leadore School

"The lessons were easy to teach and materials were well organized."
Laura Crawford, Lake Ridge Elementary School

"The program introduced our students to concepts that we don't have time to cover. I liked the way the information was presented."
Carole Harshman, Emmett Middle School

"That it is well put together and so user friendly!"
Deanna Menssen, Lake Ridge Elementary School

"I like that I can use the kit for health and science standards."
Jolene Gunn, Galileo STEM Academy

"It was a great transition from Electricity to Ecosystems. It fit well into our curriculum."
Steve Thompson, Ustick Elementary School

"I liked the user-friendly teacher materials."
Kimberly Reinecker, Lakevue Elementary School

"The ease of implementation. All the materials are organized and ready to use."
Krista Campos, Claude A. Wilcox Elementary School

"I liked helping the kids brainstorm ways to conserve water and electricity."
Ellie Elli, Owyhee Elementary

"The program was successful and I liked the discussions that occurred when reading the material. The students learned a lot about conserving energy."
Kate Van Tassel, Snake River Elementary

"The lessons lead to other questions which we were able to explore. Rich learning environment!"
Kristy Simpson, Sacajawea Elementary School

Parent/Guardian Program Evaluation Data

1 Was the Program easy for you and your child to use?

Yes	100%
No	0%

2 Will you continue to use the Kit items after the completion of the Program?

Yes	100%
No	0%

3 Would you like to see this Program continued in local schools?

Yes	97%
No	3%

Due to rounding of numbers, percentages may not add up to 100%

Parent/Guardian Comment Data

(continued from page 24)

As a parent, which aspect of the Program did you like best?

"The excitement of our son to try to save energy."
Vikki Marie Wessner, West Canyon Elementary

"I liked that my child was involved and could help put stuff together."
Christina Wilson, Washington Elementary School

"The kit because there is high efficiency showerhead that will make my bills lower."
Laft Alharbyah, Ustick Elementary School

"I like that the results were easy for my little girl to understand and she was getting so excited as the saving went on."
Talma Siegfried, Snake River Elementary

"That it brought attention to the kids that all the things actually cost money."
Ashley Floth, Silver Trail Elementary School

"The free products and information and how excited my son was to share with the family."
Stephanie Jarvis, Salmon Middle School

"I like the filter tone alarm. That is one area we forgot to take care of."
Stephanie Crawford, Reed Elementary

"The excitement of my daughter."
Mike Cob, Reed Elementary

"Got my child's interest. The items are easy to use. The shower head is great for the kids shower."
Michelle MacBride, Reed Elementary

"My child learned about how to save energy/ water and why it is important to save energy."
Kacy Dines, Reed Elementary

"That it taught them about saving money by making simple changes."
Jessica Farrer, Reed Elementary

"Teaches kids about saving money as a family."
Anna Real, Reed Elementary

"The aspect that I like best about the program is that my student was really excited to do it all!"
Adriana Corona, Reed Elementary

"The information that it provided my child about energy efficiency and about conserving water."
Metana Flake, Horseshoe Bend Elementary School

Parent/Guardian Comment Data

(continued)

"That it helped teach the kids about helping to conserve our natural resources."
Britany Goodfellow, Greenhurst Elementary School

"We needed a new shower head, but weren't sure what to buy. This gave us a chance to use one that was efficient and quality."
Heather Hamann, Fruitland Elementary School

"How excited my child got about saving energy."
Hilary Heller, Fruitland Elementary School

"The lights because they spend less light."
Juana Ponce, Fruitland Elementary School

"Educating about energy conservation."
Landi Ray, Fruitland Elementary School

"Teaching kids and the awesome gift."
Lori Tillett, Fruitland Elementary School

"The organization."
Marjorie Hawks, Fruitland Elementary School

"The free stuff to get you started being energy efficient."
Melissa Hinkey, Fruitland Elementary School

"Teaching the kids to conserve energy."
Melissa Schledewitz, Fruitland Elementary School

"The excitement my kid had about the program and the stuff."
Mike Winward, Fruitland Elementary School

"The child understanding what conservation means."
Pete and Amy Simmons, Fruitland Elementary School

"The actual supplies available and hands on participation. The shower head is awesome."
Eva Ortiz, Greenhurst Elementary School

"The thermometer, showerhead and lightbulbs."
Emily Jensen, Hagerman Elementary School

Parent/Guardian Comment Data

(continued)

Are there any comments you would like to express to your child's Program Sponsor?

"This is a wonderful and fun way to teach kids how important it is to use energy. Thank you!"
Stacy Alexander, Emmett Middle School

"This was a great project for the children to be involved in and very generous for it to be provided."
Christi Garman, Fruitland Elementary School

"Thank you for the opportunity to try this out. It has been a great conversation to have with our family. We talk a lot about avoiding waste. This gave use a way to show them how to do that easily!"
Heather Hamann, Fruitland Elementary School

"Thank you for making a fun and helpful program."
Charity Mullenaux, Fruitland Elementary School

"Thank you for the energy saving kit and information regarding our family's energy and water usage. Our family spent an evening going through each item and the education booklet!"
Julie StClair, I.B. Perrine Elementary School

"Thank you. It was well done and our student enjoyed learning more about saving energy."
Shelley Goodfellow, Fruitland Elementary School

"Great information."
Sean McEllaney, Fruitland Elementary School

"I would just like to say thank you."
kelly Frates, Fruitland Elementary School

"All the things are good and necessary from the kit."
Juana Ponce, Fruitland Elementary School

"What a great idea to make people more aware of being able to save and how much we waste."
D Waters, Iowa Elementary

"This is a great idea so the whole family can start the conversation and each person help where they can."
Racheal Parry, North Star Charter School

"Thank you for teaching our children about saving energy."
Maira Mendel and Federiro Ayala, Reed Elementary

"I loved it! We have changed our ways and love it!"
Evan Kuenaman, Galileo STEM Academy

Teacher Letters

(continued from page 26)

May 9, 2014

To Whom It May Concern:

When my class received the materials from Idaho Power, I was amazed by the wonderful supplies we were provided. The students were thrilled to get their boxes and immediately dove in to the "At-home" activities. One of the homework assignments that we did was to measure the amount of water our showers used. Students were amazed by how much water some of our shower heads used. A few were able to convince their parents to not only install the new shower head that was provided, but to also purchase a new shower head to replace the other inefficient shower heads at home. The students were also really excited about the night light. Many reported putting it in their bathrooms at home so that their younger brothers and sisters didn't have to waste electricity by turning on the light at night to use the restroom.

Overall I was impressed by how well organized all the materials were. They were easy to understand and implement in the classroom. I found that many of the lessons aligned well with our standards and ended up being a great review of concepts that we had already learned. It was great for the students to see the relationship between science concepts and real-life. I would use this program again to reiterate to students how being energy conscious at home, can lead to being responsible about our environments. Thank you so much for allowing us to be a part of this program

Thank you,

Andrea Koenig
Willow Creek Elementary
5th grade

Teacher Letters

(continued)

May 1, 2014

Dear Idaho Power,

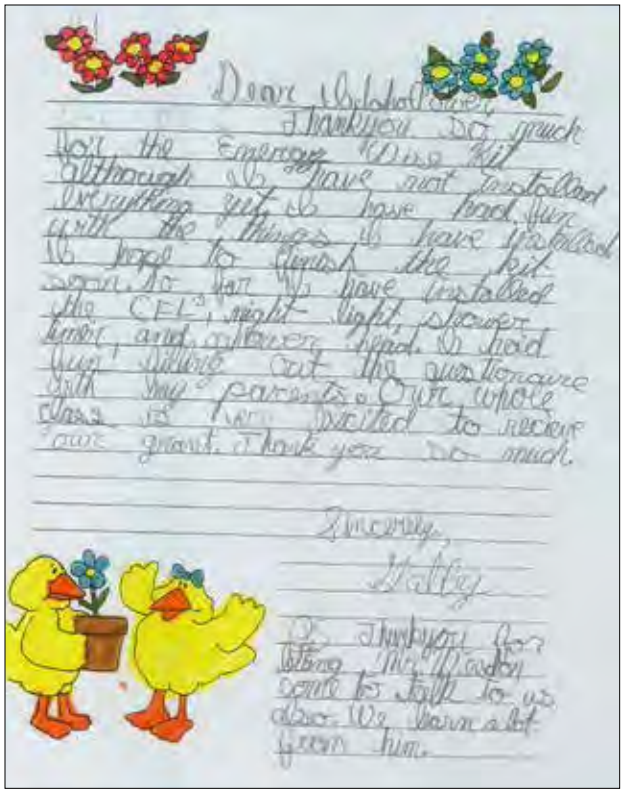
Thank you for allowing the 4th grade teachers at Amity to participate in your Energy-Wise program. My students were so excited to take their materials home and share them with their families. It was fun having discussions about how the families have made changes in their homes regarding the energy-wise materials. It tied in well with our curriculum of electricity in science and reusing, reducing, and recycling in health. Again, on behalf of the students and families here at Amity, I would like to thank you for the great kits and opportunity to make changes in our lives that are so beneficial. I am retiring next year, and will not be able to continue using your program in the future.

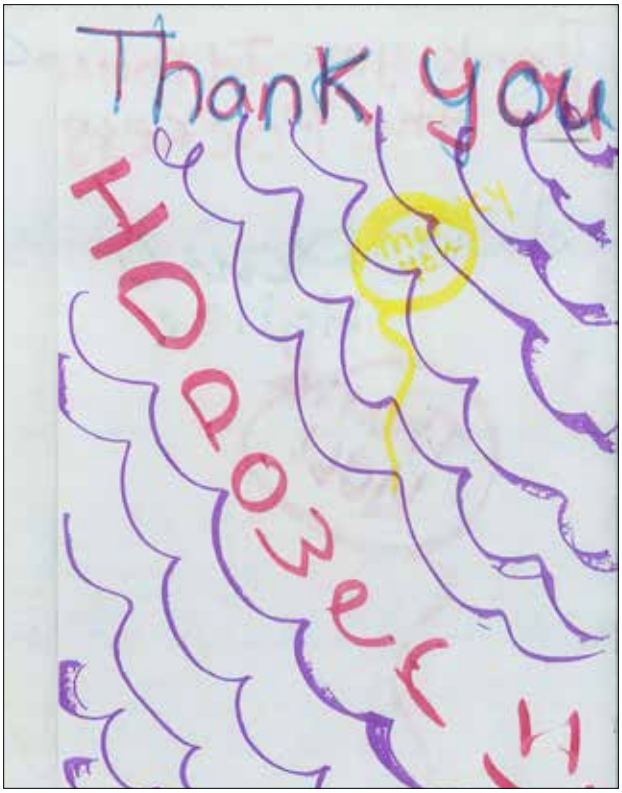
Ron Cowman

4th grade teacher

Student Letters

(continued from page 28)





May 15, 20

Dear Idaho Power,

Thank you for providing us with the energy wise kits. Before you gave us the kit, my family used way more energy than we needed to. One way we used more than we needed to was that my sisters and I would take baths that were at least an hour long. It was completely wasteful of us, be we did it to be clean. And now we spend. Another way is that we would leave the faucet running while we brushed our teeth. Again it was completely wasteful. We try to stop but it's hard so we occasionally do it. The last way is that my little sister will alway's leave the lights on when no one uses them. And she still does. But thank you Idaho Power, for changing our lives.

Sincerely,
Terra

Student Letters

(continued)

Dear Idaho power

Thank you for the workbooks, coloring books and the kit. How did you know I needed a new shower head. I even like the nightlight. My grandson is coming to fourty and he sleeps in our basement and likes nightlight.

Your program has helped me, my classmates and my family learn to, get wise, energy wise.

Sincerely,
Emma

Dear Idaho Power,

Thank you for giving us supplies and knowledge about saving recources.

Sincerely,
Ryan

Dear ID Power,

Thank you very much for the Energy Wise Kit. All your kind useful goods – plus being innovative, it was one of best experiences of my life!

My family needed everything in the kit, like the CFL. My sister Bella's lamp's lightbulb had burned out and when she saw the lightbulb – she grabbed one and rushed downstairs with me dad. The LED night light – she put in my room with that! Another thing I liked about my uncle is that he is kind, patient, and helpful. Uh cool.

337

Dear Idaho Power,

Thanks for the energy kit. Now I'm more energy efficient! My favorite part of the kit was the night light. I mainly used it for reading. I wasn't here for your presentation, but I bet it was really cool! Me and some of my friends turned the wristbands you gave us into bow ties! That was really fun...

Sincearly,
Faith
Ponderosa Elm.
Meridian School
District

Student Letters

(continued)

Dear Idaho Power,
Thank you for the Energy Saving Kit. I can't wait to be more energy efficient. My favorite part of the kit was the night light. I thought it was cool how it turned on when it was dark, at first I said "Mom the night light isn't working".

Sincerely,
Austin
Ponderosa Elementary Meridian School district

Dear Idaho Power,
Thank you for the Energy Saving Kit. I used the timer. My dad helped me install the items. It was fun, pretty much I liked it when you explained about the fish. It was funny when you showed up the picture of the sea lion eating all the fish. The fish was about to the sea lion by a leap. It also liked

Dear Idaho Power,
Thank you for the Energy Saving Kit. I can't wait to be more energy efficient.

My favorite part of the kit is the shower timer. Don't tell anyone but, I used to take 20 minute showers. I don't tell people this because it's really embarassing. I also enjoy the night light. I can't sleep without a fan and night light.

I hope you are doing well and see your family. (if you have one)

Sincerely,
Autumn
Ponderosa Elementary
Meridian School District

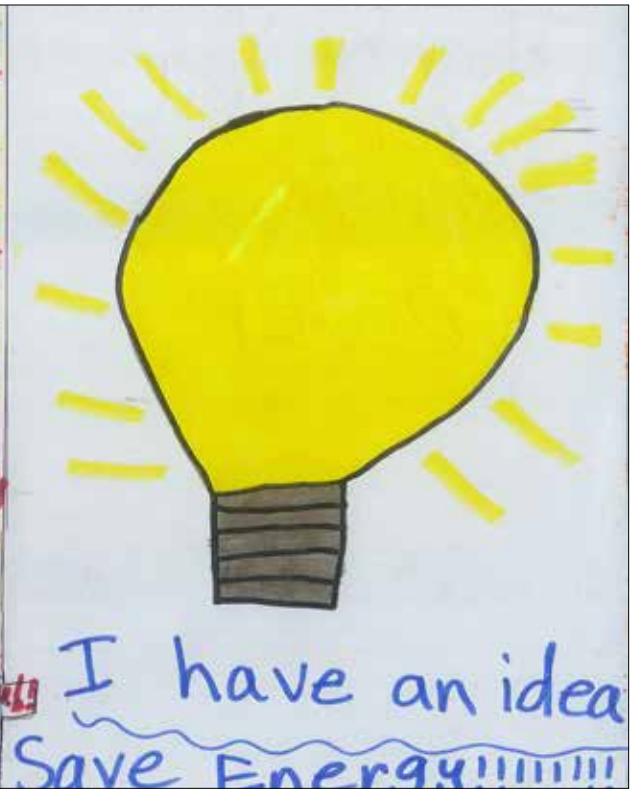
Dear Idaho Power,
Thank you for giving us our kits so save money. I really enjoy the showerhead and the pressure. The lights and putting them in are really bright. I learned that I can save money just by changing a light or a showerhead. I also learned that I should unplug my electronics. The shower timer taught me to use less water in the shower. I learned that if I recycle people can make more stuff with less money. Another thing I learned is if I reduce I can save a lot of money. Thank you for providing us with the lesson also we really appreciate learning how to save our families money easily.

Yours truly,
Emily

Student Letters

(continued)

Thank you for the lesson and the Kit!!! I really learned alot from it. This is a great program, you guys should Keep the program going for at least 20 more genorations. My family really learned how to conserve energy and how to take shorter showers, get active, and to not sit infront of tv. Thankyou!!
Sincerly,
Kylee



Dear Idaho Power,

I want to thank you for giving each student a kit. I have been using the 5 minute timer every night to save energy and water. I have used the light bulb. I noticed how brighter it was. I switched my old shower head and placed the new one and it was a lot better. I also used the water test bag and I also realized how much water I was using in 5 seconds. My parents also enjoyed the new kit. When I got my kit the CD had helped me.

Sinerely,
Amy

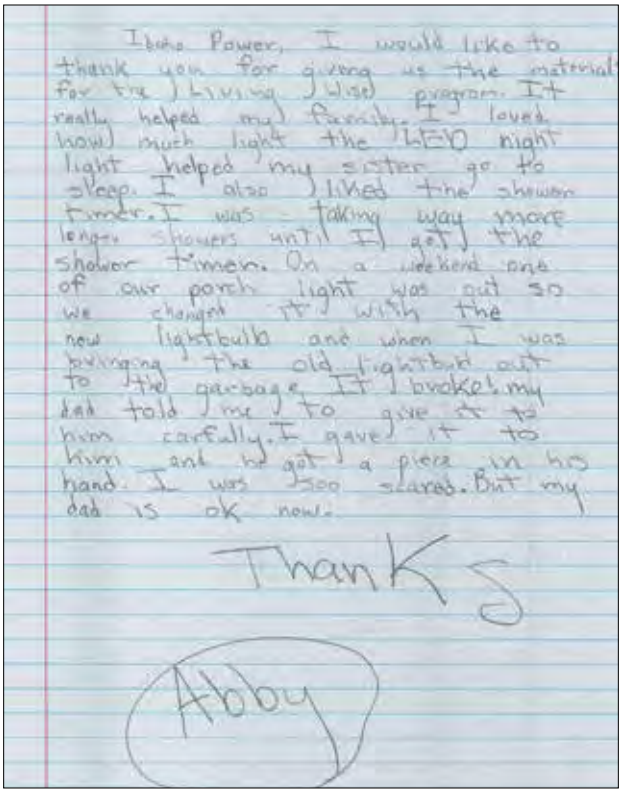
Dear Idaho Power Employees,

I thank you for the kit. I am sorry that I couldn't send this earlier. I know that you guys are trying your best to help people to save up money. You guys are a very helpful group. I'm always trying to use the kit but my dad hid some things and I can't use the shower head because I live in an apartment. I never would thinks that part of the government would try and help us out to save money. I've been taking advise and turning out the light when I'm not in a room to save electricity. I like the things you do when you're around.

Thank you again,
Nysson

Student Letters

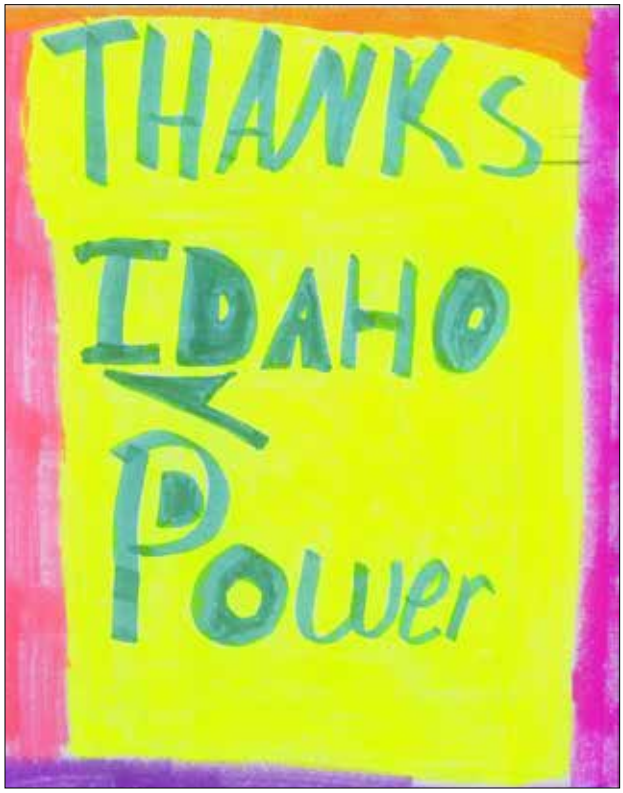
(continued)



Idaho Power, I would like to thank you for giving us the material for the Living Wise program. It really helped my family. I loved how much light the LED night light helped my sister go to sleep. I also liked the shower timer. I was taking way more longer showers until I got the shower timer. On a weekend one of our porch light was out so we changed it with the new lightbulb and when I was bringing the old lightbulb out to the garbage. It broke! my dad told me to give it to him carfully. I gave it to him and he got a piece in his hand. I was soo scared. But my dad is ok now.

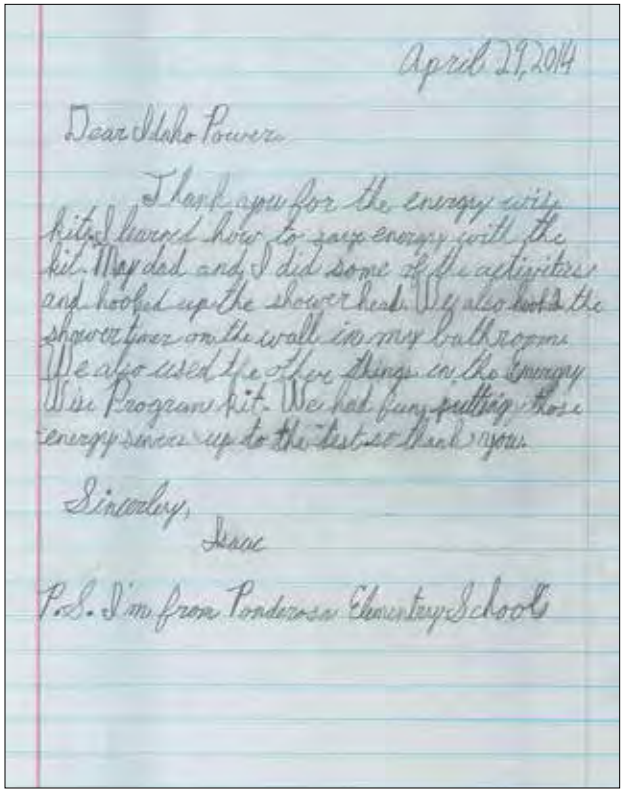
Thanks

Abby



Dear Idaho Power,

Thank you very much for the energy wise kit. The first thing [redacted] my mom and I used was the high efficiency shower heads because our other showerhead wasn't very good anymore. We also liked the night light because it glows in a whole room. I haven't [redacted] used the water flow test like because we don't know how to use it. I liked it when the Warden told us how you guys help fish and



April 29, 2014

Dear Idaho Power,

Thank you for the energy wise kit. I learned how to save energy with the kit. My dad and I did some of the activities and hooked up the shower head. We also put the shower timer on the wall in my bathroom. We also used the other things in the Energy Wise Program kit. We had fun putting those energy saver up to the test so thank you.

Sincerely,

Isaac

P.S. I'm from Ponderosa Elementary School

Student Letters

(continued)

Idaho Power

I would like to thank you for giving us the material for the living wise program. I liked testing the amount of water we use. My family really likes the new shower. And we put the night light in my bathroom. We enjoyed it very much

THANK-YOU

from, Allison

in Mr. Thompsons class

Dear Idaho Power

Idaho Power, thank you for teaching my family how to use energy and water. Also thanks for the energy saving equipment. Thanks again for the video on how to install the equipment. I also want to thank you for giving me the opportunity to see energy and water. Also thanks for letting me how to install the light bulbs, showerhead, and the thermometer. Thanks for everything that is to help us save energy and water.

Sincerely, Noah

Dear Idaho Power,

Thank you for letting us participate in your program. My class & I had a lot of fun installing & using the items in the kits. We also had fun learning more about energy & the items in our kits. For instance, I didn't know that CFLs have Mercury in them.

Thanks,

Abby

To Idaho Power: 4-21-2014

My family has installed the energy wise kit. It has really helped save energy. We have installed the new high efficiency shower head so we now use less water and also helped because of the shower timer, the led night light is awesome and is really useful. Thank you for the energy wise kit.

Travis

To Idaho Power: 4-21-14

Thank you for the energy wise kits. I really liked the CFL lightbulbs, they saved us the most energy. My sister really likes the night light, because she needs one. When I told her it was healthier for the planet she didn't really care she just thought it looked cool.

Brady

Idaho power thanks four sendings book to learn and to use are energe wisele and it helps My family to save energe and the meterals that you give us a aportanet for us to learn and save are power from are hooses and school

Sencerely

from Blandra

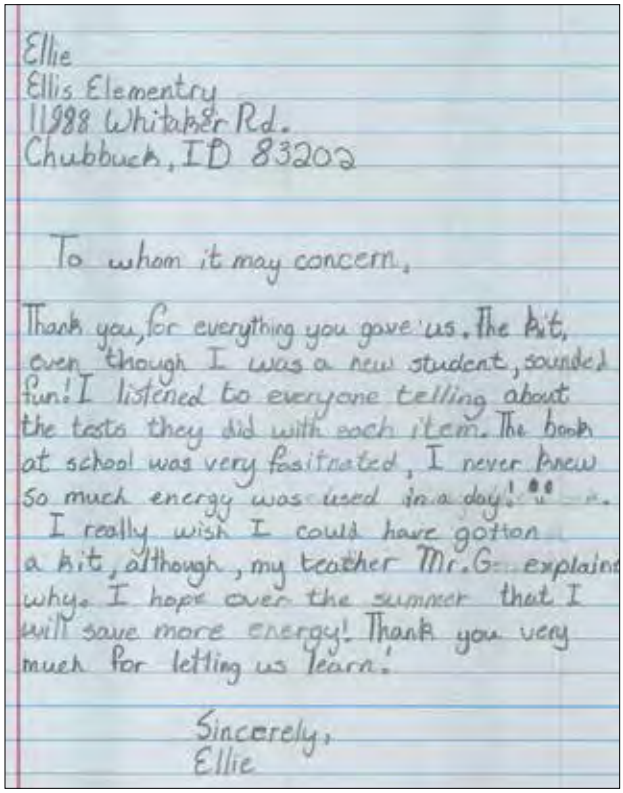
Student Letters

(continued)

Dear Idaho Power,

Thank you Idaho Power for the kit. The first thing I did when I got the kit is I put the 13 watt lightbulb in my lamp. It is going to save a lot of money and energy. What I learned is that you should really notice how much energy you are using. Also I learned that we should make sure we turn off all the things using phantom load. Another thing I learned is you can make energy from water its called hydro power. I also learned that there is on-peak time and off-peak you shouldn't use energy during on-peak time.

Sincerely,
Caden



Ellie
Ellis Elementry
11988 Whitaker Rd.
Chubbuck, ID 83202

To whom it may concern,

Thank you, for everything you gave us. The kit, even though I was a new student, sounded fun! I listened to everyone telling about the tests they did with each item. The book at school was very fasitnated, I never knew so much energy was used in a day!

I really wish I could have gotton a kit, although, my teather Mr. G explaine why. I hope over the summer that I will save more energy! Thank you very much for letting us learn!

Sincerely,
Ellie

Student Letters

(continued)

To Idaho Power: 9/21/19

Thank you for the saving energy kit. My dad installed the Led Night light and it worked perfectly. Thanks for the Student Guide book taught me a lot about energy.

We also used the temperture. Now I know whats the temperture of my refrigerator.

Bernardo

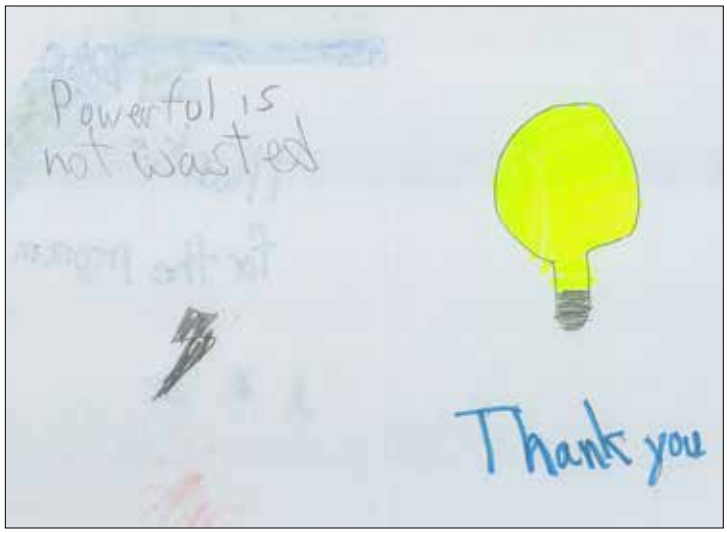
Dear Idaho Power,

Thank you for the Energy Saving Kit I really want to be more energy efficient. Me and my dad had a great time installing the new shower head and the timer worked great for me.

Sincerely, Trevor
ponderosa Ean Meridian
School District

Dear Idaho power,
Thank you so much for the energy saving kit I loved the water measure bag and measuring the high efficiency shower head and my old shower ~~head~~ ~~it old shower head~~ used less water but we installed the high efficiency shower ~~head~~ head any way.

Sinserely, Brittyn



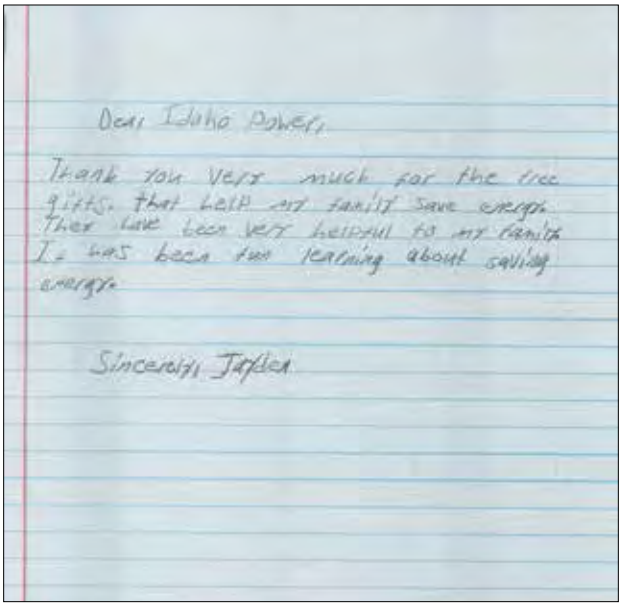
Dear Idaho Power,

Thank you for sending us these kits. It helped me realize how much energy we are actually using. I'll be making sure I use less energy, electricity, and water. This was a great opportunity to be able to learn how much energy and natural reasources we use. My family liked it. Thank you.

Sincerly
Natalie

Student Letters

(continued)



Dear Idaho Power,

Thank you very much for the free gifts. that help our family save energy. They have been very helpful to our family. It has been fun learning about saving energy.

Sincerely, Taylor

Dear Idaho power

Thankyou for ever thing. thankyou for the kit. And every thing in it. It realy hel. thank you. I would like to do it again. Just thank you for ever thing.

Sincerly Trey

Student Letters

(continued)

To Idaho Power:

4/21/14

Thanks for the kit. I tried the shower head and it saved a lot water and the LED light. I also used the light bulb and I put it in my lamp.

Diego

Idaho Power,

I would like to thank you for giving us the materials for the living wise program. I am really surpised about how much it cost to run a refrigerator. Once again thank you.

From,
Bevan

Idaho Power

Thanks for letting me learn more about not using alot of energy. I don know there was a pell time now I know this was the best leaning ever. My family like it so now we dont use to much. Thanks

Sincerely
Mara

To Idaho Power:

4/21/14

I liked the new High Efficiency Showerhead and the showertimer because it saved us way more water my water bill has changed a whole lot of water. Thank you very very much!

Eleny

To Idaho Power:

Thank you for the resource preservative appliances. They saved so much in my house. My mom is taking shorter showers, and my little brother can get to sleep cause free of "monsters" thanks to the night light. But I would like it if you didn't use mirrors bulbs. I kind of have a fobia a mirrors and it made me a little uncomfortable using them. Again thank you.

Thank You.
Mason

April 21, 2014

Dear Idaho Power,

Thank you for the conservation kits. My favorite part was putting in the shower head

Sincerely yours
Benjamin

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PROGRAMS

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Home Energy Audit Program Survey

1. How easy was it for you to apply for the Home Energy Audit program?

	Response Percent	Response Count
Very easy	**76.6%**	**72**
Somewhat easy	20.2%	19
Somewhat difficult	1.1%	1
Very difficult	2.1%	2
	answered question	**94**
	skipped question	**1**

2. If the application process was difficult what was it about that process that made it difficult?

	Response Count
	4
answered question	**4**
skipped question	**91**

3. Please identify the auditor that you used for your home audit.

	Response Percent	Response Count
Brian Bennett, The Energy Auditor	18.7%	14
Chris Callor, Affordable Energy Improvements, LLC	8.0%	6
Dallen Ward, Home Energy Efficiency Technologies (H.E.E.T.)	8.0%	6
Jessie Lumbreras, Energy Zone, LLC	16.0%	12
Robert Johnson, Savings Around Power	1.3%	1
Rod Burk, Home Energy Management	13.3%	10
Tad Duby, On Point, LLC	**34.7%**	**26**
	answered question	**75**
	skipped question	**20**

4. Please rate your home auditor on each of the following:

	Excellent	Good	Fair	Poor	Rating Count
Courteousness	**85.6% (77)**	14.4% (13)	0.0% (0)	0.0% (0)	90
Professionalism	**84.4% (76)**	14.4% (13)	0.0% (0)	1.1% (1)	90
Explanation of work/measurements to be performed as part of the audit	**76.7% (69)**	21.1% (19)	1.1% (1)	1.1% (1)	90
Explanation of recommendations resulting from audit	**72.7% (64)**	22.7% (20)	3.4% (3)	1.1% (1)	88
Overall experience with auditor (from scheduling an appointment to follow up after the audit)	**70.8% (63)**	25.8% (23)	1.1% (1)	2.2% (2)	89
				answered question	**90**
				skipped question	**5**

5. If you have additional comments you would like to offer about your home auditor, please enter them in the space below.

	Response Count
	25
answered question	**25**
skipped question	**70**

6. How did you receive your Home Energy Audit report?

	Response Percent	Response Count
Accessed report online	37.2%	29
Received paper copy	**41.0%**	**32**
Both	21.8%	17
	answered question	**78**
	skipped question	**17**

7. How difficult was it for you to access the report online?

	Response Percent	Response Count
Very easy	27.5%	22
Somewhat easy	25.0%	20
Somewhat difficult	6.3%	5
Very difficult	10.0%	8
N/A	**31.3%**	**25**
	answered question	**80**
	skipped question	**15**

8. How much did the audit influence you to reduce the amount of electricity you consume?

	Response Percent	Response Count
Influenced me a lot	39.1%	34
Influenced me some	**42.5%**	**37**
Didn't influence me much	9.2%	8
Didn't influence me at all	9.2%	8
	answered question	**87**
	skipped question	**8**

9. As a result of the Home Energy Audit program, please indicate how strongly you agree or disagree with the following statements.

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	N/A	Rating Count
I am more informed about energy usage in my home	**58.3% (49)**	36.9% (31)	3.6% (3)	0.0% (0)	1.2% (1)	84
Other members of my household are more informed about our household energy usage	35.7% (30)	**38.1% (32)**	4.8% (4)	1.2% (1)	20.2% (17)	84
I am more informed about energy efficiency programs that are available to me through Idaho Power	**46.3% (38)**	41.5% (34)	7.3% (6)	2.4% (2)	2.4% (2)	82
I know what no to low-cost actions I can take	**57.3% (47)**	29.3% (24)	6.1% (5)	1.2% (1)	6.1% (5)	82
I know what next steps I should take	**67.5% (56)**	25.3% (21)	4.8% (4)	1.2% (1)	1.2% (1)	83
					answered question	**85**
					skipped question	**10**

10. After receiving your audit through the Home Energy Audit program, please indicate if you have taken any of the following actions:

	Yes	No	Rating Count
Visited the Idaho Power website	**51.4% (36)**	48.6% (34)	70
Unplugged appliances when not in use	**60.5% (46)**	39.5% (30)	76
Signed up for myAccount	42.0% (29)	**58.0% (40)**	69
Shared my energy audit experience with relatives and/or friends	**74.7% (56)**	25.3% (19)	75
Other	**58.1% (18)**	41.9% (13)	31
If you selected "other", please specify what other actions you have taken:			25

answered question	**81**
skipped question	**14**

11. Since receiving your audit through the Home Energy Audit program, please indicate when, or if, you will complete any of the following improvements:

	Already completed	Plan to in next 6 months	Plan to in 6-12 months	Want to but not sure when	Do not plan to at all	Home does not need	Rating Count
Replace additional incandescent light bulbs with more efficient light bulbs (e.g., CFLs and LEDs)	**65.0% (52)**	10.0% (8)	8.8% (7)	6.3% (5)	2.5% (2)	7.5% (6)	80
Replace additional showerheads with low-flow models	**34.6% (27)**	11.5% (9)	6.4% (5)	7.7% (6)	11.5% (9)	28.2% (22)	78
Recycle an extra refrigerator or freezer	5.1% (4)	7.7% (6)	5.1% (4)	21.8% (17)	20.5% (16)	**39.7% (31)**	78
Replace an older, inefficient appliance with a new ENERGY STAR model	11.4% (9)	11.4% (9)	10.1% (8)	**29.1% (23)**	12.7% (10)	25.3% (20)	79
Service heating equipment	**40.5% (32)**	22.8% (18)	6.3% (5)	6.3% (5)	7.6% (6)	16.5% (13)	79
Service cooling equipment	**38.0% (30)**	16.5% (13)	5.1% (4)	7.6% (6)	5.1% (4)	27.8% (22)	79
Increase attic insulation	13.9% (11)	13.9% (11)	16.5% (13)	12.7% (10)	7.6% (6)	**35.4% (28)**	79
Increase wall insulation	4.0% (3)	5.3% (4)	1.3% (1)	14.7% (11)	16.0% (12)	**58.7% (44)**	75
Increase underfloor insulation	9.0% (7)	14.1% (11)	9.0% (7)	17.9% (14)	10.3% (8)	**39.7% (31)**	78
Seal air leaks	25.6% (20)	**26.9% (21)**	9.0% (7)	7.7% (6)	9.0% (7)	21.8% (17)	78
Seal duct work	15.8% (12)	15.8% (12)	10.5% (8)	13.2% (10)	7.9% (6)	**36.8% (28)**	76
Other	15.0% (3)	15.0% (3)	5.0% (1)	20.0% (4)	10.0% (2)	**35.0% (7)**	20
If you selected "other", please specify what other actions you have taken or plan to take:							13
						answered question	**80**

skipped question	**15**

12. For any improvements you indicated you do not plan to do, please tell us why.

	Response Count
	28
answered question	**28**
skipped question	**67**

13. What benefits did you experience from the Home Energy Audit program? (Check all that apply)

	Response Percent	Response Count
Cost savings	58.2%	46
Personal satisfaction	**75.9%**	**60**
Raised awareness of energy use	70.9%	56
Benefit to the environment	39.2%	31
Home improvement	57.0%	45
Comfort	41.8%	33
Other	7.6%	6
	(please specify)	10
	answered question	**79**
	skipped question	**16**

14. What barriers do you encounter in making energy savings changes in your home? (Check all that apply)

	Response Percent	Response Count
Cost	**73.7%**	**56**
Time	27.6%	21
Convenience	14.5%	11
Lack of necessity	14.5%	11
Do not know who to contact	14.5%	11
Other (please specify)	11.8%	9
	answered question	**76**
	skipped question	**19**

15. The most effective method for Idaho Power to provide information about energy efficiency is to: (Check all that apply)

	Response Percent	Response Count
Offer classes in convenient locations	16.7%	13
Communicate information in local newspapers	14.1%	11
Communicate information on the Idaho Power website	25.6%	20
Communicate information on social media	10.3%	8
Offer a minimal cost home audit service	51.3%	40
Send newsletters or information directly to homeowners	**59.0%**	**46**
Send email communications to homeowners	47.4%	37
Send information in monthly Idaho Power bill	37.2%	29
Other (please specify)	5.1%	4
	answered question	**78**
	skipped question	**17**

16. How much do you agree with the following statements:

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Rating Count
My Home Energy Audit report contained valuable information	**76.6% (59)**	18.2% (14)	5.2% (4)	0.0% (0)	77
I would recommend the Home Energy Audit program to a friend or relative	**79.2% (61)**	14.3% (11)	3.9% (3)	2.6% (2)	77
I am satisfied with my overall experience with the Home Energy Audit program	**76.6% (59)**	16.9% (13)	6.5% (5)	0.0% (0)	77
				answered question	**78**
				skipped question	**17**

17. If you disagree with any of these statements, please tell us why.

	Response Count
	11
answered question	**11**
skipped question	**84**

18. Please identify your age in the ranges below:

	Response Percent	Response Count
Under 25	0.0%	0
26-35	6.3%	5
36-50	12.5%	10
51-65	35.0%	28
Over 65	**46.3%**	**37**
	answered question	**80**
	skipped question	**15**

19. What is the highest level of education you completed?

	Response Percent	Response Count
Less than high school	2.5%	2
Some high school	0.0%	0
High school graduate or equivalent	7.5%	6
Some college	12.5%	10
Two year Associate degree or Trade/Technical school	15.0%	12
Four year college degree	25.0%	20
Some graduate courses	3.8%	3
Advanced degree	**33.8%**	**27**
	answered question	**80**
	skipped question	**15**

20. May we use your name and comments in Idaho Power's communication efforts?

	Response Percent	Response Count
Yes	**56.1%**	**23**
No	43.9%	18
	answered question	**41**
	skipped question	**54**

21. Do you have any issues or concerns you would like us to contact you about?

	Response Percent	Response Count
Yes	10.0%	4
No	**90.0%**	**36**
	answered question	**40**
	skipped question	**55**

22. Please provide your name and contact information:

	Response Percent	Response Count
First Name:	**100.0%**	**4**
Last Name:	**100.0%**	**4**
Phone or email:	**100.0%**	**4**
	answered question	**4**
	skipped question	**91**

23. Thank you for taking the time to participate in this survey. We value your opinions and comments. If you have any additional comments, please share your thoughts in the space below.

	Response Count
	25
answered question	**25**
skipped question	**70**

IDAHO POWER
An IDACORP Company

IDAHO POWER-CAPAI
EASY SAVINGS SURVEY
Español en el otro lado

COMPLETE AND RETURN THIS SURVEY FOR A CHANCE TO WIN

$100

ALL YOU HAVE TO DO IS...

1. **INSTALL THE ENERGY-EFFICIENCY PRODUCTS** in your Easy Savings kit at your home.
2. **IMPLEMENT THE QUICK STEPS** outlined in the Quick Start Guide and try the energy saving tips.
3. **COMPLETE AND RETURN THIS SURVEY** for a chance to win a $100!* *(Postage paid envelope included.)*
   OR COMPLETE IT ONLINE.
   Visit www.getwise.org/survey/IP-CAPAI

EASY $AVINGS

* For $100 drawing contest information, contact CAPAI at 208-375-7382
** All savings estimates are based on typical electrically heated Idaho households implementing all suggested changes. Your personal savings may vary.

107789

14011 A0048 IP-CAPAI 0000000

FILL IN EACH BUBBLE COMPLETELY
Using a black pen or pencil, fill in the bubble completely.
Please do not copy or fold forms.

NO YES

PERF - DO NOT PRINT

SAVINGS TARGET

1. How much would you like to save?
   - ○ $30 – Install just the LED Light Bulb, High-Efficiency Showerhead, Kitchen Faucet Aerator, and the LimeLight Night Light.
   - ○ $85 – Install the above items and unplug an unused refrigerator or freezer.
   - ○ $240 – Complete the Easy Savings® Quick Start Guide Steps

HEATING

2. Have you (or will you) lower your heat during the day?
   ○ Yes, I lowered it ○ Yes, I plan to lower it ○ No

3. Have you (or will you) lower your heat at night?
   ○ Yes, I lowered it ○ Yes, I plan to lower it ○ No

4. Did you place the Thermostat Temperature Sticker near your thermostat?
   ○ Yes, I placed it ○ Yes, I plan to place it ○ No
   As seasons change, adjusting your thermostat just 5 degrees or more could SAVE up to $109 per year!

LIGHTING

5. Did you (or will you) install the 11.5-watt Light-Emitting Diode (LED)?
   ○ Yes, I installed it ○ Yes, I plan to install it ○ No

6. Did you (or will you) install the Limelight Night Light?
   ○ Yes, I installed it ○ Yes, I plan to install it ○ No

7. Did you (or will you) install the Draft Stoppers?
   ○ Yes, I installed them ○ Yes, I plan to install them ○ No

8. Did you place the Turn Off Light Sticker near a light switch that was often left on?
   ○ Yes, I placed it ○ Yes, I plan to place it ○ No

FOLD - DO NOT PRINT

9. Do you turn off lights in empty rooms more often now?
   ○ Yes ○ No
   Using LEDs and shutting off unused lights can SAVE up to $6 or more a year!

WATER

10. Did you install the High-Efficiency Showerhead?
    ○ Yes, I installed it ○ No, it does not fit pipes ○ No

11. Did you install the Kitchen Faucet Aerator?
    ○ Yes, I installed it ○ No, it does not fit pipes ○ No
    By installing a High-Efficiency Showerhead and Kitchen Faucet Aerator, you could SAVE up to $26 a year!

12. Do you use cold water when you do your laundry?
    ○ Yes, always ○ Yes, Sometimes ○ Never

13. Did you place the Wash in Cold Water Magnet on your washing machine?
    ○ Yes, I placed it ○ Don't have a washing machine
    ○ Yes, I plan to place it ○ No
    By washing your laundry in cold water, you could SAVE up to $10 per year!

14. Did you use the Digital Thermometer to check the temperature of your water?
    ○ Yes ○ No

15. Did you (or will you) change the temperature setting of your water heater?
    ○ Yes, I raised it (warmer) ○ Yes, I lowered it (cooler) ○ No
    Lowering the temperature on your water heater can SAVE up to $10 a year!

APPLIANCES

16. Did you check the temperature of your refrigerator(s) and freezer(s)?
    ○ Yes ○ No

17. Did you (or will you) adjust the temperature of your refrigerator(s) and freezer(s)?
    ○ Yes, turned up (warmer) ○ Yes, turned down (cooler) ○ No
    Adjusting the setting of your refrigerator can SAVE up to $5 a year!

FOLD - DO NOT PRINT

18. Did you unplug your old or unused refrigerator(s) and freezers(s)?
    ○ Yes, I unplugged 1 unit ○ Yes, I unplugged 2 units ○ Not applicable
    ○ Yes, I plan to unplug 1 unit ○ Yes, I plan to unplug 2 units ○ No

19. Did you recycle your old or unused refrigerator(s) and freezers(s)?
    ○ Yes, I recycled 1 unit ○ Yes, I recycled 2 units ○ Not applicable
    ○ Yes, I plan to recycled 1 unit ○ Yes, I plan to recycled 2 units ○ No
    Recycling or unplugging old refrigerators and freezers can SAVE up to $55 a year!

20. Did you place the Turn Your Computer Off Sticker on your computer?
    ○ Yes ○ I don't have a computer ○ No
    Turning your computer and monitor off when unused can SAVE $21 a year!

EASY SAVINGS® QUICK START GUIDE

21. How many items from your Easy Savings® Kit did you install?
    ○ All ○ 3 ○ 1
    ○ 4 ○ 2 ○ None

22. How effective was the Easy Savings Quick Start Guide in helping you become more energy efficient?
    ○ Very effective ○ Somewhat effective ○ Not effective at all ○ Didn't use

23. Now that you have completed the Easy Savings® Quick Start Guide, how much have you learned about saving energy and money in your home?
    ○ I learned a lot ○ I learned a little ○ Nothing

RETURN THIS COMPLETED SURVEY IN THE POSTAGE PAID ENVELOPE FOUND INSIDE THE KIT FOR A CHANCE TO WIN $100!

14011E A0048 IP-CAPAI 0000000

RELLENE COMPLETAMENTE EL CÍRCULO QUE ELIJA
Con un bolígrafo o lápiz negro, rellene completamente el círculo correspondiente a la respuesta correcta. Favor de no copiar ni doblar el papel.

NO YES

OBJETIVOS DE AHORRO

1. ¿Cuánto le gustaría ahorrar?
   - ○ $30 – Instale sólo la Bombilla LED, Cabezal de Ducha de Alta Eficiencia, Aireador de Grifo de Cocina, y la Luz de la Noche LimeLight.
   - ○ $85 – Instale los elementos anteriores y desenchufe un refrigerador o congelador no utilizada.
   - ○ $240 – Complete todos los pasos de la Guía de Inicio Rápido Easy Savings®

CALENTAR

2. ¿Ha bajado (o bajará) la calefacción durante el día?
   ○ Sí, lo bajé ○ Sí, tengo planes para bajarlo ○ No

3. ¿Ha bajado (o bajará) la calefacción durante la noche?
   ○ Sí, lo subí ○ Sí, tengo planes para subirlo ○ No

4. ¿Colocó el Adhesivo del Termostato de su kit cerca de su termostato?
   ○ Sí, lo coloqué ○ Sí, tengo planes para colocarlo ○ No
   ¡Con los cambios de estaciones, ajustar el termostato sólo 5 grados o más puede AHORRARLE hasta $109 por año!

ILUMINACIÓN

5. ¿Instaló (o instalará) la Bombilla de LED de 11.5 vatios?
   ○ Sí, la instalé ○ Sí, tengo planes para instalarla ○ No

6. ¿Instaló (o instalará) la Luz Nocturna Limelight?
   ○ Sí, la instalé ○ Sí, tengo planes para instalarla ○ No

7. ¿Instaló (o instalará) los Cortadores de Corrientes de Aire de su kit?
   ○ Sí, los instalé ○ Sí, tengo planes para instalarlos ○ No

FOLD - DO NOT PRINT

8. ¿Colocó o (colocará) el Adhesivo de Apagar la Luz de su kit cerca del interruptor de la luz que habitualmente por error queda encendida?
   ○ Sí, lo coloqué ○ Sí, tengo planes para colocarlo ○ No

9. ¿Apaga las luces en habitaciones vacías con mayor frecuencia ahora?
   ○ Sí ○ No
   ¡Usar LEDs y apagar las luces que no se utilizan puede AHORRAR hasta $6 o más por año!

AGUA

10. ¿Instaló el Cabezal de Ducha de Alta Eficiencia?
    ○ Sí, lo instalé ○ No, no se ajusta a las tuberías ○ No

11. ¿Instaló el Aireador de Grifo de Cocina?
    ○ Sí, lo instalé ○ No, no se ajusta a las tuberías ○ No
    ¡Al instalar un Cabezal de Ducha de Alta Eficiencia y Aireador, puede AHORRAR hasta $26 por año!

12. ¿Usa agua fría cuando lava la ropa?
    ○ Sí, siempre ○ Sí, a veces ○ Nunca

13. ¿Colocó el Imán de Agua Fría de su kit en su lavarropas?
    ○ Sí, lo coloqué ○ No tengo lavarropas
    ○ Sí, tengo planes para colocarlo ○ No
    ¡Lavando la ropa con agua fría, puede AHORRAR hasta $10 por año!

14. ¿Utilizó el Termómetro Digital de su kit para controlar la temperatura de su agua?
    ○ Sí ○ No

15. ¿Cambió (o cambiará) la configuración del calentador de agua?
    ○ Sí, lo subí (más cálido) ○ Sí, lo bajé (más fresco) ○ No
    ¡Bajar la temperatura de su calentador de agua sólo 10 grados puede AHORRAR hasta $10 por año!

ELECTRODOMÉSTICOS

16. ¿Verificó la temperatura de su(s) refrigerador(es) y congelador(es)?
    ○ Sí ○ No

FOLD - DO NOT PRINT

17. ¿Ajustó (o ajustará) la temperatura de su(s) refrigerador(es) y congelador(es)?
    ○ Sí, lo subí (más cálido) ○ Sí, lo bajé (más fresco) ○ No
    ¡Aumentar la configuración de su refrigerador puede AHORRAR hasta $5 por año!

18. Desenchufó sus neveras o congeladores viejos, no utilizados?
    ○ Sí, desenchufé uno ○ Sí, desenchufé dos
    ○ Sí, tengo planes para desenchufarlo uno ○ Sí, tengo planes para desenchufarlos dos
    ○ No aplica ○ No

19. Recicló sus neveras o congeladores viejos, no utilizados?
    ○ Sí, reciclé uno ○ Sí, reciclé dos
    ○ Sí, tengo planes para reciclarlo uno ○ Sí, tengo planes para reciclarlos dos
    ○ No aplica ○ No
    ¡Desenchufar refrigeradores y congeladores viejos o reciclarlos podría ahorrar hasta $55 al año!

20. ¿Colocó el Adhesivo de Apagar la Computadora de su kit en su computadora?
    ○ Sí ○ No tengo computadora ○ No
    ¡Apagar su computadora y monitor cuando no se los utiliza, puede AHORRAR hasta $21 al año!

LA GUÍA DE INICIO RÁPIDO EASY SAVINGS®

21. ¿Cuántos elementos de su kit Easy Savings® instaló?
    ○ Todos ○ 3 ○ 1
    ○ 4 ○ 2 ○ Ningúno

22. ¿Cuán efectivo fue la Guía de Inicio Rápido Easy Savings® para ayudarle a instalar los elementos de su kit?
    ○ Muy efectivo ○ No fue efectivo de ninguna manera
    ○ Más or menos efectivo ○ No la usé

23. Ahora que completó la Guía de Inicio Rápido Easy Savings®, ¿cuánto aprendió acerca de ahorrar energía y dinero en su hogar?
    ○ Aprendí mucho ○ Aprendí algo ○ Nada

DEVUELVA ESTA ENCUESTA COMPLETADA EN EL SOBRE CON FRANQUEO PAGADO QUE SE ENCUENTRA DENTRO DEL KIT PARA UNA OPORTUNIDAD DE GANAR $100!

PEEL - DO NOT PRINT

IDAHO POWER® An IDACORP Company

community Action PARTNERSHIP Helping People. Changing Lives.

ENCUESTA EASY SAVINGS
IDAHO POWER-CAPAI
English on other side

COMPLETE Y DEVUELVA ESTA ENCUESTA PARA TENER LA OPORTUNIDAD DE GANAR $100*

TODO LO QUE TIENE QUE HACER ES...

1. **INSTALE LOS PRODUCTOS DE EFICIENCIA ENERGÉTICA** en su kit Easy Savings en su hogar.
2. **IMPLEMENTE LOS PASOS RÁPIDOS** detallados en la Guía de Inicio Rápido y trate los consejos de ahorro de energía.
3. **COMPLETE Y DEVUELVA ESTA ENCUESTA PARA TENER** una oportunidad de ganar $100!* *(Sobre con franqueo postal pagado incluido)*
   O COMPLETELA EN LINEA.
   Visite www.getwise.org/survey/IP-CAPAI

EASY $AVINGS®

* Para más información del sorteo del concurso de $100, pongase en contacto con CAPAI al 208-375-7382.
** Todos los objetivos de ahorro se muestra a continuación son las estimaciones anuales de ahorro en dólares potenciales. Los ahorros reales pueden variar.

Question	

1. How much would you like to save?

$30 - Install just the LED light bulb, High-efficiency showerhead, Kitchen faucet aerator, and the Limelight nightlight

$85 - Install the above items and unplug an unused refrigerator or freezer

$240 - Complete the Easy Savings® Quick Start Guide Steps

2. Have you (or will you) lower your heat during the day?

Yes, I lowered it

Yes, I plan to lower it

No

3. Have you (or will you) lower your heat at night?

Yes, I lowered it

Yes, I plan to lower it

No

4. Did you place the Thermostat Temperature Sticker near your thermostat?

Yes, I placed it

Yes, I plan to place it

No

5. Did you (or will you) install the 11.5-watt Light Emitting Diode (LED)?

Yes, I installed it

Yes, I plan to install it

No

6. Did you (or will you) install the Limelight Night Light?

Yes, I installed it

Yes, I plan to install it

No

7. Did you (or will you) install the Draft Stoppers?

Yes, I installed them

Yes, I plan to install them

No

8. Did you place the Turn Off Light Sticker near a light switch that was often left on?

Yes, I placed it
Yes, I plan to place it
No

9. Do you turn off lights in empty rooms more often now?

Yes
No

10. Did you install the High-Efficiency Showerhead?

Yes, I installed it
No, it does not fit pipes
No

11. Did you install the Kitchen Faucet Aerator?

Yes, I installed it
No, it does not fit pipes
No

12. Do you use cold water when you do your laundry?

Yes, always
Yes, sometimes
Never

13. Did you place the Wash in Cold Water Magnet on your washing machine?

Yes, I placed it
Yes, I plan to place it
Don't have a washing machine
No

14. Did you use the Digital Thermometer to check the temperature of your water?

Yes
No

15. Did you (or will you) change the temperature setting of your water heater?

Yes, I raised it (warmer)
Yes, I lowered (cooler)

No

16. Did you check the temperature of your refrigerator(s) and freezer(s)?

Yes
No

17. Did you (or will you) adjust the temperature of your refrigerator(s) and freezer(s)?

Yes, turned up (warmer)
Yes, turned down (colder)
No

18. Did you unplug your old or unused refrigerator(s) and freezer(s)?

Yes, I unplugged 1 unit
Yes, I plan to unplug 1 unit
Yes, I unplugged 2 units
Yes, I plan to unplug 2 units
Not applicable
No

19. Did you recycle your old or unused refrigerator(s) and freezer(s)?

Yes, I recycled 1 unit
Yes, I plan to recycle 1 unit
Yes, I recycled 2 units
Yes, I plan to recycle 2 units
Not applicable
No

20. Did you place the Turn Your Computer Off Sticker on your computer?

Yes
I don't have a computer
No

21. How many items from your Easy Savings® Kit did you install?

All
4
3
2
1
None

22. How effective was the Easy Savings® Quick Start Guide in helping you become more energy efficient?

Very effective
Somewhat effective
Not effective at all
Didn't use

23. Now that you have completed the Easy Savings® Quick Start Guide, how much have you learned about saving energy and money in your home?

I learned a lot
I learned a little
Nothing

Survey Response Summary

Dated:

% Answered	Qty Answered		Total Answered	
			68	
15%	10			
7%	5			
78%	53			
100%	68			
			70	
73%	51			
20%	14			
7%	5			
100%	70			
			70	
77%	54			
16%	11			
7%	5			
100%	70			
			70	
66%	46			
23%	16			
11%	8			
100%	70			
			71	
80%	57			
18%	13			
1%	1			
100%	71			
			71	
79%	56			
17%	12			
4%	3			
100%	71			
			71	
61%	43			
34%	24			

6%	4	
100%	71	
		70
64%	45	
19%	13	
17%	12	
100%	70	
		71
99%	70	
1%	1	
100%	71	
		66
70%	46	
18%	12	
12%	8	
100%	66	
		68
65%	44	
21%	14	
15%	10	
100%	68	
		70
69%	48	
29%	20	
3%	2	
100%	70	
		67
57%	38	
15%	10	
18%	12	
10%	7	
	67	
		67
75%	50	
25%	17	
100%	67	
		68
12%	8	
40%	27	

49%	33	
100%	68	
		68
88%	60	
12%	8	
100%	68	
		66
36%	24	
27%	18	
36%	24	
100%	66	
		69
7%	5	
0%	0	
0%	0	
0%	0	
88%	61	
4%	3	
100%	69	
		71
9%	6	
1%	1	
3%	2	
0%	0	
86%	59	
4%	3	
103%	71	
		70
32%	20	
68%	42	
11%	8	
	70	
		68
44%	30	
24%	16	
21%	14	
6%	4	
4%	3	
1%	1	
100%	68	

69

70%	48
25%	17
3%	2
3%	2
100%	69

69

77%	53
22%	15
1%	1
100%	69

2013 Fall Shade Tree Survey

SurveyMonkey

1. How did you hear about Idaho Power's Shade Tree Project? (Check all that apply.)

	Response Percent	Response Count
Letter from Idaho Power	**76.7%**	**99**
Friend or relative	13.2%	17
Neighbor	0.8%	1
Idaho Power employee	9.3%	12
Other (please specify)	1.6%	2
	answered question	**129**
	skipped question	**1**

2. What was the primary reason you participated in the program? (Mark one.)

	Response Percent	Response Count
Tree was free	16.3%	21
Home too warm in the summer	17.8%	23
Reduce energy bill	18.6%	24
Improve landscape/property value	14.0%	18
Wanted a tree	**20.2%**	**26**
Help the environment	7.0%	9
Other (please specify)	6.2%	8
	answered question	**129**
	skipped question	**1**

3. Prior to this Shade Tree Project, were you planning to plant a tree within the next 12 months?

	Response Percent	Response Count
Yes	**78.5%**	**102**
No	21.5%	28
	answered question	**130**
	skipped question	**0**

4. What kept you from planting a tree prior to the Shade Tree Project?

	Response Percent	Response Count
Lack of knowledge	7.8%	10
Cost	**53.1%**	**68**
Time	18.8%	24
Other (please specify)	20.3%	26
	answered question	**128**
	skipped question	**2**

5. How long did you spend on the online enrollment tool? (Mark one.)

	Response Percent	Response Count
10 minutes or less	**68.0%**	**87**
11-20 minutes	26.6%	34
21-30 minutes	3.9%	5
31 minutes or more	1.6%	2
Not applicable	0.0%	0
	answered question	**128**
	skipped question	**2**

6. Overall, how easy was it for you to use the online enrollment tool?

	Response Percent	Response Count
Very easy	**72.7%**	**93**
Somewhat easy	21.9%	28
Somewhat difficult	5.5%	7
Very difficult	0.0%	0
	answered question	**128**
	skipped question	**2**

7. Overall, how satisfied were you with the Shade Tree Project pickup event?

	Response Percent	Response Count
Very satisfied	**85.4%**	**111**
Somewhat satisfied	11.5%	15
Somewhat dissatisfied	3.1%	4
Very dissatisfied	0.0%	0
answered question		**130**
skipped question		**0**

8. What about the event did you find satisfying?

	Response Count
	105
answered question	**105**
skipped question	**25**

9. What about the event did you find dissatisfying?

	Response Count
	4
answered question	**4**
skipped question	**126**

10. When did you plant your shade tree?

	Response Percent	Response Count
Same day as the tree pickup	36.2%	47
1-3 days after the tree pickup	**48.5%**	**63**
4-7 days after the tree pickup	10.0%	13
More than 1 week after the tree pickup	4.6%	6
Did not plant the tree	0.8%	1
	answered question	**130**
	skipped question	**0**

11. On which side of your home did you plant your shade tree?

	Response Percent	Response Count
North	3.2%	4
Northeast	5.6%	7
East	5.6%	7
Southeast	5.6%	7
South	6.3%	8
Southwest	19.0%	24
West	24.6%	31
Northwest	**30.2%**	**38**
	answered question	**126**
	skipped question	**4**

12. How far from the home did you plant your shade tree?

	Response Percent	Response Count
20 feet or less	42.5%	54
21-40 feet	**48.8%**	**62**
41-60 feet	7.1%	9
More than 60 feet	1.6%	2
	answered question	**127**
	skipped question	**3**

13. How satisfied are you with the information you received on the planting and care of your shade tree at the pickup event?

	Response Percent	Response Count
Very satisfied	**89.8%**	**115**
Somewhat satisfied	8.6%	11
Somewhat dissatisfied	0.8%	1
Very dissatisfied	0.8%	1
	answered question	**128**
	skipped question	**2**

14. What information did you find most valuable from the arborist?

	Response Percent	Response Count
Planting depth	**48.4%**	**62**
Circling roots	13.3%	17
Staking	7.8%	10
Watering	10.2%	13
Not applicable	11.7%	15
Other (please specify)	8.6%	11
	answered question	**128**
	skipped question	**2**

15. Overall, how easy was it for you to plant your shade tree?

	Response Percent	Response Count
Very easy	**68.5%**	**87**
Somewhat easy	28.3%	36
Somewhat difficult	3.1%	4
Very difficult	0.0%	0
	answered question	**127**
	skipped question	**3**

16. How likely would you be to recommend Idaho Power's Shade Tree Project to a friend or relative?

	Response Percent	Response Count
Definitely would	**89.1%**	**115**
Probably would	10.1%	13
Probably would not	0.8%	1
Definitely would not	0.0%	0
	answered question	**129**
	skipped question	**1**

17. When was this residence originally built? (Select when the building was originally constructed, not when it was remodeled, added to, or converted.)

	Response Percent	Response Count
Before 1950	1.6%	2
1950-1959	1.6%	2
1960-1969	3.1%	4
1970-1979	7.8%	10
1980-1989	2.3%	3
1990-1999	20.9%	27
2000-2006	**41.1%**	**53**
2007-2013	21.7%	28
Don't know	0.0%	0
	answered question	**129**
	skipped question	**1**

18. What one fuel is most often used to heat this residence? (Mark one.)

	Response Percent	Response Count
Electricity	11.6%	15
Natural gas	**86.0%**	**111**
Propane	0.0%	0
Fuel Oil	0.0%	0
Wood	1.6%	2
Other (please specify)	0.8%	1
	answered question	**129**
	skipped question	**1**

19. What type of air conditioning system is used at this residence? (Check all that apply.)

	Response Percent	Response Count
None	0.8%	1
Central air conditioner	**94.6%**	**122**
Heat pump	5.4%	7
Individual room or window air conditioner	0.0%	0
Evaporative/swamp cooler	0.0%	0
	Other (please specify)	1
	answered question	**129**
	skipped question	**1**

20. What is your gender?

	Response Percent	Response Count
Female	**50.8%**	**65**
Male	49.2%	63
	answered question	**128**
	skipped question	**2**

21. Which of the following best describes your age?

	Response Percent	Response Count
Under 18	0.0%	0
18-24	1.6%	2
25-34	21.9%	28
35-44	**31.3%**	**40**
45-60	**31.3%**	**40**
Over 60	14.1%	18
	answered question	**128**
	skipped question	**2**

22. What is the highest level of education you have completed?

	Response Percent	Response Count
Less than high school	0.8%	1
High school or equivalent	8.6%	11
Some college/technical school	**39.1%**	**50**
4-year college degree	32.0%	41
Some graduate courses	7.0%	9
Graduate degree	12.5%	16
	answered question	**128**
	skipped question	**2**

Idaho Power Shade Tree Survey

1. How did you hear about Idaho Power's Shade Tree Project? (Check all that apply)

	Response Percent	Response Count
Letter from Idaho Power	**61.3%**	**214**
Friend or relative	28.9%	101
Neighbor	2.0%	7
Idaho Power employee	2.6%	9
Other (please specify)	6.3%	22
	answered question	**349**
	skipped question	**2**

2. What was the primary reason you participated in the program? (Mark one)

	Response Percent	Response Count
Tree was free	**23.2%**	**81**
Home too warm in the summer	18.1%	63
Reduce energy bill	19.2%	67
Improve landscape/property value	11.2%	39
Wanted a tree	20.6%	72
Help the environment	3.7%	13
Other (please specify)	4.0%	14
	answered question	**349**
	skipped question	**2**

3. What kept you from planting a tree prior to the Shade Tree Project?

	Response Percent	Response Count
Lack of knowledge	15.0%	52
Cost	**53.3%**	**185**
Time	10.7%	37
Other (please specify)	21.0%	73
	answered question	**347**
	skipped question	**4**

4. Where would you typically prefer to purchase a new tree? (Mark one)

	Response Percent	Response Count
National retailer	7.2%	25
Local nursery/garden store	**91.6%**	**318**
Other (please specify)	1.2%	4
	answered question	**347**
	skipped question	**4**

5. How long did you spend on the online enrollment tool? (Mark one)

	Response Percent	Response Count
10 minutes or less	**59.9%**	**208**
11-20 minutes	30.5%	106
21-30 minutes	7.5%	26
31 minutes or more	1.4%	5
Not applicable	0.6%	2
	answered question	**347**
	skipped question	**4**

6. Overall, how easy was it for you to use the online enrollment tool?

	Response Percent	Response Count
Very easy	**72.3%**	**250**
Somewhat easy	24.3%	84
Somewhat difficult	2.3%	8
Very difficult	1.2%	4
	answered question	**346**
	skipped question	**5**

7. When did you plant your shade tree?

	Response Percent	Response Count
Same day as the tree pickup	22.9%	80
1-3 days after the tree pickup	**47.9%**	**167**
4-7 days after the tree pickup	14.9%	52
More than 1 week after the tree pickup	12.6%	44
Did not plant the tree	1.7%	6
	answered question	**349**
	skipped question	**2**

8. On which side of your home did you plant your shade tree?

	Response Percent	Response Count
North	3.8%	13
Northeast	5.3%	18
East	7.4%	25
Southeast	7.1%	24
South	10.7%	36
Southwest	16.6%	56
West	**36.7%**	**124**
Northwest	12.4%	42
	answered question	**338**
	skipped question	**13**

9. How far from the home did you plant your shade tree?

	Response Percent	Response Count
20 feet or less	38.2%	130
21-40 feet	**53.5%**	**182**
41-60 feet	7.1%	24
More than 60 feet	1.2%	4
	answered question	**340**
	skipped question	**11**

10. How satisfied are you with the information you received on the planting and care of your shade tree?

	Response Percent	Response Count
Very satisfied	**86.9%**	**291**
Somewhat satisfied	11.0%	37
Somewhat dissatisfied	1.2%	4
Very dissatisfied	0.9%	3
	answered question	**335**
	skipped question	**16**

11. What information did you find most valuable?

	Response Percent	Response Count
Planting depth	**56.4%**	**190**
Circling roots	10.7%	36
Staking	7.4%	25
Watering	9.2%	31
Not applicable	10.1%	34
Other (please specify)	6.2%	21
	answered question	**337**
	skipped question	**14**

12. How much do you agree with the following statements:

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Rating Count
I am satisfied with the Shade Tree Project pick up event	**92.6% (315)**	7.1% (24)	0.3% (1)	0.0% (0)	340
It was easy to plant my shade tree	**89.7% (304)**	10.0% (34)	0.3% (1)	0.0% (0)	339
I would recommend the Shade Tree Project to a friend or relative	**95.3% (323)**	4.4% (15)	0.0% (0)	0.3% (1)	339
I am satisfied with my overall experience with the Shade Tree Project	**92.9% (313)**	6.2% (21)	0.9% (3)	0.0% (0)	337
				answered question	**340**
				skipped question	**11**

13. If you have additional comments you would like to offer about the Shade Tree Project, please enter them in the space below.

	Response Count
	126
answered question	**126**
skipped question	**225**

14. When was this residence originally built? (Select when the building was originally constructed, not when it was remodeled, added to, or converted.)

	Response Percent	Response Count
Before 1950	5.9%	20
1950–1959	3.5%	12
1960–1969	2.7%	9
1970–1979	18.3%	62
1980–1989	6.8%	23
1990–1999	18.6%	63
2000–2006	**24.8%**	**84**
2007–2013	18.6%	63
Don't know	0.9%	3
answered question		**339**
skipped question		**12**

15. What one fuel is most often used to heat this residence? (Mark one)

	Response Percent	Response Count
Electricity	20.6%	70
Natural gas	**75.9%**	**258**
Propane	0.6%	2
Fuel Oil	0.9%	3
Wood	2.1%	7
Other (please specify)	0.0%	0
	answered question	**340**
	skipped question	**11**

16. What type of air conditioning system is used at this residence? (Check all that apply)

	Response Percent	Response Count
None	1.2%	4
Central air conditioner	**88.2%**	**300**
Heat pump	6.5%	22
Individual room or window air conditioner	4.7%	16
Evaporative/swamp cooler	1.2%	4
	Other (please specify)	1
	answered question	**340**
	skipped question	**11**

17. What is your gender?

	Response Percent	Response Count
Female	**61.9%**	**206**
Male	38.1%	127
	answered question	**333**
	skipped question	**18**

18. Which of the following best describes your age?

	Response Percent	Response Count
Under 18	0.0%	0
18-24	1.2%	4
25-34	28.9%	96
35-44	25.0%	83
45-60	**30.4%**	**101**
Over 60	14.5%	48
	answered question	**332**
	skipped question	**19**

19. What is the highest level of education you have completed?

	Response Percent	Response Count
Less than high school	0.6%	2
High school or equivalent	8.4%	28
Some college/technical school	**34.3%**	**115**
4-year college degree	31.0%	104
Some graduate courses	6.9%	23
Graduate degree	18.8%	63
	answered question	**335**
	skipped question	**16**

NEF2013

NATIONAL ENERGY FOUNDATION™

IDAHO POWER

THINK! ENERGY
Student Energy Efficiency Kit Program
Final Report – Version Two
Fall 2013

Prepared for:

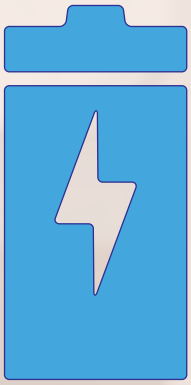
Denise Humphreys
Idaho Power

Prepared by:

Janet Hatch, Program Director
National Energy Foundation

January 24, 2014

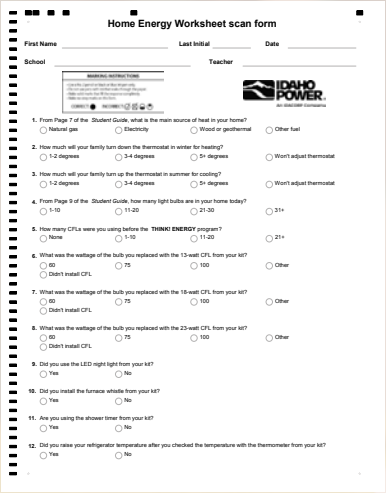
Savings



kWh

– Annual: 407,277 –

– Total: 3,819,547 –



Home Energy Worksheet scan form

First Name _____ Last Initial _____ Date _____

School _____ Teacher _____

MARKING INSTRUCTIONS

Use only Lead or Black or Blue ink pen only.
Fill in the entire bubble completely for each answer.
Make sure marks fall within the bubble.
Make no stray marks on the form.

CORRECT ● INCORRECT ✓ ✗ ● ◐ ◐

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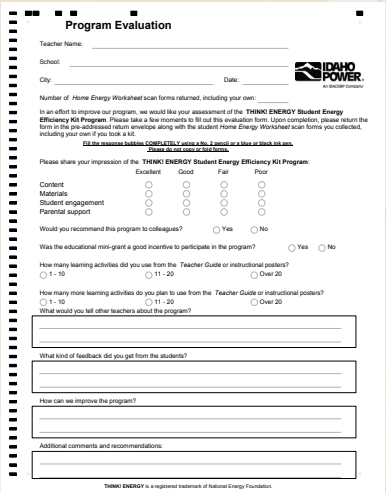
1. From Page 7 of the *Student Guide*, what is the main source of heat in your home?
   ◯ Natural gas ◯ Electricity ◯ Wood or geothermal ◯ Other fuel
2. How much will your family turn down the thermostat in winter for heating?
   ◯ 1-2 degrees ◯ 3-4 degrees ◯ 5+ degrees ◯ Won't adjust thermostat
3. How much will your family turn up the thermostat in summer for cooling?
   ◯ 1-2 degrees ◯ 3-4 degrees ◯ 5+ degrees ◯ Won't adjust thermostat
4. From Page 9 of the *Student Guide*, how many light bulbs are in your home today?
   ◯ 1-10 ◯ 11-20 ◯ 21-30 ◯ 31+
5. How many CFLs were you using before the **THINK! ENERGY** program?
   ◯ None ◯ 1-10 ◯ 11-20 ◯ 21+
6. What was the wattage of the bulb you replaced with the 13-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other
   ◯ Didn't install CFL
7. What was the wattage of the bulb you replaced with the 18-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other
   ◯ Didn't install CFL
8. What was the wattage of the bulb you replaced with the 23-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other
   ◯ Didn't install CFL
9. Did you use the LED night light from your kit?
   ◯ Yes ◯ No
10. Did you install the furnace whistle from your kit?
    ◯ Yes ◯ No
11. Are you using the shower timer from your kit?
    ◯ Yes ◯ No
12. Did you raise your refrigerator temperature after you checked the temperature with the thermometer from your kit?
    ◯ Yes ◯ No

Home Energy Worksheets

– Returned: 1,813 –

– 72.8% –



Program Evaluation

Teacher Name: _____

School: _____

City: _____ Date: _____

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Number of *Home Energy Worksheet* scan forms returned, including your own: _____

In an effort to improve our program, we would like your assessment of the **THINK! ENERGY Student Energy Efficiency Kit Program**. Please take a few moments to fill out this evaluation form. Upon completion, please return the form in the pre-addressed return envelope along with the student *Home Energy Worksheet* scan forms you collected, including your own if you took a kit.

Fill the response bubbles COMPLETELY using a No. 2 pencil or a blue or black ink pen.
Please do not copy or fold forms.

Please share your impression of the **THINK! ENERGY Student Energy Efficiency Kit Program**:

	Excellent	Good	Fair	Poor
Content	◯	◯	◯	◯
Materials	◯	◯	◯	◯
Student engagement	◯	◯	◯	◯
Parental support	◯	◯	◯	◯

Would you recommend this program to colleagues? ◯ Yes ◯ No

Was the educational mini-grant a good incentive to participate in the program? ◯ Yes ◯ No

How many learning activities did you use from the *Teacher Guide* or instructional posters?
◯ 1 - 10 ◯ 11 - 20 ◯ Over 20

How many more learning activities do you plan to use from the *Teacher Guide* or instructional posters?
◯ 1 - 10 ◯ 11 - 20 ◯ Over 20

What would you tell other teachers about the program?

What kind of feedback did you get from the students?

How can we improve the program?

Additional comments and recommendations:

THINK! ENERGY is a registered trademark of National Energy Foundation.

Teacher Packets

– Returned: 75 –

– 90.4% –

Participants

Students

– 2,419 –

Educators

– 82 –

Schools

– 26 –

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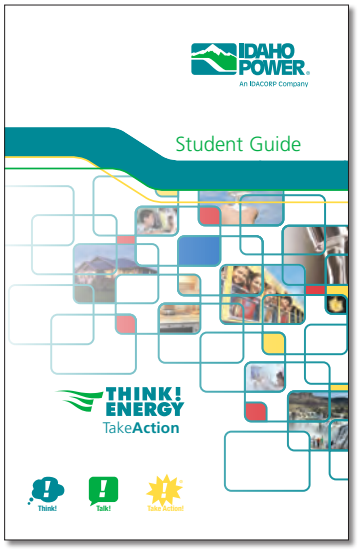
Program Overview

Program Administration

National Energy Foundation (NEF) is pleased to report on activities of the **THINK! ENERGY** Student Energy Efficiency Kit Program conducted during the 2013– 2014 school year. Our mission remains constant, to cultivate and promote an energy literate society. The objective is to provide teachers and students in Idaho with quality educational experiences and materials, which support them in teaching and learning this valuable message. NEF acknowledges that through the support of Idaho Power, the Foundation has moved the mission forward. Thank you for your commitment to this very important task.

The **THINK! ENERGY** Student Energy Efficiency Kit Program is administered by National Energy Foundation, a non-profit organization (established in 1976) dedicated to the development, dissemination, and implementation of supplementary educational materials, programs and services relating primarily to energy, water, the environment, and natural resources.



Program Summary

The fall 2013 **THINK! ENERGY** Student Energy Efficiency Kit Program provided quality energy education to 26 schools in the Idaho Power Service territory. A total of 2,490 program kits were distributed. They provided energy and water efficient technologies along with an education booklet that equips families with a better understanding of their energy use. In the classroom, the program assisted 82 educators by providing an electronic energy education lesson and program overview as well as a teacher guide containing supplementary lessons, posters and online resources.

Promotion, Enrollment and Materials

A school-to-home energy awareness and efficiency program was conducted from October 1 through December 15, 2013. To assist in program enrollment, National Energy Foundation provided Idaho Power Community Education Representatives (CERs) with a letter of invitation and a promotional flier inviting teachers, principals and superintendents to register their fourth, fifth and sixth graders.

After teacher participants were determined by CERs, they were entered into National Energy Foundation's teacher registration and information database. The database has the capacity to organize school, teacher and student information. It automatically sends approved teacher communication emails, compiles shipping lists, tracks and reports on return program documents, records teacher mini-grant amounts and delivery dates, and provides a program "dashboard" communicating enrollment statistics for Idaho Power and National Energy Foundation use. The database triggered the delivery of teacher materials box within a 24 to 48 hour period. Teacher materials box contained the following custom-designed items:

- *Teacher Materials folder*
  - *THINK! ENERGY Implementation Checklist*
  - *Student presentation on a THINK! ENERGY flash drive*
  - *Instructional Posters*
    - » *Electrical Generation Poster*

    - » *Renewable Energy Poster* – with Idaho Power custom updates
    - » *Electricity Serves Our Community Poster* – with Idaho Power custom updates
  - *The Teacher Guide – updated with custom changes requested by Idaho Power along with Idaho and Oregon curriculum correlations and Common Core Standards*
  - *Postage-paid return envelope*
  - *Rewarding Results flier*
  - *iPad Drawing flier*
  - *Program Evaluation*
- *Introduction Letter to Parents for each student (English and Spanish)*
- *Pre/Post-Survey for each student*
- *THINK! ENERGY reflector reward for each student – custom branded with the Idaho Power logo and the "Use Energy Wisely" tagline*
- *Home Energy Worksheet scan forms (English and Spanish)*
- *Certificate of Achievement for each student*

After the shipment of the teacher materials boxes, the program *TAKE ACTION* kits were shipped. The average ship date was September 27th for arrival on or before October 1, 2013. The custom design of the kit box was developed by National Energy Foundation with the input and approval of Idaho Power. This effective design scheme was seen throughout the suite of program materials and the custom website.

The *TAKE ACTION* kit provided Idaho residents with valuable efficient technologies for energy and water savings in the home. Compact fluorescent lamps in 13, 18 and 23 wattages, a high-efficiency showerhead, LED nightlight, furnace whistle, shower timer, installation tape, swivel refrigerator thermometer and a flow rate test bag were provided. Along with the efficient technologies, the kit contained the following custom-developed items for Idaho Power:

- *Student Guide* – Provides an opportunity for the student to share energy basics, natural resource, and energy efficiency knowledge learned in the **THINK! ENERGY** flash drive presentation, the instructional posters and Teacher Guide activities with family members. Allows households to participate in energy and water evaluation activities in their household and introduces savings to be accomplished through the installation of kit technologies.
- *Parent Comment Card* (English and Spanish) – For the purpose of gathering parent comments to be compiled for Idaho Power. Postage paid by NEF.
- *Getting Started Tips* (English and Spanish) – Introduces the Student Guide and the Home Energy Worksheet to parents. Communicates the student **THINK! ENERGY** reflector award for return of the guide to school. Gives installation basics to families and assists them in finding further instruction and how-to videos at *www.idahopower.com/think*.
- *Energy Efficiency Incentives for Homeowners* (English and Spanish) – A cross promotional piece communicating Idaho Power's home energy efficiency incentives. This double-sided, trifold contains a tear-off return response postcard. National Energy Foundation is responsible for postage and returning results to Idaho Power electronically within 24 hours of receipt and in hard copy during December 2013.

Energy Efficiency Incentives for Homeowners

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Idaho Power's energy efficiency programs can help you use energy wisely in your home. For information on programs and incentives, drop the attached postcard in the mail or visit www.idahopower.com/think

See ya later, refrigerator℠
Hello $30 bucks!
Chances are the older refrigerator or freezer in your basement or garage is running up your utility bill by as much as $100 a year. Recycle it, use energy wisely and keep harmful materials out of landfills. We'll pick it up for free and you'll receive $30.
For a free pickup, call toll-free 1-866-899-5539

Home Improvement Program
Idaho Power offers homeowners incentives for home improvements. Upgrading your insulation and investing in energy efficient windows helps improve the comfort of your home and can reduce your monthly energy use. This program is only available to Idaho residential customers with electrically heated homes.

Ductless Heat Pump Pilot
If your home's primary heat source comes from electric baseboards, ceiling cables or wall units, Idaho Power has a $750 incentive to help upgrade your heating and cooling equipment to a high-efficiency ductless system. A ductless heat pump doesn't require ductwork, increases overall comfort, is unobtrusive and helps to lessen energy waste.

Energy Efficiency for Manufactured Homes
Energy House Calls. You may qualify for a free house call to test your duct system for air leaks, seal the leaks, install a CFL, replace air filters and check your water heater temperature.
Rebate Advantage. Purchase a new, ENERGY STAR® all-electric manufactured home and receive a $1,000 incentive. Be more comfortable while saving energy.

Weatherization Solutions for Eligible Customers
Energy efficiency improvements, such as sealing ducts, adding insulation and reducing air leaks make your home more comfortable while lowering your energy use. If your income falls within specific guidelines, you may be eligible for improvements at no additional cost.

To learn more, visit www.idahopower.com/think, or complete this card and drop in the mail.

Name (Nombre) _____
Address (Dirección) _____
City (Ciudad) _____ State (Estado) _____ Zip (Código Postal) _____
Phone – optional (Teléfono – opcional) _____
Email – optional (Correo Electrónico – opcional) _____

YES! I would like to learn more about the following programs:
- ☐ See ya later, refrigerator® (Hasta Luego, refrigerador®)
- ☐ Home Improvement Program (Programa de Mejoras Para el Hogar)
- ☐ Ductless Heat Pump Pilot (Piloto de Calor sin Conductos)
- ☐ Energy Efficiency for Manufactured Homes (Ahorro de Energía Para Viviendas Prefabricadas)
- ☐ Weatherization Solutions for Eligible Customers (Soluciones de Climatización Para Clientes Elegibles)

Please contact me by: ☐ Mail (Correo) ☐ Phone (Teléfono) ☐ Email (Correo Electrónico)

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THINK! ENERGY Student Energy Efficiency Kit Program Implementation

The **THINK! ENERGY** Student Energy Efficiency Kit Program started in the Idaho classroom with students taking the *Pre-Survey*. It was developed to test prior knowledge of Idaho and Oregon state curriculum content taught in the program materials. After the survey, students took home the *Introduction Letter to Parents* to inform parents and guardians of their participation in the program.

Next, teachers were provided with an electronic presentation on a flash drive in three forms: PowerPoint continual play, PowerPoint manual play, and video format. The presentation focused on important concepts, such as energy basics, natural resources, the difference between renewable and nonrenewable energy sources, the three R's and tips for energy efficiency in the home. It also featured an engaging video clip that introduced students to the items in their *TAKE ACTION* kit and explained how their installation would save energy and water in the home. Lastly, the presentation explained program implementation to students, clearly defining how to use their *Student Guides* and how to return the *Home Energy Worksheet* to school to complete. This new part of Idaho Power's school education program was carefully designed to make it easy for educators to teach state curriculum standards and excite their students about using their kit and *Student Guid*e at home.

Shortly after preliminary classroom activities were accomplished, the TAKE *ACTION* kits arrived at the school. Kits were shrink-wrapped for the protection of the child. They contained the *Student Guide* with its *Home Energy Worksheet* to ensure that survey questions accompanied the kit. After working through the *Student Guide* with their family and completing survey questions, students returned the guide to school. There, they transferred questions from the guide to the *Home Energy Checklist* scan form. Students returning their guide were able to receive a **THINK! ENERGY** reflector reward.

Educators were also given helpful energy educational materials to enhance and continue energy education in the classroom. The *Teacher* Guide is a rich, 52-page guide containing activities to provide additional teaching and learning opportunities. The *Teacher Guide* has a unique emphasis on Science, Technology, Engineering and Math (STEM) education. STEM has become an important emphasis in education as careers in these fields are expanding and in need of qualified employees. The *Teacher Guide* correlates each aspect of STEM to each of its activities. To assist Idaho educators in their *Teacher Guide* instruction, National Energy Foundation developed four activity materials kits containing all nonconsumable items needed to teach each lesson in the guide. Activity materials kits will be available for check out in Idaho Power's Loan Library.

The **THINK! ENERGY** Student Energy Efficiency Kit Program also provided three NEF instructional posters for continuing energy education in the classroom. Each poster serves as an engaging visual display and was selected by Idaho Power and customized accordingly. The back of each poster also contains eight panels of information for teachers to copy and use in instruction.

Teacher Incentives

Communications in both the *Teacher Materials* folder and the *TAKE ACTION* kits motivated teachers and students to return their *Home Energy Worksheets* and other return documents. Teachers were incentivized with a mini-grant of up to $100 in the form of a check made out to individual teachers. New to the program for fall were graduated mini-grant levels encouraging return for teachers that were not able to collect 80 percent of their students' *Home Energy Worksheets:*

Return Rate	Mini-Grant Award
80 – 100 percent	$100 + entry into iPad Drawing
65 – 79 percent	$75
50 – 64 percent	$50
Less than a 49 percent	$25

Educators returning at least 80% of their *Home Energy Worksheets* were eligible for entry into an iPad drawing that took place on December 9, 2013. This action was an additional motivator for teachers to encourage a high return of the worksheet from their students. The *Enter to Win an iPad* flier also gave tips for teachers to encourage student return. Angela Zweifel, fifth grade teacher from Hunter Elementary, was the recipient of the iPad prize.

Program Website

National Energy Foundation developed a custom website in conjunction with Idaho Power for the purposes of informing households and teachers about the overall program, providing program documents, providing additional educational resources for teachers and students and assistance in kit technology installation. The website is *www.thinkenergy.org/idahopower*.

This website contains a landing page with an overview of the program and the kit. Five additional site pages provide information on specific topics.

Use Your Kit Items

Provides installation instructions as well as how-to installation videos for each item in the *TAKE ACTION* kit. One new video was developed/created addressing the filter alarm.

For Students

Gives students new activities and games that can be downloaded for further study of energy topics:

- *Water Inside and Out*
- *The Insulated Comforts of Home*
- *Forms of Energy*
- *Rebus*
- *Concentration*

For Parents

Enables parents to access important program documents online:

- *Introduction Letter to Parents*
- *Getting Started Tips*

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- *Energy Efficiency Incentives for Homeowners*

For Teachers

Allows teachers to access program documents online, such as the Spanish *Home Energy Worksheet*, the *Implementation Checklist* and curriculum correlations. This link also provides four additional lessons to incorporate into the classroom:

- *The Three R's*
- *Let's Convert Energy*
- *Water Inside and Out*
- *The Insulated Comforts of Home*

Frequently Asked Questions

Nine FAQs were developed by NEF after careful evaluation of common questions in kit-based programs. Idaho Power gave input to all questions and answers for the site.

Customer Service

Each **THINK! ENERGY** Student Energy Efficiency Kit Program teacher and parent participant received the highest level of service through National Energy Foundation's Customer Service Representative. Lisa Johnson was tasked to provide immediate feedback to inquiries concerning program shipments to teachers, aid teachers in implementing the program, and to assist parents with installation questions associated with their kit technologies.

Parents and teachers were assisted through email and a toll-free phone number, both of which were given throughout program documents and the program website. Idaho Power preapproved a customer service script for use in answering parent questions. In addition, seven teacher emails were preapproved by Idaho Power for teacher communication to encourage the timely return of program documents. Each teacher email was sent automatically by NEF's registration and information database.

Program Implementation Accomplishments

Program Implementation Accomplishments

- 2,490 kits distributed within the Idaho Power Service Territory
- 82 Teachers serviced
- 26 schools participated
- 69 *Parent Comment Cards Returned* (2.77%)
- 16 *Energy Efficiency Incentives for Homeowners postcards* returned (.64%)
- 1,813 *Home Energy Worksheets* (HEWs) returned, for a HEW return rate of 72.8%
- 75 of 82 teacher packets received, for a packet return rate of 90.4%

NEF Provided the Following Additional Services:

- Development of a custom *Student Guide*
- Development of a custom *Teacher Guide*
- Development and printing of a custom *Energy Efficiency Incentives for Homeowners* brochure advertising Idaho Power's home efficiency programs
- Development and labor toward materials kits for selected activities in the Teacher Guide

- Consultation meeting with Idaho Power and the Idaho Board of Education

Energy Savings

Significant energy and natural resource savings occurred through implementation of the program. Included below is a brief summary of the kWh savings NEF estimates resulted from the installation of energy efficient measures included in the student kits taken home. Two separate tables are provided, the first based on Regional Technical Forum (RTF) and NEF's preferred calculations (for those devices with no RTF protocols), and the second based completely on NEF's preferred calculations.

kWh savings – based on Regional Technical Forum and NEF preferred calculations

Energy Efficient Measure	Estimated Annual Program Savings	Estimated Lifetime Program Savings
Low-flow Showerhead	170,043	1,700,431
LED Night Light	57,938	463,505
Furnace Whistle	74,869	1,123,038
13W CFL	36,627	186,800
18W CFL	34,859	177,782
23W CFL	32,940	167,992
TOTAL	**407,277**	**3,819,547**
Per Household	164	1,534

based on NEF preferred calculations only

Energy Efficient Measure	Estimated Annual Program Savings	Estimated Lifetime Program Savings
Low-flow Showerhead	303,668	2,733,088
LED Night Light	57,938	463,505
Furnace Whistle	74,869	1,123,038
13W CFL	75,315	482,016
18W CFL	53,378	341,619
23W CFL	70,614	451,932
TOTAL	**635,782**	**5,595,118**
Per Household	255	2,247

The NEF-preferred calculations and RTF calculations are both based on actual installation percentages from the Home Energy Worksheet data. The NEF-preferred calculations produce higher results, however, because of some of the deemed factors in the calculations. For example, the NEF showerhead calculation (from the 2013 Illinois TRM) assumes .75 showers per person per day (compared to the RTF's .48), while the NEF calculation assumes 8.2 minutes per shower (compared to the RTF's 7.84).

Additionally, NEF estimates the following therms (natural gas) and gallons (water) savings totals achieved through program implementation (range provided based on same two calculation methodologies used for calculating kWh savings):

- Annual natural gas savings: 14,716 – 21,291 therms
- Lifetime natural gas savings: 182,928 – 234,541 therms

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- Annual water savings: 2,922,946 – 5,485,394 gallons
- Lifetime water savings: 29,229,460 – 49,368,542 gallons

Detailed savings tables and calculations can be found in the attachment portion of this report.

Summary and Attachments

National Energy Foundation is pleased to participate with Idaho Power to bring this informative program with its energy and water savings to Idaho teachers, students and families. The program developed as a result of our partnership has a different approach that accomplishes basic energy education where it is most often needed, at home. Teachers are then free to spend energy education time on higher level STEM learning that is needed in the classroom.

We look forward to receiving input from teacher participants and Idaho Power to continue to improve the program and exceed expectations. The **THINK! ENERGY Student Energy Efficiency Kit Program** is a resource for bringing energy literacy to the forefront of education. Thank you for your continued commitment to schools within your service territory.

Attachments

- Teacher Participant Information
- Teacher Evaluation Compilation
- *Pre/Post-Survey* Results
- Energy Savings Report
- Summary of *Home Energy Worksheet* Responses
- *Parent Comment Card* Summary
- Customer Service Log
- Website Analytics
- Program Documents
    - *Student presentation*
    - *Student Guide*
    - *Pre/Post-Survey*
    - *Home Energy Worksheet scan forms (English and Spanish)*
    - *Certificate of Achievement*
    - *Introduction Letter to Parents (English and Spanish)*
    - *Implementation Checklist*
    - *Teacher Guide*
    - *Rewarding Results flier*
    - *iPad Drawing flier*
    - *Program Evaluation*
    - *Parent Postcard*
    - *Cross Marketing Piece*

Teacher Participant Information

Canyon

Teacher Name	School Name	Packet Receipt Date	Return Percentage	Mini-grant Amount	Mini-grant Sent Date
Carol Briggs	Birch Elementary	10/26/2013	92.00%	$100	11/7/2013
Brenda Fly	Birch Elementary	11/14/2013	92.31%	$100	11/18/2013
Juliana Lookhart	Birch Elementary	10/26/2013	96.00%	$100	11/7/2013
Maryjo Pegram	Birch Elementary	10/26/2013	84.00%	$100	11/7/2013
Lisa Jauregui	Desert Springs Elementary	11/13/2013	87.50%	$100	11/18/2013
Lindsay Mangum	Desert Springs Elementary	11/14/2013	95.83%	$100	11/18/2013
Katie Strawser	Desert Springs Elementary	11/13/2013	91.67%	$100	11/18/2013
Heather Tucker	Desert Springs Elementary	11/13/2013	95.83%	$100	11/18/2013
Tracy Moore	Falcon Ridge Charter	11/14/2013	94.12%	$100	11/18/2013
Eden Rodriguez	Heritage Community Charter	11/8/2013	87.10%	$100	11/12/2013
Deb Storey	Heritage Community Charter	11/8/2013	83.87%	$100	11/12/2013
Linda Dux	Mill Creek Elementary	11/19/2013	79.41%	$75	12/4/2013
Annette Gifford	Mill Creek Elementary	11/8/2013	97.06%	$100	11/12/2013
Glen Kershaw	Mill Creek Elementary	11/25/2013	97.14%	$100	12/4/2013
Debbie Curl	Park Ridge Elementary	11/14/2013	96.97%	$100	11/18/2013
Christine Jayne	Park Ridge Elementary	11/25/2013	78.13%	$75	12/4/2013
Anthony Haskett	Ronald Reagan Elementary	11/25/2013	83.87%	$100	12/4/2013
Lisa Martell	Ronald Reagan Elementary	11/8/2013	87.10%	$100	11/12/2013
Jacky Miller	Ronald Reagan Elementary	10/26/2013	93.33%	$100	11/7/2013
Michelle Jenkins	Roosevelt Elementary	11/8/2013	97.22%	$100	11/12/2013
Michael Palmer	Roosevelt Elementary	Did not return	NA	NA	Not yet sent
Rhonda Wilson	Roosevelt Elementary	12/2/2013	2.78%	$25	12/4/2013
Tamara Fadgen	Ross Elementary	12/9/2013	62.96%	$50	12/13/2013
Lori Johnson	Ross Elementary	12/9/2013	57.14%	$50	12/13/2013
Lana Little	Ross Elementary	12/9/2013	68.97%	$75	12/13/2013
Karen Stear	Ross Elementary	12/16/2013	71.88%	$75	12/19/2013
Danielle Walker	Ross Elementary	12/9/2013	56.25%	$50	12/13/2013
Sandra Otero	Wilson Elementary	11/14/2013	72.41%	$75	11/18/2013
Debbie Peterson	Wilson Elementary	11/14/2013	79.31%	$75	11/18/2013
Jessica Quier	Wilson Elementary	11/18/2013	72.41%	$75	12/4/2013
D'Ann Rodwell	Wilson Elementary	11/18/2013	89.66%	$100	12/4/2013

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Capital

Teacher Name	School Name	Packet Receipt Date	Return Percentage	Mini-grant Amount	Mini-grant Sent Date
Jennifer Hunt	Cynthia Mann Elementary	11/14/2013	87.10%	$100	11/18/2013
Lisa Stitt	Cynthia Mann Elementary	11/18/2013	104.76%	$100	12/4/2013
Cindy Sundvik	Cynthia Mann Elementary	11/13/2013	74.19%	$75	11/18/2013
Rene Bilkiss	Hunter Elementary	10/29/2013	80.00%	$100	11/7/2013
Logan Easley	Hunter Elementary	11/14/2013	76.67%	$75	11/18/2013
Diane Escandon	Hunter Elementary	11/14/2013	92.86%	$100	11/18/2013
Becky Lenon	Hunter Elementary	11/14/2013	85.71%	$100	11/18/2013
Angela Zweifel	Hunter Elementary	11/5/2013	89.29%	$100	11/7/2013
Charity Bosch	Spalding Elementary	11/13/2013	46.88%	$25	11/18/2013
Shawna Brenna	Spalding Elementary	12/29/2013	80.00%	$100	1/9/2014
Marc Brousseau	Spalding Elementary	11/7/2013	70.00%	$75	11/12/2013
Jessica Burkhart	Spalding Elementary	11/14/2013	40.00%	$25	11/18/2013
Vonda Franklin	Spalding Elementary	11/13/2013	93.33%	$100	11/18/2013

Eastern

Teacher Name	School Name	Packet Receipt Date	Return Percentage	Mini-grant Amount	Mini-grant Sent Date
Jacob Foster	American Falls Middle School	11/14/2013	88.33%	$100	11/18/2013
Laura Johnson	Green Acres Elementary	11/4/2013	87.50%	$100	11/7/2013
Kathy Walker	Green Acres Elementary	11/7/2013	92.00%	$100	11/12/2013
Megan Bullock	Lewis and Clark	11/14/2013	100.00%	$100	12/4/2013
Tami Edwards	Lewis and Clark	11/13/2013	92.59%	$100	11/18/2013
Danielle Jacobs	Lewis and Clark	11/14/2013	88.89%	$100	11/18/2013
Alicia Kepler	Ridge Crest Elementary	11/25/2013	81.48%	$100	12/4/2013
Tesa Lenz	Ridge Crest Elementary	11/14/2013	81.48%	$100	11/18/2013
Cheri Warren	Ridge Crest Elementary	11/4/2013	92.86%	$100	11/7/2013

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Southern

Teacher Name	School Name	Packet Receipt Date	Return Percentage	Mini-grant Amount	Mini-grant Sent Date
Andy Arenz	Harrison Elementary	Did not return	NA	NA	Not yet sent
Kelly Gibbons	Kimberly Elementary	11/26/2013	89.29%	$100	12/4/2013
Angie Haskell	Kimberly Elementary	Did not return	NA	NA	Not yet sent
Sheryl Sharp	Kimberly Elementary	11/14/2013	78.57%	$75	11/18/2013
Andy Arenz	Morningside Elementary	Did not return	NA	NA	Not yet sent
Danielle Ashby	Summit Elementary	11/26/2013	65.52%	$75	12/4/2013
Chad Avery	Summit Elementary	11/22/2013	93.33%	$100	12/4/2013
Pam Buchheister	Summit Elementary	11/1/2013	89.66%	$100	11/7/2013
John Derr	Summit Elementary	11/21/2013	82.14%	$100	12/4/2013
Mary Fraley	Summit Elementary	11/18/2013	92.86%	$100	12/4/2013
Julie Kirk	Summit Elementary	11/25/2013	85.71%	$100	12/4/2013
Tracy Park	Summit Elementary	11/4/2013	86.21%	$100	11/7/2013
Jill Taylor	Summit Elementary	11/14/2013	89.29%	$100	11/18/2013
Audra Thompson	Summit Elementary	11/14/2013	96.43%	$100	11/18/2013
Kim Wallace	Summit Elementary	11/6/2013	92.86%	$100	11/7/2013

Western

Teacher Name	School Name	Packet Receipt Date	Return Percentage	Mini-grant Amount	Mini-grant Sent Date
Brandi Wassmuth	Barbara Morgan Elementary	Did not return	NA	NA	Not yet sent
Melissa Maini	Donelly Elementary	11/22/2013	80.77%	$100	12/9/2013
Brandi Naragon	Horseshoe Bend Middle School	11/8/2013	87.50%	$100	11/12/2013
Lacey Rashfod	Horseshoe Bend Middle School	11/25/2013	100.00%	$100	12/4/2013
Lisa Alder	Park Intermediate School	11/26/2013	75.00%	$75	12/4/2013
Damon Courtois	Park Intermediate School	Did not return	NA	NA	Not yet sent
Kristin Dickerson	Park Intermediate School	11/13/2013	85.19%	$100	11/18/2013
Connie Kerby	Park Intermediate School	Did not return	NA	NA	Not yet sent
Nicol Mink	Park Intermediate School	11/18/2013	71.43%	$75	12/4/2013
Grace Sharp	Park Intermediate School	11/18/2013	66.67%	$75	12/4/2013
Kim Walker	Park Intermediate School	11/21/2013	33.33%	$25	12/4/2013
Brenda German	Shadow Butte Elementary	11/14/2013	92.59%	$100	11/18/2013
Susan Pierson	Shadow Butte Elementary	11/8/2013	93.10%	$100	11/12/2013
Tyler Zamora	Shadow Butte Elementary	11/26/2013	69.23%	$75	12/4/2013

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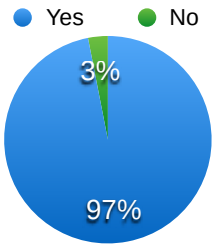
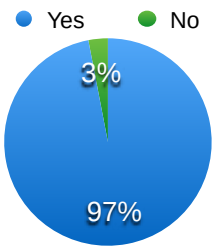
Student Energy Efficiency Kit Program
Program Evaluation

Sixty-six out of seventy-five returned packets included a program evaluation.

Was the educational mini-grant a good incentive to participate in the program?

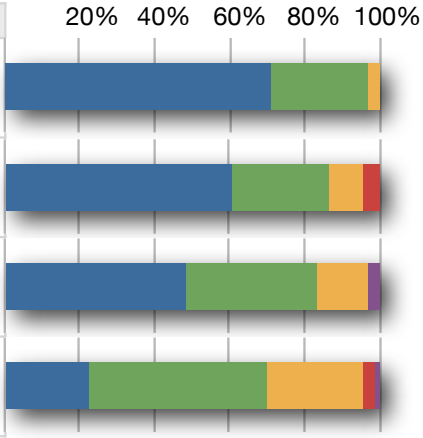


Would you recommend this program to your colleagues?



Educators' impressions of the program.

	Excellent	Good	Fair	Poor	No response
Content	47	17	2	0	0
Materials	40	17	6	3	0
Student engagement	32	23	9	0	2
Parental support	15	31	17	2	1



Number of learning activities used by teachers.

	1 - 10	11 - 20	Over 20	No response
Content	57	9	0	0

Number of learning activities teachers plan to use.

	1 - 10	11 - 20	Over 20	No response
Content	57	7	1	1

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What would you tell other teachers about the program?

A great way to get parents / students thinking about energy.

All 5th grades should use this program.

Goes nicely with 5th grade science standards.

Good information, kids loved the kits, look through the activities and try to gather materials for the hands on activities.

Great content and correlates well with standards.

Great materials in the energy kits, highly motivating for the kids.

Great program! Runs with more success in a higher socio-econoic area.

Great resources for encouraging energy saving tips.

Great way to introduce energy conservation to students.

Great!

I think Idaho Power is the best free resource for education.

I think it teaches students how to be aware of energy consumption.

I would tell others that the students really learned a lot and had fun doing it.

I would tell them how easy this program is to implement.

It gets the kids excited about new technology and what is happening in their homes.

It is a good starter to help kids understand where energy comes from and how to conserve.

It is a great program educating individuals about conservation.

It is a great program that is presented in a kid-friendly way.

It is a great way to get students involved in conserving energy.

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What would you tell other teachers about the program?
It is a great way to start conversations about saving energy and to help kids change choices.
It is a great way to start teaching kids to be energy conscious and earn money for your class.
It is a great way to teach the standards that apply to this and teach something practical and important at the same time.
It is a very good project based unit!
It is a well put together program, easy to use and easy to complete.
It is a well written curriculum and the lessons grab the student's attention.
It is a worthwhile program to talk about energy conservation.
It is easy to do and the lessons are extremely detailed and very well laid out. No extra work!
It is on excellent way to motivate students to be environmentally aware.
It is quite engaging. The students learned a lot and were very excited to take their materials home.
It is well organized curriculum that aligns to our state standards.
It motivated the students to learn how to conserve energy.
It will help students to become aware of energy and its uses.
It's a great overview of resources, uses and conservation.
It's a great way to get families involved in education at home and one that benefits the "big picture" too!
Kids love it. It's a great way to learn about conserving energy.
Lessons are great but the materials needed are hard to gather.
Lessons are very interesting, more supplies are needed.
Lots of resources to make energy unit more engaging.

What would you tell other teachers about the program?

Love when Mr. Canter (Russ) comes to speak to the class.

Overall, it is a good program. However, the revamped program takes a lot of prep time.

Quality content, resources, and standards. Fits great into Common Core.

Some expense is involved unless your school is able to fund the program.

Start early, there is a lot of information to cover.

Start early.

Study it carefully before you start.

The activities go well with one of our reading units.

The content is relevant to grade level, models real world applications, and provides many learning activities to address standards.

The Energy Wise program is highly engaging to students, provides great resources, and allows you to earn a mini-grant for your class.

The lessons do not come with enough background information or any supplies. You will need to redo all the surveys yourself.

The video was a nice add in, but liked having the student books better.

There is not enough time or materials provided to implement the program.

This is a great program easily integrated into common core standards.

This is a great program. It uses nonfiction texts to enhance real life understanding of science principles.

This is a hands on, real-world, fun, family oriented, authentic learning process.

This is an excellent program to teach conservation.

This program is a good way to integrate social studies and science in to daily curriculum.

This program is an exciting opportunity. Be sure to open the materials ASAP.

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What would you tell other teachers about the program?

This program supports the Common Core and also the fifth grade science ISAT.

Very easy to use. It correlates directly to 5th grade science standards.

Well organized, thorough, teacher and student friendly with engaging activities.

Yes, I would.

Easy to use supplement for electricity, energy, resources, and water cycle units.

What would you tell other teachers about the program?

It is well, organized curriculum that aligns to our state standards

This program is an exciting opportunity Be sure to open materials asap.

It is a well written curriculum. The lessons grab the students attention.

Well organized, thorough, teacher friendly, student friendly, engaging activities

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What kind of feedback did you get from the students?

Enjoyed the book and activities.

Excited; loved talking to parents and teaching their parents.

Items were broken or missing, parents saw it as a chore, but some loved it.

Love the free stuff. Loved the video. The reflectors were a great motivator - around halloween they wanted them for trick or treating.

Loved the kits, really engaged engaged during lessons. They really liked the renewable and nonrenewable lesson.

Loved the night lights and the shower timers.

Many really liked it, but not a lot of parent support.

Most enjoyed the activities and were excited about learning about where power comes from.

Most students have the new light bulbs in their houses already. They love the nightlight and shower timer.

Most students were very involved and excited to learn more because it related to their lives.

Most were very excited about the energy kits.

Mostly positive. They love the kits.

None, really.

Some very eager.

Students found the lessons engaging and fun.

Students found the lessons engaging and fun. they were always excited for science. They also loved the kits.

Students have been wanting only one bank of lights instead of two. They have been more energy weary!

Students liked getting their own energy kit.

Students really enjoyed the kits. Some said they were going to replace the bulbs later.

What kind of feedback did you get from the students?

Students were excited... parents took convincing.

Students were generally enthusiastic about the social aspects to conserving energy.

The feedback from students was mostly positive. They loved the kits.

The student were really excited and engaged in the learning experience. They especially loved the interactive / hands-on component.

The students came back talking about the shower timer and how cool it was.

The students enjoy having one-on-one time at home doing science.

The students enjoyed sharing experiences using kits in homes with parents.

The students loved the kits. They were very excited to try out the tools given to them. They also really enjoyed the posters.

The students loved the rewards and the box to implement at home.

The students really enjoyed their at home experiments.

The students really liked the timer and thermometer. Also, they liked learning from the posters.

The students were extremely excited about the kits.

Their parents were reluctant to change light bulbs when the old ones were still working. They wanted to wait until they burned out.

They enjoyed being able to implement the materials.

They enjoyed doing the activities at home with parents.

They enjoyed home activities.

They enjoyed installing the kit's contents.

They enjoyed it.

They enjoyed parents participating with them.

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What kind of feedback did you get from the students?

They had a lot of fun working through the kit, parents included.

They had fun doing the activities with their families.

They liked getting stuff, but didn't install half of it.

They liked the materials. It was easy to use.

They love the boxes full of goodies. It gave them confidence to help their family save energy.

They loved it and liked working with their parents.

They loved it!

They loved it!

They loved it! Awesome!

They loved the box of home improvements, especially the shower gauge and timer.

They loved the box!

They loved the boxes, told stories about using the items and timed their showers!

They loved the home kits! Their parents helped them with the booklets and surveys. All pluses.

They loved the kits and the reflectors as rewards.

They loved the kits and using the items in the kits.

They loved the tree box and rewards.

They really enjoyed the activities.

They really like it.

They said they enjoyed it and the activities were a fun way to expand knowledge.

What kind of feedback did you get from the students?

They seemed to really enjoy it!

They were energetic and excited to be getting something to take home and use that went perfectly with our current science unit.

They were excited to use the 3 R's!

They were generally eager to participate and made connections throughout the lessons.

Those who fully participated found it very interesting.

Very excited about it!

Most students were excited to receive the kits (like Christmas), and their responses to activities were great.

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What kind of feedback did you get from the students?

Most students were excited to receive the kits (like Christmas), and their responses to activities were great.

The students loved the kits. They were very excited to try out the tools given to them. They also really enjoyed the posters.

How can we improve the program?

A vocabulary sheet of terms in CFL.

Again - Materials

Again - provide materials.

All good.

Allow them to be turned in later - we haven't done our energy unit yet.

Due to timing and our grade level curriculum, we were only able to do a few of the activities. Many were very time intensive, but the students really learned from those we did. We worked with our sixth grade to split activities.

Fewer and higher quality lessons/activities. Provide more background information and simplify instructions.

Have a permission slip for parents to sign and return before a kit can go home.

Have a representative come in to present the kit.

I had hoped parents would have been more enthusiastic maybe they should get reflections, and I'll provide more communication to parents next time.

I like the addition of the flash drive with the power point presentation this year.

I like the student and teacher guides from last year better. I thought they were more informative for the students.

I preferred the bigger student workbooks form last year! They had more information.

I think it is good how it is.

I think it is great!

I think it's awesome.

I think it's great!

I thought this year’s lessons were a little more difficult to teach with more materials required and a little too technical.

I would have appreciated having the students guides separate form the kits, so we could use them for teaching and reading comprehension.

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How can we improve the program?

I would like to see activities more clearly marked in the student guides so they can be graded assignments.

Information on the back of posters could be more kid-friendly.

It is a lot of information.

It is great as is.

It's great!

Keep the parent survey short and sweet had a hard time getting parents to send it back!

Keep the same activities and content from year to year.

Loved the flash drive!

Maybe a visit from someone, like a guest speaker.

Maybe have a workbook/class book on flash drive to have the whole class along with the video.

Maybe some ideas on where we could get some of the unique materials needed for the activity demonstrations.

Maybe use initials for kids rather than names. Some parents did not like the fact that the kids were reporting about household use.

My USB was corrupted, which made it unusable. Luckily, my coworker lent me hers. Please check the tools.

N/A

Need simple student book both activities that don't need extra supplies.

No recommendations.

Not sure I saw it (I could have missed it) but some teachers appreciate when things are connected to common core and/or state standards.

Nothing. I thought it was superb and very generous. Very helpful in my own home.

Please bring back the student work books that were used last year. The homework guides were great.

How can we improve the program?

Provide background for the lessons, make them more appropriate for 9 year olds.

Provide materials for each lesson. Give less lessons and more broad on lessons. Don't make teachers redo all the surveys.

Provide materials for the hands on activities.

Provide the copy resource. The district budget is extremely limited.

Some content was too difficult for my students. I had to supplement most activities.

Some of the lessons require materials outside of the school.

Student books needed more in depth information and background.

The materials were not as user friendly as they were last year.

The smaller work book and simpler format was much more student/parent friendly.

The student book/teacher book from the 2012 program was more student/teacher friendly. This one had holes that needed to be filled in.

The student books like last year.

The teacher guide/posters were hard to follow. I would want the instruction to be all in one place supplemented by posters, etc.

Timing was tight due to other obligations, send kits earlier or extend deadline to the end of December.

You need to send extra kits and forms. If we happen to get a new student they can't participate.

Timing of our teaching of units with kits and the often unanticipated interruptions are the real issues we can’t always control.

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Additional comments and recommendations:

A great resource! Doing it in the fall allowed us to use it with our reading unit.

Go back and use the 2012 booklets. Mail money to teachers, not schools. Teachers do not get it for their classrooms if it is mailed to the school.

I hope I can participate again in the future.

I miss having student workbooks.

I really liked students books that the students has last year.

I really love this program! Thank you!

I really miss the student/class workbooks and I think a virtual copy would be great to have.

I see value in this program but was my intent to share my enthusiasm with my students.

I would love to do more of the activities, but time does not allow that. Keep it as concise as possible.

It was my error and I mixed up the forms. Surveys were completed, but not worksheets. I'm new to the program as this is my first year teaching. I thought it was 80% or more of surveys.

It was nice to have the thumb drive but would be nice it you didn't tell them when it is due so teachers can use their own date.

Keep it simple and to the point. Too much "work" for families is overwhelming.

Keep it up! Great way to get the word out about saving energy!

Kids loved the lights. Just in time for Halloween!

Many districts (like mine) have few resources and copies to do the copying this program requires the student workbooks in last years program were well written and made it so I didn't have to use very many copies. My district doesn't have enough resources to support this program unless I use my own money - which I can''t this year due to cut in my pay. Please bring back the old student workbooks!

N/A

Online Questions.

Really enjoyed the prepared lessons and I even learned a ton. Thanks.

Additional comments and recommendations:

Thank you for making the box more manageable.

Thank you for supporting schools!

Thank you for this opportunity.

Thank you sincerely!

Thank you!

Thank you!

Thanks for a great program. The incentive going to the school will make it more difficult to access for our classroom supplies, due to the need to request in writing everything we need to purchase ahead of time.

Thanks for everything!

Thanks so much. Thanks for the flash drive.

Thanks!

The reflectors were not all working - some kids felt bad that theirs didn't work.

The students booklets are no longer interactive and the lessons require more background in order to teach them.

This is a great program and educates both students and teachers.

This is a great program. Thank you!

This program is excellent!

Word search, crossword, creative story writing and color sheets.

Thank you to everyone who supports these programs. They are fabulous. Thank you.

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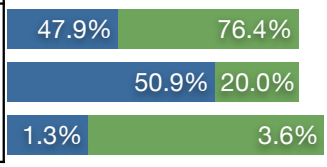
Pre/Post Survey

Think! Energy Student Energy Efficiency Kit Program

Which is a nonrenewable resource?

Total: 1,901

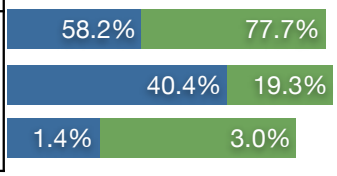
Response	Pre-survey	Percent	Post-survey	Percent
Correct	910	47.9%	1452	76.4%
Incorrect	967	50.9%	381	20.0%
No response	24	1.3%	68	3.6%



A resource that is naturally replaced, that goes on and on, is called a

Total: 1,901

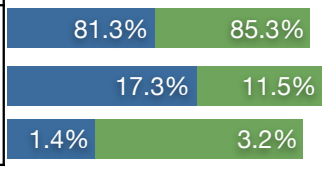
Response	Pre-survey	Percent	Post-survey	Percent
Correct	1106	58.2%	1477	77.7%
Incorrect	768	40.4%	367	19.3%
No response	27	1.4%	57	3.0%



Which renewable resource do plants use in the process of photosynthesis?

Total: 1,901

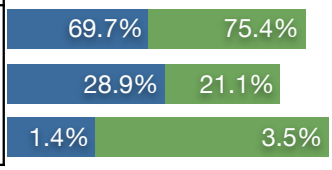
Response	Pre-survey	Percent	Post-survey	Percent
Correct	1546	81.3%	1622	85.3%
Incorrect	329	17.3%	219	11.5%
No response	26	1.4%	60	3.2%



Melting bottles and using the plastic to make something new like a shopping bag is called

Total: 1,901

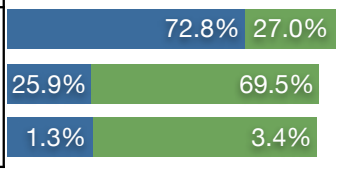
Response	Pre-survey	Percent	Post-survey	Percent
Correct	1325	69.7%	1433	75.4%
Incorrect	550	28.9%	401	21.1%
No response	26	1.4%	67	3.5%



Which of the following would help conserve energy and resources?

Total: 1,901

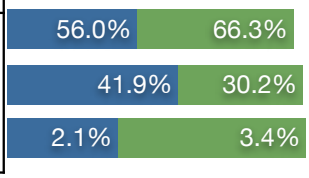
Response	Pre-survey	Percent	Post-survey	Percent
Correct	1384	72.8%	514	27.0%
Incorrect	492	25.9%	1322	69.5%
No response	25	1.3%	65	3.4%



The results on this question involve an error on the survey document.

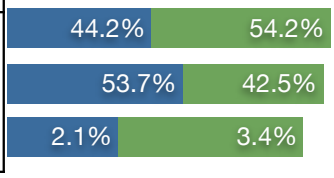
Which is the product we obtain from oil? **Total: 1,901**

Response	Pre-survey	Percent	Post-survey	Percent
Correct	1065	56.0%	1261	66.3%
Incorrect	797	41.9%	575	30.2%
No response	39	2.1%	65	3.4%



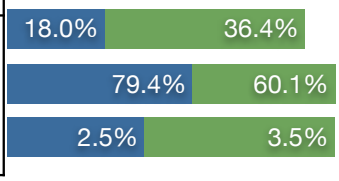
A lump of coal has what type of energy? **Total: 1,901**

Response	Pre-survey	Percent	Post-survey	Percent
Correct	841	44.2%	1030	54.2%
Incorrect	1021	53.7%	807	42.5%
No response	39	2.1%	64	3.4%



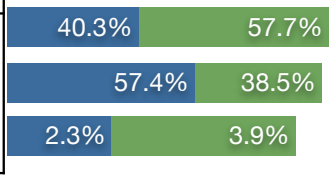
Aluminum foil is an example of **Total: 1,901**

Response	Pre-survey	Percent	Post-survey	Percent
Correct	343	18.0%	692	36.4%
Incorrect	1510	79.4%	1143	60.1%
No response	48	2.5%	66	3.5%



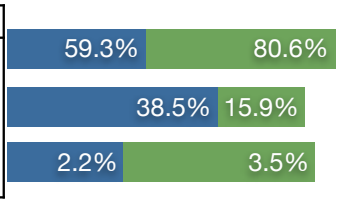
When electricity flows in a circuit, some of the energy is ALWAYS changed into **Total: 1,901**

Response	Pre-survey	Percent	Post-survey	Percent
Correct	766	40.3%	1096	57.7%
Incorrect	1092	57.4%	731	38.5%
No response	43	2.3%	74	3.9%



Energy efficiency means **Total: 1,901**

Response	Pre-survey	Percent	Post-survey	Percent
Correct	1128	59.3%	1533	80.6%
Incorrect	732	38.5%	302	15.9%
No response	41	2.2%	66	3.5%



Summary

The pre-test score was 55 percent. The post-test score was 64 percent.
A nine percent improvement was shown.

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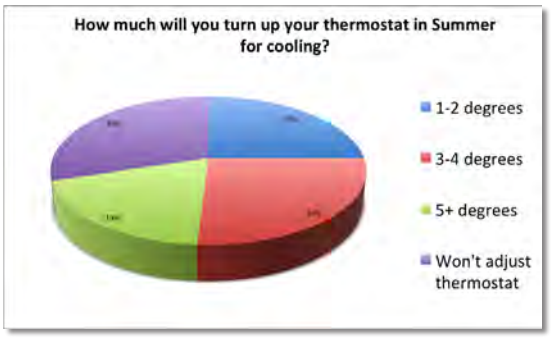
Behavioral Change and Impact on Savings

Idaho Power's electric-focused program has been implemented with a goal of positively impacting the energy use behavior of Idaho students and families. In the Idaho Power model, NEF developed an automated presentation for teachers to show students in a classroom setting, building enthusiasm for change, and showing students how they can make a difference in their own homes.

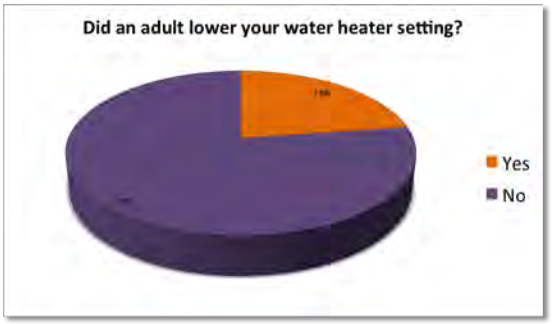
A number of specific behavior change ideas and suggestions have been made to students in the Idaho Power program. Examples include: raising the home's thermostat setting in summer; lowering the water heater setting; using "turn it off" reminder stickers on electronics; and using the shower timer included in the student's *Take Action Kit*.



Following up on these suggestions, NEF used the Home Energy Worksheet to ask families if they have adopted any of these behaviors. One promising response from the survey: 80% of respondents said that they have used the shower timer to shorten showers to 5 minutes, a sure way to garner energy savings in the home.

Additionally, 23% of respondents said that, because of the **THINK! ENERGY** program, they had lowered their water heater temperature setting, and over a fourth of participants claimed they raised the temperature of their refrigerator. Again, these behavioral changes in the home are certain to create positive savings impacts.

While NEF is not in a position to make any specific savings claims based on the responses we have received, the results are very promising. The charts on this page indicate impressive evidence of behavioral action that has either already occurred or is planned by families living in the Idaho Power service territory.



THINK! ENERGY with Idaho Power - ENERGY SAVINGS

Based on Regional Technical Forum calculations (when available)

TAKE ACTION PROGRAM

Estimated Gross Electric Savings - 2013 Program

Energy-Efficient Measure	Number of Participants[4]	Electric Water Heater Share[1]	In-Service Rate (ISR)[1]	Unit kWh Savings[2]	Annual kWh Savings	Years[2]	Lifetime kWh Savings
Low Flow Showerhead	2,490	43.6%	43.6%	359.4	170,043	10	1,700,431
LED Night Light	2,490	n/a	88.5%	26.3	57,938	8	463,505
Furnace Whistle	2,490	n/a	23.9%	125.9	74,869	15	1,123,038
13W CFL	2,490	n/a	63.0%	23.4	36,627	5.1	186,800
18W CFL	2,490	n/a	59.9%	23.4	34,859	5.1	177,782
23W CFL	2,490	n/a	56.6%	23.4	32,940	5.1	167,992
Total TAKE ACTION kWh Savings					**407,277**		**3,819,547**

Additional Estimated Gross Savings - Natural Gas

Energy-Efficient Measure	Number of Participants[4]	Natural Gas Water Heater Share[1]	In-Service Rate (ISR)[1]	Unit Therm Savings[3,6]	Annual Therm Savings	Years[3]	Lifetime Therm Savings
Low Flow Showerhead	2,490	47.7%	43.6%	14.6	7,563	10	75,630
Furnace Whistle	2,490	n/a	23.9%	12.0	7,153	15	107,298
Total TAKE ACTION Therm Savings					**14,716**		**182,928**

Additional Estimated Gross Savings - Water

Energy-Efficient Measure	Number of Participants[4]	Water Heater Share	In-Service Rate (ISR)[1]	Unit Gallon Savings[5]	Annual Gallon Savings	Years[5]	Lifetime Gallon Savings
Low Flow Showerhead	2,490	n/a	43.6%	2,693.0	2,922,946	10	29,229,460
Total TAKE ACTION Gallon Savings					**2,922,946**		**29,229,460**

[1] Data from Home Energy Worksheets.

[2] kWh savings for showerhead and CFLs from RTF. kWh savings for kitchen aerator, LED night light, and furnace whistle from 2013 Pennsylvania TRM.

[3] Therm savings for showerhead from RTF.

[4] Total number of participants taking home Take Action kits.

[5] Gallon savings for showerhead from RTF.

[6] Therm savings for furnace whistle, Reichmuth P.E., Howard, 1999. Engineering Review and Savings Estimates for the 'Filtertone' Filter Restriction Alarm.

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THINK! ENERGY with Idaho Power - ENERGY SAVINGS

Based on NEF Preferred Calculations and Program Experience

TAKE ACTION PROGRAM

Estimated Gross Electric Savings - 2013 Program

Energy-Efficient Measure	Number of Participants[4]	Electric Water Heater Share[1]	In-Service Rate (ISR)[1]	Unit kWh Savings[2]	Annual kWh Savings	Years[2]	Lifetime kWh Savings
Low Flow Showerhead	2,490	43.6%	43.6%	641.8	303,668	9	2,733,008
LED Night Light	2,490	n/a	88.5%	26.3	57,938	8	463,505
Furnace Whistle	2,490	n/a	23.9%	125.9	74,869	15	1,123,038
13W CFL	2,490	n/a	63.0%	48.0	75,315	6.4	482,016
18W CFL	2,490	n/a	59.9%	35.8	53,378	6.4	341,619
23W CFL	2,490	n/a	56.6%	50.1	70,614	6.4	451,932
Total TAKE ACTION kWh Savings					**635,782**		**5,595,118**

Additional Estimated Gross Savings - Natural Gas

Energy-Efficient Measure	Number of Participants[4]	Natural Gas Water Heater Share[1]	In-Service Rate (ISR)[1]	Unit Therm Savings[3,6]	Annual Therm Savings	Years[3]	Lifetime Therm Savings
Low Flow Showerhead	2,490	47.7%	43.6%	27.3	14,138	9	127,243
Furnace Whistle	2,490	n/a	23.9%	12.0	7,153	15	107,298
Total TAKE ACTION Therm Savings					**21,291**		**234,541**

Additional Estimated Gross Savings - Water

Energy-Efficient Measure	Number of Participants[4]	Water Heater Share	In-Service Rate (ISR)[1]	Unit Gallon Savings[5]	Annual Gallon Savings	Years[5]	Lifetime Gallon Savings
Low Flow Showerhead	2,490	n/a	43.6%	5,053.8	5,485,394	9	49,368,542
Total TAKE ACTION Gallon Savings					**5,485,394**		**49,368,542**

[1] Data from Home Energy Worksheets.

[2] kWh savings for CFLs, Night Light, and Furnace Whistle from 2013 Pennsylvania TRM.

[3] Therm savings for showerhead from 2013 Illinois TRM.

[4] Total number of participants taking home Take Action kits.

[5] Gallon savings from 2013 Illinois TRM.

[6] Therm savings for furnace whistle, Reichmuth P.E., Howard, 1999. Engineering Review and Savings Estimates for the 'Filtertone' Filter Restriction Alarm.

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Showerhead Algorithms - Regional Technical Forum

Showerhead - RTF - kWh	BASELINE	RETROFIT	SAVINGS
Daily showers per person (any shower)	0.46	0.46	
Annualized occupancy	350	350	
Persons per showerhead	2.51	2.51	
Avg shower length (min. per shower)	7.84	7.84	
Shower GPM	2.2	1.35	
Shower Water from Hot Tap	0.731	0.782	
Water Heater outlet temp minus Inlet temp	75	75	
Total gallons per year	6,970	4,277	**2,692.9890**
Hot water gallons per year	5,095	3,345	
Hot water gallons degF per year	382,135	250,852	
Water Heater Heating energy per year (kWh)	0.002493	0.002493	
Annual kWh	952.6629	625.3739	327.2891
Water/wastewater kWh savings per installed measure			14
Electric water heater ratio			0.4359
Program water/wastewater kWh savings per installed ELECTRIC measure			32.1175
Annual kWh savings per installed measure			**359.4065**

Showerhead - RTF - Therms	BASELINE	RETROFIT	SAVINGS
Daily showers per person (any shower)	0.46	0.46	
Annualized occupancy	350	350	
Persons per showerhead	2.51	2.51	
Avg shower length (min. per shower)	7.84	7.84	
Shower GPM	2.2	1.35	
Shower Water from Hot Tap	0.731	0.782	
Water Heater outlet temp minus Inlet temp	75	75	
Total gallons per year	6,970	4,277	**2,692.9890**
Hot water gallons per year	5,095	3,345	
Hot water gallons degF per year	382,135	250,852	
Water Heater Heating energy per year (therms)	0.0001112	0.0001112	
Annual therm savings per installed measure	42.4934	27.8947	**14.5987**

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Showerhead Algorithms - 2013 Illinois TRM

Showerhead - 2013 Illinois TRM - kWh

GPM Base	2.35
GPM Low	1.5
Minutes per Shower	8.2
Household Size	5.1506
Showers per capita per day	0.75
Days per year	365.25
Showers per household *(based on NEF Nicor-ComEd 2011-12 program data)*	1.9459
EPG_Gas (Energy per gallon of hot water supplied by electric)	0.127
Annual kWh savings per installed measure with electric water heating	**641.8378**

kWh Algorithm: ((b2*b4)-(b3*b4))*b5*b6*b7*b9/b8

Showerhead - 2013 Illinois TRM - Therms

GPM Base	2.35
GPM Low	1.5
Minutes per Shower	8.2
Household Size	5.1506
Showers per capita per day	0.75
Days per year	365.25
Showers per household *(based on NEF Nicor-ComEd 2011-12 program data)*	1.9459
EPG_Gas (Energy per gallon of hot water supplied by gas)	0.0054
Annual therm savings per installed measure with gas water heating	**27.2907**

Therms Algorithm: ((b14*b16)-(b15*b16))*b17*b18*b19*b21/b20

Showerhead - 2013 Illinois TRM - Gallons

GPM Base	2.35
GPM Low	1.5
Minutes per Shower	8.2
Household Size	5.1506
Showers per capita per day	0.75
Days per year	365.25
Showers per household *(based on NEF Nicor-ComEd 2011-12 program data)*	1.9459
Annual gallon savings per installed measure	**5053.8410**

Gallons Algorithm: ((b30*b32)-(b31*b32))*b33*b34*b35/b36

Lighting and Furnace Whistle Algorithms - 2013 Pennsylvania TRM

13W CFL Algorithm - 2013 Pennsylvania TRM	
Wattage - baseline	60
Wattage - retrofit	13
Hours of Use	2.8
Days per Year	365
Annual kWh savings per installed measure	**48.034**

18W CFL Algorithm - 2013 Pennsylvania TRM	
Wattage - baseline	53
Wattage - retrofit	18
Hours of Use	2.8
Days per Year	365
Annual kWh savings per installed measure	**35.77**

23W CFL Algorithm - 2013 Pennsylvania TRM	
Wattage - baseline	72
Wattage - retrofit	23
Hours of Use	2.8
Days per Year	365
Annual kWh savings per installed measure	**50.078**

LED Night Light Algorithm - 2013 Pennsylvania TRM	
Delta Watts (baseline - retrofit)	6
Hours of Use	12
Days per Year	365
Annual kWh savings per installed measure	**26.28**

Furnace Whistle - 2013 Pennsylvania TRM	
Average Seven PA cities kWh savings per installed measure	125.8571
Annual kWh savings per installed measure	**125.8571**

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Summary of *Home Energy Worksheet* Responses

Total scan forms: 1813

Q1

From Page 7 of the Student Guide, what is the main source of heat in your home?

Other fuel	Wood or geothermal	Electricity	Natural gas
68	117	745	870
3.78%	6.50%	41.39%	48.33%

Q2

How much will your family turn down the thermostat in winter for heating?

Won't adjust thermostat	5+ degrees	3-4 degrees	1-2 degrees
469	382	484	440
26.42%	21.52%	27.27%	24.79%

Q3

How much will your family turn up the thermostat in summer for cooling?

Won't adjust thermostat	5+ degrees	3-4 degrees	1-2 degrees
527	343	461	455
29.51%	19.20%	25.81%	25.48%

Q4

From Page 9 of the Student Guide, how many light bulbs are in your home today?

31+	21-30	11-20	1-10
699	408	457	223
39.12%	22.83%	25.57%	12.48%

Q5

How many CFLs were you using before the THINK! ENERGY program?

21+	11-20	1-10	None
282	313	734	454
15.82%	17.55%	41.17%	25.46%

Q6

What was the wattage of the bulb you replaced with the 13-watt CFL from your kit?

Didn't install CFL	Other	100	75	60
661	176	73	237	638
37.03%	9.86%	4.09%	13.28%	35.74%

Q7

What was the wattage of the bulb you replaced with the 18-watt CFL from your kit?

Didn't install CFL	Other	100	75	60
718	149	98	418	409
40.07%	8.31%	5.47%	23.33%	22.82%

Q8

What was the wattage of the bulb you replaced with the 23-watt CFL from your kit?

Didn't install CFL	Other	100	75	60
778	166	288	228	334
43.37%	9.25%	16.05%	12.71%	18.62%

Q9

Did you use the LED night light from your kit?

No	Yes
207	1600
11.46%	88.54%

Q10

Did you install the furnace whistle from your kit?

No	Yes
1360	427
76.11%	23.89%

Q11

Are you using the shower timer from your kit?

No	Yes
366	1438
20.29%	79.71%

Q12

Did you raise your refrigerator temperature after you checked the temperature with the thermometer from your kit?

No	Yes
1329	467
74.00%	26.00%

Q13

From Page 15 of the Student Guide, what was the flow rate of your old shower head?

Did not test	3.1+ gpm	2.6-3.0 gpm	2.1-2.5 gpm	1.6-2.0 gpm	1.1-1.5 gpm	0-1.0 gpm
1053	99	100	113	164	160	67
59.97%	5.64%	5.69%	6.44%	9.34%	9.11%	3.82%

Q14

Did you install the new high-efficiency shower head from your kit?

No	Yes
999	772
56.41%	43.59%

Q15

From Page 16 of the Student Guide, how is your water heated?

Other	Electricity	Natural gas
153	769	842
8.67%	43.59%	47.73%

Q16

Did an adult lower your water heater temperature settings?

No	Yes
1350	397
77.28%	22.72%

Q17

How many people live in your home?

10+	9	8	7	6	5	4	3	1	0
28	43	77	163	342	458	453	182	35	5
1.57%	2.41%	4.31%	9.13%	19.15%	25.64%	25.36%	10.19%	1.96%	0.28%

Q18

Has participation in THINK! ENERGY changed the way you use energy in your home?

No	Yes
335	1415
19.14%	80.86%

Q19

Did you work with your family on this program?

No	Yes
314	1464
17.66%	82.34%

Q20

How would you rate the Idaho Power THINK! ENERGY Student Energy Efficiency Kit Program?

Not so good	Okay	Pretty good	Great
30	197	584	974
1.68%	11.04%	32.72%	54.57%

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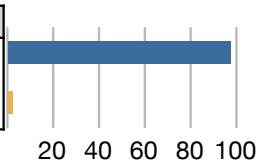
Parent Evaluation
Take Action Program

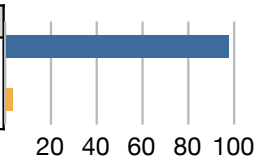
Were the kit and devices easy for you and your child to install and use?

Response	Frequency	Percent
Yes	67	97.1%
No	0	0.0%
No response	2	2.9%



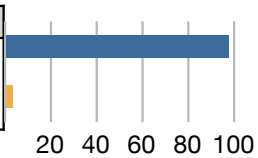
Will you continue to use the kit items after the completion of the program?

Response	Frequency	Percent
Yes	67	97.1%
No	0	0.0%
No response	2	2.9%



Would you like to see this program continued in local schools?

Response	Frequency	Percent
Yes	67	97.1%
No	0	0.0%
No response	2	2.9%



Do you have any comments about the THINK! ENERGY program you would like to share with the program sponsor? (Favorite aspect, etc.)
Excellent! Thank you so very much.
Good educational tool
Great idea!
Great idea!
Great idea!!!
Great program for children and adults.
Great program.
Great! You try to teach kids to shut off lights, but this makes them think and actually do!
How come you don't tell customers about this on their bills each month?
I liked the shower head, it saves me water and keeps the time when showering. It motivates us to be faster. I also like the lamp in the night.
I think it was a very nice idea.
It was a fun project. Thank you.
It's great.
Muchas gracias por ensenta alos ninos a adiay energia. (Thank you for teaching the children about saving energy.)
Shower head was great and loved the items that taught energy conservation.
Thank you for doing this.
Thank you so much! Love that they learn about this!
Thank you!
Thanks, what a great idea!
The furnace whistle ref. thermometer was not easy to use. It was a great family activity!
This is a great way to make children learn to be energy conscious.
Use led's instead of CFL. We know about your plan... We're not that dumb.

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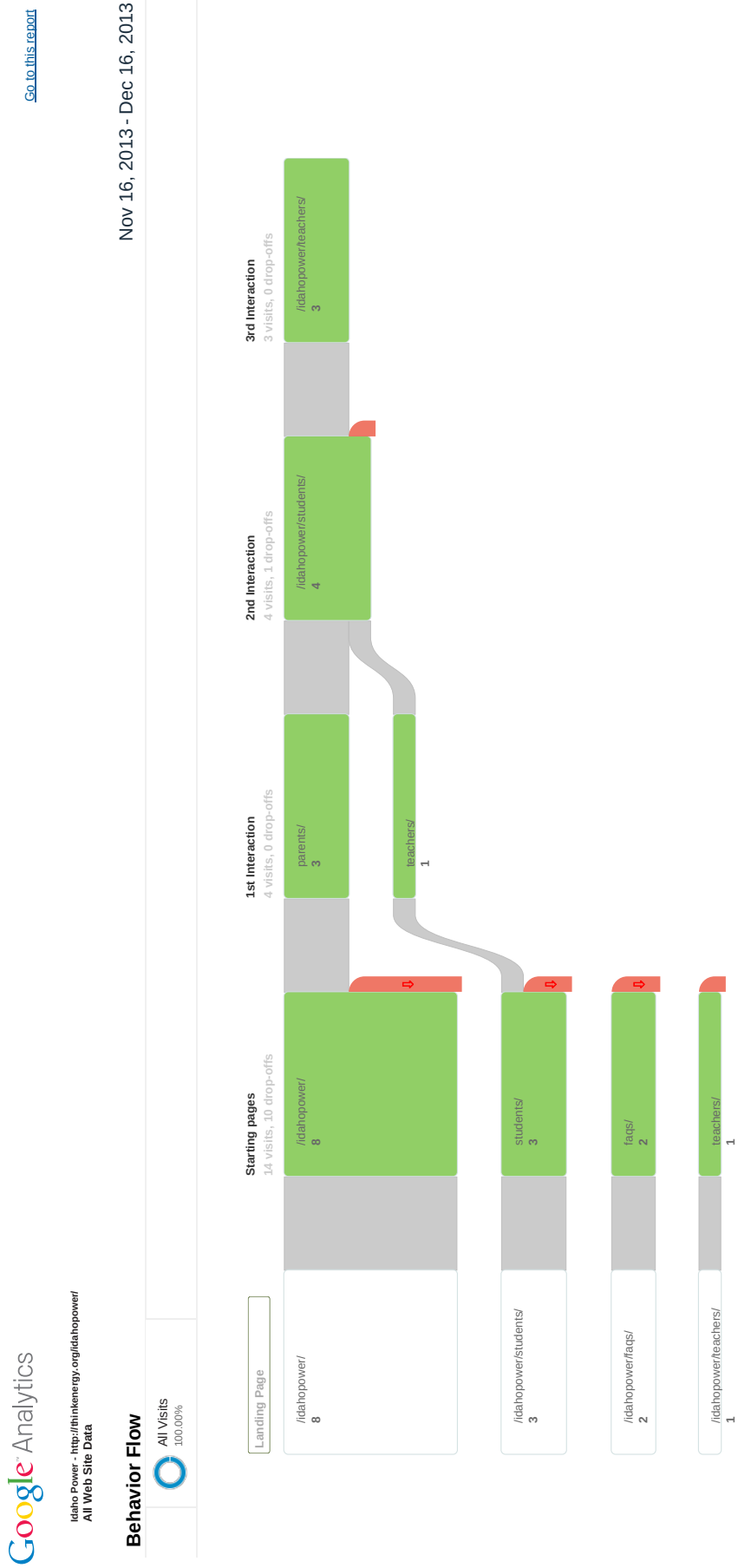
Website Analytics



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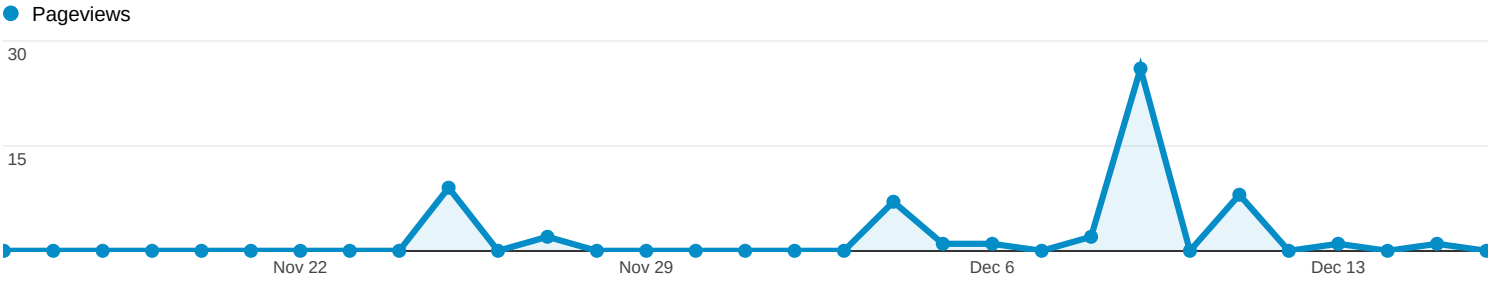
All Web Site Data

Overview

Nov 16, 2013 - Dec 16, 2013

All Visits
100.00%

Overview



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Pageviews	Unique Pageviews	Avg. Time on Page	Bounce Rate	% Exit
58	28	00:00:54	64.29%	24.14%

	Page	Pageviews	% Pageviews
1.	/idahopower/students/	17	29.31%
2.	/idahopower/	16	27.59%
3.	/idahopower/teachers/	11	18.97%
4.	/idahopower/parents/	8	13.79%
5.	/idahopower/faqs/	6	10.34%

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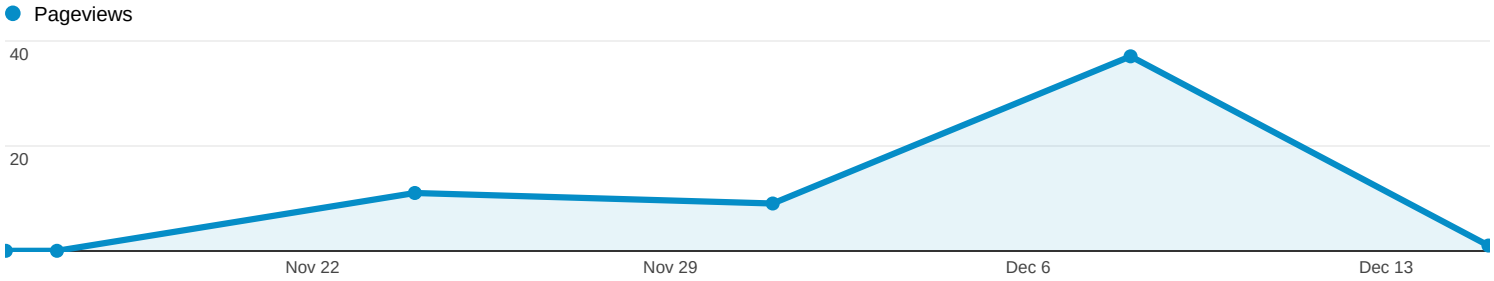
Idaho Power - http://thinkenergy.org/idahopower/
All Web Site Data

Overview

Nov 16, 2013 - Dec 16, 2013

All Visits
100.00%

Overview



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Pageviews	Unique Pageviews	Avg. Time on Page	Bounce Rate	% Exit
58	28	00:00:54	64.29%	24.14%

	Page	Pageviews	% Pageviews
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2.	/idahopower/	16	27.59%
3.	/idahopower/teachers/	11	18.97%
4.	/idahopower/parents/	8	13.79%
5.	/idahopower/faqs/	6	10.34%

Customer Service Log

	Teacher Email		Lisa Response		
Email Reason	**Date**	**Time**	**Date**	**Time**	**Emotion level 1-5 (highest)**
Received items confirmation	9/26/13	5:57 PM	9/26/13	5:58 PM	3
	9/26/13	5:39 PM	9/26/13	5:50 PM	3
	9/27/13	9:37 AM	9/27/13	9:41 AM	3
	9/27/13	3:31 PM	9/27/13	3:37 PM	3
	10/3/13	11:19 AM	10/3/13	12:01 PM	3
	10/8/13	5:37 PM	10/9/13	8:03 AM	3
	10/8/13	11:47 AM	10/8/13	12:08 PM	3
	10/8/13	10:20 AM	10/8/13	11:59 AM	3
	10/8/13	10:20 AM	10/8/13	11:58 AM	3
	10/10/13	10:13 AM	10/10/13	10:37 AM	3
Additional items needed	9/26/13	3:52 PM	9/27/13	2:36 PM	3
	9/30/13	5:25 PM	9/30/13	5:43 PM	3
	10/7/13	2:31 PM	10/7/13	2:41 PM	3
	10/7/13	4:00 PM	10/7/13	6:17 PM	3
	10/10/13	4:37 PM	10/10/13	5:16 PM	3
	10/11/13	1:46 PM	10/14/13	9:23 AM	3
	11/1/13	10:11 AM	11/4/13	8:58 AM	3
	11/7/13	9:04 PM	11/8/13	7:55 AM	3
Kits to return	10/1/13	9:44 AM	10/1/13	2:10 PM	3
	10/22/13	4:49 PM	10/24/13	5:56 AM	3
Inquiry about shipment	10/3/13	4:18 PM	10/3/13	5:20 PM	3
	10/4/13	3:07 PM	10/4/13	3:32 PM	3
	10/4/13	3:36 PM	10/4/13	3:40 PM	3
	10/5/13	9:37 AM	10/15/13	9:46 AM	3
	10/9/13	5:56 PM	10/10/13	8:03 AM	3
	10/10/13	8:20 AM	10/10/13	8:27 AM	3
	10/10/13	2:43 AM	10/10/13	2:58 PM	3

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Lost items "Requested Replacements"	10/21/13	4:34 PM	10/21/13	5:36 PM	3
	11/1/13	7:45 AM	11/1/13	8:30 AM	3
	11/7/13	6:15 PM	11/8/13	7:54 AM	3
	11/12/13	12:31 PM	11/12/13	5:04 PM	3
Expense of program	10/22/13	10:39 AM	10/22/13	11:25 AM	3
	10/23/13	4:49 PM	10/24/13	8:56 AM	3
Items not working (flash drive or reflector)	10/1/13	1:21 PM	10/2/13	8:18 PM	3
	10/8/13	5:37 PM	10/9/13	8:03 AM	3
	10/9/13	8:37 PM	10/10/13	8:13 AM	3
	10/10/13	12:34 PM	10/10/13	1:59 PM	3
	10/22/13	10:48 AM	10/22/13	12:06	3
	11/2/13	10:45 AM	11/4/13	8:45 AM	3
	11/4/13	9:30 AM	11/4/13	9:36 AM	3
"Thank You" for reminder emails	11/1/13	3:36 PM	11/4/13	8:52 AM	3
	11/10/13	7:49 PM	11/11/13	8:10 AM	3
	11/10/13	6:25 PM	11/11/13	8:09 AM	3
	11/14/13	7:33 AM	11/14/13	8:57 AM	3
	11/15/13	12:35 PM	11/15/13	12:42 PM	3
	11/15/13	9:16 AM	11/15/13	9:30 AM	3
	11/15/13	10:19 AM	11/15/13	10:49 AM	3
Mini-grant clarification	11/1/13	2:57 PM	11/4/13	8:54 AM	3
Inquiry - Did We Receive Packet?	11/1/13	11:40 AM	11/1/13	1:00 PM	3
	11/1/13	9:27 AM	11/4/13	9:00 AM	3
	11/4/13	11:53 AM	11/4/13	1:00 PM	3
	11/10/13	6:44 PM	11/11/13	8:10 AM	3
	11/12/13	3:04 PM	11/12/13	5:07 PM	3
	11/14/13	12:02 PM	11/14/13	3:52 PM	3
Needs extension	11/15/13	1:27 PM	11/15/13	2:24 PM	3

"Thank You" loved program	11/1/13	10:50 AM	11/4/13	8:55 AM	3
	11/4/13	4:59 PM	11/5/13	1:31 PM	3
	11/4/13	1:23 PM	11/4/13	1:30 PM	3
	11/11/13	5:46 PM	11/12/13	8:09 AM	3
	11/13/13	10:28 AM	11/13/13	10:30 AM	3
	11/18/13	4:00 PM	11/18/13	4:07 PM	3
	12/7/13	2:27 PM	12/7/13	2.30 pm	4

Additional request sent to return HEWs			12/6/13	3:07 PM	3
	12/6/13	5:42 PM	12/6/13	5:45 PM	3
	12/9/13	10:41 AM	12/9/13	11:49 PM	3
	12/9/13	12:06 PM			3
			12/6/13	3:37 PM	3
	12/6/13	4:18 PM	12/6/13	5:22 PM	3
	12/7/13	8:48 PM	12/8/13	7:07 PM	3
	12/9/13	9:51 AM	12/9/13	10:26 AM	3
			12/6/13	3:06 PM	3
	12/6/13	3:28 PM	12/6/13	5:22 PM	3
			12/6/13	3:00 PM	3
	12/6/13	3:23 PM	12/6/13	5:21 PM	3

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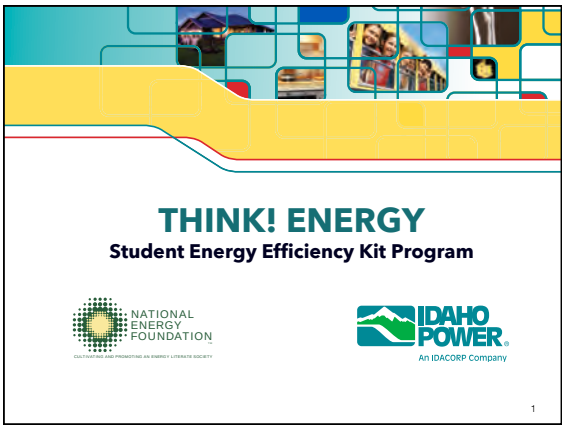
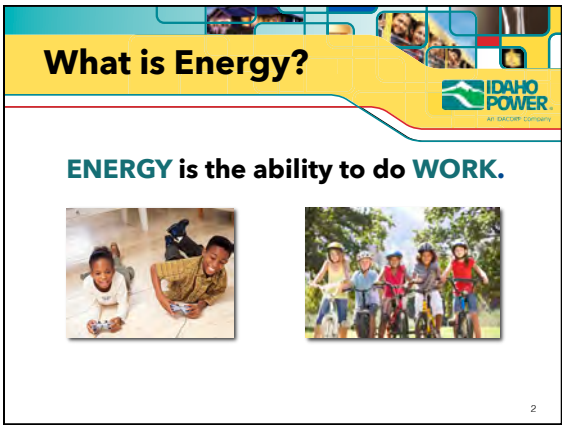
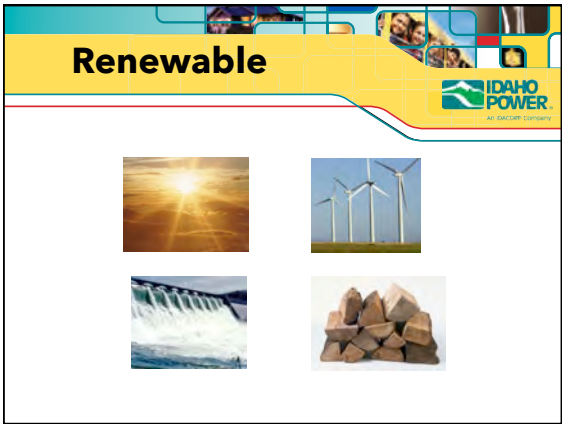
Program Documents

Student presentation







Energy Efficiency

Technology + Behavior
to reduce energy use

Furnace Filter

Furnace Filter Whistle

The 3 Rs

Reduce
-Use it less.

Reuse
-Use it again.

Recycle
-Break it down and make it into something new.

Recycling saves resources and the energy to make them into products.

THINK! ENERGY

You can make a difference!

Use the items in your kit. Visit www.idahopower.com/think for help.

Then, complete the *Home Energy Worksheet*.

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Student Guide

IDAHO POWER®
An IDACORP Company

Student Guide

Program Partner:

NATIONAL ENERGY FOUNDATION™
CULTIVATING AND PROMOTING AN ENERGY LITERATE SOCIETY

www.idahopower.com/think

800–616–8326 x 131

THINK! ENERGY
TakeAction

Think! Talk! Take Action!

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IDAHO POWER®
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Dear Student,

Thank you for participating in Idaho Power's **THINK! ENERGY Student Energy Efficiency Kit Program**. We know that learning about energy while you are young will prepare you to make good energy choices throughout your life.

In this program, you will be asked to pay attention to how you are using electricity at home. When you think about how you use energy and begin to talk about it with your family, you will discover ways to save and become more efficient. Installing the items in your kit will help. Taking positive action and making thoughtful energy choices daily can help your family save energy and can help preserve the natural resources we enjoy.

Have fun and remember that wise, responsible use of resources benefits everyone.

Sincerely,

Denise C. Humphreys
Program Specialist, Energy Efficiency Education
Idaho Power

/idahopower

For additional resources for teachers, students and parents, visit *www.idahopower.com/think*.

HOME ENERGY WORKSHEET

1. From Page 7 of the *Student Guide*, what is the main source of heat in your home?
   ◯ Natural gas ◯ Electricity ◯ Wood or geothermal ◯ Other fuel
2. How much will your family turn down the thermostat in winter for heating?
   ◯ 1 – 2 degrees ◯ 3 – 4 degrees ◯ 5+ degrees ◯ Won't adjust thermostat
3. How much will your family turn up the thermostat in summer for cooling?
   ◯ 1 – 2 degrees ◯ 3 – 4 degrees ◯ 5+ degrees ◯ Won't adjust thermostat
4. From Page 9 of the *Student Guide*, how many light bulbs are in your home today?
   ◯ 1 – 10 ◯ 11 – 20 ◯ 21 – 30 ◯ 31+
5. How many CFLs were you using before the **THINK! ENERGY** program?
   ◯ None ◯ 1 – 10 ◯ 11 – 20 ◯ 21+
6. What was the wattage of the bulb you replaced with the 13-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other ◯ Didn't install CFL
7. What was the wattage of the bulb you replaced with the 18-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other ◯ Didn't install CFL
8. What was the wattage of the bulb you replaced with the 23-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other ◯ Didn't install CFL
9. Did you use the LED night light from your kit?
   ◯ Yes ◯ No
10. Did you install the furnace whistle from your kit?
    ◯ Yes ◯ No
11. Are you using the shower timer from your kit?
    ◯ Yes ◯ No
12. Did you raise your refrigerator temperature after you checked the temperature with the thermometer from your kit?
    ◯ Yes ◯ No
13. From Page 15 of the *Student Guide*, what was the flow rate of your old shower head?
    ◯ 0 – 1.0 gpm ◯ 1.1 – 1.5 gpm ◯ 1.6 – 2.0 gpm ◯ 2.1 – 2.5 gpm
    ◯ 2.6 – 3.0 gpm ◯ 3.1+ gpm ◯ Did not test
14. Did you install the new high-efficiency shower head from your kit?
    ◯ Yes ◯ No
15. From Page 16 of the *Student Guide*, how is your water heated?
    ◯ Natural gas ◯ Electricity ◯ Other
16. Did an adult lower your water heater temperature settings?
    ◯ Yes ◯ No
17. How many people live in your home?
    ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9 ◯ 10+
18. Has participation in **THINK! ENERGY** changed the way you use energy in your home?
    ◯ Yes ◯ No
19. Did you work with your family on this program?
    ◯ Yes ◯ No
20. How would you rate the Idaho Power **THINK! ENERGY Student Energy Efficiency Kit Program**?
    ◯ Great ◯ Pretty Good ◯ Okay ◯ Not So Good

Great job! Remember to take this workbook back to school so you can receive your certificate and a reward for completing the program.

NAME _____ DATE _____

SCHOOL _____ TEACHER _____

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Make solid marks that fill the response completely.
- Make no stray marks on this form.

CORRECT: ● **INCORRECT:** ✓ ☒ ◒ ◔

PRE SURVEY

Fill in **PRIOR TO** viewing the presentation from the flash drive. Answer each question to the best of your ability.

1. Which is a nonrenewable resource?
   - (A) Coal
   - (B) Water
   - (C) Wood
   - (D) Sunlight

2. A resource that is naturally replaced, that goes on and on, is called a
   - (A) Nonrenewable resource
   - (B) Flow resource
   - (C) Renewable resource
   - (D) Secondary resource

3. Which renewable resource do plants use in the process of photosynthesis?
   - (A) Natural gas
   - (B) Sunlight
   - (C) Coal
   - (D) Wind

4. Melting bottles and using the plastic to make something new like a shopping bag is called
   - (A) Reducing
   - (B) Reusing
   - (C) Recycling
   - (D) Rethinking

5. Which of the following would help conserve energy and natural resources?
   - (A) Using incandescent light bulbs
   - (B) Turning off lights
   - (C) Leaving the thermostat at the same setting all year long
   - (D) Asking an adult to set your water heater to 140 degrees

6. Which is the product we obtain from oil?
   - (A) Gasoline
   - (B) Natural gas
   - (C) Vegetable oil
   - (D) Charcoal

7. A lump of coal has what type of energy?
   - (A) Kinetic energy
   - (B) Gravitational potential energy
   - (C) Chemical potential energy
   - (D) Elastic potential energy

8. Aluminum foil is an example of
   - (A) Insulator
   - (B) Conductor
   - (C) Load
   - (D) Power source

9. When electricity flows in a circuit, some of the energy is ALWAYS changed into
   - (A) Heat
   - (B) Light
   - (C) Sound
   - (D) Motion

10. Energy efficiency means
    - (A) Not being able to meet our needs with energy
    - (B) Not using energy
    - (C) Finding ways to meet our needs using less energy
    - (D) Not thinking about our energy use

ID

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NAME _____ DATE _____

SCHOOL _____ TEACHER _____

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Make solid marks that fill the response completely.
- Make no stray marks on this form.

CORRECT: ● **INCORRECT:** ✓ ☒ ◒ ◔

POST SURVEY

Fill in **AFTER** returning the completed *Home Energy Worksheet* in your *Student Guide*. Answer each question to the best of your ability.

1. Which is a nonrenewable resource?
   - (A) Coal
   - (B) Water
   - (C) Wood
   - (D) Sunlight

2. A resource that is naturally replaced, that goes on and on, is called a
   - (A) Nonrenewable resource
   - (B) Flow resource
   - (C) Renewable resource
   - (D) Secondary resource

3. Which renewable resource do plants use in the process of photosynthesis?
   - (A) Natural gas
   - (B) Sunlight
   - (C) Coal
   - (D) Wind

4. Melting bottles and using the plastic to make something new like a shopping bag is called
   - (A) Reducing
   - (B) Reusing
   - (C) Recycling
   - (D) Rethinking

5. Which of the following would help conserve energy and resources?
   - (A) Using incandescent light bulbs
   - (B) Asking an adult to set your water heater to 120 degrees
   - (C) Leaving the thermostat at the same setting all year long
   - (D) Running the dishwasher after every meal

6. Which is the product we obtain from oil?
   - (A) Gasoline
   - (B) Natural gas
   - (C) Vegetable oil
   - (D) Charcoal

7. A lump of coal has what type of energy?
   - (A) Kinetic energy
   - (B) Gravitational potential energy
   - (C) Chemical potential energy
   - (D) Elastic potential energy

8. Aluminum foil is an example of
   - (A) Insulator
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   - (C) Load
   - (D) Power source

9. When electricity flows in a circuit, some of the energy is ALWAYS changed into
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   - (C) Sound
   - (D) Motion

10. Energy efficiency means
    - (A) Not being able to meet our needs with energy
    - (B) Not using energy
    - (C) Finding ways to meet our needs using less energy
    - (D) Not thinking about our energy use

Home Energy Worksheet scan form

First Name _____ **Last Initial** _____ **Date** _____

School _____ **Teacher** _____

MARKING INSTRUCTIONS

- Use a No. 2 pencil or black or blue ink pen only.
- Do not use pens with ink that soaks through the paper.
- Make solid marks that fill the response completely.
- Make no stray marks on this form.

CORRECT: ● INCORRECT:

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An IDACORP Company

1. From Page 7 of the *Student Guide*, what is the main source of heat in your home?

◯ Natural gas ◯ Electricity ◯ Wood or geothermal ◯ Other fuel

2. How much will your family turn down the thermostat in winter for heating?

◯ 1-2 degrees ◯ 3-4 degrees ◯ 5+ degrees ◯ Won't adjust thermostat

3. How much will your family turn up the thermostat in summer for cooling?

◯ 1-2 degrees ◯ 3-4 degrees ◯ 5+ degrees ◯ Won't adjust thermostat

4. From Page 9 of the *Student Guide*, how many light bulbs are in your home today?

◯ 1-10 ◯ 11-20 ◯ 21-30 ◯ 31+

5. How many CFLs were you using before the **THINK! ENERGY** program?

◯ None ◯ 1-10 ◯ 11-20 ◯ 21+

6. What was the wattage of the bulb you replaced with the 13-watt CFL from your kit?

◯ 60 ◯ 75 ◯ 100 ◯ Other
◯ Didn't install CFL

7. What was the wattage of the bulb you replaced with the 18-watt CFL from your kit?

◯ 60 ◯ 75 ◯ 100 ◯ Other
◯ Didn't install CFL

8. What was the wattage of the bulb you replaced with the 23-watt CFL from your kit?

◯ 60 ◯ 75 ◯ 100 ◯ Other
◯ Didn't install CFL

9. Did you use the LED night light from your kit?

◯ Yes ◯ No

10. Did you install the furnace whistle from your kit?

◯ Yes ◯ No

11. Are you using the shower timer from your kit?

◯ Yes ◯ No

12. Did you raise your refrigerator temperature after you checked the temperature with the thermometer from your kit?

◯ Yes ◯ No

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13. From Page 15 of the *Student Guide*, what was the flow rate of your old shower head?

◯ 0-1.0 gpm ◯ 1.1-1.5 gpm ◯ 1.6-2.0 gpm ◯ 2.1-2.5 gpm
◯ 2.6-3.0 gpm ◯ 3.1+ gpm ◯ Did not test

14. Did you install the new high-efficiency shower head from your kit?

◯ Yes ◯ No

15. From Page 16 of the *Student Guide*, how is your water heated?

◯ Natural gas ◯ Electricity ◯ Other

16. Did an adult lower your water heater temperature settings?

◯ Yes ◯ No

17. How many people live in your home?

◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9 ◯ 10+

18. Has participation in **THINK! ENERGY** changed the way you use energy in your home?

◯ Yes ◯ No

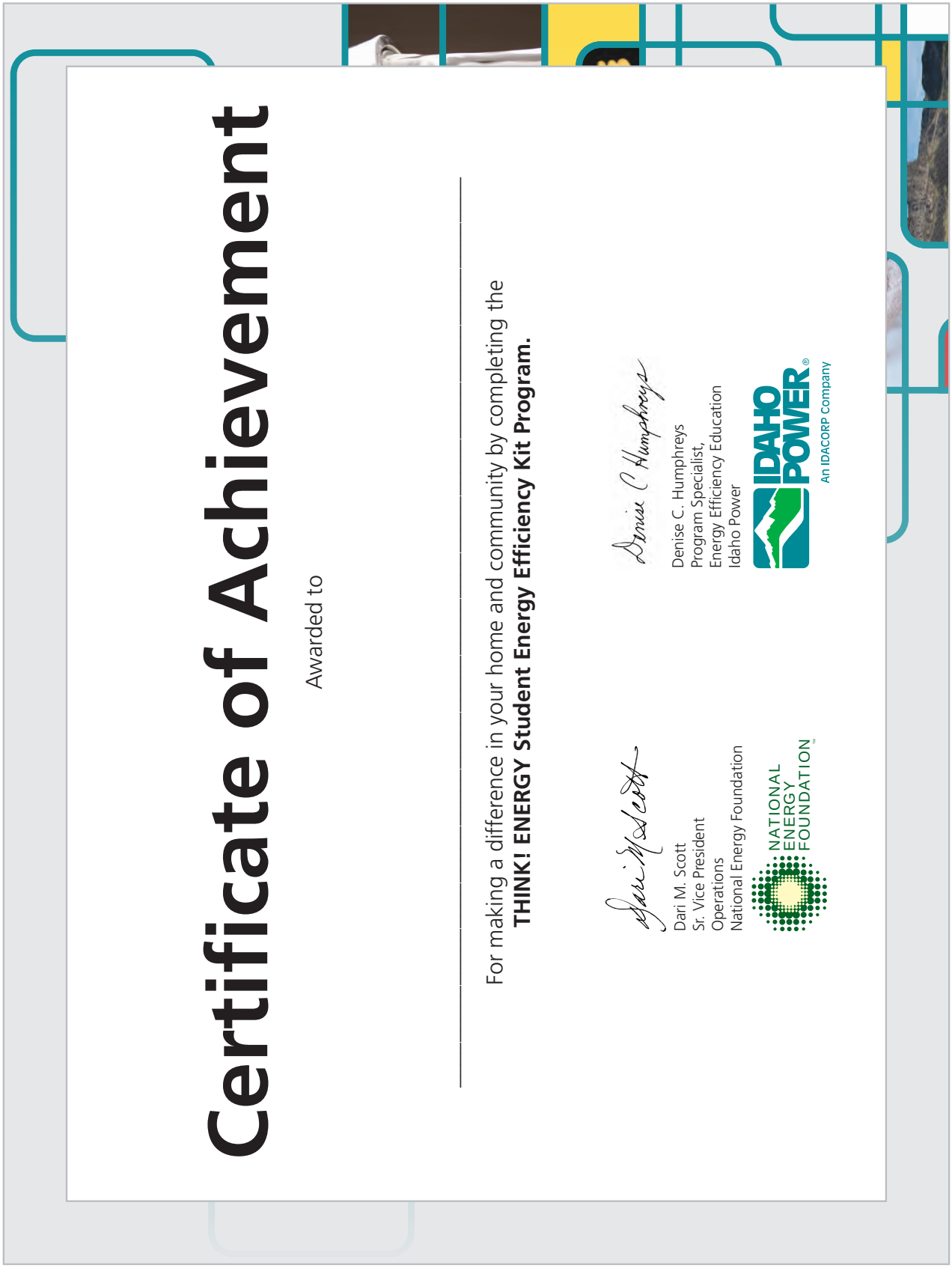
19. Did you work with your family on this program?

◯ Yes ◯ No

20. How would you rate the Idaho Power **THINK! ENERGY Student Energy Efficiency Kit Program**?

◯ Great ◯ Pretty good ◯ Okay ◯ Not so good

Certificate of Achievement



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Introduction Letter to Parents (English and Spanish)

IDAHO POWER®
An IDACORP Company

Dear Parent/Guardian,

This year our class has been selected to participate in Idaho Power's exciting **THINK! ENERGY Student Energy Efficiency Kit Program**. The program enhances our curriculum and was designed to help your child learn easy ways to use energy and water responsibly.

As part of the program, you will also receive a take-home kit to encourage your child to apply principles learned at school to real-life situations at home. The items in the kit, when combined with the assigned activities, will give your family the ability to make simple changes that can help you save energy.

Here's what you can expect from the program:

- Your child will participate in **THINK! ENERGY** lessons at school.
- Your child will bring home a *Take Action* kit full of energy efficiency products.
- We ask that you help your child install the energy-efficient products. It is easy. Review the *Student Guide* in the kit to learn how to use each item. As you complete the guide, you will see how much energy you will be able to save.
- Your child will use the *Student Guide* to complete the *Home Energy Worksheet* in the back of the book. This information helps connect the learning to real-world actions, completing the learning cycle. When your child returns the *Home Energy Worksheet*, he/she will receive a *THINK! ENERGY* reflector reward. And when the class completes the program, it can earn an additional mini-grant of up to $100.
- Your feedback is important. Once you and your child have completed the program, please take a moment to fill out the postage-paid *Parent Comment Card* located in the kit.
- For assistance, call National Energy Foundation toll-free at 800-616-8326 x 131, or visit the program website at *www.idahopower.com/think*.

We believe the **THINK! ENERGY Student Energy Efficiency Kit Program** will be a positive experience for your entire family and will encourage your child to be a leader at home and in the community. Thank you for participating.

***Take Action* kit**
Learn more at
www.idahopower.com/think

Estimados Padres/Tutor:

Este año nuestra clase ha sido seleccionada para participar en el programa emocionante de **THINK! ENERGY Student Efficiency Kit Program**. El programa aumenta nuestro plan de estudios y fue diseñado para ayudar a su hijo(a) a aprender maneras sencillas de usar la energía y agua responsablemente.

Al participar en el programa, recibirá un kit para animar a su hijo(a) a aplicar principios que ha aprendido en la escuela a situaciones de la vida real en el hogar. Los artículos en el kit, combinado con los actividades asignados, le daría a su familia la habilidad de hacer cambios fáciles que pueden ayudarle a ahorrar energía.

Aquí está lo que puede esperar del programa:

- Su hijo(a) participará en una presentación de **THINK! ENERGY** que será realizada en la escuela.
- Su hijo(a) traerá a casa el kit de *Take Action* lleno de productos de eficiencia energética.
- Le pedimos que usted ayudará a su hijo(a) a instalar los productos de eficiencia energética. Es fácil. Repase la Guía Estudiantil en el kit para aprender cómo utilizar cada artículo. Al completar la guía, le dará cuenta de cuánta energía ahorrará.
- Su hijo(a) usará la *Guía Estudiantil* para completar la *Boletín del Hogar* en el parte posterior del libro. Ésta información ayuda a conectar nuestro aprendizaje a acciones del mundo real, y así completamos el ciclo de aprendizaje. Cuando su hijo(a) devuelva la Hoja de Trabajo, recibirá un reflector THINK! ENERGY de recompensa. Y cuando la clase cumple el programa, se puede ganar una mini-subvención adicional de hasta $100.
- Su opinión es importante. Una vez que usted y su hijo(a) han completado el programa, por favor tome un momento para llenar la *Tarjeta de Comentarios de Padres* con franqueo pagado, situado en el kit.
- Para obtener asistencia, llame a la National Energy Foundation a 800-616-8326, o visite el programa en el web a *www.idahopower.com/think*.

Creemos que el **Programa THINK! ENERGY Student Energy Efficiency Kit** será una experiencia positive para la familia entera y también animará a su hijo(a) ser un líder en el hogar y en la comunidad. Gracias por su participación.

***Take Action* kit**
Aprenda más a
www.idahopower.com/think

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THINK! ENERGY Student Energy Efficiency Kit Program

Implementation Checklist

DO TODAY

_____ Confirm that you received a *Teacher Materials* folder and one of the following for each student: *Take Action* kit, *Certificates of Achievement*, *THINK! ENERGY* reflector reward, *Home Energy Worksheets*, *Pre/Post Surveys* (double-sided on one form). If you did not, call Lisa Johnson toll-free at 800-616-8326 ext 131.

_____ Find the *Introduction Letter to Parents* and send home with students.

_____ Review the contents of the *Teacher Materials* folder and *Teacher Guide*.

_____ Give students the *Pre-Survey* and collect for safe keeping.

DO AS SOON AS POSSIBLE

_____ Store the completed *Pre-Surveys* to be finished at a later time.

_____ Show the presentation from the flash drive to your students.

_____ Pass out kits to students and set a due date for return of the completed *Student Guide*. Give students about a week to install the products. For best results, do NOT send home the *Home Energy Worksheet* scan forms.

_____ Review the curriculum from you *Teacher Guide* and the back of your instructional posters. Choose which curriculum is appropriate for presenting.

DO AFTER STUDENTS RETURN STUDENT GUIDES

_____ Give students the *Post-Survey* (on the back of the *Pre-Survey* given earlier).

_____ Have students transfer their answers from the *Student Guide* to the *Home Energy Worksheet* scan forms. Don't forget to do one yourself if you have a kit!

Home Energy Worksheet scan forms cannot be copied since they are on special paper. Make sure teacher names are printed legibly on the form. Student names should be recorded on the form for record keeping. Contact Lisa Johnson toll-free at 800-616-8326 ext 131 if you need more scan forms.

_____ Give students that return their *Home Energy Worksheet* a *THINK! ENERGY* reflector and *Certificate of Achievement*.

_____ Return the *Pre/Post Surveys*, *Home Energy Worksheet* scan forms and *Thank You Card* in the postage-paid envelope from your *Teacher Materials* folder on or before November 15, 2013 to receive your mini-grant.

Note: Please do NOT send the back pages of the *Student Guide*, as they are not readable and will not count toward the mini-grant.

_____ Watch for an email from National Energy Foundation acknowledging receipt of your packet. Mini-grants will be distributed in December 2013.

Remember the amount of the mini-grant is based on the percentage of *Home Energy Worksheet* scan forms returned. Eighty percent or more earns your class the full $100.

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Teacher Guide

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Teacher Guide

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TakeAction

Think! Talk! Take Action!

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Thank you for choosing to participate in Idaho Power's **THINK! ENERGY Student Energy Efficiency Kit Program**. We hope this program will help you teach students to value resources and be thoughtful and responsible about their energy use both at school and at home. To find more tips and tools to help save energy or to learn more about our energy efficiency programs, go to www.idahopower.com/think.

For assistance or support, visit www.idahopower.com/think or call 800-616-8326 x 131.

/idahopower

HOME ENERGY WORKSHEET

1. From Page 7 of the *Student Guide*, what is the main source of heat in your home?
   ◯ Natural gas ◯ Electricity ◯ Wood or geothermal ◯ Other fuel
2. How much will your family turn down the thermostat in winter for heating?
   ◯ 1 – 2 degrees ◯ 3 – 4 degrees ◯ 5+ degrees ◯ Won't adjust thermostat
3. How much will your family turn up the thermostat in summer for cooling?
   ◯ 1 – 2 degrees ◯ 3 – 4 degrees ◯ 5+ degrees ◯ Won't adjust thermostat
4. From Page 9 of the *Student Guide*, how many light bulbs are in your home today?
   ◯ 1 – 10 ◯ 11 – 20 ◯ 21 – 30 ◯ 31+
5. How many CFLs were you using before the **THINK! ENERGY** program?
   ◯ None ◯ 1 – 10 ◯ 11 – 20 ◯ 21+
6. What was the wattage of the bulb you replaced with the 13-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other ◯ Didn't install CFL
7. What was the wattage of the bulb you replaced with the 18-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other ◯ Didn't install CFL
8. What was the wattage of the bulb you replaced with the 23-watt CFL from your kit?
   ◯ 60 ◯ 75 ◯ 100 ◯ Other ◯ Didn't install CFL
9. Did you use the LED night light from your kit?
   ◯ Yes ◯ No
10. Did you install the furnace whistle from your kit?
    ◯ Yes ◯ No
11. Are you using the shower timer from your kit?
    ◯ Yes ◯ No
12. Did you raise your refrigerator temperature after you checked the temperature with the thermometer from your kit?
    ◯ Yes ◯ No
13. From Page 15 of the *Student Guide*, what was the flow rate of your old shower head?
    ◯ 0 – 1.0 gpm ◯ 1.1 – 1.5 gpm ◯ 1.6 – 2.0 gpm ◯ 2.1 – 2.5 gpm
    ◯ 2.6 – 3.0 gpm ◯ 3.1+ gpm ◯ Did not test
14. Did you install the new high-efficiency shower head from your kit?
    ◯ Yes ◯ No
15. From Page 16 of the *Student Guide*, how is your water heated?
    ◯ Natural gas ◯ Electricity ◯ Other
16. Did an adult lower your water heater temperature settings?
    ◯ Yes ◯ No
17. How many people live in your home?
    ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9 ◯ 10+
18. Has participation in **THINK! ENERGY** changed the way you use energy in your home?
    ◯ Yes ◯ No
19. Did you work with your family on this program?
    ◯ Yes ◯ No
20. How would you rate the Idaho Power **THINK! ENERGY Student Energy Efficiency Kit Program**?
    ◯ Great ◯ Pretty Good ◯ Okay ◯ Not So Good

Great job! Remember to take this workbook back to school so you can receive your certificate and a reward for completing the program.

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Rewarding Results

Reward Your Students:

Give students a *THINK! ENERGY* reflector when they return their *Student Guides* to class and transfer their answers to the *Home Energy Worksheet* scan form.

Reward Yourself:

Earn a mini-grant of up to $100 from Idaho Power by returning your *Home Energy Worksheet* scan forms to NEF by November 15, 2013.

It's easy. Have students transfer the answers from the back of their *Student Guide* to the official *Home Energy Worksheet* scan form, place them in the postage-paid envelope located in your *Teacher Materials* folder, and drop them in the mail. You will receive a mini-grant based on the percentage of completed forms returned.

Return Rate	Mini-Grant Award
80 – 100 percent	$100 + entry into iPad Drawing
65 – 79 percent	$75
50 – 64 percent	$50
Less than a 49 percent	$25

A check will be made out to the school for the total funds earned by teachers participating in the **THINK! ENERGY Student Energy Efficiency Kit Program**. Funds are designated for classroom use and dispersed according to each teacher's qualifications.

Questions? Call 800-616-8326 ext. 131 toll-free.

NATIONAL ENERGY FOUNDATION™

IDAHO POWER®
An IDACORP Company

iPad Drawing flier

Enter to win an iPad®

Teachers who return 80 percent or more of their students' completed *Home Energy Worksheet* scan forms by November 15, 2013, will be entered into a drawing for a chance to win a new iPad®. Please use the postage-paid envelope provided in your *Teacher Materials* folder to mail your completed forms.

Easy tips to make sure your students complete the homework and return the *Home Energy Worksheet* questions:

- Introduce the **THINK! ENERGY Student Energy Efficiency Kit Program** to parents at parent-teacher conferences or other parent meetings.
- Have students complete the *Home Energy Worksheet* questions in the *Student Guide* at home and bring it back to class. Students can then transfer their answers onto the *Home Energy Worksheet* scan forms that are provided in your *Teacher Materials* folder in class. This eliminates scan forms getting lost or damaged.
- Offer extra credit to students who complete the *Home Energy Worksheet* in their guide and return it when you ask.
- Reward each student who completes and returns the *Home Energy Worksheet* with a reflector. DO NOT pass out the reflectors until the student has returned the completed form.

Contest rules can be found online at *www.idahopower.com/think*
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iPad and the Apple logo are registered trademarks of Apple Inc.

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Program Evaluation

Teacher Name: _____

School: _____

City: _____ Date: _____

Number of *Home Energy Worksheet* scan forms returned, including your own: _____

In an effort to improve our program, we would like your assessment of the **THINK! ENERGY Student Energy Efficiency Kit Program**. Please take a few moments to fill out this evaluation form. Upon completion, please return the form in the pre-addressed return envelope along with the student *Home Energy Worksheet* scan forms you collected, including your own if you took a kit.

Fill the response bubbles COMPLETELY using a No. 2 pencil or a blue or black ink pen.
Please do not copy or fold forms.

Please share your impression of the **THINK! ENERGY Student Energy Efficiency Kit Program**:

	Excellent	Good	Fair	Poor
Content	◯	◯	◯	◯
Materials	◯	◯	◯	◯
Student engagement	◯	◯	◯	◯
Parental support	◯	◯	◯	◯

Would you recommend this program to colleagues? ◯ Yes ◯ No

Was the educational mini-grant a good incentive to participate in the program? ◯ Yes ◯ No

How many learning activities did you use from the *Teacher Guide* or instructional posters?
◯ 1 - 10 ◯ 11 - 20 ◯ Over 20

How many more learning activities do you plan to use from the *Teacher Guide* or instructional posters?
◯ 1 - 10 ◯ 11 - 20 ◯ Over 20

What would you tell other teachers about the program?

What kind of feedback did you get from the students?

How can we improve the program?

Additional comments and recommendations:

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Parent Postcard

Attention Parents/Guardians,
Atención Padres/Tutores,

To continuously improve the **THINK! ENERGY Student Energy Efficiency Kit Program** we'd like to see how you like it. Simply fill out this postage-paid postcard and drop it in the mail. It's easy. We look forward to hearing from you.
*Al mejorar continuamente el programa de **THINK! ENERGY Student Energy Efficiency Kit**, les gustaríamos saber como vamos Simplemente llene la siguiente tarjeta con franqueo pagado y déjelo en el correo. ¡Es fácil! Tenemos ganas de oír noticias de Usted.*

School _____ Parent/Guardian Name _____
Escuela *Padres/Tutores*
City _____ State _____ ZIP Code _____
Ciudad *Estado* *Código postal*
Email address: _____
Correo electrónico

1. Were the products in the kit easy to use? ○ Yes ○ No
   ¿Fueron los productos en el kit fáciles de usar?
2. Will you continue to use the kit items after the completion of the program? ○ Yes ○ No
   ¿Seguirá usando los artículos del kit después de la finalización del programa?
3. Would you like to see this program continued in local schools? ○ Yes ○ No
   Quisiera usted ver este programa continúa en las escuelas locales?
4. Do you have any comments about the **THINK! ENERGY** program you would like to share with Idaho Power? (Favorite aspect, etc.)
   *¿Tiene algún comentario sobre el programa de **THINK! ENERGY** que le gustaría compartir con Idaho Power? (Aspecto favorito, etc.).*

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Energy Efficiency Incentives for Homeowners

IDAHO POWER®
An IDACORP Company

Idaho Power's energy efficiency programs can help you use energy wisely in your home. For information on programs and incentives, drop the attached postcard in the mail or visit *www.idahopower.com/think*

See ya later, refrigerator®

Hello $30 bucks!
Chances are the older refrigerator or freezer in your basement or garage is running up your utility bill by as much as $100 a year. Recycle it, use energy wisely and keep harmful materials out of landfills. We'll pick it up for free and you'll receive $30.

For a free pickup, call toll-free 1-866-899-5539

Home Improvement Program

Idaho Power offers homeowners incentives for home improvements. Upgrading your insulation and investing in energy efficient windows helps improve the comfort of your home and can reduce your monthly energy use. This program is only available to Idaho residential customers with electrically heated homes.

Ductless Heat Pump Pilot

If your home's primary heat source comes from electric baseboards, ceiling cables or wall units, Idaho Power has a $750 incentive to help upgrade your heating and cooling equipment to a high-efficiency ductless system. A ductless heat pump doesn't require ductwork, increases overall comfort, is unobtrusive and helps to lessen energy waste.

Energy Efficiency for Manufactured Homes

Energy House Calls. You may qualify for a free house call to test your duct system for air leaks, seal the leaks, install a CFL, replace air filters and check your water heater temperature.
Rebate Advantage. Purchase a new, ENERGY STAR® all-electric manufactured home and receive a $1,000 incentive. Be more comfortable while saving energy.

Weatherization Solutions for Eligible Customers

Energy efficiency improvements, such as sealing ducts, adding insulation and reducing air leaks make your home more comfortable while lowering your energy use. If your income falls within specific guidelines, you may be eligible for improvements at no additional cost.

To learn more, visit *www.idahopower.com/think*, or complete this card and drop in the mail.

Name (Nombre) _____

Address (Dirección) _____

City (Ciudad) _____ State (Estado) _____ Zip (Código Postal) _____

Phone – optional (Teléfono – opcional) _____

Email – optional (Correo Electrónico – opcional) _____

YES! I would like to learn more about the following programs:

- ☐ See ya later, refrigerator® (Hasta luego, refrigerador®)
- ☐ Home Improvement Program (Programa de Mejoras Para el Hogar)
- ☐ Ductless Heat Pump Pilot (Piloto de Calor sin Conductos)
- ☐ Energy Efficiency for Manufactured Homes (Ahorro de Energía Para Viviendas Prefabricadas)
- ☐ Weatherization Solutions for Eligible Customers (Soluciones de Climatización Para Clientes Elegibles)

Please contact me by: ☐ Mail (Correo) ☐ Phone (Teléfono) ☐ Email (Correo Electrónico)

Energy Efficiency Incentives for Homeowners

IDAHO POWER®
An IDACORP Company

Los programas de eficiencia energética de Idaho Power pueden ayudarle a usar energía sabiamente en su hogar. Para obtener información sobre programas e incentivos, deje esta tarjeta postal en el correo o visite www.idahopower.com/think.

Hasta luego, refrigerador®

¡Hola $30! Es posible que el refrigerador o congelador viejo en el sótano o garaje está aumentando su factura de servicios hasta $100 al año. Recíclelo, utilice la energía sabiamente y mantenga los materiales nocivos de los vertederos. Lo recogeremos gratuitamente y usted recibirá $30.

Para una recogida gratuita, llame gratuitamente a 1-866-899-5539.

Programa de Mejoras Para el Hogar

Idaho Power ofrece incentivos a los propietarios de viviendas para mejoras en el hogar. Mejorando su aislamiento e invirtiendo con ventanas de uso eficiente de la energía ayuda a mejorar la comodidad de su hogar y reduce su uso mensual de energía. Este programa sólo está disponible para clientes residenciales de Idaho con hogares calentados eléctricamente.

Piloto de Calor sin Conductos

Si la fuente primaria de calor de su hogar proviene de zócalos eléctricos, cables de techo o unidades que se montan en la pared, Idaho Power tiene un incentivo de $750 para ayudarle a actualizar sus equipos de calefacción y refrigeración y transformarlos en un sistema de alta eficiencia sin conductos. Una bomba de calor sin conductos no requiere conductos, aumenta la comodidad en general, es discreto y ayuda a disminuir el desperdicio de energía.

Ahorro de Energía Para Viviendas Prefabricadas

Visitas a Domicilio de Energía. Usted puede calificar para una visita a domicilio gratuita para comprobar su sistema de conductos por pérdidas de aire, sellar las pérdidas, instalar un CFL, reemplazar filtros de aire y verificar la temperatura de su calentador de agua.

Ventaja de Descuento. Compre una nueva vivienda prefabricada, ENERGY STAR® toda eléctrica y reciba un incentivo de $1,000. Sea más cómodo mientras que el ahorro de energía.

Soluciones de Climatización Para Clientes Elegibles

Las mejoras de ahorro de energía, como sellar conductos, agregar aislamiento y reducir fugas de aire hacen que su hogar sea más cómodo a la vez que reduce su consumo de energía. Si su ingreso cae dentro de las directrices especificas, usted puede ser elegible para mejoras sin costo adicional.

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 9789 SALT LAKE CITY UT

POSTAGE WILL BE PAID BY ADDRESSEE

NATIONAL ENERGY FOUNDATION
4516 S 700 E STE 100
SALT LAKE CITY UT 84107-9916

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Idaho Power Weatherization Programs

1. Agency/Contractor Job #:

	Response Count
	237
answered question	237
skipped question	0

2. Agency/Contractor Name:

	Response Percent	Response Count
CCOA - Aging, Weatherization and Human Services	27.4%	65
Eastern Idaho Community Action Partnership	0.8%	2
El Ada Community Action Partnership	**41.4%**	**98**
South Central Community Action Partnership	8.0%	19
Southeastern Idaho Community Action Agency	18.6%	44
Community Connection of Northeast Oregon	0.0%	0
Community in Action	3.8%	9
Energy Zone, LLC	0.0%	0
Home Energy Management	0.0%	0
Savings Around Power	0.0%	0
Power Savers	0.0%	0
	0.0%	0
	0.0%	0
	0.0%	0
	answered question	**237**
	skipped question	**0**

3. Date survey completed?

	Response Percent	Response Count
Date:	**100.0%**	**231**
	answered question	**231**
	skipped question	**6**

4. Idaho Power program name:

	Response Percent	Response Count
Weatherization Assistance for Qualified Customers	**100.0%**	**237**
Weatherization Solutions for Eligible Customers	0.0%	0
	answered question	**237**
	skipped question	**0**

5. How did you learn about the weatherization program(s)?

	Response Percent	Response Count
Agency/Contractor flyer	14.9%	34
Idaho Power employee	5.3%	12
Idaho Power web site	5.3%	12
Friend or relative	**47.4%**	**108**
Letter in mail	5.7%	13
Other (please specify)	21.5%	49
	answered question	**228**
	skipped question	**9**

6. What was your primary reason for participating in the weatherization program?

	Response Percent	Response Count
Reduce utility bills	**89.3%**	**209**
Improve comfort of home	45.3%	106
Furnace concerns	24.8%	58
Water heater concerns	10.3%	24
Improve insulation	23.5%	55
Other (please specify)	5.6%	13
	answered question	**234**
	skipped question	**3**

7. If you received any energy efficiency equipment upgrade as part of the weatherization, how well was the equipment's operation explained to you?

	Response Percent	Response Count
Completely	**84.3%**	**183**
Somewhat	12.9%	28
Not at all	2.8%	6
	answered question	**217**
	skipped question	**20**

8. Which of the following did you learn about from the auditor or crew during the weatherization process? (Check all that apply)

	Response Percent	Response Count
How air leaks affect energy usage	**73.8%**	**169**
How insulation affects energy usage	65.5%	150
How to program the new thermostat	48.9%	112
How to reduce the amount of hot water used	29.3%	67
How to use energy wisely	56.8%	130
How to understand what uses the most energy in my home	42.8%	98
Other (please specify)	1.3%	3
	answered question	**229**
	skipped question	**8**

9. Based on the information you received from the agency/contractor about energy use, how likely are you to change your habits to save energy?

	Response Percent	Response Count
Very likely	**79.3%**	**184**
Somewhat likely	19.0%	44
Not very likely	0.9%	2
Not likely at all	0.9%	2
	answered question	**232**
	skipped question	**5**

10. How much of the information about energy use have you shared with other members of your household?

	Response Percent	Response Count
All of it	**79.3%**	**176**
Some of it	18.5%	41
None of it	2.3%	5
	answered question	**222**
	skipped question	**15**

11. Based on the energy use information you shared with other members of your household, how likely do you think your household overall will change habits to save energy?

	Response Percent	Response Count
Very likely	**70.4%**	**159**
Somewhat likely	27.0%	61
Somewhat unlikely	0.9%	2
Very unlikely	1.8%	4
	answered question	**226**
	skipped question	**11**

12. What habits are you and other members of your household most likely to change to save energy? (check all that apply)

	Response Percent	Response Count
Washing full loads of clothes	61.4%	135
Washing full loads of dishes	42.7%	94
Turning off lights when not in use	**86.4%**	**190**
Unplugging electrical equipment when not in use	50.0%	110
Turning the thermostat up in the summer	50.9%	112
Turning the thermostat down in the winter	57.7%	127
	Other (please specify)	10
	answered question	**220**
	skipped question	**17**

13. How much do you think the weatherization you received will affect the comfort of your home?

	Response Percent	Response Count
Significantly	**86.3%**	**202**
Somewhat	12.4%	29
Very little	0.9%	2
Not at all	0.4%	1
	answered question	**234**
	skipped question	**3**

14. Rate the Agency/Contractor based on your interactions with them.

	Excellent	Good	Fair	Poor	Rating Count
Courteousness	**87.9% (203)**	10.8% (25)	1.3% (3)	0.0% (0)	231
Professionalism	**87.4% (201)**	11.7% (27)	0.9% (2)	0.0% (0)	230
Explanation of work to be performed on your home	**82.5% (189)**	16.6% (38)	0.4% (1)	0.4% (1)	229
Overall experience with Agency/Contractor	**85.2% (195)**	14.0% (32)	0.4% (1)	0.4% (1)	229
				answered question	**231**
				skipped question	**6**

15. Were you aware of Idaho Power's role in the weatherization of your home?

	Response Percent	Response Count
Yes	**77.3%**	**180**
No	22.7%	53
	answered question	**233**
	skipped question	**4**

16. Overall how satisfied are you with the weatherization program you participated in?

	Response Percent	Response Count
Very satisfied	**93.5%**	**217**
Somewhat satisfied	6.5%	15
Somewhat dissatisfied	0.0%	0
Very dissatisfied	0.0%	0
	answered question	**232**
	skipped question	**5**

17. How has your opinion of Idaho Power changed as a result of its role in the weatherization program?

	Response Percent	Response Count
Improved	**84.1%**	**196**
Stayed the same	15.9%	37
Decreased	0.0%	0
	answered question	**233**
	skipped question	**4**

18. How many people beside yourself live in your home year-round?

	Response Percent	Response Count
1	**41.8%**	**79**
2	19.6%	37
3	10.6%	20
4	14.3%	27
5	7.9%	15
6 or more	5.8%	11
	answered question	**189**
	skipped question	**48**

19. How long have you been an Idaho Power customer?

	Response Percent	Response Count
Less than 1 year	4.3%	10
1 - 10 years	**32.9%**	**77**
11 - 25 years	29.9%	70
26 years or more	**32.9%**	**77**
	answered question	**234**
	skipped question	**3**

20. Please select the category below that best describes your age:

	Response Percent	Response Count
Under 25	0.9%	2
25 - 34	12.8%	30
35 - 44	13.7%	32
45 - 54	16.7%	39
55 - 64	20.9%	49
65 - 74	**21.4%**	**50**
75 or older	13.7%	32
	answered question	**234**
	skipped question	**3**

21. Select the response below that best descirbes the highest level of education you have attained:

	Response Percent	Response Count
Less than High School	18.3%	42
High School graduate or GED	**35.2%**	**81**
Some College or Technical School	32.2%	74
Associate Degree	3.5%	8
College Degree (including any graduate school or graduate degrees)	10.9%	25
	answered question	**230**
	skipped question	**7**

22. Please share any other comments you may have regarding Idaho Power's weatherization programs. Thank you.

	Response Count
	93
answered question	**93**
skipped question	**144**

Idaho Power Weatherization Programs

1. Agency/Contractor Job #:

	Response Count
	115
answered question	115
skipped question	0

2. Agency/Contractor Name:

	Response Percent	Response Count
CCOA - Aging, Weatherization and Human Services	0.0%	0
Eastern Idaho Community Action Partnership	0.0%	0
El Ada Community Action Partnership	0.0%	0
South Central Community Action Partnership	0.0%	0
Southeastern Idaho Community Action Agency	0.0%	0
Community Connection of Northeast Oregon	0.0%	0
Community in Action	0.0%	0
Energy Zone, LLC	**45.6%**	**52**
Home Energy Management	30.7%	35
Savings Around Power	4.4%	5
Power Savers	19.3%	22
	0.0%	0
	0.0%	0
	0.0%	0
	answered question	**114**
	skipped question	**1**

3. Date survey completed?

	Response Percent	Response Count
Date:	**100.0%**	**115**
	answered question	**115**
	skipped question	**0**

4. Idaho Power program name:

	Response Percent	Response Count
Weatherization Assistance for Qualified Customers	0.0%	0
Weatherization Solutions for Eligible Customers	**100.0%**	**115**
	answered question	**115**
	skipped question	**0**

5. How did you learn about the weatherization program(s)?

	Response Percent	Response Count
Agency/Contractor flyer	6.2%	7
Idaho Power employee	5.3%	6
Idaho Power web site	5.3%	6
Friend or relative	25.7%	29
Letter in mail	**33.6%**	**38**
Other (please specify)	23.9%	27
	answered question	**113**
	skipped question	**2**

6. What was your primary reason for participating in the weatherization program?

	Response Percent	Response Count
Reduce utility bills	**84.2%**	**96**
Improve comfort of home	49.1%	56
Furnace concerns	24.6%	28
Water heater concerns	6.1%	7
Improve insulation	30.7%	35
Other (please specify)	9.6%	11
	answered question	**114**
	skipped question	**1**

7. If you received any energy efficiency equipment upgrade as part of the weatherization, how well was the equipment's operation explained to you?

	Response Percent	Response Count
Completely	**87.8%**	**79**
Somewhat	4.4%	4
Not at all	7.8%	7
	answered question	**90**
	skipped question	**25**

8. Which of the following did you learn about from the auditor or crew during the weatherization process? (Check all that apply)

	Response Percent	Response Count
How air leaks affect energy usage	67.9%	76
How insulation affects energy usage	**70.5%**	**79**
How to program the new thermostat	37.5%	42
How to reduce the amount of hot water used	29.5%	33
How to use energy wisely	60.7%	68
How to understand what uses the most energy in my home	42.0%	47
Other (please specify)	5.4%	6
	answered question	**112**
	skipped question	**3**

9. Based on the information you received from the agency/contractor about energy use, how likely are you to change your habits to save energy?

	Response Percent	Response Count
Very likely	**68.4%**	**78**
Somewhat likely	23.7%	27
Not very likely	3.5%	4
Not likely at all	4.4%	5
	answered question	**114**
	skipped question	**1**

10. How much of the information about energy use have you shared with other members of your household?

	Response Percent	Response Count
All of it	**64.8%**	**70**
Some of it	26.9%	29
None of it	8.3%	9
	answered question	**108**
	skipped question	**7**

11. Based on the energy use information you shared with other members of your household, how likely do you think your household overall will change habits to save energy?

	Response Percent	Response Count
Very likely	**66.7%**	**74**
Somewhat likely	26.1%	29
Somewhat unlikely	3.6%	4
Very unlikely	3.6%	4
	answered question	**111**
	skipped question	**4**

12. What habits are you and other members of your household most likely to change to save energy? (check all that apply)

	Response Percent	Response Count
Washing full loads of clothes	67.0%	71
Washing full loads of dishes	50.0%	53
Turning off lights when not in use	**83.0%**	**88**
Unplugging electrical equipment when not in use	47.2%	50
Turning the thermostat up in the summer	57.5%	61
Turning the thermostat down in the winter	67.9%	72
	Other (please specify)	8
	answered question	**106**
	skipped question	**9**

13. How much do you think the weatherization you received will affect the comfort of your home?

	Response Percent	Response Count
Significantly	**88.5%**	**100**
Somewhat	9.7%	11
Very little	0.9%	1
Not at all	0.9%	1
	answered question	**113**
	skipped question	**2**

14. Rate the Agency/Contractor based on your interactions with them.

	Excellent	Good	Fair	Poor	Rating Count
Courteousness	**96.5% (109)**	3.5% (4)	0.0% (0)	0.0% (0)	113
Professionalism	**93.8% (106)**	5.3% (6)	0.9% (1)	0.0% (0)	113
Explanation of work to be performed on your home	**87.3% (96)**	10.0% (11)	1.8% (2)	0.9% (1)	110
Overall experience with Agency/Contractor	**91.9% (102)**	8.1% (9)	0.0% (0)	0.0% (0)	111
				answered question	**113**
				skipped question	**2**

15. Were you aware of Idaho Power's role in the weatherization of your home?

	Response Percent	Response Count
Yes	**85.2%**	**98**
No	14.8%	17
	answered question	**115**
	skipped question	**0**

16. Overall how satisfied are you with the weatherization program you participated in?

	Response Percent	Response Count
Very satisfied	**95.6%**	**108**
Somewhat satisfied	4.4%	5
Somewhat dissatisfied	0.0%	0
Very dissatisfied	0.0%	0
	answered question	**113**
	skipped question	**2**

17. How has your opinion of Idaho Power changed as a result of its role in the weatherization program?

	Response Percent	Response Count
Improved	**72.6%**	**82**
Stayed the same	27.4%	31
Decreased	0.0%	0
	answered question	**113**
	skipped question	**2**

18. HOw many people beside yourself live in your home year-round?

	Response Percent	Response Count
1	**52.2%**	**47**
2	23.3%	21
3	14.4%	13
4	5.6%	5
5	3.3%	3
6 or more	1.1%	1
	answered question	**90**
	skipped question	**25**

19. How long have you been an Idaho Power customer?

	Response Percent	Response Count
Less than 1 year	0.9%	1
1 - 10 years	20.5%	23
11 - 25 years	26.8%	30
26 years or more	**51.8%**	**58**
	answered question	**112**
	skipped question	**3**

20. Please select the category below that best describes your age:

	Response Percent	Response Count
Under 25	0.0%	0
25 - 34	6.4%	7
35 - 44	9.1%	10
45 - 54	18.2%	20
55 - 64	15.5%	17
65 - 74	24.5%	27
75 or older	**26.4%**	**29**
	answered question	**110**
	skipped question	**5**

21. Select the response below that best descirbes the highest level of education you have attained:

	Response Percent	Response Count
Less than High School	1.8%	2
High School graduate or GED	33.0%	37
Some College or Technical School	**38.4%**	**43**
Associate Degree	11.6%	13
College Degree (including any graduate school or graduate degrees)	15.2%	17
	answered question	**112**
	skipped question	**3**

22. Please share any other comments you may have regarding Idaho Power's weatherization programs. Thank you.

	Response Count
	47
answered question	**47**
skipped question	**68**

EVALUATIONS

Table 4. 2014 Evaluations

Report Title	Program or Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
A/C Cool Credit	Residential	PECI	Idaho Power	Other
Custom Efficiency	Commercial/Industrial	Evergreen Economics	Idaho Power	Process/Impact
Energy Efficient Lighting	Residential	Tetra Tech, MA	Idaho Power	Impact
Home Energy Audit Program	Residential	Johnson Consulting Group	Idaho Power	Process
Irrigation Peak Rewards	Irrigation	PECI	Idaho Power	Other
Irrigation Peak Rewards Program Report	Irrigation	Idaho Power	Idaho Power	Evaluation
Northwest ENERGY STAR® Homes	Residential	Tetra Tech, MA	Idaho Power	Impact
Shade Tree Project	Residential	Johnson Consulting Group	Idaho Power	Process

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A/C Cool Credit Program

2014 Impact Evaluation

Prepared for Idaho Power Company | October 2014

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Executive Summary

Idaho Power Company contracted PECI to complete an impact evaluation of the 2014 A/C Cool Credit program. The goal of the impact evaluation was to calculate the estimated demand reduction achieved by three A/C Cool Credit curtailment test events and update the program's existing predictive model to account for the 2014 curtailment event results.

PECI completed analyses of curtailment events held on July 14th, July 31st, and August 11th, 2014, each with a three hour duration. The results of the analyses showed maximum single hour demand reductions of 1.33, 0.91, and 1.07 kW per participant, respectively, for the three events. The average hourly demand reduction was 1.25, 0.86, and 1.00 kW per participant, respectively, for the three events. Due to the distinct weather patterns between the Boise and Pocatello/Twin Falls regions, each curtailment event analysis includes region-specific results. Driven by cooler temperatures, the maximum demand reductions seen in the Pocatello/Twin Falls region were on average 40 percent less than those in the Boise region.

The impact evaluation demonstrated that Idaho Power's A/C Cool Credit program functions as intended, and, if properly maintained, can be relied on to provide dispatchable demand reduction to the electricity grid.

Introduction

Background

Summer use of air conditioning (A/C) systems places a burden on Idaho Power Company's power supply, power contracts, and transmission and distribution systems. Demand reduction programs in which customers agree to curtail A/C use in times of high demand have proven to successfully deliver significant and dispatchable demand (kW) reduction.

Idaho Power's A/C Cool Credit is one such program that curtails demand from residential A/C units. After being suspended for the 2013 season, the program was reinstated in 2014 on a limited basis, completing three test curtailment events during the June 15th through August 15th, 2014 program season. The program's function is to curtail residential A/C demand during periods of peak demand by utilizing direct load control technology to cycle A/C units OFF for a portion of each curtailment event period. A/C Cool Credit program curtailment events are limited to non-holiday weekdays and must be 40 hours or less per month (with the exception of a system emergency). In exchange for having their A/C units curtailed, program participants receive a $5 credit on their June, July, and August electric bills.

PECI completed impact evaluations on the A/C Cool Credit program in both 2011 and 2012. The 2012 evaluation also included a research component, investigating how different cycling strategies and temperatures impacted kW reduction results, as well as indoor air temperatures of participating homes. The outcome of this research was used to develop a predictive model (the "IPC Curtailment Calculator") that uses regression formulas to estimate load reductions based on cycling strategy and temperature inputs.

The goals of this 2014 impact evaluation were to:

- Determine and verify the demand reduction (MW) during a minimum of three test events in 2014
- Utilize data analysis results to update regressions informing the existing predictive model

Analysis Methodology

The demand reduction impact evaluation was conducted through the analysis of hourly Advanced Metering Infrastructure (AMI) data provided by Idaho Power. This approach was supported by the findings of the 2012 impact evaluation, which analyzed both AMI and logger data, and showed both sources to produce similar estimations of energy reduction per curtailment event.

Analysis of the AMI data was conducted using the SAS analytics program. SAS provides a robust platform for analyzing large amounts of data in a consistent manner. The SAS model developed as part of the 2012 AC Cool Credit research project was utilized to complete the analysis for each 2014 curtailment event. The model first imports the relevant AMI data from Comma Separated Values (CSV) files; second, processes the data to configure it in a way suitable for analysis; and third, analyzes the data to produce the desired result metrics.

The sub-sections below describe the project's methodology related to the sampling plan, demand reduction analysis, and updating of the predictive model.

Sampling Plan

The availability of AMI data for all program participants allowed the project's sampling plan to be a census of program participants. Table 1 below details the number of participants included in each of the curtailment event analyses.

Table 1. Unit Counts by Curtailment Event

Curtailment Event	Count of Participants Analyzed - Boise	Count of Participants Analyzed - Twin Falls/ Pocatello	Count of Participants Analyzed - Total
July 14	25,347	4,077	29,424
July 31	25,443	4,085	29,528
August 11	25,487	4,093	29,580

Demand Reduction Analysis

Baseline Data

The load reduction achieved during curtailment events was calculated by comparing the average load from each curtailment day against the average load developed from non-curtailment days selected for the baseline. The "previous days" approach was used, which utilizes the average load data from the previous 10 non-weekend, non-curtailment days. Baseline kW was calculated as the average of the three days with the greatest demand from these previous ten non-curtailment days, as ranked by the highest hourly demand occurring during the curtailment timeframe. Curtailment days normally occur on hot, high demand days, thus selecting high demand days for the baseline ensures a similar load profile is used for the baseline days as the curtailment days.

Offset Factor

In order to effectively compare baseline and curtailment day loads, the baseline load was adjusted using an offset factor, calculated as the difference in kW between the baseline and curtailment event day load during the hour prior to the start of the curtailment. The offset factor was applied to the baseline day to "normalize" the baseline kW to the curtailment day kW. The offset factor mitigates underlying differences in load due to slight differences in outdoor temperature or other external factors.

Predictive Model

The "IPC Curtailment Calculator" was developed using data results from the seven curtailment events from the 2012 AC Cool Credit Research Project with the aim of providing Idaho Power with a tool for estimating demand reduction levels based on temperature and cycling percentage inputs. The model is Excel-based and driven by regression formulas developed in the SAS analytics program. Users can input expected temperature at the start of the curtailment event and percent cycling strategy and the model will provide an estimated kW reduction per unit and total MW for the population of program participants. Alternatively, users can input temperature and a

requested MW reduction amount and the model will estimate the percent cycling required to achieve the requested MW reduction.

The model uses a regression formula developed for both regions (Boise & Pocatello/Twin Falls) based on an independent variable representing the interaction of "Temperature at start of curtailment event" and "Percent cycling." This variable was shown in the 2012 Research Project to produce the most statistically significant results.

As part of the 2014 impact evaluation, the predictive model was updated to account for the results of the 2014 curtailment events. This entailed developing new regression formulas that used as inputs results from both 2012 and 2014 curtailment events, as well as slightly changing the methodology for delivering estimated maximum kW reductions. In the 2012 version of the model, the regression formulas referenced average kW reduction values due to maximum kW reduction values not providing statistically significant results. The model's estimation of average kW reductions was scaled up by the average difference between average and maximum kW reductions, to ultimately output maximum kW reduction estimates. After adding the results from the 2014 curtailment events, the regression formula for maximum kW reductions was shown to be statistically significant (at an 80 percent confidence interval), resulting in the removal of the "average to maximum kW reduction" escalation used in the 2012 version of the model.

Results

Curtailment Events Summary

A total of three test curtailment events were completed as part of the 2014 A/C Cool Credit program.

Table 2 below details the characteristics of these events, including high temperature, event time period, and cycling percent. All A/C Cool Credit participants were included in each curtailment event that Idaho Power called. The maximum temperature in Boise during event days ranged from 95 degrees on July 31st to 102 degrees on July 14th. The maximum temperature in Pocatello during event days ranged from 90 degrees on July 31st to 98 degrees on July 14th.

Table 2. 2014 Curtailment Event Schedule

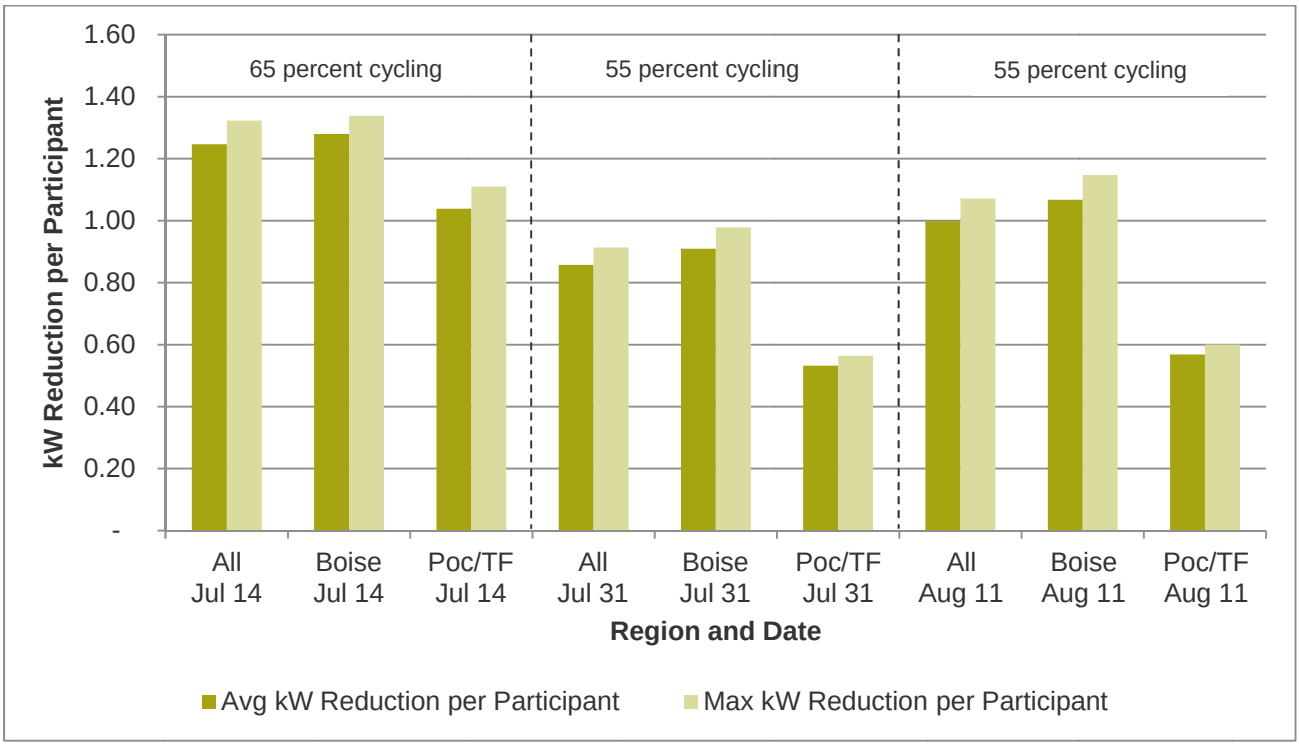
Curtailment Event	Boise Temp (high)	TF/Pocatello Temp (high)	Control Event Start Time	Control Event End Time	Length (hrs)	Cycling Percent
July 14	102	98	4:00pm	7:00pm	3	65%
July 31	95	90	4:00pm	7:00pm	3	55%
August 11	101	93	4:00pm	7:00pm	3	55%

Table 3 summarizes the AMI data analysis results for each curtailment event. Figure 1 also shows an overview of the results for each curtailment event. Because temperatures in Boise differ from the Twin Falls/Pocatello area, they are treated as separate events and results are reported individually. The July 14th event, which had the highest percent cycling of all three events, showed the highest maximum and average kW reductions for both Boise and Pocatello/Twin Falls regions.

Table 3. 2014 Summary Results of Executed Control Events

Date & High Temp	Percent Curtailment	Region	Avg. kW Reduction per Participant	Max kW Reduction per Participant	Avg. kW Reduction - Total	Max kW Reduction - Total
July 14		All	1.25	1.33	36,874	39,139
Boise: 102°	65%	Boise	1.28	1.34	32,617	34,118
Poc/TF: 98°		Poc/TF	1.04	1.11	4,250	4,542
July 31		All	0.86	0.91	25,310	26,972
Boise: 95°	55%	Boise	0.91	0.98	23,136	24,885
Poc/TF: 90°		Poc/TF	0.53	0.56	2,174	2,304
August 11		All	1.00	1.07	29,529	31,701
Boise: 101°	55%	Boise	1.07	1.15	27,202	29,243
Poc/TF: 93°		Poc/TF	0.57	0.60	2,326	2,458

Figure 1. 2014 Summary Results for Executed Curtailment Events



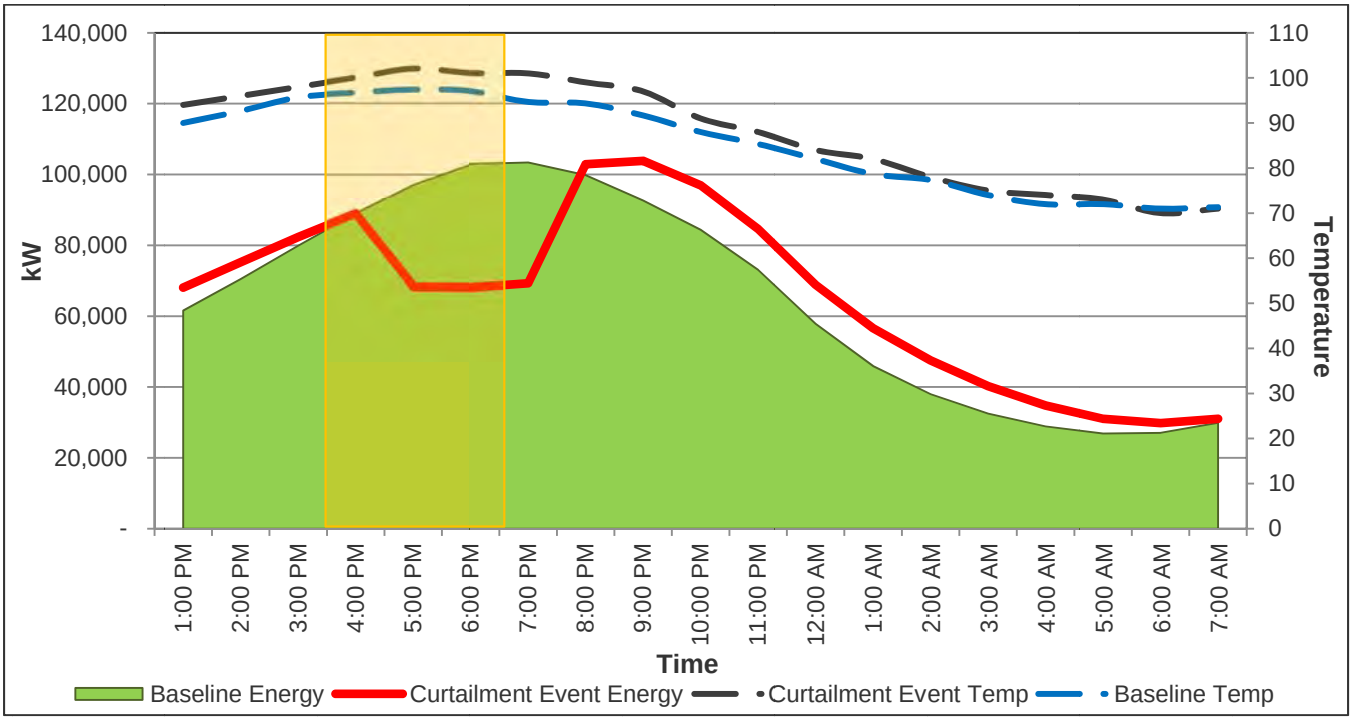
July 14th Curtailment

The event called on July 14th used a 65 percent curtailment strategy and resulted in a system wide average demand reduction of 1.25 kW per participant across the three hours of the event, and a maximum single hour demand reduction of 1.33 kW per participant. In the Boise region, the average demand reduction for the event was 1.28 kW per participant, whereas in Pocatello/Twin Falls it was 1.04 kW per participant. The maximum

demand reduction for the Boise area was 1.34 kW per participant and in Pocatello/Twin Falls it was 1.11 kW per participant.

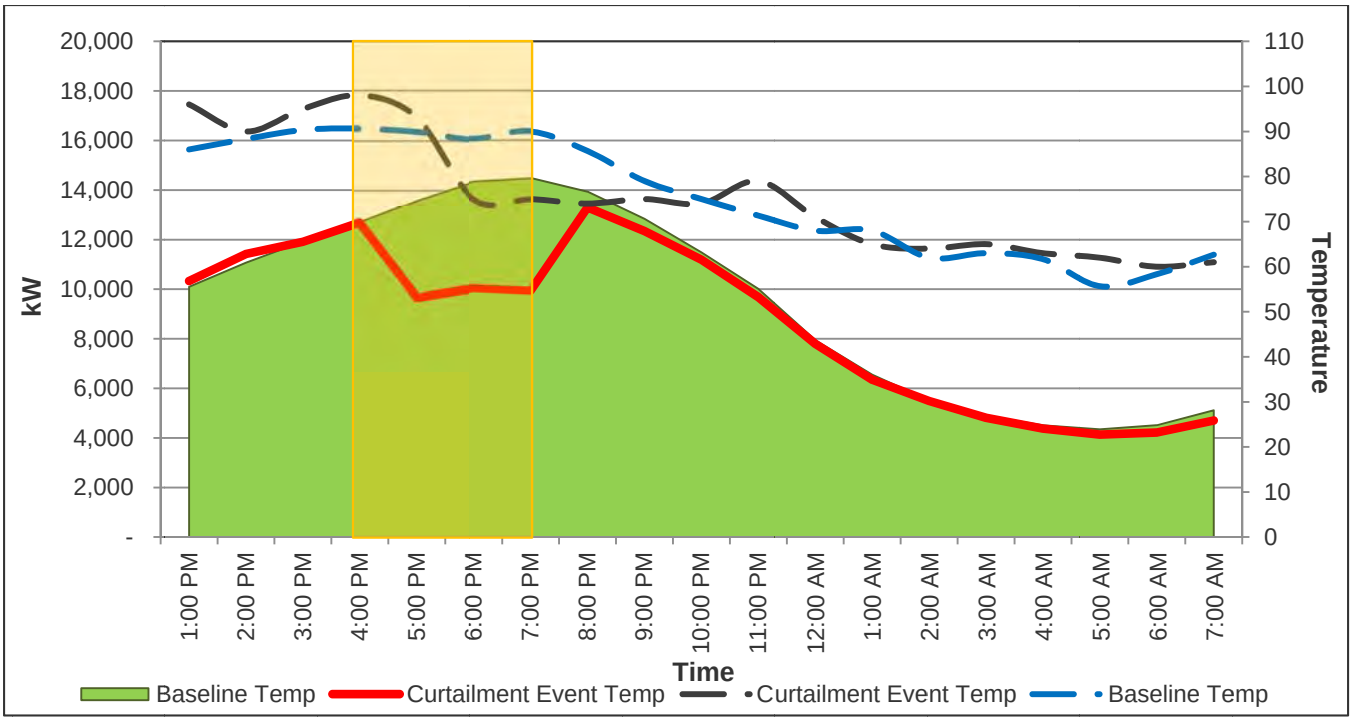
Figure 2 and Figure 3 below present the aggregate load profiles for the Boise and Pocatello/Twin Falls participants, respectively, for the July 14th curtailment event. Note that the charts' timeframes are extended to 7AM the following morning to show the extended period for the curtailment event load profile to meet the baseline load profile.

Figure 2. July 14 Curtailment Event Results - Boise



As seen in Figure 3 below, the temperature in Pocatello dropped from 98 degrees at the start of the curtailment event at 4pm to 73 degrees at 6pm. This is likely due to many participants/thermostats turning OFF their A/C units, leading to demand reduction results that are artificially high. In other words, the demand reduction seen was only partly attributed to the curtailment event. This hypothesis is validated by the other two Pocatello/Twin Falls events showing maximum demand reduction results 40-50 percent less than those seen in the July 14th event. As a result, the July 14th event results for Pocatello/Twin Falls were not used as inputs to the updated predictive model.

Figure 3. July 14 Curtailment Event Results - Pocatello/Twin Falls



July 31st Curtailment

The event called on July 31st utilized a 55 percent curtailment strategy and resulted in a system wide average demand reduction of 0.86 kW per participant across the three hours of the event, and a maximum single hour demand reduction of 0.91 kW per participant. In the Boise area, the average demand reduction for the event was 0.91 kW per participant, whereas in Pocatello/Twin Falls it was 0.53 kW per participant. The maximum demand reduction for the Boise area was 0.98 kW per participant and in Pocatello/Twin Falls it was 0.56 kW per participant.

Figure 4 and Figure 5 below present the aggregate load profiles for the Boise and Pocatello/Twin Falls participants, respectively, for the July 31st curtailment event.

Figure 4. July 31 Curtailment Event Results - Boise

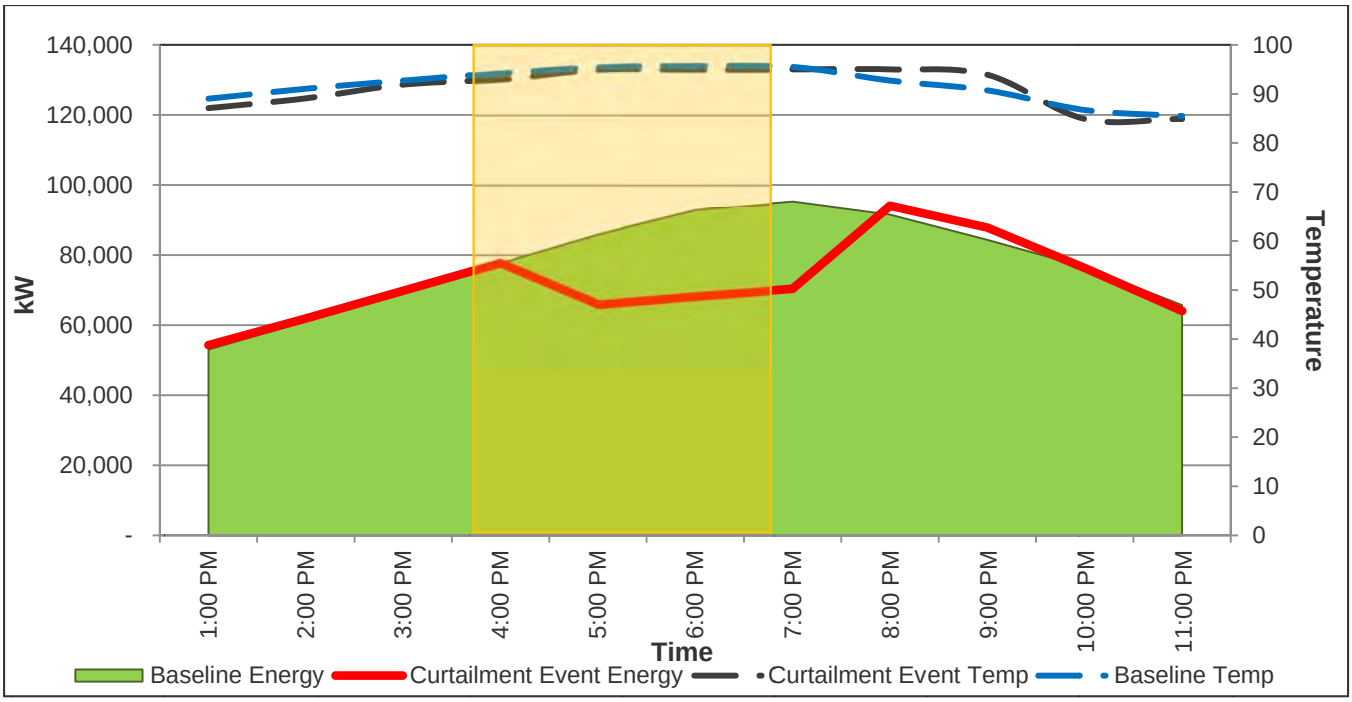
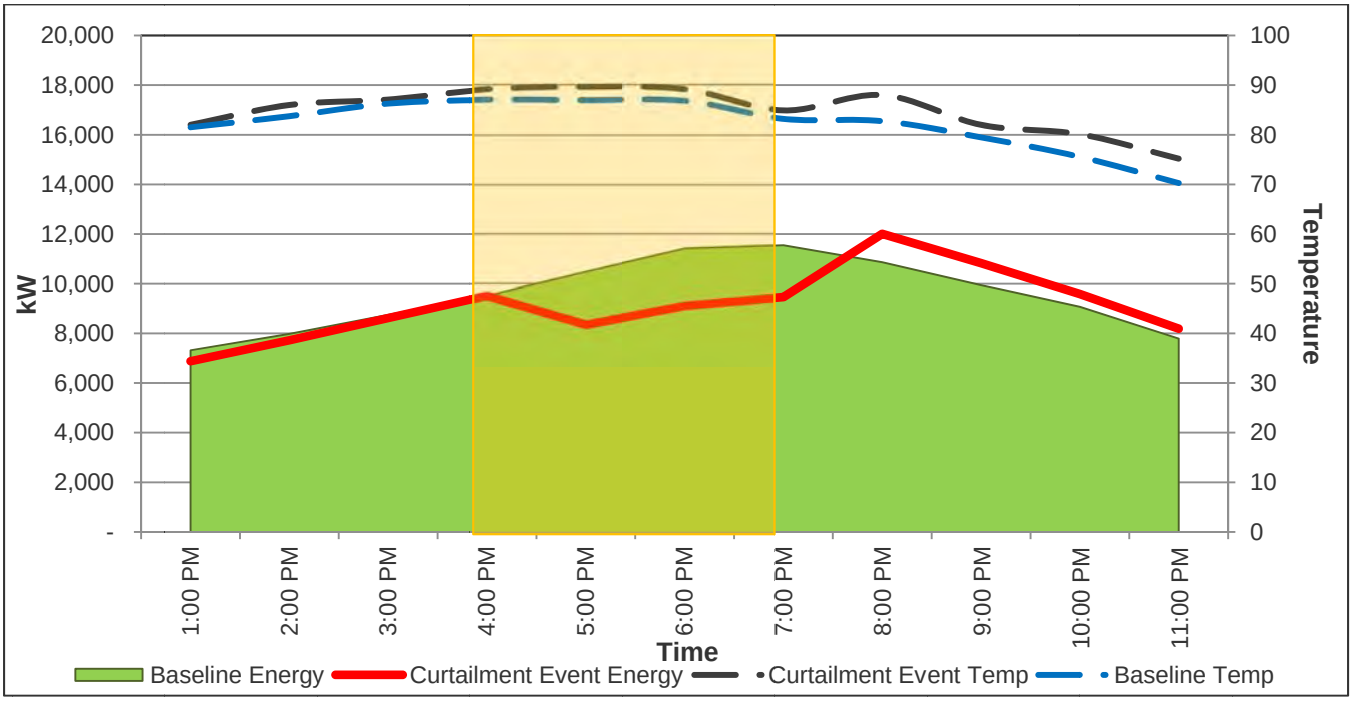


Figure 5. July 31 Curtailment Event Results - Pocatello/Twin Falls



August 11th Curtailment

The event called on August 11th utilized a 55 percent curtailment strategy and resulted in a system wide average demand reduction of 1.00 kW per participant across the three hours of the event, and a maximum single hour demand reduction of 1.07 kW per participant. In the Boise area, the average demand reduction for the event was

1.07 kW per participant, whereas in Pocatello/Twin Falls it was 0.57 kW per participant. The maximum demand reduction for the Boise area was 1.15 kW per participant and in Pocatello/Twin Falls it was 0.60 kW per participant.

Figure 6 Figure 7 below present the aggregate load profiles for the Boise and Pocatello/Twin Falls participants, respectively, for the August 11th curtailment event.

Figure 6. August 11 Curtailment Event Results - Boise

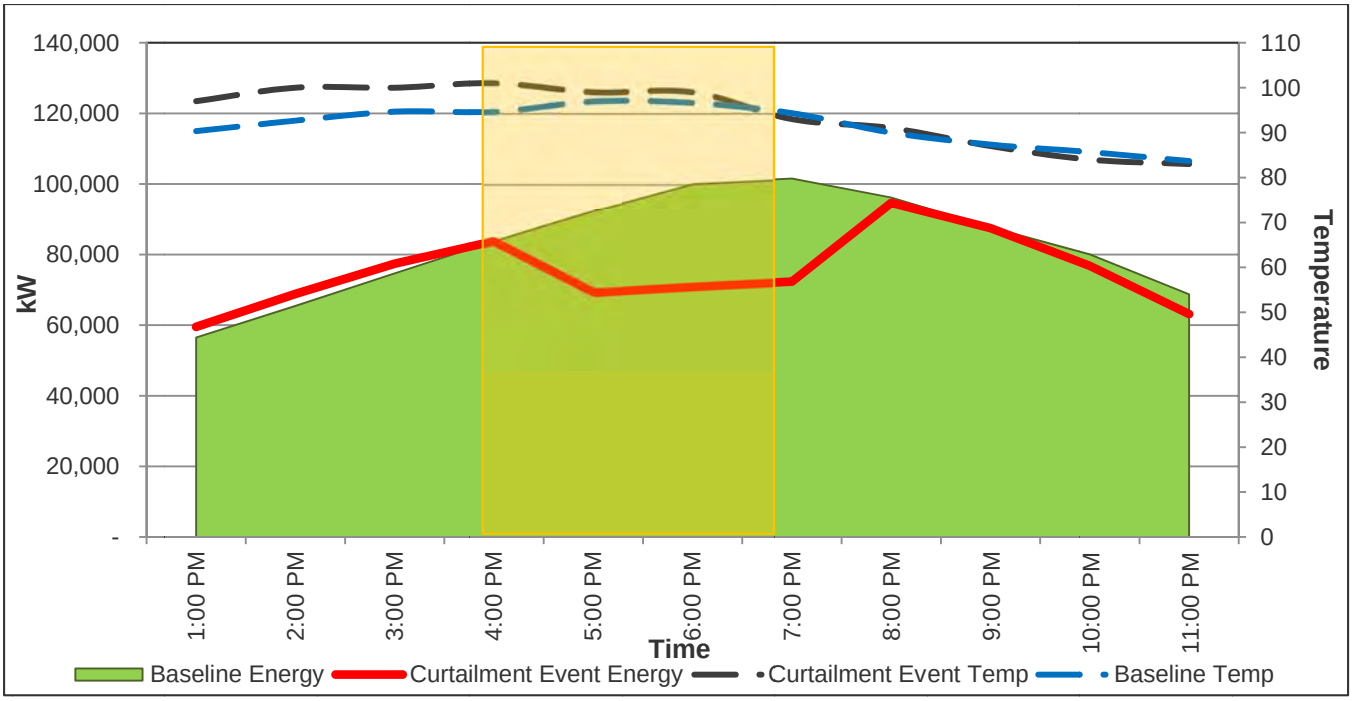
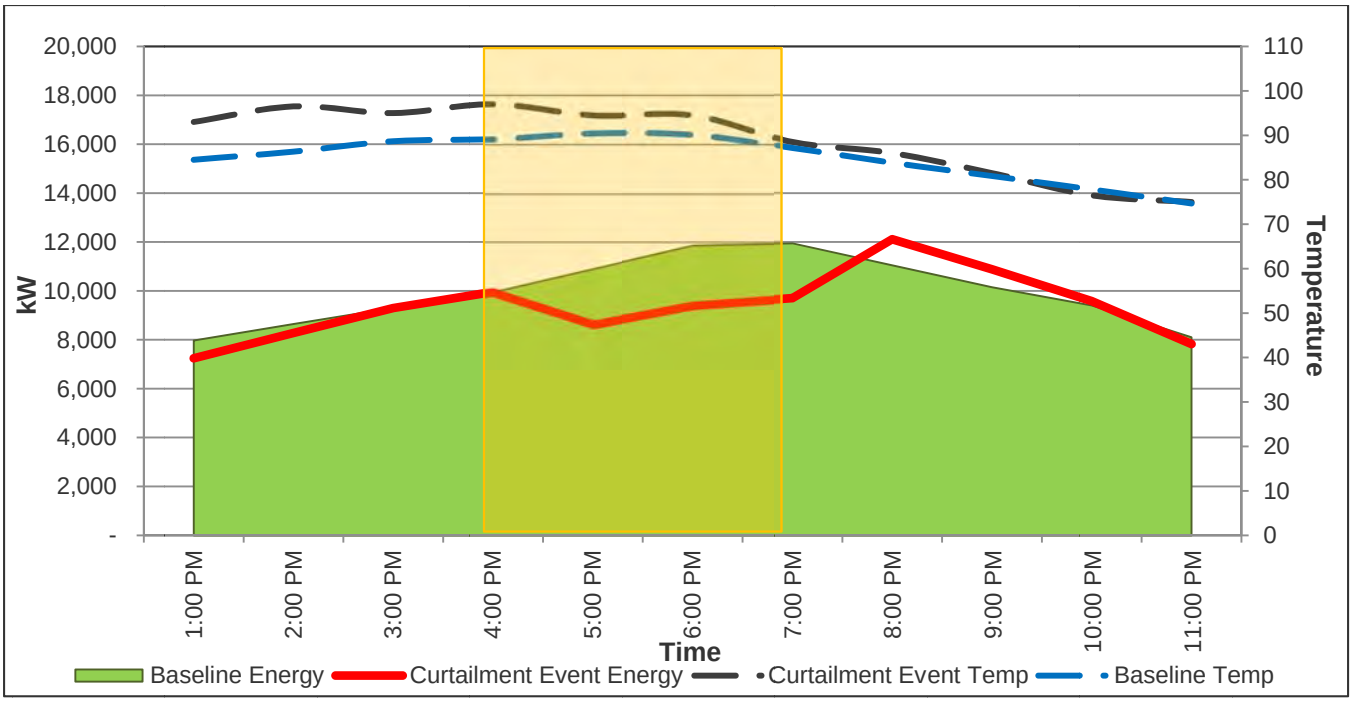


Figure 7. August 11 Curtailment Event Results - Pocatello/Twin Falls



Predictive Model

As part of the 2012 impact evaluation, a predictive model was developed that estimates load reductions based on cycling strategy and temperature inputs. The model utilizes a regression formula for each region (Boise & Pocatello/Twin Falls) based on an independent variable representing the interaction of "Temperature at start of curtailment event" and "Percent cycling." As discussed in the Methodology section above, the model was updated in 2014 to account for the results of both 2012 and 2014 curtailment events.

Table 4 and Table 5 below compare the actual maximum demand reduction results in the the 2012 and 2014 impact evaluations with the estimated maximum demand reductions output by the model. The results of this comparison show a high amount of variability between model outputs and actual results for the Boise region, and moderate amounts of variability for the Pocatello/Twin Falls region.

For 2014 curtailment events, the model predicted lower demand reduction than actual demand reduction, significantly in the Boise region's case. Conversely, for most 2012 curtailment events, the model predicted higher demand reduction than actual demand reduction. These results reflect the program's increased performance from 2012 to 2014. Unfortunately, there is not a sufficient sample size from 2014 curtailment events to create a new model based solely on 2014 data. If there is reason to believe that the improved performance seen in 2014 will continue into future program years, Idaho Power could consider multiplying the model's formula by a factor that would bring the average model results for 2014 up to match the actual results. For the Boise region, that factor would be 1.36, and for Pocatello/Twin Falls it would be 1.08.

Table 4. Predictive Model Outputs Compared to Actual - Boise

Curtailment Event	Temp at Start of Event	Percent Cycling	Max kW Reduction Predicted by Model	Actual Maximum kW Reduction	Percent Difference
12-Jul-12	105	60%	1.03	1.14	-9.7%
19-Jul-12	104	65%	1.08	0.99	9.4%
31-Jul-12	97	70%	0.97	0.89	9.5%
13-Aug-12	97	50%	0.73	0.40	81.5%
16-Aug-12	93	75%	0.92	0.83	9.9%
20-Aug-12	93	65%	0.81	0.58	39.4%
22-Aug-12	90	100%	1.07	0.86	23.8%
14-Jul-14	100	65%	0.98	1.34	-26.6%
31-Jul-14	93	55%	0.70	0.98	-28.2%
11-Aug-14	101	55%	0.87	1.15	-24.2%
Average	97	66%	0.92	0.92	8.5%

Table 5. Predictive Model Outputs Compared to Actual - Pocatello/Twin Falls

Curtailment Event	Temp at Start of Event	Percent Cycling	Max kW Reduction Predicted by Model	Actual Maximum kW Reduction	Percent Difference
12-Jul-12	99	60%	0.73	0.69	5.3%
19-Jul-12	93	65%	0.66	0.66	0.5%
31-Jul-12	94	70%	0.72	0.90	-19.2%
13-Aug-12	93	50%	0.53	0.44	22.2%
16-Aug-12	91	75%	0.70	0.59	18.5%
20-Aug-12	85	65%	0.50	0.52	-3.6%
22-Aug-12	87	100%	0.78	0.75	3.5%
31-Jul-14	89	55%	0.51	0.56	-9.8%
11-Aug-14	93	55%	0.57	0.60	-4.3%
Average	92	66%	0.63	0.63	1.5%

Note: The July 14th curtailment event was not included as an input to the predictive model regression formula due to the day's rare temperature profile (25 degree drop over two hours). Thus, the July 14 event is not included in this table's comparison between the model's predicted demand reductions and actual demand reductions.

Conclusions

The 2014 impact evaluation of the A/C Cool Credit program test events confirmed that the program is operating as intended, and, properly maintained, can be relied on to provide dispatchable demand savings to the electricity grid. The results of the analyses showed maximum single hour demand reductions of 1.33, 0.91, and 1.07 kW per participant, respectively, for the curtailment events held on July 14th, July 31st, and August 11th. The average hourly demand reduction was 1.25, 0.86, and 1.00 kW per participant, respectively, for the three events. Due to the distinct weather patterns between the Boise and Pocatello/Twin Falls regions, each curtailment event analysis includes region-specific results. Driven by cooler temperatures, the maximum demand reductions seen in the Pocatello/Twin Falls region were on average 40 percent less than those in the Boise region.

Idaho Power Company Custom Efficiency Program Process and Impact Evaluation

Final Report

Evergreen Economics

February 4, 2015

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Executive Summary

Evergreen Economics, along with SBW Consulting, was hired by Idaho Power Company (IPC) to conduct a process and impact evaluation of the Custom Efficiency program. The Custom Efficiency program is an incentive based program designed to encourage commercial and industrial customers to install equipment, systems, or processes that increase the energy efficiency of their operations.

The 2013 Custom Efficiency program also included two separate offerings: Streamlined Custom Efficiency (SCE) and Refrigeration Operators Coaching for Energy Efficiency (ROCEE). IPC has also developed a wastewater offering, Wastewater Energy Efficiency Cohort (WWEEC) for municipalities. All three offerings were new beginning in 2013 and are implemented by Cascade Energy. The SCE offering is designed to provide streamlined incentives for smaller projects that would otherwise fit into the Custom Efficiency program. The ROCEE and WWEEC offerings utilize a cohort approach to provide training, education, audits, energy management software, and technical assistance for implementation of energy efficient process changes or improvements.

Impact Evaluation

The primary objectives of the impact evaluation were to measure kWh and kW impacts, provide ex-post savings and realization rates, and provide recommendations to enhance future engineering analysis and accuracy of reported program savings.

To address the impact evaluation objectives, the evaluation team selected a stratified random sample of 30 projects and conducted an engineering analysis, which included desk reviews for all sampled projects and on-site verification for five projects. For lighting projects, the evaluation team reviewed whether projects were inside a conditioned space and then used Bonneville Power Administration's lighting tool to calculate heating, ventilating and air conditioning (HVAC) interactive effects for lighting. Once all engineering reviews were complete, the evaluation team calculated ex-post kWh and kW savings for the sampled projects along with realization rates. The team then used the realization rates calculated for the review sample to calculate ex-post kWh and kW savings for the entire 2013 participant population. The results of the impact evaluation activities are shown in Table 1. The realization rate for kWh savings and kW savings was 99 percent and 136 percent, respectively. From a statistical standpoint, the relative precision achieved for kWh impacts was 90/3 and for kW impacts was 90/4.

Table 1: 2013 Custom Efficiency Program Participation and Realization Rates

Measure Category	Participation Total	Ex-Ante kWh Savings Total	Ex-Ante kW Savings Total	kWh Realization Rate	kW Realization Rate
Lighting	34	9,777,630	1,076.6	98%	142%
Refrigeration	22	3,786,819	435.9	90%	88%
Other	17	7,722,787	793.5	108%	157%
Total	**73**	**21,287,236**	**2,306.0**	**99%**	**136%**

Findings from the impact evaluation indicate that realization rates are high and IPC currently provides a high level of internal review for each custom project. Lighting interactive effects resulted in a slight reduction in savings overall, less than two percent.

Going forward, the evaluation team recommends that Custom Efficiency projects with large savings receive measurement and verification (M&V), but that the internal IPC review of project applications can likely be reduced. Additionally, the duration of installation metering should be based on the variability of the equipment operating conditions. Finally, IPC should modify the lighting tool to include HVAC interactive effects so that these are accurately captured within the ex-ante savings estimates.

Process Evaluation

The primary objectives of the process evaluation were to evaluate program design, program processes, and participant satisfaction, as well as to provide early feedback on the three new offerings.

To address the process evaluation objectives, the evaluation team conducted in-depth interviews with implementers of the three new offerings, SCE trade allies, SCE participants, ROCEE participants, and WWEEC participants. The evaluation team also reviewed results from interviews with Custom Efficiency participants and non-participants conducted by MDC Research for IPC earlier this year.

Overall, the Custom Efficiency program and SCE offering are well received by participants, but there is low awareness of the program and other IPC offerings. SCE participants reported some difficulty with applications and the time it takes to receive an incentive but were generally satisfied with their experience. Trade allies were the primary source of awareness for the SCE offering.

The cohort approach appears to be working well for the ROCEE and WWEEC offerings, but there has been some difficulty with the ROCEE participants getting enough support from upper management at the participating facilities for the implementation of all action items to take place. One major benefit to the ROCEE and WWEEC cohorts has been the creation of

a network of refrigeration and wastewater professionals, which has proved to be a valuable resource for feedback and new ideas.

The evaluation team recommends that IPC increase the marketing and outreach for the Custom Efficiency program. Awareness is low among participants and non-participants, and many acknowledged a desire to know more about other programs IPC offers. For the SCE offering, Cascade Energy should continue to assist participants with energy savings analysis and completing applications, and should let participants know that this assistance is available. If possible, IPC should look for ways to speed up or streamline the application process and rebate process, as these were the main sources of dissatisfaction among participants.

For the ROCEE offering, IPC should ensure that all recruitment activities are targeted at both upper management and technician staff to get full support for the offering before enrolling participants. IPC should also review and consider the recommendations from Cascade Energy provided in its Year 1 ROCEE Summary Report. For the WWEEC offering, Cascade could provide additional support to participants in the form of engineers specialized in wastewater treatment and could provide assistance for WWEEC participants who need to prepare project proposals for internal approval of efficiency projects.

1 Introduction

1.1 Program Background

The Idaho Power Company (IPC) Custom Efficiency program is an incentive-based program designed to encourage commercial and industrial customers to install equipment, systems, or processes that increase the energy efficiency of their operations. Customers who wish to receive a financial incentive through this program are required to submit a pre-approval application for review by IPC to determine project viability and cost-effectiveness. Maximum incentives do not exceed 70 percent of total project cost or $0.12 per annual kWh saved, whichever is less. This program also encourages and assists commercial and industrial customers to use electricity in an economically efficient manner through education and information, expert energy audits, and monitoring and verification.

The 2013 Custom Efficiency program included two new offerings: Refrigeration Operators Coaching for Energy Efficiency (ROCEE) and Streamlined Custom Efficiency (SCE). ROCEE provides technical training, audits and expert advice for customers with complex refrigeration systems. SCE, which is being administered by a third-party contractor, provides streamlined incentives for smaller projects. Measures included in the SCE component are compressed air, fast acting doors in cold storage, refrigeration controllers, and variable speed drives.

IPC has also developed a wastewater offering, Wastewater Energy Efficiency Cohort (WWEEC) for municipalities, and began recruiting customers in 2013. The cohort approach may increase cost-effectiveness for such programs that require substantial technical guidance. The ROCEE program and Energy Trust of Oregon (for Commercial Real Estate Strategic Energy Management) are using similar cohort approaches. IPC customers are active participants in regional offerings including the Northwest Energy Efficiency Alliance's Industrial Training project. IPC co-funds this effort, doubling the number of trainings offered in its territory.

Within this program context, IPC contracted with the Evergreen Economics evaluation team to conduct an impact evaluation of the 2013 Custom Efficiency Program and a process evaluation of current Custom Efficiency Program processes. The evaluation team consisted of the following firms:

- Evergreen Economics, which was the prime contractor, was involved in all project tasks, and was the lead author of the evaluation report; and
- SBW Consulting, which conducted the engineering analysis including the desk reviews and on-site verifications.

This report presents the methods and findings of the impact and process evaluations, as well as overarching evaluation conclusions and recommendations.

1.2 Evaluation Objectives

The Evergreen team began the evaluation with a project initiation meeting held at IPC offices on June 24, 2014. During that meeting, the evaluation team and IPC established the research objectives that were to guide this evaluation.

The key objectives identified for the impact evaluation include:

- Measuring and verifying the energy (kWh and kW) and non-energy impacts attributable to the 2013 Custom Efficiency program;
- Providing credible and reliable ex-post program energy savings and realization rates and non-electric impact estimates attributed to the Custom Efficiency program for the 2013 program year; and
- Reporting findings and observations, and providing recommendations that would enhance the effectiveness of future engineering analysis and the accurate and transparent reporting of program savings.

The key objectives identified for the process evaluation include:

- Evaluating program design including program mission, logic and use of best practices;
- Evaluating program implementation including quality control, operational practice and outreach;
- Evaluating program administration including program oversight, staffing, management, training, documentation and reporting;
- Evaluating participant and stakeholder response including customer interaction and satisfaction; and
- Reporting findings and observations and providing recommendations that enhance program effectiveness.

A number of more specific research questions and objectives emerged as a result of the evaluation team's conversations with IPC staff. The researchable issues born of those conversations are as follows:

- Does IPC need more third-party measurement and verification (M&V)? Or are on-sites and invoice review sufficient?
- What project size should require M&V?
- Is current level of internal IPC review appropriate for project applications (two IPC reviewers for each), or could they get by with less?
- How much post-installation metering is recommended? IPC does logging for bigger projects, but would like guidance on how much is recommended, while balancing accuracy in savings with providing incentives in a timely manner.
- Provide numeric score for customer satisfaction in participant interviews.
- Should IPC representatives be visiting customers more?
- What can IPC do to market the program better?
- Provide early feedback on the three new offerings: SCE, ROCEE, and WWEEC.

The evaluation team addressed all of the objectives listed in this section through the team's impact or process evaluation activities, and the resulting conclusions and recommendations are included at the end of this report.

1.3 Impact Evaluation Overview

The impact evaluation analysis consisted of the following activities:

1. **File Review.** Engineers from the evaluation team completed a desk review of savings for a sample of 2013 custom projects based on the project application files maintained by IPC. For the review, the team drew a stratified random sample of projects to achieve a 90/10 level of relative precision. IPC provided additional detail on these projects as requested by the evaluation team.

2. **Site Visit.** The evaluation team selected a sample of three projects for on-site verification visits. The team chose these sites as they involved more complicated projects and therefore would benefit most from a site visit in addition to a desk review. Information collected during the site visits included details on the baseline conditions, removed equipment, and current operating conditions that might affect energy savings achieved by the project.

3. **Re-estimate Savings.** The evaluation team re-estimated project savings (kWh and kW) for all sampled projects based on the results of the file review and on-sites. Based on the re-estimated ex-post savings, the team calculated realization rates that reflect the portion of ex-ante savings that were actually achieved. The team then used the realization rates calculated for the review sample to calculate ex-post kWh and kW savings for the entire 2013 participant population.

Table 2 shows the 2013 participation levels and the adjusted ex-post savings. For sampling purposes, the evaluation team placed program participants into three main measure categories: Lighting, Refrigeration, and Other. The team based these categories on the final measure category provided in the IPC program tracking data. This measure categorization scheme was designed to provide a well-balanced mix of project types and to avoid a sample dominated by one measure category (that is, lighting, which represents approximately 46 percent of both customers and energy savings).

As shown in Table 2, there were 73 participants in the 2013 Custom Efficiency Program, with reported ex-ante savings of 21,287,236 kWh and 2,306 kW. As shown in the right hand side of the table, the impact evaluation resulted in ex-post savings that closely matched the original ex-ante values for kWh (realization rate = 99 percent) and exceeded the original kW savings (realization rate = 136 percent).

Table 2: 2013 Custom Efficiency Program Participation and Realization Rates

Measure Category	Participation Total	Ex-Ante kWh Savings Total	Ex-Ante kW Savings Total	kWh Realization Rate	kW Realization Rate
Lighting	34	9,777,630	1,076.6	98%	142%
Refrigeration	22	3,786,819	435.9	90%	88%
Other	17	7,722,787	793.5	108%	157%
Total	**73**	**21,287,236**	**2,306.0**	**99%**	**136%**

Section 2.1 and Section 3 of this report provide additional detail on the impact evaluation analysis methods and results, respectively.

1.4 Process Evaluation Overview

The process evaluation consisted of developing an interview guide and conducting interviews with implementers, trade allies, and participants of the SCE, ROCEE, and WWEEC offerings. Evergreen worked with IPC staff to develop an interview guide that would gather information on the research objectives and provide early feedback on the three new offerings.

Table 3 summarizes the targets for number of interviews with each group and how many were completed. In all cases except for SCE participants, Evergreen was able to reach the goal, completing three interviews with Cascade Energy implementation staff, five interviews with SCE trade allies, four interviews with SCE participants, three interviews with ROCEE participants, and four interviews with WWEEC participants. Due to the difficulty of recruiting SCE participants to be interviewed, the evaluation team could not reach the goal for this group.

Table 3: 2013 Custom Efficiency Interviews Summary

Interview Target Group	Participation Total	Interview Goal	Interviews Completed
Implementers	3	3	3
SCE Trade Allies	13	5	5
SCE Participants	19*	8	4
ROCEE Participants	8	3	3
WWEEC Participants	10	4	4
Total	**53**	**23**	**19**

*Note: SCE participants shown here only include those with completed and paid projects.

2 Evaluation Methods

2.1 Impact Analysis Methods

2.1.1 Sampling Plan

Immediately following the project initiation meeting, the evaluation team began developing a sampling plan for the desk reviews. The sampling strategy utilized a stratified random sampling approach with a target of achieving a minimum of 90/10 relative precision for the entire Custom Efficiency Program. A sample of this precision level allows for extrapolating the sample results to the participant population with a high degree of confidence (for example, the evaluation team could be 90 percent confident that the sample average was within 10 percent of the true population average). To achieve this level of precision, the evaluation team developed sample strata based on three general measure categories: Lighting, Refrigeration, and Other (encompassing all other project types). Stratifying based on measure type provided two important benefits. First, the stratified sample allowed for meeting the 90/10 relative precision criterion with a fewer number of sample points compared to simple random sampling without stratification. Second, using a stratification based on measure category ensured that the sample would not be overly dominated by lighting projects and allowed for a mix of project types.

The final sampling plan for the desk reviews and on-sites is shown in Table 4. The evaluation team first grouped projects by general measure category (Lighting, Refrigeration, and Other), as shown in Column A. Within each measure category, the evaluation team then grouped projects by size, with projects that account for the first 25 percent of savings in stratum 1, the next 50 percent in stratum 2, and the remaining 25 percent in stratum 3. The team also assigned projects to a certainty stratum when the project comprised 10 percent or more of the total savings in that measure category. In some cases, the team assigned all projects within stratum 1 to the certainty stratum; therefore, stratum 1 does not appear in the table below for Refrigeration and Other measures. Column F summarizes the total kWh contained in each stratum based on this allocation.

Column D shows the total of sites selected for on-sites (3), and Column E shows the number of projects selected for a desk review (27). All projects within the certainty stratum are selected for either an on-site or desk review.[1] In total, the evaluation desk review and on-site analysis covered over 66 percent of total program savings. The combination of on-sites and desk reviews meets the requirements of at least 10 percent precision at the 90 percent level of confidence for each of the three measure group categories, as well as for the Custom Efficiency Program as a whole.

[1] Note that sites chosen for on-sites also received a desk review, but for sampling purposes they are included as part of the on-site sample only.

[2] The most recent version of BPA's Lighting Calculator can be found at:

Table 4: 2013 Custom Efficiency Program Impact Evaluation Sample

A	B	C	D	E	F	G	H
Measure Category	**Strata**	**Total Number of Projects**	**On-site Sample Size**	**Desk Review Sample Size**	**Ex-Ante kWh in Stratum**	**Ex-Ante kWh in Sample**	**Percent of Ex-Ante kWh Sampled**
Lighting	1	1	0	1	941,384	941,384	100.0%
	2	14	0	7	5,221,665	2,132,626	40.8%
	3	18	0	5	2,462,466	805,975	32.7%
	Certainty	1	0	1	1,152,115	1,152,115	100.0%
	Total	**34**	**0**	**14**	**9,777,630**	**5,032,100**	**51.5%**
Refrigeration	2	1	0	1	278,732	278,732	100.0%
	3	17	0	3	1,088,536	386,366	35.5%
	Certainty	4	2	2	2,419,551	2,419,551	100.0%
	Total	**22**	**2**	**6**	**3,786,819**	**3,084,649**	**81.5%**
Other	2	1	0	1	621,078	621,078	100.0%
	3	12	0	3	2,066,827	295,918	14.3%
	Certainty	4	1	3	5,034,882	5,034,882	100.0%
	Total	**17**	**1**	**7**	**7,722,787**	**5,951,878**	77.1%
Total		**73**	**3**	**27**	**21,287,236**	**14,068,627**	**66.1%**

The evaluation team conducted an initial review of project documentation for the nine projects in the certainty stratum to identify those that would most benefit from a site visit. The on-site sample focused on projects that included complicated measures, lacked clarity in calculations or assumptions, or could otherwise benefit from an on-site review. The evaluation team excluded lighting projects from the on-site sample because these projects typically have straightforward savings calculations and are easily verified by a desk review. Finally, the team excluded any project sites that IPC had recently visited for monitoring and verification work from the sample to avoid over-burdening the customer with site visits. Upon selecting three projects for on-sites, the evaluation team discovered that two of these customers had actually completed two projects each. This resulted in a total of five projects being covered across three participants in the final on-site sample.

2.1.2 Review of Savings

2.1.2.1 Desk Reviews

To conduct the desk review of project-level savings, the evaluation team requested all available documentation for each of the projects included in the sample. This included the original project application, initial ex-ante savings estimates, project review information

conducted by the IPC program engineers, engineering model results, and any other information that IPC had in its program tracking files for these projects.

Once assembled, the evaluation team replicated the savings calculations and then looked for any opportunities where it could refine the savings estimates. Areas that could have been changed in the calculations included the basic input parameters, assumed efficiency levels, baseline assumptions, and/or changes to the overall savings calculation algorithm. Throughout this process, the evaluation team discussed project documentation and calculation details with IPC staff to clarify various aspects of the savings estimates. Based on reviews of calculation inputs, assumptions, and all data provided, the evaluation team re-calculated savings where necessary to obtain the verified ex-post kWh and kW savings and realization rates for each project. The evaluation results section below includes additional detail on changes made to specific projects.

2.1.2.2 On-sites

With the assistance of IPC staff and account managers, the evaluation team engineers contacted each of the three sites and made arrangements for a site visit. The engineers gathered information that would be used to represent both baseline and efficient-case conditions for the project during the site visit. For each site visited, the evaluation tam gathered additional information on the project through discussion with operators, inspecting the as-operated condition of the equipment, and (if applicable) reviewing control settings that affect equipment operation. The evaluation team used the results of these site visits in combination with the desk reviews to verify kWh and kW savings for the five projects covered by the three site visits.

2.1.2.3 Interactive Effects

Part of the desk reviews involved estimating HVAC-lighting interactive effects where appropriate. The desk review sample contained 12 projects involving lighting retrofits in conditioned spaces where calculating interactive effects is appropriate. For these projects, IPC provided the Lighting Calculator tool that was used to calculate the energy savings along with supplemental project information needed to estimate interactive effects. The supplemental information included the facility type, the space heating fuel type, and space cooling fuel type for the facility. For each line item in the lighting calculator, IPC also indicated whether the space was heated and/or cooled or was exterior unconditioned space.

The evaluation team estimated lighting interactive effects using the Bonneville Power Administration (BPA) Lighting Calculator.[2] From the BPA calculator, the team referenced the appropriate electric HVAC interaction factor from the interaction table and used to adjust the kWh savings for each lighting measure in the IPC project. If the space was heated with a non-electric fuel type, the team applied the BTU per saved lighting kWh value from

[2] The most recent version of BPA's Lighting Calculator can be found at: http://www.bpa.gov/EE/Sectors/Commercial/Pages/Commercial-Industrial-Lighting.aspx.

the BPA interaction table to calculate the energy increase associated with the additional heating energy requirement.

2.2 Process Evaluation Methods

The primary process evaluation activity was to conduct interviews with individuals involved in the implementation or participation of the three new offerings: SCE, ROCEE, and WWEEC. The objective of these interviews was to provide IPC with early feedback on the offerings while they are still in the second year of operation. More specifically, the interviews were designed to:

- Evaluate program processes;
- Assess participant satisfaction;
- Identify any gaps in services provided by IPC; and
- Recommend areas for improvement of the offerings.

The following subsections describe the interview targets and interview topics for each target group.

2.2.1 Interview Targets

IPC staff provided the evaluation team with a list of participants and contact information for each of the three offerings. For SCE, this included project details such as facility type, measures installed, and project status. The ROCEE and WWEEC participant lists included information on the general level of involvement of each customer who attended trainings and workshops. With this information in hand, the evaluation team narrowed the interview sample frame down to SCE projects that were completed and paid and all ROCEE and WWEEC participants that had attended trainings. The evaluation team initially selected, at random, eight SCE participants, three ROCEE participants, and four WWEEC participants to call for interviews to meet the goals. Ultimately, the evaluation team contacted all participants in the interview sample frame in order to reach the desired number of completed interviews.

SCE trade allies were another target group for interviews, and IPC staff provided contact information for 13 vendors who had installed a variety of measure types for SCE participants.

IPC also provided contact information for implementation staff at Cascade Energy, which included John Christiansen for SCE, Steve Koski for ROCEE, and Layne McWilliams for WWEEC.

The interview goals for each of these groups were:

- Three with Cascade Energy implementers (one each for the three SCE, ROCEE, and WWEEC offerings);
- Eight with SCE participants who had completed and paid projects;

- Five with SCE trade allies who are active in the offering;
- Three with ROCEE participants who were fully active in the offering; and
- Four with WWEEC participants who were fully active in the offering.

Prior to the evaluation team calling for interviews, IPC customer representatives contacted participants to let them know evaluators would be reaching out to get their feedback on the offering in which they participated.

2.2.2 Interview Topics

Interview topics necessarily varied by the target audience for each set of interviews. The general topics that the evaluation team attempted to cover across all interviews were marketing/recruiting, implementation or participation process, offering design, and satisfaction. The specific interview topics for each of the target groups are listed below.

- Implementation staff and SCE trade allies:
    - Types of Services Provided
    - Marketing and Outreach
    - Offering Design/Operations
    - Implementation Successes/Challenges
    - Recommendations for Improvement

- SCE participants
    - Facility Characteristics
    - Offering Awareness and Motivations
    - Participant Experience
    - Applications and Incentives
    - Satisfaction and Recommendations for Improvement

- ROCEE and WWEEC participants
    - Facility Characteristics
    - Offering Awareness and Motivations
    - Participant Experience
    - Training Workshops/Webinars
    - Engineering/Technician Assistance
    - Energy Management Software
    - Audits
    - Satisfaction and Recommendations for Improvement

The full interview guide included as Appendix B of this report shows additional detail on the specific questions asked during interviews.

3 Impact Analysis Results

3.1 Summary of Program-level Results

Table 5 summarizes the results of the Custom Efficiency Program impact evaluation analysis. The evaluation team calculated the final ex-post savings estimates by taking the project-level savings estimates from the desk reviews, weighting them by their ex-ante savings values, and then aggregating savings within each measure category. For each measure category, the team calculated a realization rate by dividing the total ex-post impacts by the original ex-ante savings estimates.

In general, the ex-post savings were very consistent with the original ex-ante values with an overall program realization rate of 99 percent (that is, 99 percent of the original savings amount was achieved based on the results of the impact evaluation).

Table 5: Summary of Impact Results (kWh)

Measure Category	Ex-Ante kWh Savings	Ex-Post kWh Savings	Realization Rate
Lighting	6,088,672	5,937,012	98%
Refrigeration	3,084,649	2,770,459	90%
Other	4,895,306	5,272,076	108%
Total	**14,068,627**	**13,979,547**	**99%**

The evaluation team used the realization rates from the evaluation sample to determine the total ex-post savings for the entire 2013 population of projects. As shown in Table 6, the 2013 Custom Efficiency Program achieved 21,252,200 kWh in ex-post energy savings.

Table 6: Sample and Program Population Savings (kWh)

Measure Category	Sample Ex-Ante kWh Savings	Sample Ex-Post kWh Savings	Realization Rate	Population Ex-Ante kWh Savings	Population Ex-Post kWh Savings
Lighting	6,088,672	5,937,012	98%	9,777,630	9,534,079
Refrigeration	3,084,649	2,770,459	90%	3,786,819	3,400,942
Other	4,895,306	5,272,076	108%	7,722,787	8,317,179
Total	**14,068,627**	**13,979,547**	**99%**	**21,287,236**	**21,252,200**

The evaluation team used a similar analysis to determine kW impacts; Table 7 shows these results. The team recalculated total demand savings for each project in the sample based on the results of the desk reviews and on-sites to determine ex-post kW impacts and realization rates. Overall, the realization rate for the entire program was 136 percent. There was significantly more variation within the measure categories, with realization rates ranging from 88 percent for Refrigeration to 157 percent for Other. The following

section includes details on the specific adjustments made that resulted in these realization rates.

Table 7: Summary of Impact Results (kW)

Measure Category	Ex-Ante kW Savings	Ex-Post kW Savings	Realization Rate
Lighting	644.7	960.5	142%
Refrigeration	324.4	315.8	88%
Other	558.9	877.7	157%
Total	**1,528.0**	**2,153.9**	**136%**

Table 8 shows the total program kW savings for 2013 based on the realization rates derived from the evaluation sample. In total, the 2013 Custom Efficiency Program achieved 3,154.7 of kW savings, a 36 percent increase over the original ex-ante estimate of 2,306 kW.

Table 8: Sample and Program Population Savings (kW)

Measure Category	Sample Ex-Ante kW Savings	Sample Ex-Post kW Savings	Realization Rate	Population Ex-Ante kW Savings	Population Ex-Post kW Savings
Lighting	644.7	960.5	142%	1,076.6	1,527.1
Refrigeration	324.4	315.8	88%	435.9	381.6
Other	558.9	877.7	157%	793.5	1,246.0
Total	**1,528.0**	**2,153.9**	**136%**	**2,306.0**	**3,154.7**

The following tables show the confidence intervals and final relative precision calculations for the kWh and kW realization rates.[3] The original sampling plan had a target of 90/10 relative precision for the entire Custom Efficiency Program. As shown in Table 9 and Table 10, this was achieved not only for the entire program, but also for the individual measure categories for both kWh and kW. Overall, the kWh relative precision was 90/3 and kW relative precision was 90/4.

[3] These calculations are based on the final *ex post* realization rates for both kWh and kW and weighted based on the original ex-ante savings values.

Table 9: Confidence Intervals and Relative Precision (kWh)

Measure Category	Realization Rate	Lower 90%	Upper 90%	Relative Precision at 90% Confidence
Lighting	97.5%	96.7%	98.2%	0.8%
Refrigeration	89.8%	86.6%	93.4%	3.8%
Other	107.7%	101.0%	115.2%	6.6%
Total	**99.4%**	**96.4%**	**102.6%**	**3.1%**

Table 10: Confidence Intervals and Relative Precision (kW)

Measure Category	Realization Rate	Lower 90%	Upper 90%	Relative Precision at 90% Confidence
Lighting	141.8%	134.3%	150.8%	5.8%
Refrigeration	87.5%	79.2%	95.6%	9.5%
Other	157.0%	143.3%	169.8%	8.6%
Total	**135.9%**	**130.3%**	**141.8%**	**4.2%**

3.2 Detailed Impact Results by Measure Category

This section presents more detailed results by measure category group. The project-level adjustments are presented along with discussion of any general trends in the savings adjustments.

3.2.1 Lighting Projects

Table 11 presents the original and adjusted savings for each of the 16 lighting projects in the sample. Common reasons for adjusting the ex-ante savings for lighting projects included the following:

- Incorporating the effects of HVAC interactions for lighting projects in conditioned space;
- Calculating savings using actual operating hours, rather than assuming operating hours of 8,760; and
- Reducing savings to account for ineligible equipment.

Table 11: Project-Level Savings Adjustments (Lighting)

	Realization Rate		
Project #	**kWh**	**kW**	**Reason(s) For Change**
IND0888	92%	94%	Approximately half of the LED fixtures were off during the site visit; savings recalculated based on occupancy sensors.
IND0898	96%	96%	HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND0924	101%	188%	HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND0942	97%	120%	Fixture quantities updated in accordance with post-installation inspection findings; HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND0954	103%	165%	HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND0959	98%	150%	HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND0961	97%	103%	Evaluators adjusted some of the values given in the workbook in an effort to reconcile them with the data provided in the documentation. The lower value was assumed to be valid and then multiplied by an HVAC interaction factor of 97%; demand savings recalculated using lighting operating hours instead of all hours of the year.
IND0962	100%	208%	Savings associated with controls were erroneously entered; HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND0963	103%	117%	HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND0975	96%	156%	HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND0990	98%	212%	Proposed wattages for 7 of 48 records had been understated; demand savings recalculated using operating hours instead of all hours of the year.
IND1006	100%	N/A	Tracking data did not report kW savings. Evaluation calculated kW savings as kWh savings divided by the savings weighted operating hours across all lines in the lighting calculator.
IND1034	105%	125%	HVAC interaction was included in evaluation savings; demand savings recalculated using lighting operating hours instead of all hours of the year.
IND1041	105%	190%	HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.
IND1065	100%	378%	Demand savings recalculated using lighting operating hours instead of all hours of the year.
IND1106	103%	112%	HVAC interaction included; demand savings recalculated using operating hours instead of all hours of the year.

3.2.2 Refrigeration Projects

Table 12 shows the adjustments made to refrigeration projects in the analysis sample. There were no common trends observed in the adjustments for these projects; the revisions were either due to incorporating additional information obtained during the site visits (two projects) or else correcting for miscellaneous calculation errors.

Table 12: Project-Level Savings Adjustments (Refrigeration)

	Realization Rate		
Project #	**kWh**	**kW**	**Reason(s) For Change**
IND0872	86%	87%	Observed counter on one door which corresponded to about 14 openings per hour; temperature setpoints for the spaces on both sides of the doors were obtained from the site contact; algorithm inputs were revised as per site visit.
IND0930	178%	181%	Savings increased due to the temperature difference between the rooms separated by the doors installed.
IND0944	48%	45%	Savings reduced due to smaller delta temperature across the opening; savings also reduced due to manual override of doors by workers; savings increased due to baseline assumption change for two of the three doorways.
IND0982	64%	50%	Several errors in algorithm inputs and calculations; reduction in refrigeration load from door addition was 241 Btu/hr/ft; 214 watts of doorframe anti-sweat heat were not included; ex-ante calculations were not consistent.
IND1033	100%	N/A	Tracking data did not show kW savings. Evaluation calculated as the average kW across all 8,760 operating hours.
IND1038	100%	100%	
IND1071	119%	119%	Savings increased to be consistent with post inspection revised savings calculated using the preferred ADM model.
IND1072	100%	100%	

3.2.3 Other Projects

Table 13 summarizes adjustments to the remaining projects in the sample; the team grouped these remaining projects into the Other measure category. Given the small number of projects and the wide variety of measure types, there were no general adjustment trends observed for this group.

Table 13: Project-Level Savings Adjustments (Other)

	Realization Rate		
Project #	**kWh**	**kW**	**Reason(s) For Change**
IND0839	109%	109%	Baseline UV system still in place and unused. Baseline data in the project file appears to be the only available baseline data. Data included about eight months of semi-daily hand written logs including effluent flow and visual transmittance, and UV system amperage draw. Revised algorithm to correlate equipment kW to effluent flow and visual transmittance.
IND0949	100%	100%	
IND0968	138%	138%	Tracking values were based on the ex-ante analysis; evaluation values report the savings based in M&V performed by vendor.
IND1022	103%	147%	The nameplate motor efficiency entered in the Calculator was based on a premium 40 horsepower (HP) motor rather than a premium 20 HP motor
IND1025	100%	100%	
IND1056	100%	240%	Demand savings recalculated using lighting operating hours instead of all hours of the year

Table 14 summarizes all of the project adjustments and provides the original ex-ante savings and the adjusted ex-post values.

Table 14: 2013 Custom Project Savings Summary (Full Sample)

	Ex-Ante		Ex-Post		Realization Rate	
Project #	**kWh**	**kW**	**kWh**	**kW**	**kWh**	**kW**
IND0839	1,626,879	185.7	1,765,217	201.5	109%	109%
IND0872	729,065	83.0	629,572	71.9	86%	87%
IND0888	1,152,115	128.0	1,059,242	120.9	92%	94%
IND0898	456,768	54.0	438,497	51.9	96%	96%
IND0924	132,669	16.0	133,384	30.1	101%	188%
IND0930	169,530	19.0	301,125	34.4	178%	181%
IND0942	941,384	87.0	915,231	104.7	97%	120%
IND0944	712,349	86.0	340,707	38.9	48%	45%
IND0949	774,822	88.5	774,822	88.5	100%	100%
IND0954	127,422	17.0	130,732	28.1	103%	165%
IND0959	239,561	28.0	235,742	42.0	98%	150%
IND0961	929,150	106.1	905,336	109.0	97%	103%
IND0962	424,251	48.0	422,821	100.0	100%	208%
IND0963	181,768	21.0	186,563	24.5	103%	117%
IND0968	621,078	71.0	857,427	97.9	138%	138%
IND0975	308,813	26.0	297,048	40.6	96%	156%
IND0982	29,626	3.4	19,079	1.7	64%	50%
IND0990	169,959	19.4	167,024	0.0	98%	212%
IND1006	200,056	0.0	200,056	46.0	100%	N/A
IND1022	69,165	7.9	71,248	11.6	103%	147%
IND1025	99,331	11.3	99,331	11.3	100%	100%
IND1033	278,732	0.0	278,732	31.8	100%	N/A
IND1034	155,714	17.8	162,789	22.2	105%	125%
IND1038	506,654	57.8	506,654	57.8	100%	100%
IND1041	181,555	20.7	190,089	39.3	105%	190%
IND1056	1,704,031	194.5	1,704,031	466.9	100%	240%
IND1065	321,409	36.7	321,409	138.8	100%	378%
IND1071	187,210	21.4	223,107	25.5	119%	119%
IND1072	471,483	53.8	471,483	53.8	100%	100%
IND1106	166,078	19.0	171,049	21.3	103%	112%
Total	**14,068,627**	**1,528.0**	**13,979,547**	**2,154.0**	**99%**	**136%**

4 Process Evaluation Results

A summary of the interviews conducted for the process evaluation is shown below in Table 15. In total, 19 interviews were conducted across the five groups of implementers, SCE trade allies, SCE participants, ROCEE participants, and WWEEC participants.

Table 15: 2013 Custom Efficiency Interviews Summary

Interview Target Group	Participation Total	Interview Goal	Interviews Completed
Implementers	3	3	3
SCE Trade Allies	13	5	5
SCE Participants	19*	8	4
ROCEE Participants	8	3	3
WWEEC Participants	10	4	4
Total	**53**	**23**	**19**

*Note: SCE participants shown here only includes those with completed and paid projects

4.1 Implementer Interviews

4.1.1 SCE

For the SCE offering, the evaluation team spoke with John Christiansen at Cascade Energy; John is active in the implementation of this offering. John described the implementation process as getting a lead from IPC or an equipment vendor on a customer with a project that fits the description of the Custom Efficiency program but is typically smaller in nature. He then gives approval that the project description fits the SCE program and conducts analysis using a tool-based approach to determine energy savings. Cascade assists the customer in filling out the pre-approval application and submits it to IPC for review. Once IPC has approved the project, the customer moves forward with installation of equipment, and Cascade conducts a post-install inspection to verify the project. Once verified, Cascade prepares the payment application, sends it to the customer for signature, and then submits it to IPC for approval and payment of incentive to the customer.

The current offering process appears to be working well in its current state, and John believes that coordination between Cascade and IPC staff has been effective and timely. He mentioned that leveraging vendors as a marketing and recruiting tool would be a good focus point for IPC to get the word out about the program, as vendors are often the customers' first point of contact when they need to replace or upgrade equipment. Encouraging vendors to actively promote the program is likely the best and most cost effective way to raise awareness among small and medium sized industrial customers. Cascade already conducts outreach with vendors serving the industrial sector, and this should be continued.

Benefits to customers participating in the SCE offering include energy cost savings, but John said another benefit is that the offering helps get the word out to customers that IPC

has other rebate programs that they may be eligible for. Another benefit of the program is the creation of an additional touch point between IPC and the customer, which John believes has been a positive outcome of the offering.

From the implementer's perspective, there have not been many challenges in implementing this offering. One of the few challenges has been dealing with customers and vendors who always want a faster turnaround on the incentives; however, there is little Cascade can do to change this, and John believes the turnaround times for this offering are better than comparable programs implemented by other utilities. The time required for IPC to produce a check varies, but the implementer says that IPC staff are very responsive in reviewing project applications, and he doesn't know if there is much they could improve here.

In terms of serving the customers' needs, the implementer stated that the SCE offering "scratches the itch it was intended to scratch," but that with anything, there is always room for improvement. He mentioned faster turnaround, better analysis tools, and serving more customer segments as areas for potential improvement, but did not offer specific ideas for how these could change. The feedback that the implementer has heard from participants is generally positive; the only negative comments have typically been participants wanting bigger rebates, but he added that he hears this for any rebate program.

4.1.2 ROCEE

For the ROCEE offering, the evaluation team spoke with Steve Koski at Cascade Energy; Steve is actively involved in the implementation of this offering. Steve has worked with ROCEE participants throughout the offering process, leading training sessions and regularly reaching out to participants.

To supplement research on the implementation and progress of the ROCEE offering, the evaluation team also reviewed the ROCEE Year 1 Summary Report produced by Cascade Energy (Cascade Energy, *Summary Report: ROCEE Year 1*, November 20, 2014), which summarizes the implementation activities and participant savings for the first year of the offering. Evergreen reviewed this document prior to speaking with Steve to answer some initial questions and focus the interview on questions that were not already covered in the report.

Steve first provided some information on marketing and recruitment for ROCEE. The Northwest Energy Efficiency Alliance (NEEA) conducted recruitment for this offering with help from IPC customer representatives to identify customers with medium or large refrigeration requirements. NEEA approached IPC customers about the initiative to recruit participants and then presented Cascade with a cohort of facilities ready to participate in the offering. The offering included a series of training workshops lead by Cascade staff and a number of facility site visits conducted by Cascade engineers to identify action items for efficiency improvements.

The ROCEE implementer noted that the offering and most participants had been quite successful in the first year, but that some momentum has been lost in the second year after

the trainings ended. He reported that without the trainings to motivate facilities to complete action items, it has been difficult for facilities to achieve savings, and some are losing interest.

The implementer also stated that the trainings and general implementation of the offering have met his expectations, and the primary difficulty has been in keeping participants engaged and getting them to complete action items. He explained that the difficulty arises from a lack of support from upper management at the facilities. Management's primary focus is keeping costs down, and they often view action items as just another cost and do not understand the energy cost savings that will follow.

Besides the energy savings that many participants have achieved, the implementer said he believes there are other benefits to customers participating in this offering. He thinks increased awareness of IPC's other programs is a huge benefit, and estimated that about half of the customers involved in the offering had no previous knowledge that they could get incentives from IPC for some facility upgrades. He added that IPC staff attended every training workshop and used this as an opportunity to get face time with customers and as a platform to increase awareness of their other programs. The implementer felt that there has been an appropriate level of involvement from IPC throughout the process.

The biggest challenge and primary recommendation from the ROCEE implementer was getting the right facilities staff involved in the offering from the beginning to ensure success in implementing action items and achieving energy savings. He recommends that in the future, recruitment for ROCEE should focus on reaching out to both facilities maintenance management staff as well as the hourly technicians and mechanics that will actually be implementing the action items. Involvement from both levels of staff is critical to the success of this offering.

4.1.3 WWEEC

For the WWEEC offering, the evaluation team spoke with Layne McWilliams at Cascade Energy; Layne is actively involved in the implementation of this offering. Layne has worked with the WWEEC participants throughout the process, leading training sessions and maintaining frequent contact with participants. He also conducted the recruitment for this offering himself, approaching customers directly to create the cohort of 11 of IPC's largest wastewater facility customers. IPC helped identify these customers, but ultimately the face-to-face recruitment was pivotal in getting facilities to participate. Layne mentioned that wastewater facilities staff was skeptical that their power company knew anything about operating a wastewater plant, and believes that in-person recruitment is the best option for this customer segment.

Cascade conducted an initial walkthrough of each wastewater facility to conduct an audit to identify opportunities for efficiency improvements. Cascade also conducted an energy management assessment at the start of the offering to gauge participants' energy awareness. There were five in-person workshops held, interspersed with webinars and phone calls from Cascade to participants to provide support. Cascade also tracked energy

usage at each site with the same energy management software that participants received as part of their training.

The implementer stated that one of the biggest benefits to participation is likely the energy savings, but he believes that even bigger than that, the community of wastewater facilities staff that has been created by this cohort approach has been invaluable to participants. He says they have created relationships between wastewater facilities that did not exist before, and participants now have a network of partners across the state to communicate with on a variety of issues facing wastewater facilities.

One of the challenges the implementer has had with this offering is keeping participants engaged. Initially, everyone was very involved and interested, but wastewater facilities staff were attending trainings in addition to their regular everyday jobs, and it was hard to compete with all the demands for their time. The implementer thinks the day-long training sessions may have been difficult to sit through and this would be one thing he would consider changing the next time around, perhaps making them shorter. He would also rely less on PowerPoint presentations and would try to include more discussion to keep participants engaged during trainings. The implementer stated that getting facilities management on board was not at all a barrier to participants' success, and he attributes this to their success in getting both management and facilities staff involved from the start.

Finally, the implementer shared that IPC has been very supportive throughout the implementation process, both at the start with recruiting and during the offering with IPC customer representatives reaching out to offer support. He thinks that the WWEEC participants also see IPC in a better light than before as a result of participating.

4.2 SCE Trade Ally Interviews

The evaluation team conducted five interviews with SCE trade allies to better understand their experiences with the SCE offering. The respondents included two milking equipment installers for the dairy industry, two general air compressor distributors, and one industrial equipment manufacturer specializing in the cold storage, food processing, and transportation industries. The trade allies varied in size in regards to the number of projects completed under the SCE offering, ranging from three projects to approximately 15 projects. A majority, three out of five, estimated they have completed between 12 and 15 projects under the offering, which would be between 15 and 19 percent of SCE projects each. The trade allies also indicated they perform a variety of services for the offering including the following:

- Manufacturing of equipment
- Sales and distribution
- Troubleshooting and repairs
- Installation of qualifying equipment
- Project and design identification and proposal
- Data analysis

4.2.1 Marketing and Outreach

The evaluation team asked trade allies a series of questions focused on the SCE offering's general marketing and outreach. Trade allies indicated they felt the target market for the offering depended on their respected markets. For example, both dairy equipment installers felt the target market consisted of dairy farms, while the more general air compressor distributors said the target market is potentially anyone with applicable equipment that could benefit from energy efficiency upgrades.

When asked about how the SCE offering is currently marketed to customers, all five trade allies said they were very involved with the marketing efforts to customers. As a result, all five trade allies indicated they were the primary conduit for how customers found out about the SCE offering from IPC. Additionally, two out of five trade allies said that there is some word-of-mouth marketing that comes from field reps and other customers that know about the offering. However, none of the trade allies knew if IPC or Cascade Energy provided marketing assistance in addition to their other support services.

Three of the five trade allies said the customers who had participated in the SCE offering were medium- to large-sized companies that had the time and staff resources to participate. The remaining two respondents did not provide specifics about their primary customers, but one implied participants are generally customers that have enough resources to make the necessary capital investments

The evaluation team asked trade allies if they felt there may be better methods for recruiting participants. Responses varied across trade allies, but three out of five said that a greater marketing presence from IPC would help promote the program. Specifically, respondents said brochures, information on potential leads, and overall additional efforts from IPC would help recruit participants. Overall, though, four out of five trade allies felt the current marketing and outreach efforts were effective, with tradeshow participation and increased sales efforts being the only two suggestions for increasing awareness among the target audiences.

4.2.2 Offering Design and Operations

To evaluate the SCE offering design and operation, the evaluation team asked the participating SCE trade allies about the benefits they anticipated customers would experience as a result of participating in the offering. All five trade allies said energy savings was the primary benefit for customers, while a subset of respondents mentioned additional benefits including increased awareness of energy efficiency equipment longevity and customer satisfaction.

4.2.3 Implementation Challenges and Successes

Participating SCE trade allies said overall energy savings and the initial rebate were the primary reasons that customers participated in the SCE offering. Trade allies felt that a combination of the initial rebate and long term energy savings is generally enough to get customers to participate in the offering. However, three out of five respondents indicated

there were some participation barriers including customer budget constraints, lack of understanding of the long term energy savings benefits, and customer need for a quick project turnaround that may allow less time than necessary for the SCE rebate process. Respondents suggested that additional support from Cascade Energy and IPC along with increased educational efforts for customers would help address some of the barriers and increase participation. In regards to the equipment installation, all five trade allies said they have had limited or no challenges thus far for this offering

The main successes reported by the trade allies implementing the offering included saving their customers money and increasing their overall business. As one respondent said:

"One company in Idaho is a great example. We showed them they could qualify for these rebates and it helped with their budget. Instead of 10 doors they ordered 24 doors which is obviously great for our business as well."

While not all trade allies said the offering has directly grown their respective businesses, all five said they felt the offering was successful for them and their customers because of the rebate level and energy savings. One respondent added that the offering has increased their customers' satisfaction, which in effect positively impacts their own business, while another trade ally said that the rebate was significant enough that they were able to persuade customers to participate when they might have not otherwise.

In addition, the evaluation team asked trade allies about IPC's and Cascade Energy's involvement with the coordination of the SCE offering. All five trade allies said IPC's involvement has been relatively low, with multiple respondents stating they never worked with IPC at all. This is not unexpected given the design of the SCE offering. Conversely, all five trade allies said Cascade Energy was very involved with the coordination, especially in terms of providing rebate and savings information, processing paperwork, and overall support. This would be expected given the SCE offering design and all-inclusive involvement of Cascade Energy. While four out of five respondents said Cascade Energy's involvement has been helpful, none said IPC's involvement has been helpful. Specifically, three out of five trade allies said IPC seems to slow down the approval process, which consequently can hinder the overall offering.

4.2.4 General Comments and Recommendations

Overall, all five trade allies said they were satisfied with the SCE offering and its ability to serve targeted customers' needs. Additionally, two of the trade allies said that additional rebate offerings from IPC, such as refrigeration and water consumption rebates, would further help targeted customers. However, in general, the only recommendation from trade allies was to find ways to further streamline the offering and cut down on the length of time for the approval side of the process.

4.3 SCE Participant Interviews

There were a total of 19 SCE participants with completed and paid projects that we attempted to reach for interviews. The evaluation team completed four in-depth interviews with SCE participants. The four participants we spoke with included two farming operation managers, one large potato processing plant electrical maintenance supervisor, and an electrical expert who installs variable frequency drives for IPC customers. All four participants were directly involved in their company's participation in SCE and oversaw various components of the offering.

Initially, the evaluation team set a goal of eight SCE participant interviews. However, the evaluation team was unable to reach this target because of the low response rate from participants. Every participant in the interview sample was contacted multiple times via email or phone, with voicemails left on most occasions. Evaluation team staff also varied the time of day they contacted participants in an attempt to increase the likelihood of reaching the participants directly. It appeared that many of the SCE participants that could not be reached were facility operations staff that were often not near their phone or desk during business hours.

4.3.1 Awareness and Motivations

To better understand how SCE participants learned about the SCE offering and other potential IPC offerings, the evaluation team asked participants how they first became aware of the Custom Efficiency Program and other energy efficiency programs for businesses. Two out of the four participants said they learned about the SCE offering from electricians who contacted their businesses. The interviewed electrician corroborated this by saying he contacts potential customers directly. The large potato processing plant learned about the offering through the engineers and industrial representatives at their firm. These methods were consistent for how customers learned about other energy efficiency programs as well, although only one participant remembered participating in another specific energy efficiency program – one that primarily dealt with lighting retrofits. One other participant said they had previously tried another efficiency program but could not remember which one. Both of those participants said their previous experiences with other energy efficiency programs were "okay", although neither provided recommendations or additional information regarding their program experience.

For the SCE offering, the three direct participants said their primary motivation for participating in the offering was the initial rebate on the variable frequency drives. The electrician's main motivation was increasing his business with existing clients versus using the offering as a tool to actively pursue outside customers. All four interviewees acknowledged that the initial rebate was crucial to their participation because of the inherently high up-front costs of variable frequency drives.

4.3.2 Offering Process and Participant Experience

The evaluation team also asked SCE participants a series of questions about the offering process and their experience with the offering. Three out of the four participants found it easy to participate in the offering, with the fourth participant acknowledging "it should be easy but ended up being very difficult." The participant said the difficulty occurred because of the excessive amount of time it took to complete the necessary forms and receive the rebate. One other participant shared this feeling, saying the best way to improve their overall experience with the offering would be to streamline the process and make it quicker overall.

Evergreen staff also asked participants if they had noticed any change in their energy usage since participating in the SCE offering. One participant had seen an obvious decrease in usage since installing the new equipment, while two of the participants indicated it was hard to evaluate because of the relatively small size of the project or because they installed the equipment in an area of their business that was previously not used. The remaining participant, the electrical professional, was unable to estimate the change in energy usage for his customers.

In addition to energy savings, Evergreen staff asked participants if they had experienced any other benefits from participating in the offering, such as, an improved work environment, safety, comfort, added jobs, or avoided layoffs. None of the participants said they had experienced additional benefits or had been able to hire any new employees as a result of participating in the offering. All four acknowledged the only benefit they anticipated as a result of participating was the initial rebate. As previously stated, the main way participants felt the offering could increase the current participation benefits was by speeding up the response and processing time to make the overall process more efficient.

4.3.3 Applications and Incentives

In addition to the overall offering process, Evergreen Economics asked participants about their experiences with the applications and incentives of the offering. All four participants filled out the SCE applications themselves, including the electrician that worked with customers. Three out of the four said the application process went well and was relatively easy to complete. However, one participant said the experience was less than satisfactory because it took much longer to complete and pass onto Cascade Energy than they anticipated. To alleviate this issue going forward, the participant suggested improved communication between Cascade Energy and participants as well as less paperwork. Additionally, while all four said they had received the incentive for participating in the offering,[4] two participants said the process took considerably more time to complete than expected. One of those two participants also said the rebate amount ended up being significantly less than the initial quote by Cascade Energy. Overall, three out of four

[4] The electrician that helped install rebate-eligible equipment for the participating customers did not keep the rebate personally but acknowledged the customers they had worked with had received the rebate.

participants said the application and incentive payment processes met their expectations for the most part, with the remaining participant again citing the longer than expected timeframe to complete the process as the main reason the process did not meet their expectation.

4.3.4 Participant Satisfaction and Recommendations

The participants evaluated their satisfaction of the overall offering as well as specific components of the offering on the following scale: very dissatisfied, somewhat dissatisfied, neither satisfied nor dissatisfied, somewhat satisfied, very satisfied. The individual components included:

- Determining how their electrical process could be more energy efficient;
- Obtaining a cost estimate to modify or install more efficient electrical equipment;
- Completing a Custom Efficiency program application and agreement;
- Reviewing of their application by IPC and pre-approval;
- Installation of the equipment; and
- Having IPC inspect the project or measurement and verification (M&V) plan by a contractor.

In terms of overall satisfaction with the offering, the results were mixed, with one participant very satisfied, one in between very and somewhat satisfied, one somewhat satisfied, and one very dissatisfied. The participant that was very dissatisfied thought the participation process took too long and that the paperwork became repetitive. The overall satisfaction findings were consistent for the individual components as well, with two exceptions. The participant that was very satisfied overall was somewhat dissatisfied with the installation of the equipment because of the difficulty involved with installing variable frequency drives and the filters. Additionally, the participant that was very dissatisfied overall, was very satisfied with determining how their electrical process could be more energy efficient, obtaining a cost estimate, and with the installation of the equipment because it was done in-house and executed in a timely manner. This participant was happy with the SCE offering components that he had control over, but was frustrated by the length of time and amount of paperwork that it took to participate. Figure 1 below summarizes the participant satisfaction results by component and for the SCE offering overall.

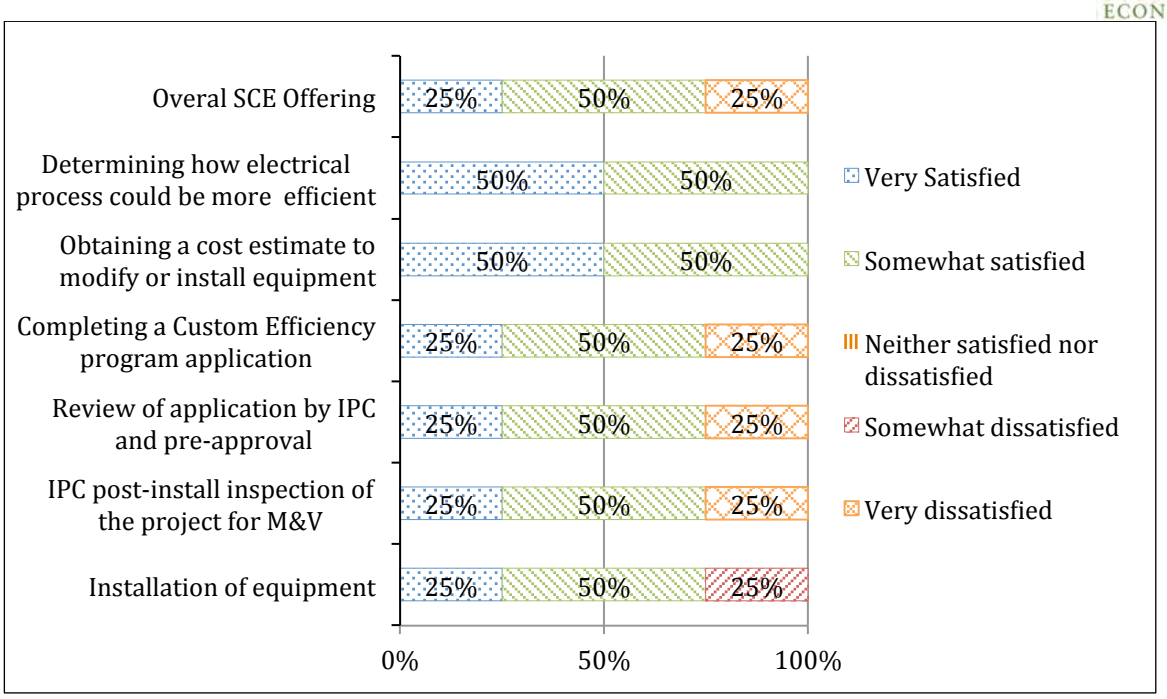

Figure 1: SCE Participant Satisfaction (n=4)

As previously described, the main recommendation from two of the participants involved speeding up the overall process for obtaining the rebate. Additionally, one participant recommended making the application form more straightforward or including an instruction sheet that explains the important information.

4.4 ROCEE Participant Interviews

The evaluation team interviewed three of the eight participants from the ROCEE offering. The respondents included:

- A facility service manager from a temperature-controlled warehouse that stores multiple types of products;
- A facility maintenance manager from a grocery distribution center; and
- A mechanic from a dairy processing plant.

All three participants interviewed were responsible for the maintenance of refrigeration equipment at their respective facilities.

4.4.1 Awareness and Motivations

One of the respondents learned about the program through their IPC liaison partner, who then arranged for Cascade Energy to contact them directly. Another learned about the program from their supervisor, and the last respondent had been working with Cascade Energy on other projects at the facility when Cascade told them about the opportunity to participate.

Each of the respondents had participated in other energy efficiency programs that IPC offered and had positive experiences, with two saying that these programs helped them save energy and were very informative. They learned about these programs through emails from IPC and from other people at their facility (the general manager or their supervisor). Their preferred sources for learning about IPC program offerings and trainings are emails and the web.

Their motivations for participating in the ROCEE offering came from their desire to learn about savings opportunities for the company, because the facility management told them to participate, or because they wanted to learn how to upgrade the facility themselves. Specifically, this last respondent preferred to learn how to work on the equipment themselves instead of having someone come in and make changes to the facility without explaining what they are doing and why. They chose not to participate in some of the other IPC programs because those programs did not appear to include an education component.

All of the respondents said that their participation in the ROCEE offering has spurred interest in other areas of their company to save energy. One said that they had either completed or made plans to upgrade the refrigeration units, doors, and lighting. Another said that they spoke with other people in the facility and encouraged them to attend classes and learn about new ways to save energy. The last respondent said the facility management had become more open to funding energy efficiency projects, which was causing more people to take advantage of energy savings opportunities.

4.4.2 Offering Process and Participant Experience

Prior to participating in the offering, two of the respondents believed that the benefit of participating in this offering was gaining education about energy efficiency, while the other person did not expect to learn much. All of the participants felt the offering exceeded their expectations.

The respondents found it easy to participate in the ROCEE offering. They have all seen a decrease in energy use at their businesses and expected this decrease to continue into the future. One was not sure how much of their energy savings could be attributed to ROCEE because they made other changes to their facility during the same period, while another said that they were “consistently saving energy”. The last respondent said they had reduced their total energy usage and drastically reduced their peak demand.

One person could not think of any non-energy benefits they experienced from participating, but the other two said that they benefited from networking with other people who work for refrigeration companies; these contacts are able to help when they need feedback or new ideas. None of the participants believed that participation in the ROCEE offering allowed them to hire any new employees or avert any layoffs (possible non-energy benefits).

4.4.3 Training Workshops and Webinars

The three respondents attended all of the ROCEE workshops in the series. They said the benefit of the trainings was learning "little things that I can do to save energy", learning "how to look out for savings opportunities", and finding out about resources they can continue using to find and implement efficiency improvements. After attending the trainings, two respondents decided to retrofit their lighting with LEDs, one installed variable frequency drives for their compressors, one converted from electric to gas heating, one switched the refrigeration compressor from running on suction pressure of refrigerant to circulation liquid, one had their mechanics work on becoming certified assistants and one decided to eventually earn the Certified Refrigeration Energy Specialists (CRES) certification. The only barrier that one respondent felt might impede their ability to complete these actions was budget. None of the respondents had any recommendations for improving the training.

4.4.4 Engineering and Technician Assistance

Only one of the respondents utilized the engineering assistance that is offered by ROCEE. They spent a day walking through the facility with a Cascade Energy engineer who identified opportunities for improvement. They were happy with the assistance they received and are continuing to work with the engineer.

4.4.5 Energy Management Software

All of the respondents said the energy management software provided by IPC was easy to use and met their expectations. They all felt that IPC and Cascade Energy have been very responsive to any problems they ran into. The only recommendation one respondent had for improving the software was to create an easier way to generate reports.

One respondent said they used the energy management software provided by IPC to monitor their energy use "on a regular basis" and they would like to continue using the software after the end of the ROCEE offering. Their processes and protocols have not changed in response to using the software, but their technicians use the software to verify that all of the equipment is working as expected, especially after they make changes to the system. They are not planning to implement any changes in the near future.

Another respondent said they use the software on occasion and it has caused them to change some of their processes. Specifically, they have three filtration plants that operate independently. They used to circulate two at a time, but after using the software, they realized that these filtration systems have very high demand. They stopped circulating them at the same time, and instead stagger them by 15 minutes. This small change in operational procedure has reduced the peak demand at the facility and resulted in significant bill reductions. They plan to continue using the software.

The remaining respondent said that they use the energy management software provided by IPC a little, but use different software provided by Cascade Energy more regularly and will probably use this alternate software after the end of the ROCEE offering. They did not have

any difficulty using the software after being trained during the classes and did not have any recommendations to improve it; they just preferred to use the other software.

4.4.6 Audits

All of the respondents received an energy audit of their facility by a qualified refrigeration expert, including two that were confident the audit was part of the ROCEE offering.[5] Both of these respondents said it was helpful at identifying no-cost and low-cost efficiency improvements at their facility. The first said they implemented all of the recommendations that they remembered receiving (fan cycling and switching to LED lighting), but there may have been more recommendations that they forgot. The second respondent said they either completed or are in the process of implementing everything that was recommended; they kept a list of all the suggestions as reference. Neither of these respondents had any recommendations for improving the audits.

4.4.7 Participant Satisfaction and Recommendations

Satisfaction with the offering was very high; the respondents were either "very satisfied" or "somewhat satisfied" with each component of the ROCEE offering, as shown in Figure 2. The highest satisfaction was reported for the training workshops, with all respondents being "very satisfied". Only one satisfaction rating was provided for engineering assistance because two of the respondents did not have experience with this component of the offering.

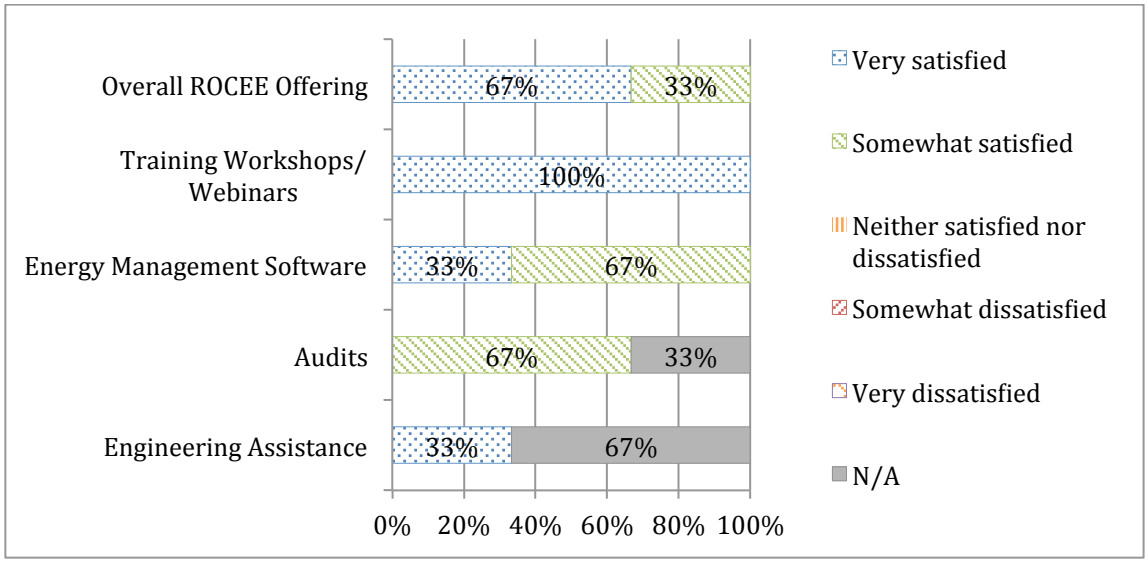

Figure 2: ROCEE Participant Satisfaction (n=3)

[5] The third respondent remembered having an audit but was not sure it was done as part of ROCEE.

When given the opportunity to provide additional comments or recommendations for improving the program, the respondents simply reiterated that they were happy with the ROCEE offering.

4.5 WWEEC Participant Interviews

Evergreen interviewed four WWEEC participants from facilities in Idaho, out of 10 total WWEEC participants. The respondents included a mechanic, a plant foreman, a lead operator, and a superintendent. Two of these respondents were the Energy Champions for their facility, one was the Management Sponsor, and the remaining respondent was referred to us because they had been more involved in the offering than the Energy Champion.

4.5.1 Awareness and Motivations

Two of the participants indicated that IPC representatives contacted someone at their facility (the plant superintendent, public works director, and/or plant engineer) to tell them about the WWEEC offering; the other two learned about the program from someone else at their facility. None of the respondents were aware of any other energy efficiency programs that IPC offers for businesses. Two indicated that they would like to learn more about IPC's program offerings and trainings, preferably through email or direct phone calls.

Their motivations for participating in the WWEEC offering came from the possibility of saving money and energy, a desire to share ideas and experiences with other wastewater personnel, and one was simply required to participate by their plant superintendent.

Three of the respondents were not sure whether or not they could attribute any of their city's interest in energy savings to the facility's participation in WWEEC. However, the other respondent felt confident that the WWEEC offering motivated the city council members, the mayor, and city employees to look for more opportunities to save energy. They did indicate that the mayor was already motivated to make energy savings a priority for the city, but that the facility's participation in WWEEC gave them the education they needed to actually start getting audits and planning projects.

4.5.2 Offering Process and Participant Experience

All of the respondents said that they found it to be fairly easy to participate in the offering. One of the respondents thought that any difficulties they had participating was due to their unique situation as a very new and energy efficient facility in a growing city. Another said that they found participating in the workshops was much easier than fulfilling the documentation and planning requirements. However, they felt the staff from Cascade Energy and IPC was very responsive and helpful whenever specific problems arose.

Two of the respondents said that their facility's energy use had decreased since they started participating in WWEEC; one of these respondents estimated the decrease was about 25 percent. Another of the respondents said they had not seen a change in energy use at their facility since participating, but they attributed this lack of change to the fact

that they have not yet been able to implement any of the suggested improvements. Another respondent's facility increased usage since they started participating, but they believed this was due to the fact that their facility was already very new and energy efficient and that the city's rapid growth has required the facility to increase energy consumption to meet the increased demand. All of the respondents believed that these trends in energy consumption would continue into the future.

The evaluation team also asked each of the respondents about any potential non-energy benefits they experienced. One said that the WWEEC workshops helped them learn how to improve their plant operations while meeting all of their permit requirements. The offering brought wastewater professionals together so they could learn from each other, and they discussed more than just energy efficiency. This respondent believed that this type of discussion would continue into the future. The rest could not think of any specific non-energy benefits. The WWEEC offering did not allow any of the respondents to hire any new employees or avert any layoffs; any changes in employment were reportedly due to normal employee turnover.

Prior to participating in the WWEEC offering, the facilities anticipated that they would benefit from increased awareness of energy efficiency opportunities that would save them money and from discussions with other wastewater professionals about their operational strategies. Three of the four respondents said they realized all the benefits that they expected. The one remaining respondent was disappointed because they felt that WWEEC did not come up with any ideas for saving money, suggesting that all of the opportunities for savings identified were too small to have a significant financial impact.

4.5.3 Training Workshops and Webinars

All of the respondents attended the training workshops. Three indicated that they attended all but one workshop and the other respondent was not sure which they attended. The benefits that respondents cited as resulting from the training are that the employees now turn off lights when they leave a room, they are able to learn about other incentive opportunities and requirements, they are able to gain knowledge and discuss new ideas with other wastewater professionals, and they can monitor their energy usage allowing them to detect when equipment is accidentally left on.

All of the respondents said they were planning to implement some changes in the future. For instance, some said they planned to replace all or some of their lighting, install programmable variable frequency drives, perform a large scale upgrade of the entire facility, and/or pursue additional energy efficiency and cogeneration projects. Two of these respondents did not anticipate any significant barriers for taking these actions, while the other two were concerned about budget limitations.

One of the respondents who was concerned about budget explained that the biggest barrier until recently was getting their administration interested in the projects. After attending the trainings, they personally became passionate about saving energy, but their management did not become interested until Cascade Energy found experts who would

join them on a conference call to explain why these projects are worthwhile. They felt this process would have been easier if the superintendent had been required to attend the first seminar. Another respondent suggested that IPC tell participants about any likely barriers that they can prepare to address, and another asked that IPC help arrange for them to meet with an engineering firm to go over their plans and make comments.

All of the respondents said that the trainings met their expectations, attributing this to getting to tour actual facilities during the training, IPC's willingness to get involved and help, and their low expectations. They also provided some recommendations for improving the training: incorporate more hands-on training, encourage people to be more open and less secretive about their facility's process, and provide examples of successful facilities from Idaho so they can be confident that their facility could achieve similar results without being fined.

4.5.4 Engineering and Technician Assistance

Two of the respondents remembered utilizing the engineering assistance that is offered by Cascade. The first used both onsite and remote assistance. The engineer suggested many areas of the facility that could be improved and went over the incentive report to help the respondent identify the top priorities. During the walk-throughs, the engineer also made suggestions for ways to improve the plant operations, which did not necessarily apply to energy efficiency directly. The respondent was very happy with the assistance they received and felt like the engineer was always available when questions arose.

The other respondent utilized only the onsite assistance. The engineer gave them many recommendations, but unfortunately, most of these were not feasible to implement due to budgetary or operational limitations. For instance, one recommendation was to reduce water pressure. This was not feasible for the facility because their pumps are old and frozen; until they are able to replace the pumps, they have to keep the water pressure high to keep the water moving. In general, they were happy with the assistance, which met their expectations.

This respondent proceeded to describe the ideal engineering assistance: they would meet with a wastewater engineer who understood the WWEEC offering, walk through the plant and discuss why they choose to operate the plant the way they do (including any unique limitations), then they would discuss the engineer's recommendations and any remaining concerns and go over any additional ideas for how the facility could utilize the resources provided by WWEEC. The plant staff is afraid of changing their operational process because any mistake could result in huge fines and they cannot typically afford to hire an engineer who is knowledgeable enough to help them. Therefore, the program would be more effective for plants like theirs if a wastewater treatment specialist provided the engineering assistance.

4.5.5 Energy Management Software

All four of the respondents said they use IPC's energy management software to monitor their energy use. One works on it every day, one uses it two to three times a week, one uses

it at least once a week, and the other has not had enough time to use it in a while but has used it in the past and plans to use it every week.

Each of the respondents said the software was not too difficult, but indicated that they did have some problems. For instance, they cited difficulties labeling events, creating graphs, using comparable data, or uploading the plant data to a website. Some suggestions they had for improving the software were creating a mobile interface, allowing events to be flagged for a specific time period rather than selecting an entire day, and adding definitions for key terms. All four respondents were very happy with IPC and Cascade Energy's responsiveness to any issues with the program and did not think that additional assistance was needed. Three specifically mentioned the helpfulness of fast responses to phone calls (usually less than an hour) and remote assistance.

The respondents all said that their processes/protocols had not changed in response to using the software; it was only being used to track current operations. However, two said they believe the software will become more effective once they find the time to get together, discuss the data, and make a plan for the next steps. One person was worried about losing access to the software when the offering ended. Every respondent said that the software met their expectations and they would like to continue using the software after the end of the WWEEC offering.

4.5.6 Audits and Energy Management Assessment

Two of the respondents recalled receiving an opportunities list for their facility that was prepared during an audit by a qualified wastewater expert. Both said that the experience met their expectations and neither had suggestions for improvement.

One of the respondents said that the audit was not helpful at identifying no-cost and low-cost efficiency improvements. The list had great ideas for how to substantially improve the plant's operations, but every idea was expensive, prohibiting them from being able to implement any yet. They gave a copy of the opportunities list to their supervisor and everyone else involved to help gain interest and open up the discussion for future plans, but they expect to continue struggling with budget and management approval.

The other respondent said that the wastewater expert spent four to five hours going though the plant and making suggestions. They felt that many of the ideas could be very beneficial in the future, but the plant is only currently running at 20 percent capacity and the opportunities are minimal right now. Unlike the other respondent, they said that budget approval would not be a large barrier as long as they could justify it with significant energy savings.

There were also two respondents who recalled receiving an initial Energy Management Assessment. Neither felt that the assessment helped identify organizational improvements at their facility, but they did indicate that the suggestions were helpful. Neither of these respondents had implemented any significant recommendations due to difficulties with management approval and budget limitations.

One of these respondents went on to explain the difficulties they have had getting approval for projects. In order to modify their budget and make energy efficiency upgrades, they have to get approval from the wastewater management authorities as well as the city council. The management was opposed to their project proposals until Cascade Energy and IPC joined them on a conference call and helped explain the benefits of this type of project. The respondent said it would be very helpful to have help preparing their proposals for the council, for instance a special training for the staff who are in charge of getting approval that helps them explain the projects to other people. Alternatively, IPC or Cascade Energy could create a PowerPoint template that has a guideline for presenting the project and some basic arguments for energy efficiency as an investment strategy, or they could physically meet with the council during the presentation to offer support in answering questions. The offering has provided participants with great ideas for improvements, but unless they find a way to help their facilities get approval for funds, the improvements will be limited to no-cost and maybe a few low-cost options. Therefore, providing this type of support to participants could make the WWEEC offering far more effective with respect to energy savings.

4.5.7 Participant Satisfaction and Recommendations

Satisfaction with the offering was very high, with no respondents being "somewhat dissatisfied" or "very dissatisfied" with any component of the WWEEC offering, as shown in Figure 3. The highest satisfaction was reported for the energy management software, with all four respondents being "very satisfied". The lowest satisfaction was reported for the initial energy management assessment, with one being "very satisfied" and one being "neither satisfied nor dissatisfied".

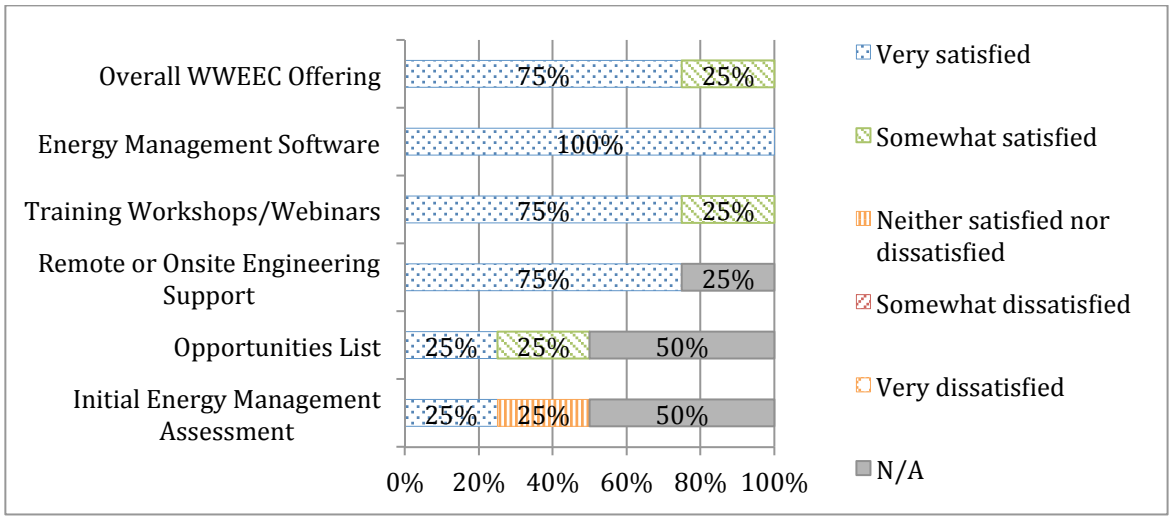

Figure 3: WWEEC Participant Satisfaction (n=4)

At the end of the interview, the evaluation team asked each of the respondents if they had any other recommendations for improving the offering. One of the respondents said that they should make sure that the engineers they send to the facilities have experience in the

wastewater industry, not just in energy efficiency. The people in the plant are often afraid of making changes to their operations due to the risks of pollution, fines, or other problems. They need someone who can immediately address these concerns and assure them that it is possible to reduce energy without harming their operations.

Another respondent said that they initially decided not to sign up for the WWEEC offering. The contract required them to implement improvements based on recommendations from Cascade Energy and IPC if they signed up. Since their budget was already set for 2014, any changes would have to be approved individually by the council. Cascade Energy and IPC spent time going over the contract with them and explained that they could choose to implement only the no-cost and perhaps some low-cost recommendations. Other facilities may have similar concerns about the WWEEC offering and would benefit from further discussion about the eligibility requirements.

When given the opportunity to provide additional comments, one respondent said "the offering has been great because it provided us with so much education and they were very willing to send us extra assistance when needed" and that IPC staff were eager to help in any way they could, even bringing in a lighting expert when they showed interest in upgrades. Another respondent said they would like to participate again in three or four years if IPC decides to make it available.

4.6 Summary of Custom Efficiency Interviews by MDC Research and IPC

IPC contracted with MDC Research (MDC) to conduct interviews with custom program participants and non-participants just prior to the Evergreen evaluation, and these interviews covered many of the same questions originally proposed for this evaluation. Rather than conduct interviews covering the same topics (and likely contacting some of the same customers), the results of the previous IPC research are instead summarized as part of this report.

For the IPC research, MDC interviewed 36 energy decision-makers to learn about their views on energy efficiency and the Custom Efficiency program offering. The respondents included 26 participants and 10 non-participants, distributed across large commercial (n=29) and industrial (n=7) sectors from a variety of industries. This section summarizes the results presented in MDC's *Idaho Power Custom Efficiency Program Research* PowerPoint presentation, provided to IPC on March 20, 2014.

4.6.1 Program Engagement

The respondents' initial engagement with the Custom Efficiency program was either through outside sales (typically contractors/trade allies), their existing relationship with IPC (often a dedicated IPC representative), or from prior experience with the program. The need for additional outreach is demonstrated by the fact that first time participants who had a pressing need for new equipment often failed to find the program on their own. Many of the participants were already considering some type of upgrade, but they indicated that the program engagement was a catalyst that contributed to their decision.

The process for engaging with the Custom Efficiency program was largely dependent on the size and structure of the company. They differed in terms of the formality of the decision-making process, the scope of the upgrades selected, and their concerns about the impact of a shutdown on their business.

The main program benefit cited by contractors and IPC representatives to the participants was the return on investment (ROI) from energy savings, but this was not the only driver of their participation. Many of the large businesses expressed that their participation was driven at least in part by the company's desire to be "green", and smaller businesses were driven by their need for a capital improvement/upgrade. It is important to emphasize these types of program benefits in addition to the ROI/savings.

Though ROI is not always the main driver of participation, ROI is nearly always a consideration. Some of the businesses indicated that their ROI was negated by the IPC rate increases. Similarly, many of the businesses would only consider energy efficiency projects if the payback period did not exceed a certain threshold. The longest acceptable payback period ranged from two to five years in most cases, with the shorter periods being identified by businesses who were more ROI driven.

4.6.2 Program Processes and Satisfaction

The process of participating in the program according to the program design involved six steps: 1) efficiency evaluation, 2) cost estimates, 3) completing the application and agreement, 4) IPC review and approval, 5) equipment installation, and 6) final inspections and payment. One "pain point" mentioned by some of the participants was the need for assistance calculating kWh savings for a proposed project. This is integral for the approval process in their businesses, and they struggle with the calculations.

In general, participants were very satisfied with the program. The few participants who were not satisfied with the program explained that they had problems with the contractors during the installation process and considered these issues as signs that IPC is failing to properly vet the program contractors. Those who worked directly with an IPC representative had much higher satisfaction than those who did not. Similarly, the industrial businesses had especially high satisfaction, though some suggested that the program allow large customers to customize their projects.

4.6.3 Non-Participant Program Awareness and Engagement

Only three of the ten non-participants were aware of the program before the interview. After hearing a basic description, they rated the appeal of the program eight out of ten on average. All believed they were at least "somewhat likely" to participate in the future and were interested in learning more about the program. The respondents had diverse opinions about the best channels for program outreach, but most said they would "pay the most attention to" a face-to-face visit with an IPC representative (not a contractor).

The non-participants said they consider many factors when making decisions about energy efficiency equipment, but that ROI is the most important factor to the

corporate/bureaucratic decision-makers. More than half of non-participant respondents said they have plans to upgrade to efficient equipment. Many reported that they understand the necessity of efficient equipment to protect themselves against rising energy costs. The most common barriers to actually making the upgrades are high upfront costs, uncertain ROI (they find the calculations difficult and worry about overestimating savings), and skepticism about the quality of the incentivized equipment (particularly true for industrial companies).

4.6.4 Program Strategies for the Future

Overall, the interviews suggested that the program could increase participation by increasing awareness and motivation. Specifically, the responses identified a need for explaining realistic ROI and upfront costs and providing details about the incentivized equipment, as well as having IPC reach out frequently to promote their audit services.

5 Conclusions and Recommendations

Below are our conclusions and recommendations resulting from the impact and process evaluation activities.

5.1 Impact Evaluation Findings and Conclusions

- There were 73 participants in the 2013 Custom Efficiency Program, with reported ex-ante savings of 21,287,236 kWh and 2,306 kW. The impact evaluation resulted in ex-post savings that closely matched the original ex-ante values for kWh with a realization rate of 99 percent and exceeded the original kW savings with a realization rate of 136 percent. This translates to ex-post savings of 21,252,200 kWh and 3,154.7 kW.
- The evaluation team calculated interactive effects for lighting and found that in general, the HVAC interaction resulted in a slight reduction in savings. The average HVAC interaction factor for the 12 lighting projects reviewed that were in conditioned space was 98.5 percent, or a 1.5 percent reduction in electric savings.
- It is difficult to specify a particular project size that should require M&V. Some very large projects may have nearly constant loads that are verified by pre metering, where only the overall efficiency is affected by the measure (for example, a more efficient process chiller under constant production schedule). This may only need a post-install inspection to verify chiller load and kW from the control panel. Other smaller projects with highly variable loads will likely benefit more from additional M&V.
- IPC currently provides a high level of internal review for each custom project. The post-install inspections are very thorough, especially for lighting projects, which receive a complete post-install inventory of fixtures. This level of review has resulted in the high realization rate achieved for the program.

5.2 Process Evaluation Findings and Conclusions

Overarching Findings and Conclusions

- In general, target customer awareness of the Custom Efficiency program and offerings appears to be low, as evidenced by the results of our interviews with implementers, trade allies, and participants, as well as the results of interviews conducted by MDC Research earlier this year. There may be opportunities to increase participation by increasing awareness of the programs. Participants have been receptive to program information from trade allies and IPC staff.
- IPC conducts outreach to industrial customers, but these customer contacts are not always the same staff that make decisions about equipment upgrades or replacements. Decision makers may not be receiving the message about IPC's available programs through this channel. The best way to reach decision makers with program information may be through trade allies. During interviews with SCE

trade allies, they indicated they are often the primary source for program information for IPC customers, yet did not know if IPC provides any marketing support.

SCE Findings and Conclusions

- SCE trade allies were generally satisfied with their experience with the offering and believe that the offering is serving the targeted customers' needs appropriately. Trade allies have benefitted from the SCE offering by seeing increased business from participating IPC customers.
- SCE participants were generally satisfied with their experience with the SCE offering. The primary suggestion for improvement was the application and rebate process, which some thought was slow and troublesome. All SCE participants the evaluation team spoke with had completed their project application themselves and some found it difficult to complete or repetitive.
- All SCE participants the evaluation team spoke with learned about the SCE offering from in-person meetings with electricians or trade allies who came to their business.

ROCEE Findings and Conclusions

- For both ROCEE and WWEEC, one of the major non-energy benefits of participating in these offerings was the creation of a network of refrigeration or wastewater professionals, which has proved to be a valuable resource for feedback and new ideas.
- All of the ROCEE respondents found the energy management software to be easy to use and thought it was helpful for tracking their energy usage.
- All of the ROCEE participants the evaluation team spoke with were "very satisfied" with the trainings and at least "somewhat satisfied" with all other components of the ROCEE offering.
- All ROCEE respondents had reportedly taken action and made improvements to their facility after attending the trainings. While participants have made progress with some action items, ROCEE implementers reported having difficulty keeping participants engaged and getting them to implement all action items. There is pressure from facilities management staff to keep costs down and not spend time on the action items, so the technicians and mechanics that attend trainings have a hard time making progress with the recommended actions.

WWEEC Findings and Conclusions

- At least three-quarters of WWEEC participants we spoke with said they were "very satisfied" with the energy management software, training workshops, and

engineering support. None of the participants indicated that they were dissatisfied with any component of the WWEEC offering.

- Two WWEEC respondents have not been able to implement many changes to their facility's energy usage due to barriers gaining management approval, budget, and having insufficient time to plan.
- All of the WWEEC participants interviewed said IPC and Cascade Energy were very responsive to any questions, concerns, or problems that arose. The program staff and IPC representatives were eager to help in any way possible and typically responded to calls within a few hours.

5.3 Impact Evaluation Recommendations

Recommendations based on our impact evaluation findings are as follows:

- **Custom Efficiency projects with large savings justify additional M&V.** There were some projects with large savings in the evaluation sample that only received inspections, but are sensitive to the assumptions made in the initial ex-ante savings analysis.[6] Large lighting projects where controls provide a significant portion of the savings would benefit from M&V to verify the assumed post hours of operations from the controls. Large HVAC measures are also good candidates for M&V, as are other large projects that involve energy savings that are sensitive to weather or production factors.
- **The duration of post installation metering should be based on the variability of the equipment operating conditions.** There is no set rule on how much M&V is required for custom projects, as this will vary based on the variability of operating conditions. A constant load pump that operates 24/7 only needs a short metering period (one week) to verify the constant load, but other projects that have load variation with production or weather need to have post metering periods long enough to span a large range of variation so that the savings can be extrapolated to the year using the appropriate weather and production data. The evaluation team has not seen any current utility programs that require an entire year of metering, and does not believe that this level of metering is necessary for IPC projects.
- **Internal IPC review of project applications can likely be reduced.** Based on the quality of the documentation and the high realization rate achieved, IPC can likely maintain the high level of quality control with only having one engineer reviewing the applications (rather than two engineers, as is currently done). This is particularly true for the custom lighting projects, which tend to have relatively straightforward calculations based on the IPC Lighting Tool. The larger, more complex projects, and projects in the three new program initiatives, may still benefit

[6] Examples include project 888 (lighting retrofit with occupancy sensor controls) and project 1056 (thermostat and ventilation control on space heaters).

from having two reviewers, particularly until the new initiatives become more firmly established.

- **Modify the Lighting Tool to include HVAC interactive effects**. The evaluation team used the BPA Lighting Tool to manually calculate lighting interactive effects to develop the ex-post impact results presented in this report. For future program years, the evaluation team recommends that these calculations be incorporated into the IPC Lighting Tool so that the interactive effects are automatically included in the ex-ante savings estimates. While the effect on savings was low in this evaluation (less than two percent), the interactive effects may be significant in future program years depending on the measures and technologies adopted in future custom projects. Currently, the Regional Technical Forum is conducting a study on lighting interactive effects, and we recommend that these study results be incorporated into the IPC Lighting Tool once available, as they will reflect the latest research on this issue for the Pacific Northwest.

5.4 Process Evaluation Recommendations

Recommendations based on our process evaluation findings are as follows:

Overarching Recommendations

- **Increase marketing and outreach for Custom Efficiency as a whole.** This should include marketing both to trade allies to leverage the existing relationships between industrial customers and their equipment vendors and directly to customers via outreach by IPC customer representatives. IPC customer representatives should strive to reach the energy efficiency decision makers at each facility, rather than billing or administrative staff that are often IPC's point of contact with the customer. Participants stated that direct contact from IPC customer representatives was one of their preferred forms of contact, and IPC staff should pursue this channel. This would increase customer awareness of programs and likely increase participation. Messages used in marketing should focus on the customer's ability to control their energy bill, helping to make their company green, and incentives to assist with making energy efficient capital improvements.
- **Provide participants with information about other IPC program offerings and trainings.** IPC should take the opportunity to inform existing participants of other IPC programs for which they may be eligible. Awareness of IPC programs appeared to be low overall. Specifically, none of the WWEEC participants were aware of other energy efficiency programs that IPC offers for businesses, but they expressed interest in learning more about them, preferably through email or direct phone calls.

SCE Recommendations

- **Increase marketing and outreach specifically for the SCE offering to increase customer awareness.** These marketing activities should target trade allies to leverage their existing relationships with industrial customers, and specifically with energy efficiency decision makers at customer facilities. Trade allies are often the source of program information for decision makers, but the trade allies we spoke with did not know whether IPC provides any marketing support. This marketing and outreach support could come directly from IPC staff or through the implementer, Cascade Energy. This approach may translate into awareness among the target customer decision makers and increased participation.
- **Continue to improve coordination and communication efforts between IPC, Cascade Energy, and participants to further streamline the SCE offering**. Currently, Cascade Energy works as a coordinator to help participants complete applications and get all documentation submitted to IPC for review and rebate payment. These lines of communication appear to be working well and should continue to be strengthened to ensure success and participant satisfaction with the offering.
- **Cascade Energy should continue to provide a high level of support to customers for SCE and mention this support when marketing the offering**. Cascade Energy conducts savings analysis and completes application forms to assist customers who would not be able to do this on their own. Despite the availability of this assistance, some participants completed paperwork themselves and reported difficulty with the application forms. Continuing the level of support provided by Cascade and making sure customers are aware of the available assistance may translate into higher satisfaction with this component of the offering.
- **Investigate whether there are ways to speed up or streamline the SCE application and rebate payment processes.** This was the primary reason cited by participants who were less than fully satisfied with their experience with the SCE offering. It is recommended to revisit the application paperwork and determine if it can be made more straightforward or if an instruction sheet should be included to explain the required information. Such improvements may translate into higher satisfaction with the offering, and could also lead to increased future program participation if satisfied customers stay engaged with IPC programs in the future.

ROCEE Recommendations

- **Consider the recommendations for Year 2 presented in Cascade Energy's ROCEE Year 1 Summary Report.** Specifically, IPC should consider the recommendation to either suspend the offering after Year 1 or to provide more funding to continue customer engagement and outreach through Year 2. The offering had the most success during Year 1 when trainings and site visits were being conducted regularly. Since then, participants have slowed on the implementation of action items and as a result, savings have slowed as well. The

cost of providing a two-year offering must be weighed against the decline in savings being seen in Year 2.

- **For recruitment for the ROCEE offering in the future, IPC should strive to get upper management involved in the offering from the beginning.** In conversations with implementation staff, the lack of support from upper management was the greatest barrier to making progress at facilities and getting participants to implement action items. Management and other participating staff should also be informed of incentives that can help offset the costs of participation and implementing recommended action items.

WWEEC Recommendations

- **Provide assistance to WWEEC participants who are preparing project proposals for internal approval.** The biggest barriers to participants implementing action items were gaining management interest and budget approval. The offering could include guidelines for presenting projects to upper management and some basic arguments for energy efficiency as an investment strategy in the form of a PowerPoint template, additional class sessions, or offering to meet with the decision-makers (in person or over the phone). This approach could lead to higher participating customer satisfaction, increased implementation of action items, and more energy savings.
- **Utilize engineers that specialize in wastewater treatment who are also knowledgeable about energy efficiency.** Some of the WWEEC participants we spoke with said they chose not to implement some of the recommended changes because they were afraid that any changes to their operation would result in pollution and/or fines. There was some concern that the engineers providing the recommendations did not know enough about the wastewater treatment process and regulations to answer their questions and assure participants that they could save energy without sacrificing the quality of their operations. Ensuring participating customers that the technical advice that is being offered is consistent with their industry's regulations is critical to gaining their trust and leading to actions and energy savings.

6 Appendix A – On-site Reports

This section includes the technical details for the three sites (covering five projects) that were visited by the evaluation team.

6.1 Project IND0839

Measure: UV Disinfection System

Previously, plant effluent was disinfected using medium intensity UV lamps. The lamps were housed in modules located in an open channel. The system contained 11 modules, each with eight 3,200-watt lamps for a total of 88 lamps. This resulted in a total connected lamp load of 281.6 kW. Modules were cycled on and off with disinfection demand determined by effluent flow and visual transmittance.

The new system consists of two banks of 15 modules, each with eight 250-watt low intensity lamps. This resulted in a total connected lamp load of 60 kW. Modules are dimmed and cycled on and off with disinfection demand determined by effluent flow and visual transmittance. The new low intensity lamps also have a much longer life than the old medium intensity lamps.

This evaluation included the site inspection and re-analysis of energy savings for the new UV disinfection system. Table 16 shows the ex-ante project savings from the IPC tracking data, along with the ex-post project savings estimated by the evaluation team.

Table 16: On-site Results Project IND0839

Savings Quantity	Ex-Ante Tracking Estimate	Ex-Post Evaluated Savings	Realization Rate
Annual Energy (kWh)	1,626,879	1,765,217	109%
Demand (kW)	185.7	201.5	109%

The primary reason for the difference in savings values was that the ex-post calculations were able to incorporate an entire year of post installation operations data.

6.1.1 Data Collection

The site visit was performed on September 26, 2014, by Jeff Romberger of SBW Consulting and accompanied by Chris Pollow of IPC. The customer was also present during the site visit and showed the system to the evaluation team, answered questions and provided plant data.

The customer was very happy with the new system and indicated that he has observed energy savings of about 100,000 kWh per month on the electric bills. The installed control system monitors UV system kW as well as effluent flow rate and visual transmittance. The

control system does not log these parameters, but values are manually observed and entered into a database twice daily. The customer provided twelve months of operating parameter values for the post installation period, which had been entered into a logbook twice daily. Pre-installation values were not available in electronic format, but eight months of hand written data were available in the project files (also recorded twice daily) and was incorporated into the evaluation analysis.

As part of the on-site visit, the customer was asked about other IPC programs or measures potentially relevant to their site. The customer was not aware of the Streamlined Custom Efficiency Program, but upon discussion, was interested in it and would keep it in mind for potential compressed air or variable frequency drive (VFD) measures in the future. He was aware of the Waste Water Energy Efficiency Cohort Program, and was interested, but indicated that they were too busy with the plant expansion to participate at this time. The customer did indicate that they were actively working with IPC as part of the plant expansion.

6.1.2 Analysis

The ex-ante analysis used the average kW based on the eight months of twice daily logs for the baseline consumption. The installed average kW was based on two weeks of logged data. Savings were then calculated as the difference between the pre- and post-average kW applied to all hours of the year.

The evaluation analysis used a more detailed approach in an attempt to capture any seasonal variations in effluent flow rate and transmittance characteristics. The approach also applied the operational performance of both the baseline and installed systems to the same production period, which eliminates the effect of production differences between the pre and post periods. The twice daily log values of flow rate, transmittance and electric demand, for both the eight months of pre data and 12 months of post data were averaged to daily values.

To estimate ex-post savings based on actual operating conditions, a regression model was estimated based on the following equation:

$$kW = a + b \times Flow + c \times Trans$$

Where:

kW = Average daily electric demand (kW),

$Flow$ = Average daily effluent flow in million gallons per day (mgd),

$Trans$ = Average daily visual transmittance,

a, b, c = Coefficients to be estimated.

The resulting coefficients and R-Square values are shown in Table 17. All coefficient estimates were statistically significant with t-statistic values greater than 2.0.

Table 17: Regression Results Project IND0839

Coefficient	Pre Data	Post Data
Constant (a)	587.00	38.79
Flow (b)	8.51	6.21
Trans (c)	-6.41	-0.753
R-Square	0.276	0.309

The model results were applied to the post period average daily values of *Flow* and *Trans* to calculate average daily kW under both the pre- and post-system operating conditions. The difference between daily pre- and post-kW values were then calculated and averaged across the year to determine average kW demand savings. Finally, the average kW demand savings was multiplied by 8,760 hours to obtain the annual kWh savings (shown in Table 16).

6.2 Project IND0944

Measure: Infiltration Reduction Vestibules (IRV) and Fast Refrigeration Door

The plant has a production area with three conveyor openings in a wall separating the warm production area and the cooled storage space. The openings are 3 feet wide and 6 feet tall. This project involved the installation of a fast acting door for one of the openings and IRVs for the other two openings.

This evaluation included the site inspection and re-analysis of energy savings for two new IRVs and one new door installed on openings to a refrigerated space. The project ex-ante and evaluated ex-post savings are shown in Table 18.

Table 18: On-site Results Project IND0944

Savings Quantity	Ex-Ante Tracking Estimate	Ex-Post Evaluated Savings	Realization Rate
Annual Energy (kWh)	712,349	340,707	48%
Demand (kW)	86.0	38.9	45%

During the on-site, the evaluation team found that two of the three doors had been manually overridden and consequently remain open during production hours. This resulted in a significant reduction in annual energy savings. The evaluation team also found space temperatures different than those used in the ex-ante savings estimates, which tended to decrease savings, but adjusted baseline conditions of the openings increased energy savings.

6.2.1 Data Collection

The site visit was performed on September 26, 2014, by Jeff Romberger of SBW Consulting and accompanied by Chris Pollow from IPC. The customer was also present and showed the evaluation team the installed equipment and provided information on facility operations.

The customer indicated that he was happy with the new system, but stated that the workers in the space tend to override the door controls and leave them open during production hours. Upon inspection, it was observed that two of the three doors were overridden and fully open. Other data collection included production hours (20 hours/day, all days/year), estimated number of door openings for the functioning IRV (~1,000 openings/day), temperature of cold space (40 F) and temperature of the production area on warm side of doors (85 F). The doorway opening dimensions were also measured and confirmed to be consistent with the values in the project documentation. The site contact also stated that the doorways were fully open in the baseline. All of this information was used in the savings calculations discussed below.

As part of the on-site visit, the customer was asked about other IPC programs or measures potentially relevant to their site. The customer was not aware of the Streamlined Custom Efficiency Program, but was interested and will keep it in mind for potential fast acting door, VFD and compressed air projects in the future. The customer was vaguely aware of the Refrigeration Operator Coaching for Energy Efficiency Program. He was definitely interested in this program and thought that if he gets the right staff involved, it would help eliminate the door override problem.

The potential for other efficiency projects was also discussed with the customer. Currently, the site is in the middle of a plant expansion and the customer is working actively with IPC to explore options. They would like to determine if there are potential upgrade possibilities at the wastewater treatment plant located at this site. The evaluation team also discussed the addition of VFDs on the evaporator fans in the warehouse, but the customer stated that since the product is packed very tightly, they require constant high velocity air flow to ensure uniform product temperature and therefore would not be interested in this VFD application.

6.2.2 Analysis

The ex-ante analysis used vendor software to calculate the energy savings for each of the three door retrofits. The vendor software is based on an ASHRAE calculation method that requires as an input the air velocity through the unobstructed door opening. The results using this method are highly sensitive to this input value, which can vary significantly depending on the specific doorway configuration, space temperatures and fan operating conditions. For this project, a third-party energy firm was commissioned to measure the air velocity to inform the model. They determined the velocity to be 166 feet per minute (FPM). The ex-ante analysis assumed space temperatures of 35 F in the cold space and 90 F in the production area. The ex-ante savings values also assumed for the two IRV doorways that the baseline condition included strip curtains with 40 percent effectiveness.

The evaluation analysis used the same vendor software to re-calculate savings, but updated the models with information obtained during the site visit. Table 19 summarizes the model changes made using data collected on-site, along with the resulting impact on energy savings. Electric kW demand savings was calculated consistently with the ex-ante method as total annual kWh savings divided by 8,760 operation hours of the refrigeration system.

Table 19: Changes to Savings Calculation Parameters Project IND0944

Input Parameter	Ex-Ante Value	Ex-Post Value	Savings Impact
Cold space temperature (F)	35	40	Decrease
Warm space temperature (F)	90	85	Decrease
Center door post open time	0.19%	83.3%	Decrease
Right door post open time	0.276	83.3%	Decrease
Right door baseline	40% effective strips	No strips	Increase
Left door baseline	40% effective strips	No strips	Increase

6.3 Project IND0930

Measure: Fast Acting Refrigeration Door

The plant has a production area with one conveyor opening and one forklift access in a wall separating the warm production area and the cooled storage space. The forklift opening is 6 feet wide and 10 feet tall. The conveyor opening was originally 8 feet wide and 10 feet tall, but was reduced as part of this project to result in opening 4.5 feet wide and 5 feet tall. This project involved the installation of fast acting doors on both the forklift opening and the reduced area conveyor opening.

This evaluation included the site inspection and re-analysis of energy savings for two new fast acting doors installed on openings to a refrigerated space. The project ex-ante and evaluated ex-post savings are shown in Table 20.

Table 20: On-site Results Project IND0930

Savings Quantity	Ex-Ante Tracking Estimate	Ex-Post Evaluated Savings	Realization Rate
Annual Energy (kWh)	169,530	301,125	178%
Demand, kW	19.0	34.4	181%

The reason for the significant increase in annual energy savings is due to the observed space temperature difference across the door opening being greater than that assumed in the ex-ante analysis. The evaluation also found that one of the two doors had been overridden in the open position, which reduced energy savings. However, even with the door open, savings still occur because the door size is significantly less than the original opening size.

6.3.1 Data Collection

The site visit was performed on September 26, 2014, by Jeff Romberger of SBW Consulting and accompanied by Chris Pollow from IPC. The customer was also present and showed the evaluation team the installed equipment and provided information on facility operations.

The customer was happy with the new doors, but stated that the workers in the space tend to override the conveyor door controls and leave it open. Upon inspection, it was observed that the conveyor door was overridden and fully open. Other data collection included production hours (24/7), estimated number of forklift door openings (three openings/hour), temperature of cold space (40 F) and temperature of the production area on warm side of doors (80 F), and forklift door open time per cycle (10 seconds). The doorway opening dimensions were also measured. The site contact also stated that the doorways were fully open in the baseline.

As part of the site visit, the customer was asked about other IPC programs or measures potentially relevant to their site. The customer was not aware of the Streamlined Custom Efficiency Program, but was interested and will keep it in mind for potential fast acting door, VFD and compressed air projects in the future. The customer was vaguely aware of the Refrigeration Operator Coaching for Energy Efficiency Program. He was definitely interested in this program and thought that if he gets the right staff involved, it could potentially eliminate the door override problem.

The potential for other efficiency projects was also discussed with the customer. The customer indicated that they would like to upgrade the lighting in this facility, and T12 fluorescent lighting was observed to be common in the plant. The evaluation team also discussed the addition of VFDs on the evaporator fans in the warehouse, but the customer stated that since the product is packed very tightly, they require constant high velocity air flow to ensure uniform product temperature and therefore would not be interested in this VFD application.

6.3.2 Analysis

The ex-ante analysis used the spreadsheet calculator developed by ADM Associates to calculate the energy savings for both door retrofits. The software is based on an ASHRAE calculation method that uses flow factors for airflow through the unobstructed door opening, effectiveness factors for the doors and percent door open time. This method is generally considered to be better than the other ASHRAE method that requires air velocity through the unobstructed doorway, which is usually not available and can be difficult to measure. The ex-ante analysis assumed space temperatures of 45 F for the cold space and 70 F in the production area. The ex-ante analysis also assumed the forklift door width at 5 feet, compared to the 6 feet dimension measured during the site visit, and different door open times than observed.

The evaluation analysis used the same software to re-calculate savings, but updated the models with information obtained during the site visit. Table 21 summarizes the model changes made using the site visit data collection along with the resulting effect on energy savings. Electric kW demand savings was calculated consistently with the ex-ante method as total annual kWh savings divided by 8,760 operation hours of the refrigeration system.

Table 21: Changes to Savings Input Parameters Project IND0930

Input Parameter	Ex-Ante Value	Ex-Post Value	Impact on Savings
Cold space temperature (F)	45	40	Increase
Warm space temperature (F)	70	80	Increase
Forklift door width (feet)	5	6	Increase
Forklift door cycle time (seconds)	5.2	10.0	Decrease
Forklift door openings per hours	2	3	Decrease
Conveyor door % open time	0.86%	100%	Decrease

6.4 Projects IND0872 and IND0888

Measures: IND0872 – Fast acting Freezer Doors

IND0888 – LED Lighting with Occupancy Sensors

The plant has a large high volume busy frozen food warehouse, which is the subject of these two projects. One project included the replacement of five freezer door strip curtain sets with fast acting automatic roll-up doors. The doors separate the freezer space from the loading dock area. The other project included replacement of 108 1,000-watt metal halide lighting fixtures with 152 200-watt LED lighting fixtures. Occupancy sensor control was also installed on 142 of the new LED fixtures.

This evaluation included the site inspection and re-analysis of energy savings for two projects involving new fast acting doors installed on freezer space and LED lighting with occupancy control in the same freezer space. The project ex-ante and evaluated ex-post savings are shown in Table 22.

Table 22: On-site Results Project IND0872 and IND0888

Project ID	Savings Quantity	Ex-Ante Tracking Estimate	Ex-Post Evaluated Savings	Realization Rate
IND0872	Annual Energy (kWh)	729,065	629,572	86%
IND0872	Demand (kW)	83	72	86%
IND0888	Annual Energy (kWh)	1,152,115	1,059,242	92%
IND0888	Demand (kW)	128	121	94%

The primary reason for the decreased annual energy savings for the door project (IND0872) is due to an observed space temperature difference across the door opening that was greater than that assumed in the original ex-ante analysis. For the lighting project (IND0888), the decrease is due to occupancy sensor control having less impact than expected.

6.4.1 Data Collection

Jeff Romberger of SBW Consulting conducted the site visit on September 25, 2014, and was accompanied by Chris Pollow, Gary Grayson, and Jim Hovda of IPC. Two customer representatives were also present and showed the evaluation team the installed equipment and provided operations information.

The customer was happy with these two projects, and has worked with IPC on several previous projects. The customer is currently working with IPC as part of a major plant expansion. Data collection included production hours (24/7), estimated number of freezer

door openings (14 openings/hour/door), temperature of cold space (-5 F), temperature of the Loading dock area on warm side of doors (45 F), and door open time per cycle (14 seconds). The doorway opening dimensions were also measured and verified to be consistent with the project documentation. A lighting fixture count was also completed (152) with observation of fixtures that were initially off during the walk through (~50% of fixtures off). The customer also provided a list of equipment in the engine room to verify the COP estimate of the refrigeration system.

As part of the site visit, the customer was asked about other IPC programs or measures that may be relevant to their site. The customer was not aware of the Streamlined Custom Efficiency Program, but was interested and will keep it in mind for potential fast acting door, VFD and compressed air projects in the future. The customer was aware of and interested in the Refrigeration Operator Coaching for Energy Efficiency Program.

The potential of other efficiency projects was also discussed with the customer. They would like to upgrade the control system in the engine room serving the freezer warehouse. They were also interested in the potential addition of VFDs to the evaporator fans in the freezer.

6.4.2 Analysis

The ex-ante analysis for the door project used the spreadsheet calculator developed by ADM Associates to calculate the energy savings for the door retrofits. The software is based on an ASHRAE calculation method that uses flow factors for airflow through the unobstructed door opening, effectiveness factors for the doors and percent door open time. This method is generally considered to be better than the ASHRAE method that requires air velocity through the unobstructed doorway, which is usually not available and can be difficult to measure. The ex-ante analysis assumed space temperatures at -10 F in the cold space and 50 F in the loading dock area. The ex-ante analysis also assumed seven door openings per hour and cycle times of 17.4 seconds per door opening. The ex-ante lighting project used the IPC Lighting Calculator with an added calculation to account for refrigeration savings. The analysis assumed that the occupancy sensors would keep the lights off 80 percent of the time.

The evaluation analysis used the same software to re-calculate savings, but updated the models with information obtained during the site visit. Table 23 summarizes the model changes made per site visit data collection along with the resulting relative impact on energy savings. Electric kW demand savings was calculated consistently with the ex-ante method as total annual kWh savings divided by 8,760 operation hours of the refrigeration system.

Table 23: Changes to Savings Input Parameters Project IND0872 and IND0888

Input Parameter	Ex-Ante Value	Ex-Post Value	Impact on Savings
Cold space temperature (F)	-10	-5	Decrease
Warm space temperature (F)	50	45	Decrease
Door cycles per hour	7	14	Decrease
Door cycle time (seconds)	17.4	14.0	Increase
LED occupancy sensor % time-off	80%	50%	Decrease

7 Appendix B – Participant, Trade Ally, and Implementer Interview Guides

MEMORANDUM

Date: November 13, 2014

To: Gary Grayson – Idaho Power Company

Re: Custom Efficiency Process Evaluation Interview Guide Summary

This memo provides a summary of our approach to conducting in-depth interviews for the Custom Efficiency Program process evaluation. Included below are the interview objectives, a list of potential interviewees and interview topics.

The primary objective of these interviews will be to provide Idaho Power with early feedback on three new offerings: Streamlined Custom Efficiency (SCE), Refrigeration Operator Coaching for Energy Efficiency (ROCEE), and Wastewater Energy Efficiency Cohort (WWEEC). More specifically, the interviews will be designed to:

- Evaluate program processes
- Assess participant satisfaction
- Identify any gaps in services provided by Idaho Power
- Recommend areas for improvement of the initiatives

The targets for these in-depth interviews will include:

- Program implementation staff for SCE, ROCEE, and WWEEC – 3 staff total
- SCE participants – 8 total completed projects
- ROCEE participants – 3 total fully active participants
- WWEEC participants – 4 total fully active participants
- SCE trade allies – 5 active vendors

Once we receive feedback on our planned approach, we will begin by arranging telephone interviews with implementation contractor staff. Based on the findings of these interviews we will modify participant interview topics if necessary to best evaluate each offering.

Below we provide a list of interview topics for program implementers, trade allies, and participants, including specific questions and potential probes that are illustrative of the types of follow-up questions we are likely to ask. The questions we ask will necessarily vary by offering because of the different program designs. Where relevant, we have indicated to which offering the topic or question applies.

1. Program Offering Implementer (i.e., Cascade Energy) Interview Topics

Introduction to interviewee: We are evaluating Idaho Power's Streamlined Custom Efficiency (SCE), Refrigeration Operator Coaching for Energy Efficiency (ROCEE), and Wastewater Energy Efficiency Cohort (WWEEC) offering under the Custom Efficiency program and would like to talk with you about your experience with implementing this offering. We have some questions about marketing, offering design, and implementation challenges and successes that will help us in the evaluation of this offering.

Introduction

- Brief discussion of firm and the types of services it provides generally (confirm what we have already learned)
- What services do you currently provide for the offering? Have you had involvement with other Idaho Programs (in the past and/or currently)? Describe.
    - Probe on trainings (for ROCEE and WWEEC), scoping audits (for ROCEE and WWEEC), energy management assessment (for WWEEC), project analysis (for SCE)

Marketing and Outreach

- Who is the target audience for this offering? (Confirm what we have learned from Idaho Power/elicit implementer perspective)
- How is the offering marketed to target customers? (Probe on channels – field reps, customers came to them, etc.) How involved are you in marketing the offering to customers? Do you have enough time for proper recruiting?
- Describe the customers who have currently participated (customer size, business type, location). Are these characteristics in line with expectations of the target audience for this offering? Do you feel that there may be better methods for recruiting participants?
- Is marketing and outreach effective for this offering? If yes, what is most effective? If no, what could be done to make it more effective to increase awareness among the target audience?

Offering Design/Operations

- What benefits do you anticipate participants would experience as a result of offering participation?
    - Probe for SCE:
        - Energy savings
        - Customer satisfaction

        - Increased awareness of energy efficiency
    - Probe for ROCEE and WWEEC:
        - Increased awareness of energy efficiency
        - Behavioral or process changes to reduce consumption
        - Energy savings
        - Participation in Idaho Power equipment incentive programs
        - Customer satisfaction

Implementation Challenges/Successes

- SCE ONLY: Have participation levels been what you anticipated? If lower than anticipated, why do you think fewer customers have participated than anticipated? If in line with expectations, what has worked well to attract customers? To your knowledge, what is the primary reason that customers have chosen to participate in this offering?
- SCE ONLY: Describe any barriers to getting customers to participate and what is being done or is planned to address them.
    - If any, probe: What has been done, or is being planned, to address these barriers? Clarify whether Cascade and/or Idaho Power has or is planning to take action.
- ROCEE and WWEEC ONLY: Are you aware of any barriers or difficulties customers have had in participating in this offering? If so, what barriers/difficulties are you aware of? What, if anything, is being done to address these issues?
    - Probe on challenge for customers to get an energy champion and management support internally – how can the offering assist these customers?
- ROCEE and WWEEC ONLY: How did the cohort-based training sessions go? . Did the implementation/delivery of the training meet your expectations? Why or why not? In terms of:
    - Levels of participation
    - Types of customers participating
    - Effectiveness of the trainings/audits/analysis
- For ROCEE: do you think additional focus on Strategic Energy Management (SEM) would be beneficial to customers?
- What, if any, challenges have you faced in implementing this offering?
    - How are you overcoming these challenges?
- What successes have you experienced implementing this offering so far? To what do you attribute these successes?

- How much was Idaho Power involved in coordination? How were the IP customer reps involved? How has their involvement helped or hindered the offering? (Probe on if they would like more or less involvement from fields and/or other IPC staff).
- What, if any, additional support from Idaho Power do you think would help the offering? What outcomes would you expect from this additional support?

Wrap Up

- How well does the offering serve targeted customers needs?
- Are there other offering services that are needed to more fully meet target customers' needs?
    - For ROCEE: Probe on additional SEM if not already mentioned
- Do you have any recommendations for improving the offering design?
- Do you have any other comments on the design or implementation of this offering?
- Any suggestions on who else we should talk to about how the offering is being implemented? (Other than participating customers)

2. Trade Ally Interview Topics for SCE ONLY

Introduction to interviewee: We are evaluating Idaho Power's Streamlined Custom Efficiency (SCE) offering under the Custom Efficiency program and would like to talk with you about your experience with installing equipment for participants of this offering. We have some questions about marketing, offering design, and implementation challenges and successes that will help us in the evaluation of this offering.

Introduction

- Brief discussion of firm and the types of services it provides generally (confirm what we have already learned)
    - Approximately how many projects have you worked on for the SCE offering?
    - Approximately what percent of your jobs are for Idaho Power's SCE offering?
- What services do you currently provide for the offering? Have you had involvement with other Idaho Programs (in the past and/or currently)? Describe.

Marketing and Outreach

- To your knowledge, who is the target audience for this offering? (Confirm what we have learned from Idaho Power/elicit trade ally perspective)
- How is the offering marketed to target customers? (Probe on channels – field reps, customers, Cascade Energy came to them, etc.) How involved are you in marketing the offering to customers?
- Describe the customers who have currently participated (customer size, business type, location). Are these characteristics in line with expectations of the target

audience for this offering? Do you feel that there may be better methods for recruiting participants?

- From your perspective, is marketing and outreach effective for this offering? If yes, what is most effective? If no, what could be done to make it more effective to increase awareness among the target audience?

Offering Design/Operations

- What benefits do you anticipate participants would experience as a result of offering participation?
    - Energy savings
    - Customer satisfaction
    - Increased awareness of energy efficiency
    - Participation in Idaho Power equipment incentive programs.

Implementation Challenges/Successes

- To your knowledge, what is the primary reason that customers have chosen to participate in this offering?
- Describe any barriers to getting customers to participate. and what is being done or is planned to address them. If any, probe: What has been done, or is being planned, to address these barriers? Clarify whether Trade Ally and/or Idaho Power has or is planning to take action.
- What, if any, challenges have you faced in installing equipment for this offering?
    - How are you overcoming these challenges?
- What successes have you experienced implementing this offering so far? To what do you attribute these successes?
- How much was Idaho Power involved in coordination? How much was Cascade Energy involved? How were the IP customer reps involved? How has their involvement helped or hindered the offering? (Probe on if they would like more or less involvement from fields and/or other IPC staff).
- What, if any, additional support from Idaho Power do you think would help the offering? What outcomes would you expect from this additional support?

Wrap Up

- How well does the offering serve targeted customers needs?
- Are there other offering services that are needed to more fully meet target customers' needs?
- Do you have any recommendations for improving the offering design?
- Do you have any other comments on the design or implementation of this offering?

- Any suggestions on who else we should talk to about how the offering is being implemented? (Other than participating customers)

3. Participant Interview Topics

Introduction to interviewee: We are evaluating Idaho Power's Streamlined Custom Efficiency (SCE), Refrigeration Operator Coaching for Energy Efficiency (ROCEE), and Wastewater Energy Efficiency Cohort (WWEEC) offering under the Custom Efficiency program and would like to talk with you about your experience participating in this offering. We have some questions about your experience with various aspects of the offering and your satisfaction with each aspect. A few of the questions may seem repetitive, but we are asking similar questions about different aspects of the offering and your experience with them. Your responses will help us in providing recommendations to Idaho Power to improve the SCE/ROCEE/WWEEC offering.

Introduction

- Brief discussion of customer characteristics (confirming what we know, probing for type of business, length of time it has been operating)
- What has your role been in your company's participation in this offering?

Awareness and Motivations

- How did you first become aware of this offering by Idaho Power's Custom Efficiency Program?
- Are you aware of any other energy efficiency programs for businesses that Idaho Power offers? If yes, describe.
    - How have you found out about these programs?
    - What is your preferred source(s) for learning about Idaho Power's program offerings/trainings?
- Has your business participated in any of these other programs? If yes, describe.
    - Generally what has been your experience with these/this prior program(s)?
- What motivated you to participate in the [SCE/ROCEE/WWEEC] offering?
- Has the offering spurred interest in other areas of your company (ROCEE)/city (WWEEC) to save energy?

Offering Processes/Participant Experience (SCE, ROCEE, and WWEEC)

- How easy or difficult have you found it to participate in this offering?
    - Probe: what have you found particularly easy (or difficult)?
    - If difficult, what could be done to improve your experience?
- Have you noticed a change in energy use at your business since participating?

  - Probe on what the change has been: increase/decrease, what percent of energy use
  - Do you expect this change to continue into the future?
- Have you/your company experienced any other benefits from participating?
  - Probe on non-energy benefits: Improved work environment, safety, comfort, reliability, reduced absenteeism, added jobs/avoid layoffs, better equipment function/less maintenance required, impact on quality/quantity of product or process
  - [If yes to any of the above]: How did the offering impact this aspect of your business?
  - Do you expect these benefits to continue into the future?
- [If not already mentioned above]: Has participation in the [SCE/ROCEE/WWEEC] offering allowed you to hire any new employees or avert any layoffs?
  - [If yes]: What types of employees have you hired (or been able to keep) for these jobs (job categories)? Has this included any interns?
  - [If yes]: What are the qualifications, job title/responsibilities, of the employees you have been able to hire due to participation?
  - [If yes]: What is the anticipated growth for these jobs in the next 5 years?
- Prior to participating in this offering what benefits did you/your company anticipate as a result of participating? Have you/your company realized the benefits you expected from participating at this point? If no, why not? Do you expect these benefits to continue into the future? Is there anything that could be done to increase the benefits from participating?

Applications & Incentives (SCE)

- Did you fill out your application or did someone at Cascade Energy assist you in calculating the energy savings and filling out and submitting your offering application?
  - How did this process go? Could it be improved at all? If yes, how so?
- Have you received an incentive for your participation in the offering?
  - [If yes] How did the incentive payment process go?
- Did the application process meet your expectations? If yes, how so? If no, why not?
- Did the incentive payment process meet your expectations? If yes, how so? If no, why not?
- Do you have any recommendations for improving either of these processes?

Training Workshops/Webinars (ROCEE and WWEEC)

- Did you attend the training workshops or webinars for this offering? If so, which did you attend?

- How effective were the trainings/webinars in improving your awareness of energy efficiency?
- What benefits or outcomes have occurred as a result of the trainings/webinars?
    - Probe on what specific changes at the facility or operations have occurred as a result of the training.
    - What changes, if any, are you planning to implement in the future? When are these likely to occur?
    - Are there any barriers you anticipate that might impede your facility's ability to take action as a result of the trainings? What could be done, if anything, to address those barriers?
    - [If not already mentioned] Would additional assistance from Idaho Power help address barriers?
- Did the trainings meet your expectations? If yes, how so? If not, why not?
- What recommendations, if any, do you have to improve the trainings?

Engineering/Technician Assistance (ROCEE and WWEEC)

- Did you utilize the engineering assistance that is offered? If yes, did you use the remote or onsite assistance?
- What was the outcome of having the engineer/technician assist you?
- Did this engineering support experience meet your expectations?
- What recommendations, if any, do you have to improve the assistance that is offered?

Energy Management Software (ROCEE and WWEEC)

- How often does your facility use the energy management software provided by Idaho Power to monitor energy use?
- Have any of your processes or protocols changed in response to using the energy management software?
    - Probe on what specific changes at your facility have been made as a result of the software.
    - What changes, if any, are you planning to implement in the future? When are these likely to occur?
    - Are there any barriers you anticipate that might impede your company's ability to take action as a result of using the energy management software? What could be done, if anything, to address those barriers?
    - [If not already mentioned] Would additional assistance from Idaho Power help address barriers?
- How easy or difficult have you found using the software to be?
    - Probe if they had problems.

  - How responsive was Idaho Power or Cascade Energy in helping you find solutions? Would additional assistance from Idaho Power or Cascade Energy help address issues with the software?
- Did the software meet your expectations? If yes, how so? If not, why not?
- Do you have any recommendations to improve the software?
- Do you plan to keep using the software after the end of the 2-year ROCEE/WWEEC offering?

Audits (ROCEE and WWEEC)

- ROCEE: Did you receive an energy audit of your facility by a qualified refrigeration expert?
- WWEEC: Did you receive an opportunities list for your facility prepared during an audit by a qualified wastewater expert?
- ROCEE and WWEEC: How helpful do you feel the audit was in identifying no-cost and low-cost efficiency improvements at your facility?
  - [If "not very helpful"]: How would you recommend the audit process be improved to make it more useful?
- What efficiency improvements were recommended to you by the remote or onsite engineer/technician (ROCEE), engineer (WWEEC)?
  - Which did you choose to implement?
  - Which do you plan to implement in the future?
  - Are there any barriers you anticipate that might impede your company's ability to implement recommendations? What could be done, if anything, to address those barriers?
  - For any recommendations that you did not implement or do not plan to implement, why? Could anything be done to make those additional recommendations more feasible to implement? (Including additional assistance from Idaho Power – either current offerings or other support)
  - [If not already mentioned] Would additional assistance from Idaho Power help your company implement additional recommendations?
- Did the audit meet your expectations? If yes, how so? If not, why not?
- What recommendations, if any, do you have to improve the audits?
- WWEEC: Did you receive an initial Energy Management Assessment?
- WWEEC: How helpful do you feel the Energy Management Assessment was in identifying organizational improvements at your facility?
  - [If "not very helpful"]: How would you recommend the energy management assessment process be improved to make it more useful?
- WWEEC: What organizational improvements were recommended to you in the Energy Management Assessment?

- Which did you choose to implement now?
- Which do you plan to implement in the future?
- Are there any barriers you anticipate that might impede your company's ability to implement recommendations from the Energy Management Assessment? What could be done, if anything, to address those barriers?
- For any recommendations that you did not implement or do not plan to implement, why? Could anything be done to make those additional recommendations more feasible to implement? (Including additional assistance from Idaho Power – either current offerings or other support)

- WWEEC: Did the Energy Management Assessment meet your expectations? If yes, how so? If not, why not?
- WWEEC: What recommendations, if any, do you have to improve the Energy Management Assessment?

Satisfaction/Recommendations

(Satisfaction questions for the SCE initiative are taken from the survey instrument used in the last Custom Efficiency evaluation. Satisfaction questions for ROCEE and WWEEC are adapted from the format used in the last Custom Efficiency evaluation, since offering processes are different. For all questions below, we will ask the participant to rate their satisfaction along the following scale: very dissatisfied, somewhat dissatisfied, neither satisfied nor dissatisfied, somewhat satisfied, very satisfied)

- For SCE:
  - In general, how would you rate your satisfaction with the offering?
  - Let's break down the offering into a number of components. There are a number of critical steps or requirements to the offering, and I would like you to help us understand your experience with each.
    - The first step is **determining how your electrical process could be more energy efficient**.
      - How would you rate satisfaction with this process of the offering?
    - The second step is to **obtain a cost estimate to modify or install more efficient electrical equipment**.
      - How would you rate satisfaction with this process of the offering?
    - The third step is to **complete a Custom Efficiency program application and agreement**.
      - How would you rate satisfaction with this process of the offering?

- The fourth step is **review of your application by IPC and pre-apprvoal**.
    - How would you rate satisfaction with this process of the offering?
- The fifth step is **installation of the equipment**.
    - How would you rate satisfaction with this process of the offering?
    - How satisfied were you with the equipment that was installed?
- The last step is to **have IPC inspect the project or measurement and verification (M&V) plan by a contractor**.
    - How would you rate satisfaction with this process of the offering?

- For ROCEE/WWEEC:
    - In general, how would you rate your satisfaction with the offering?
    - Let's break down the offering into a number of components. There are a number of critical steps or requirements to the offering, and I would like you to help us understand your experience with each.
        - Training Workshops/Webinars
            - How would you rate satisfaction with this aspect of the offering?
        - Remote or Onsite Engineering Support
            - How would you rate satisfaction with this aspect of the offering?
        - Initial Energy Management Assessment (WWEEC only)
            - How would you rate satisfaction with this aspect of the offering?
        - Energy Management Software
            - How would you rate satisfaction with this aspect of the offering?
        - Audits (ROCEE) / Opportunities List (WWEEC)
            - How would you rate satisfaction with this aspect of the offering?
- Do you have any recommendations for improving this offering?
- Do you have any other comments on the offering that we've not already covered?
- Do you have any other recommendations for how Idaho Power can better serve businesses like yours?

That's all the questions I have for you today. Thank you for taking the time to talk with me!

Idaho Power Company

Impact Evaluation Report for Energy Efficient Lighting—Program Year 2013 (Final)

October 16, 2014

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1. EXECUTIVE SUMMARY

This report presents the results of the independent impact evaluation for Idaho Power Company's (IPC) Energy Efficient Lighting (EEL) program for activity corresponding to the 2013 program year. IPC offers the EEL program to residential customers within its Idaho and Oregon service areas.

The key objectives of the impact evaluation for the Energy Efficient Lighting program were to:

- Verify the 2013 program energy and quantifiable non-electric impacts
- Provide credible and reliable ex-post program energy savings along with associated realization rates and quantifiable non-electric impact estimates
- Report findings and observations and provide recommendations that would enhance the effectiveness of future analysis and the accurate and transparent reporting of program savings

The impact evaluation kicked off in June 2014. The impact evaluation work plan, finalized on July 14, 2014, outlines the program impact evaluation goals, methods, schedule, and sampling approach based on discussions with Idaho Power staff and Tetra Tech's understanding of IPC's priorities and data availability. Tetra Tech gathered program tracking system data and documentation, interviewed staff, and reviewed the basis of program savings calculations. The results from the analysis of this data and information allowed Tetra Tech to develop program ex-post energy savings and realization rates. In addition, Tetra Tech developed recommendations to enhance the effectiveness of future analyses, the accuracy and transparency of reporting of program savings, and non-electric impacts for IPC to consider.

The impact evaluation approach emphasized compliance with the Regional Technical Forum (RTF) energy savings as the basis for verifying savings. The approach Tetra Tech took to verify RTF compliance included the following:

- A review of 100 percent of program tracking data that led to reported savings using RTF metrics and independent calculations as appropriate
- A review of a sample of tracking data records to verify lighting retailer allocation metrics
- Sampling of a portion of the retailer reports provided by CLEAResult
- Interviews with program staff and other research to verify methods and address variances
- Developing independent savings calculations for lamps without deemed RTF savings values

As part of the EEL program impact evaluation, Tetra Tech reviewed existing literature to identify quantified non-electric impacts (NEIs) estimated or used in other regions of the United States. The review did not consider societal benefits or utility related emissions benefits, focusing on participant and utility non-electric benefits related specifically to energy efficient lighting.

Table 1-1 shows the claimed and evaluated energy savings for the EEL program for program year 2013. Total ex-post verified savings were 10,047,811 kWh compared to 9,995,753 kWh ex-ante claimed savings resulting in a gross realization rate of 100.5 percent. The driver of the difference in the overall kWh realization rate from 100 percent were adjustments primarily made to the high wattage lamps. The table also provides a summary of the ex-ante versus ex-post savings by state. Since high wattage lamp sales existed in Idaho and Oregon, adjustments in realization rates occurred in both service territories.

Table 1-1. Program Year 2013 Ex-Ante and Ex-Post Energy Savings

State	2013 Ex-Ante Energy Savings (kWh)	2013 Ex-Post Energy Savings (kWh)	Realization Rate (%)
Idaho	9,789,865	9,840,504	100.5 %
Oregon	205,888	207,307	100.7 %
Total	9,995,753	10,047,811	100.5 %

The impact evaluation found that the EEL program has well-established program design and delivery processes, supported by the program tracking systems, program documentation, and savings tools. The healthy realization rate of the program supports this finding. At the same time, the objective of the impact evaluation is to facilitate more accurate, transparent, and consistent savings calculation and program reporting as well as provide feedback on improvement opportunities.

Tetra Tech identified the following key findings and recommendations for the EEL program as a result of the impact evaluation.

The EEL program tracking system is working well. The current tracking system appears to work well for IPC, and careful attention to detail by staff allows for accurate tracking.

Continue to comprehensively track retailer reports and RTF savings, but consider a shared system that aligns all specifications that lead to reported energy savings. To the degree possible, consider a database or similar system that can share information between CLEAResult and IPC to enable additions of stock keeping units (SKUs) and available technical data to drive consistency between CLEAResult reporting and IPC tracking data for all factors.

For non-RTF lamps, consider directly calculating energy savings using standard industry approaches or working with others to develop region-wide savings values. For lamps that fall well beyond the RTF categories or Energy Independence and Security Act (EISA) affected baseline lamps, IPC should consider several options:

1) Work with the Northwest Energy Efficiency Alliance (NEEA) and/or the RTF to develop lamp adjustment factors and baseline assumptions based on regional market knowledge
2) Conduct independent market research to understand the utilization of these lamps
3) Utilize energy savings calculations based on general engineering principles and underlying RTF market adjustment and performance factors

2. INTRODUCTION

This report presents the third-party impact evaluation results for Idaho Power Company's (IPC) Energy Efficient Lighting (EEL) program implemented in program year 2013 (PY2013). The purpose of the impact evaluation is to verify energy and non-electric program impacts, along with providing observations and recommendations to enhance the effectiveness of future analysis and the accurate and transparent reporting of program savings.

2.1 PROGRAM DESCRIPTION

The EEL program develops energy savings for residential customers through two mechanisms. The primary source of savings is an upstream lighting program that provides incentives to retailers to mark down the price of efficient lamps at the point of sale. A smaller component delivers lamps via giveaways at periodic community events. The EEL program is an important part of IPC's energy efficiency program portfolio, delivering nearly 60 percent of reported residential portfolio savings for 2013.

The upstream portion of the EEL program is organized under the Northwest Energy Efficiency Alliance (NEEA) and delivered by CLEAResult. CLEAResult works with retailers throughout the Pacific Northwest to coordinate retailer enrollments, ensure a standard program experience for the retailers and customers, and report sales for each participating utility each month. IPC contracts with CLEAResult to allocate savings associated with participating retailers that cover IPC-related sales. IPC incentivized over one million lamps through the upstream program in 2013. Incentive payments ranged from $0.50 per lamp to $2 per lamp, depending on the lamp type.

IPC operates the giveaway portion of the EEL program directly and provides lamps to customers at events hosted by community organizations. In contrast to the upstream lighting program, this effort provided about 1,300 lamps to customers and with no financial requirement on the part of participating customers. IPC purchases, warehouses, and tracks the distribution of these lamps in-house.

2.2 REPORTED PROGRAM SAVINGS

IPC relies on the Northwest Power & Conservation Council (NPCC) for savings estimates based on lamp type. NPCC's Regional Technical Forum (RTF) develops energy savings for a wide range of energy efficiency measures based on technology performance, market conditions, and distribution methods. The RTF develops "proven" savings values that serve as deemed savings for IPC for nearly all lamps found in the IPC program.

IPC reported 9,995,753 kWh savings for the EEL program for 2013. Table 2-1 reports the breakout of reported energy savings based on the EEL program tracking system.

Table 2-1. Reported Energy Efficiency Lighting Program Savings[1]

Program Segment	Number of Lamps	Reported Savings (kWh)
Upstream RTF Lamps	1,080,485	9,957,704
Upstream Non-RTF Lamps	2,099	25,188
Giveaway RTF Lamps	1,322	12,861
Total	1,083,906	9,995,753

2.3 EVALUATION APPROACH

The purpose of the impact evaluation was to verify reported gross energy savings, document evaluation activities, and provide recommendations to enhance the effectiveness of the program. The approach emphasizes compliance with the RTF energy savings as the basis for verifying savings, with variations relying on other methods as needed.

The approach Tetra Tech took to verify RTF compliance included the following:

- A review of 100 percent of program tracking system data that led to reported savings using RTF metrics and independent calculations as appropriate
- A review of a sample of tracking system records to verify retailer allocation metrics
- Sampling a portion of the retailer reports provided by CLEAResult
- Interviews with program staff and other primary research to verify methods and address variances
- Developing independent savings calculations for non-RTF lamps

2.4 REPORT ORGANIZATION

The report describing the impact evaluation for program year 2013 includes the following sections:

- Chapter 2 presents the evaluation methodology
- Chapter 3 describes the analysis, findings, and verified energy savings along with recommendations for savings adjustments or program considerations
- Chapter 4 presents a discussion of non-electric benefits that may be associated with the program
- Chapter 5 presents the evaluation recommendations and conclusions emerging from the evaluation activities and findings
- Appendix A provides a discussion of non-electric impacts that may be associated with the EEL program

[1] Data developed from the EEL program tracking system, provided to the evaluation in July 2014.

3. EVALUATION METHODOLOGY

The purpose of the evaluation was to verify the reported savings of IPC's EEL program. Additionally, IPC asked Tetra Tech to investigate non-electric benefits that may be associated with the program, providing quantifiable results as available. Tetra Tech reviewed a number of program documents, taking a census approach where possible and sampling where needed.

The overall methodology focused on three topics:

1) Verifying savings based on RTF savings values
2) Developing verified savings for non-RTF lamps
3) Confirming tracking system accuracy based on retailer sales and other factors related to quantifying lamp sales or lamp distribution

Tetra Tech began the evaluation with a meeting with the IPC evaluation lead to outline goals for the evaluation and identify key issues and IPC personnel for subsequent interviews. Tetra Tech interviewed the program specialist to understand data tracking, data availability, and program policies and to develop an ongoing dialogue to discuss questions that may emerge from the initial data review and findings.

To review tracking data, Tetra Tech applied a census approach to the review of per-lamp savings tracked in the program's tracking system. The census approach avoids sampling error, resulting in an outcome that exceeds the minimum 90 percent ± 10 percent confidence required of the evaluation findings. For specific points of inquiry, Tetra Tech sampled data to verify practices and metrics. These points included a verification of lumen values associated with RTF savings categories and a review of retailer reports to verify data entry accuracy.

As with the tracking system review, Tetra Tech based the verification of lumen values on a census review approach. In addition, Tetra Tech completed an independent check of reported lumens to verify the lumen bin assignments among a sample of lamps representing high, medium, and low program savings to assess the reasonableness of the lumen bin assignments.

Tetra Tech based the sampling for retailer report sales data entry accuracy on a review of a sample of retailer store-level annual sales and based the store sample on a random selection from the list of participating stores involved in the program. Tetra Tech reviewed all lamp types and monthly sales for each store. Store sales volumes varied widely across IPC's service territory. Tetra Tech based the sampling on three strata using the reported kWh savings, with each stratum containing approximately one-third of reported program savings. Tetra Tech randomly selected three sample stores from each stratum. The nine total sampled stores represented 4,167,464 kWh (42 percent) of the retail store savings, 139 stock keeping units (SKUs), and 446,080 lamps. Tetra Tech compared all SKUs for the nine stores within each monthly retail report to the tracking data to confirm all lamp counts (sales and adjustments) match those quantities within the program tracking system for that respective month.

Tetra Tech reviewed additional program documentation to understand program policies and practices and the allocation method for retailer sales allocated to multiple utilities.

As part of the impact evaluation of IPC's EEL program, Tetra Tech reviewed existing literature to identify quantified non-electric impacts (NEIs) estimated or used in other regions of the United States. The review did not consider societal benefits or utility related emissions benefits, focusing on participant and utility non-electric benefits related specifically to energy efficient lighting. Such a focus aligns with the Total Resource Cost test approach to viewing program cost effectiveness. The literature review focused on work conducted in California, Massachusetts, and New York, though some of the literature referenced related NEIs and approaches in other regions of the United States as well. Tetra Tech also reviewed the RTF Residential Lighting compact fluorescent lamp savings workbook to identify how NEIs may be used within the RTF savings calculation methods. The results of the literature review of non-electric impacts that may be associated with the program are presented in Appendix A.

4. ANALYSIS, FINDINGS, AND VERIFIED SAVINGS

This chapter discusses the methodology and results of the impact evaluation of the 2013 EEL program. Each section in this chapter includes recommendations that emerged through the process of completing the analysis and the impact or risk to IPC's energy savings. Tetra Tech presents the analysis in four main sections: tracking system review, verification of RTF savings compliance, the development of verified savings for non-RTF lamps, and alignment of tracking data with retail sales reports.

4.1 TRACKING SYSTEM REVIEW

IPC tracks energy savings for the EEL program in a Microsoft Excel® workbook for each program year. IPC provided the 2013 tracking system to Tetra Tech for review and as a foundation for verifying program savings. The tracking system contains monthly sales, allocation, incentive payment, and energy savings for each retailer and lamp SKU, with 18,163 records. The data spans retail sales reported to IPC for December 2012 through November 2013. Tetra Tech aggregated energy savings and lamp counts to report total energy savings. Additionally, Tetra Tech made adjustments to account for RTF changes and address non-RTF lamps.

The energy savings presented in the tracking system match those reported by the program. The tracking system review also revealed a significant shift in program savings due to a mid-year change to how the RTF calculates savings. The RTF began to assign savings values based on a given lamp's lumens, with six lumen "bins" used to present savings for varying types of lamps and program delivery methods. The change required IPC to carefully map the retailer-reported lamps to the new RTF categories and assign the correct RTF savings value. Additionally, the retailer reports did not present sales with lumens identified for the lamps, necessitating a careful lumen assignment to each lamp SKU. The evaluation's review found that IPC correctly mapped the retailer reports to the new RTF categories, with one minor exception (described in the next section).

Tetra Tech also reviewed how the EEL program allocated savings among retailers. Tetra Tech discussed savings allocation with program staff during in-depth interviews in July 2014. Program staff described a "regional allocation tool" they utilize to allocate savings to lamp sales that leak out of the IPC service territory or accrete to the IPC territory from retailers outside of the IPC service territory. This tool helps the staff divide shoppers and their sales among IPC service territory and areas serviced by other utilities. Staff indicated that they calculate the allocation through consideration of city and ZIP code, and store type (big box store, chain, or local retailer). Through this interview, Tetra Tech understood that while CLEAResult suggests allocations within stores/regions through its process, there is also an overarching negotiation about sales in certain stores/regions between utilities.

Tetra Tech reviewed allocation documentation provided by IPC and noted several tracking system records that had allocation percentages that were lower than any allocation percentages located in the allocation documentation provided by IPC. Tetra Tech ultimately concluded these cases were part of the case-by-case negotiations the program team described during the in-depth

interview. Further internal and external allocation verification and accuracy checking of these savings calculations was not possible due to a lack of documentation about records with negotiated savings allocations. However, as CLEAResult provides the allocation percentage for each retailer SKU and calculates the number of sold lamps allocated to IPC, IPC was accurately addressing allocations in their tracking system. A review of CLEAResult data and processes may help clarify this issue, but that is beyond the scope of this evaluation effort.

The method for entering retailer reports from CLEAResult was direct and did not require substantial data entry effort, minimizing potential for data entry errors. The tracking system is comprehensive and allowed Tetra Tech to conduct a census review of all lamps and aggregate reported energy savings.

Recommendation 1: The current tracking system appears to work well for IPC, and careful attention to detail by staff allows for accurate tracking. IPC should consider adding data to the tracking system, such as lumens, for each SKU. IPC has already engaged CLEAResult to have lumens be part of standard retailer report. Additional RTF changes in 2014 include the consolidation from six to three lumen range categories. These and potential future changes to the RTF methodology should be identified in collaboration with CLEAResult.

Recommendation 2: Work with CLEAResult to track allocation methods and negotiations that relate to allocations. While CLEAResult includes the allocation used for each monthly report for each retailer and SKU, IPC should receive and retain a full accounting of their own allocation and resolve any variances as part of monthly quality assurance checks.

4.2 REGIONAL TECHNICAL FORUM COMPLIANCE

IPC used version 3.0 of the Residential Lighting compact fluorescent lamp (CFL) RTF deemed savings values to report 2013 savings for the EEL program for lamps between 250 and 2,600 lumens. The RTF periodically updates savings values, with IPC using the latest version to report savings for the entire year in which the latest savings values are developed. Tetra Tech utilized the program tracking system and RTF workbooks to verify compliance with RTF savings based on this policy.

At the start of the 2013 program year, version 2.2 of the Residential Lighting CFL RTF workbook was active and in use. By the end of 2013, version 3.0 of the Residential Lighting CFL RTF workbook was active. Between the two workbooks, the RTF had made a significant change to the residential CFL lighting savings by assigning savings based on a given CFL lamp's lumens. As a result, for IPC to comply with its policy, the lamps sold during 2013 and reported for the 2013 year had to be mapped to the lumen-based savings developed by the RTF. For lamps with lumens greater than 2,600, Tetra Tech assigned a custom savings value as discussed below under high watt CFLs.

The RTF's version 3.0 Residential CFL workbook provides deemed savings values for CFLs through calibrated engineering estimation procedures. Lamps sold through retail sales are grouped into six lumen bin categories in which an average savings is assigned to all lamps within

that lumen range and for a given lamp type.[2] Table 4-1 presents the lumen ranges within RTF version 3.0 and the corresponding savings assignments for General Purpose lamps.

Table 4-1. RTF Lumen Bins (General Purpose Lamps) and their Savings Assignment

RTF Lumen Bin Range	Savings Assignment Value (kWh)
250 to 369[3]	1
370 to 664	7
665 to 1,014	8
1,015 to 1,439	13
1,440 to 2,019	8
2,020 to 2,600	12

To confirm that the correct lamp savings were assigned for each lamp type, Tetra Tech analyzed the tracking system across several factors that define RTF measure characteristics and resulting savings. First, Tetra Tech confirmed the kWh savings value for each lamp type matched the savings corresponding to the RTF's lumens, savings, and delivery methods. Tetra Tech verified that the RTF's Sub Category names for each lamp/lumen bin are the same names and ranges that the program used in their assignment for each lamp. Second, Tetra Tech verified that lumens assigned to each lamp type fell within the RTF lumen bins. Tetra Tech completed this comparison for all lamps within the tracking system. Tetra Tech found only one lamp SKU that did not fall into an RTF lumen bin. This single SKU was noted by IPC as being 220 lumens, just under the RTF lowest lumen category of 250 lumens. Although outside the lumen bin, the wattage was the same as others in that bin and savings were minor (four lamps at 1 kWh per lamp). Tetra Tech considers the lumen bin and savings assignment as accurate, with the one exception a reasonable approach to assigning savings.

Tetra Tech completed an additional independent check of reported lumens to verify whether the lumens assigned to the lamps aligned with manufacturer or similar market data. To verify alignment with market data, Tetra Tech stratified the 409 lamp SKUs by their contribution to program reported savings, assigning them to a high, medium, or low-energy savings stratum. The strata represent the top energy savings SKUs, the middle saving SKUs, and the low savings SKUs, with each strata representing one-third of total program energy saving. Within these three strata, four manufacturer/SKU combinations dominated the high kWh savers tier. Fourteen unique combinations fell in the middle kWh savers tier, and 379 manufacturer/SKU combinations made up the low kWh savers tier. Program savings are clearly driven by a relatively small percentage of SKUs.

[2] The RTF Residential CFL workbook uses five types of lamps to refine savings beyond just the lumen bins. These include Decorative, General Purpose Replacement, Globe, Reflector (Flood/Spot), and Other.

[3] The 250 to 369 lumens bin does not include General Purpose Replacement lamps, only Decorative, Globe, and Reflector. The savings presented in Table 4-1 reflect the Decorative category and is included to provide a comprehensive coverage of all RTF lumen bins.

Once all possible manufacturer/SKU groups were assigned a savings tier, Tetra Tech constructed a subset of records to verify that they encompassed at least 40 percent of the program's total energy savings. Because there were only four unique lamps driving the top tier for program savings, Tetra Tech used a census of all records within the highest savings tier. To round out the sample, Tetra Tech randomly sampled four records from each of the middle and bottom tiers.

Tetra Tech found that the lumen bin assignments and RTF savings values were correctly assigned to each SKU, with reported and verified savings for RTF lamps being correctly mapped and with program savings being correctly counted.

Recommendation 3: Continue careful tracking of retailer reports and RTF savings. To the degree possible, consider a database system that CLEAResult and IPC could share to enable additions of SKUs and available technical data to drive consistency between CLEAResult reporting and IPC tracking system and address potential RTF savings changes.

4.3 REVIEW OF NON-RTF LAMPS

Tetra Tech identified a small number of lamps in the IPC EEL tracking system that were not assigned to RTF Residential CFL workbook categories. Ex-ante savings for these lamps totaled 25,188 kWh across 2,099 lamps. IPC assigned 12 kWh of savings to each of these lamps. The general approach taken by IPC was to track these lamps as "high lumen lamps," outside of the RTF lumen categories. Ex-ante savings were based on the highest lumen general lamp category, 2,020 to 2,600 lumens. Table 4-2 presents the wattage, reported lumens, and reported quantities for these lamps.

Table 4-2. Non-RTF Lamp Verified Results

Lamp Watts	Reported Lumens	Reported Number of Lamps
14	2,800	15
40	2,720	275
42	2,700–2,997	1,042
55	3,860	278
68	4,200	489
Total		2,099

The 14 watt lamps were all A-lamps, made by a single manufacturer and sold by a single retailer. The reported 2,800 lumens would place these lamps beyond the RTF category, but also well beyond the efficacy of standard CFLs. Tetra Tech reviewed the manufacturer's current specifications and found that the specific lamp model was no longer manufactured. However, no similar lamps (in watts or style) have lumens outside of typical CFL efficacy performance. The manufacturer's current 13 watt A-lamp provides 650 lumens, while their spiral 15 watt lamp provides 900 lumens. Most other 14 watt A-lamps in the program tracking system were assigned to the RTF's 665 to 1,014 category, with RTF savings of 8 kWh. Based on these findings, Tetra Tech reassigned all 15 of these 14 watt lamps from the 2,800 lumen and 12 kWh to 665–1,014

lumen and 8 kWh savings assignment category. The total effect of adjusting the savings downward from 12 kWh to 8 kWh, a difference of 4 kWh per lamp, resulted in a decrease in program savings of 60 kWh for the 14 watt lamps, as shown in Table 4-3 below.

Table 4-3. Energy Savings and Net Result for 14 watt Lamps

Lamp Type	Ex-Ante Savings per Lamp	Ex-Post Savings per Lamp	Lamp Count	Total Ex-Ante Savings	Total Ex-Post Savings
14 watt	12 kWh	8 kWh	15	180 kWh	120 kWh

In the case of the 40 and 42 watt non-RTF lamps, IPC assigned these lamps to the highest lumen category—2,020 to 2,600 lumens and 12 kWh. As the lumens for these lamps did not greatly exceed the highest RTF lumen category, and IPC assigned other lamps with the same or similar wattage to this category, the approach taken by IPC is reasonable. Tetra Tech did not adjust savings assigned to these lamps.

In the case of the 55 watt and 68 watt lamps, the lumens well exceeded the highest RTF lumen category. IPC assigned these lamps 12 kWh per lamp savings, based on the RTF's highest lumen category. In Tetra Tech's view, this approach may be overly conservative. Given the relatively high lumen output for these lamps, the RTF's baseline assumption for the 2,020- to 2,600-lumen category will utilize a baseline wattage far less than would be found for sockets that utilize the 55 watt and 68 watt CFLs. Further, the implied baseline lamps are not subject to Energy Independence and Security Act (EISA) standards.

Tetra Tech developed an independent calculation for the 55 watt and 68 watt lamps using a standard engineering approach to calculating per-lamp savings. Other than the baseline lamp and general market saturation assumptions, all other assumptions used in the calculation were the same as the RTF's assumptions. Based on a review of online marketing and lumen comparisons, Tetra Tech assigned 55 watt lamps a baseline equivalence of a 200 watt incandescent and 68 watt lamps a baseline equivalence of a 250 watt incandescent.

The RTF Residential lighting workbook uses default multipliers that adjust lamp savings by several factors. These factors include removal, takeback, storage, and HVAC effects. Additionally, for different lamp types, the RTF has underlying assumptions regarding hours of use. Table 4-4 describes the multipliers used to develop and adjust savings for the 55 watt and 68 watt lamps.

Table 4-4. Lighting Energy Savings Factors and Adjustments

Factor/Adjustment	Metric	Description
Removal	2 percent	Accounts for removal before end of useful life
Takeback	0 percent	Accounts for store returns
Storage	24 percent	Accounts for purchased lamps being stored and not immediately installed
HVAC effects	13.3 percent	Net heating and air-conditioning effect. Penetration of electric heating and air-conditioning results in heating load increase greater than air-conditioner savings
Hours of use per day	2.01	Based on highest lumen category for general lamps

For each type of lamp, Tetra Tech calculated savings by multiplying the wattage savings (baseline less efficient lamp) along with annual hours of use and the net effect of the associated adjustment factors. The following equation describes the calculation:

kWh Savings = wattage savings * (1-removal) * (1-takeback) * (1-storage) * (1-HVAC effects) * 2.01 * 365.25

Table 4-5 presents the results for the 55 watt and 68 watt lamps. The result is an increase in program savings of 52,119 kWh.

Table 4-5. Energy Savings and Net Result for 55 watt and 68 watt Lamps

Lamp Type	Ex-Ante Savings per Lamp	Ex-Post Savings per Lamp	Lamp Count	Total Ex-Ante Savings	Total Ex-Post Savings
55 watt	12 kWh	69 kWh	278	3,336 kWh	19,117 kWh
68 watt	12 kWh	86 kWh	489	5,868 kWh	42,206 kWh
Total				9,204 kWh	61,323 kWh

The total adjustment for the non-RTF lamps, as tracked by the program, is 52,058 kWh. The results reflect the increase in savings from the 55 watt and 68 watt lamps and the decrease in savings from the 14 watt lamps.

These savings adjustments affected state-level assigned savings. All 14 watt lamp adjustments (a reduction of 60 kWh) were for lamps sold in Idaho. Similarly, all 68 watt lamp adjustments (a gain of 36,338 kWh) were sold in Idaho. Of the 278 55 watt lamps, 25 were sold in Oregon. As no adjustments were made to the 40 or 42 watt lamps, state-level savings were not affected by these non-RTF lamps. Table 4-6 describes the state-level change to energy savings due to the analysis of non-RTF lamps.

Table 4-6. State Level Effect of Non-RTF Lamp Savings Adjustments

	Lamp Type			Total Adjustment
State	**14 watt (kWh)**	**55 watt (kWh)**	**68 watt (kWh)**	**(kWh)**
Idaho	-60	14,361	36,338	50,639
Oregon	NA	1,419	NA	1,419
Total	-60	15,780	36,338	52,058

Recommendation 4: When identifying lamps that are not part of the RTF, IPC should take care to confirm that lamps actually are substantially different from an RTF category. IPC should verify lamp efficacy against manufacturer specifications and general performance.

Recommendation 5: IPC should continue to utilize RTF lumen categories when non-RTF lamps are identified that have lumen outputs close or similar to wattages of RTF categorized lamps.

Recommendation 6: For lamps that fall well beyond the RTF categories or EISA-affected baseline lamps, IPC should consider several options:

1) Work with the NEEA and/or the RTF to develop lamp adjustment factors and baseline assumptions based on regional market knowledge
2) Conduct independent market research to understand the utilization of these lamps
3) Utilize energy savings calculations based on general engineering principles and underlying RTF market adjustment and performance factors

4.4 REVIEWING RETAIL SALES

In addition to performing the tracking system review as discussed above in Section 4.1, a key evaluation objective is to verify the crucial inputs that guide the deemed savings selection value. Tetra Tech selected a sample to check the accuracy of the entered data. Tetra Tech reviewed project documentation for sampled participants (such as retail stores) and compared values for measure-specific details (such as quantities) against the data in the tracking system.

Tetra Tech collected program year 2013 monthly retailer reports that are provided to IPC from their vendor, CLEAResult, for the Simple Steps program. The retailer reports comprised December 2012 through November 2013 invoiced lamp sales. Due to retailer sales report timing, all or a portion of December sales are assigned to the subsequent calendar year. These retailer reports provide Excel-based data on monthly retail promotional product sales and adjustments to sales from previous months. The retailer reports include details of lamp sale quantities by store/address, manufacturer, SKU, type, and allocation.

From the tracking system, Tetra Tech assigned the retail stores into three strata using the reported kWh savings. Tetra Tech sorted the stores from largest to smallest reported kWh savings and placed them into one of three strata such that each stratum contains about one-third of the annual total kWh claimed. Tetra Tech then randomly selected three sample points (stores) from each stratum so that approximately one-third of the sample was pulled randomly from each

of the three kWh strata. The nine sampled stores selected represented 4,167,464 kWh (42 percent) of the retail store savings, 139 SKUs, and 446,080 lamps. Tetra Tech compared all SKUs for the nine stores to confirm that all lamp counts (sales and adjustments) within the CLEAResult retailer reports match those quantities within IPC's tracking system for each respective month.

The results of the retail sales review show consistent and accurate documentation of program lamp quantities, which is an important element that guides the ultimate savings for the program. IPC obtains information such as retail sales data from CLEAResult through electronic spreadsheets that are utilized directly by IPC's tracking system. This reduces the potential for data entry errors. The consistencies found comparing retail sales documentation to the program's tracking system support this finding.

Recommendation 7: Continue to use the electronic spreadsheets from the implementer to directly feed IPC's tracking system and reduce the potential for data entry errors.

5. CONCLUSIONS AND RECOMMENDATIONS

This chapter of the report describes Tetra Tech's overall conclusions and recommendations. Overall, Tetra Tech found only minor points for adjusting savings. Tetra Tech recommends total program savings be adjusted upward, but only by less than one percent. In reviewing program documentation and processes, Tetra Tech found that the program is operating efficiently and with careful attention to detail. IPC should not view Tetra Tech's recommendations as significant deficiencies in the program's operations but as points for potential improvement that will help drive greater confidence in reported savings values and future evaluation efforts. That said, the recommendations do point to areas of potential risk that, if left unaddressed, could create future challenges for the program. Program staff's careful attention to detail has mitigated this risk to date.

5.1 VERIFIED SAVINGS

Table 5-1 shows the claimed and evaluated energy savings for the Energy Efficient Lighting program for program year 2013. Total ex-post verified savings were 10,047,811 kWh compared to 9,995,753 kWh ex-ante claimed savings resulting in a gross realization rate of 100.5 percent. The driver of the difference in the overall kWh realization rate from 100 percent was the adjustments primarily made to the non-RTF high wattage lamps. The table also provides a summary of the ex-ante versus ex-post savings by state. Since high wattage lamp sales existed in Idaho and Oregon, adjustments in realization rates occurred in both service territories.

Table 5-1. Program Year 2013 Ex-Ante and Ex-Post Energy Savings

State	2013 Ex-Ante Energy Savings (kWh)	2013 Ex-Post Energy Savings (kWh)	Realization Rate (%)
Idaho	9,789,865	9,840,504	100.5 %
Oregon	205,888	207,307	100.7 %
Total	9,995,753	10,047,811	100.5 %

5.2 RECOMMENDATIONS

The impact evaluation found that the EEL program has well-established program design and delivery processes, supported by the program tracking systems, program documentation, and savings tools. The healthy realization rate of the program supports this finding. At the same time, the objective of the impact evaluation is to facilitate more accurate, transparent, and consistent savings calculation and program reporting as well as provide feedback on improvement opportunities. Tetra Tech identified the following findings and recommendations for the EEL program as a result of the impact evaluation.

***The EEL program tracking system working well*:** The current tracking system appears to work well for IPC, and careful attention to detail by staff allows for accurate tracking.

Work with CLEAResult to track allocation methods and negotiations that relate to allocations. While CLEAResult includes the allocation used for each monthly report for each retailer and SKU, IPC should receive and retain a full accounting of their own and CLEAResult's understandings of allocation and resolve any variances as part of monthly quality assurance checks.

***Consider updates to the EEL program tracking system*:** With the recent shift in RTF deemed savings for lighting from wattage to lumen based, IPC may want to consider adding data to the tracking system, such as lumens, for each SKU. IPC has already engaged CLEAResult to have lumens be part of standard retailer reports. Also, additional RTF changes in 2014 include the consolidation from six to three lumen range categories. These and potential future changes to the RTF should be identified in collaboration with CLEAResult.

Continue to comprehensively track retailer reports and RTF savings, but consider a shared system that aligns all specifications that lead to reported energy savings. To the degree possible, consider a database or similar system that CLEAResult and IPC could share to enable additions of SKUs and available technical data to drive consistency between CLEAResult reporting and IPC tracking data for all factors.

Consider alternative reviews of unique non-RTF lamps and characterizations: When identifying lamps that are not part of the RTF, IPC should take care when lamps are substantially different from an RTF category. IPC should verify lamp efficacy against manufacturer specifications and general performance.

Continue use of RTF categories for similarly identified non-RTF lamps: IPC should continue to utilize RTF lumen categories when non-RTF lamps are identified that have lumen outputs close or similar to wattages as RTF categorized lamps.

For non-RTF lamps, consider directly calculating energy savings using standard industry approaches or working with others to develop region-wide savings values. For lamps that fall well beyond the RTF categories or EISA affected baseline lamps, IPC should consider several options:

1) Work with NEEA and/or the RTF to develop lamp adjustment factors and baseline assumptions based on regional market knowledge
2) Conduct independent market research to understand the utilization of these lamps
3) Utilize energy savings calculations based on general engineering principles and underlying RTF market adjustment and performance factors

Continue to use the electronic spreadsheets from the implementer. Utilizing the implementer's spreadsheets to feed directing into the tracking system used to monitor and calculate program savings appears to work well for IPC, and reduces the potential for data entry errors.

APPENDIX A: NON-ELECTRIC IMPACTS

A.1 INTRODUCTION

As part of the evaluation of Idaho Power Company's (IPC) Energy Efficient Lighting program, Tetra Tech reviewed existing literature to identify quantified non-electric impacts (NEIs) estimated or used in other regions of the United States. For IPC, non-electric impacts are defined as non-energy impacts plus fuel impacts. Other regions and studies use the term non-energy impacts to address the positive or negative impacts of energy efficiency programs outside of energy impacts, while non-energy benefits are also considered, but only include the benefit side of non-energy impacts. The review did not consider societal benefits or utility related emissions benefits, focusing on participant and utility non-electric benefits related specifically to energy efficient lighting. Such a focus aligns with the Total Resource Cost test approach to viewing program cost effectiveness. The literature review focused on work conducted in California, Massachusetts, and New York, though some of the literature referenced non-energy impacts and approaches in other regions of the United States as well. Tetra Tech also reviewed the Regional Technical Forum (RTF) Residential Lighting compact fluorescent lamp (CFL) savings workbook to identify how NEIs may be used within the RTF savings calculation methods.

Our recommendation provides two metrics and approaches that IPC could consider in the short term for the Energy Efficient Lighting program:

- Apply a dollar value to the annual benefits in the range of $1.00 to $2.25 to each lamp delivered through the Retail or Give-away program channels to account for NEIs
- Increase program benefits by 10 percent to account for NEIs in the Total Resource Cost test

Tetra Tech further recommends that IPC consider researching NEIs specific to the IPC service territory, identifying the attributes that program participants recognize. Additionally, utility-related NEIs, such as reduced arrearages, should also be researched and would enable IPC to quantify specific utility benefits.

These options each have their own benefit-cost calculation considerations, discussed below. Tetra Tech notes that including non-energy benefits (NEBs) is becoming more common for energy efficiency programs. NEBs are "sometimes more important than the energy benefits" and "many efficiency programs are successfully promoted to customers because of the non-energy benefits." (Malone, 2014). The results of the literature review for energy efficient lighting support this view. If IPC develops an approach to include NEIs for the Energy Efficient Lighting program, IPC would be in-alignment with emerging industry practices.

A.2 LITERATURE REVIEW

The literature review focused on three reports from Massachusetts, New York, and California. Additionally, Tetra Tech reviewed the RTF's Residential Lighting CFL savings workbook to inform adjustments and understand the RTF's approach to lighting non-energy impacts.

In Massachusetts in 2011, Tetra Tech and NMR researched non-energy impacts referenced and quantified in existing energy efficiency literature for the residential and low-income segments. NYSERDA provided the second report, discussing non-energy impacts across energy efficiency programs and with a section specific to CFLs. In California, the California Public Utilities Commission provided a report with foundational perspectives on NEBs for demand side management programs, as well as a discussion on approaches and issues taken in other states.

Tetra Tech found that there are quantified NEIs used in other regions. However, the approaches and metrics differ substantially. In comparing work conducted in Massachusetts and New York, specific dollar values are noted. In other regions, a default percentage approach is used to avoid the complexity of calculating (and potentially miscalculating) those NEIs. A direct application of the Massachusetts and New York quantified values to IPC's programs may miss regional differences, requiring research to adjust those savings to the IPC regulatory and market context. A default percentage approach may be simple to apply, but may also miscalculate the actual NEIs. The RTF addresses NEIs in several ways.

A.2.1 Massachusetts

In Massachusetts, Tetra Tech and NMR (Tetra Tech & NMR, 2011) identified an extensive list of non-energy impacts related to utility, participant, and societal perspectives. The Massachusetts report covered a broad range of residential energy efficiency measures and non-energy impacts, including CFL lamps and fixtures. The non-energy impacts do not include heating fuel adjustments. As the study reviewed a range of existing efficiency industry materials, it may be reasonable for IPC to adopt the recommended non-energy impacts from the Massachusetts study, with a few adjustments. Table A-1 presents the recommendation from the Massachusetts study.

Table A-1. Non-Energy Impacts of CFLs Recommended for Massachusetts

Non-Energy Impact	Beneficiaries	Value	Timeframe	Applicable Sectors
CFL bulbs	Participants	$3.00 per lamp	One time	Residential
CFL fixtures	Participants	$3.50 per fixture	One time	Residential

The non-energy impacts recommended for Massachusetts include impacts related to lighting quality and lifetime benefits associated with reduced lamp replacements relative to traditional incandescent lamps. The longer lighting life impact was valued at $1.80. This value may also have implications for LED lamps relative to incandescent lamps, but not necessarily CFLs relative to LEDs.

The Massachusetts study noted that there may be additional benefits for multifamily buildings and reduced labor costs associated with the frequency of lamp replacement. Additional impacts may also exist for low-income tenants, but were not considered. Additionally, the Massachusetts study noted a negative non-energy impact of warm-up time associated with CFLs. The warm-up time negative impact may be absent or reduced for LED lamps.

The use of a $3 per lamp value is a relatively straight-forward approach to valuing non-energy impacts of CFL or other high efficacy lamps. However, some discounting may be warranted based on further findings from the balance of the literature review. At a minimum, Tetra Tech recommends discounting the $3 per lamp value by the assumptions used in the RTF for storage, take-back and removal used for Retail and Give-away lamps. The total discount multiplier for these factors is 0.7448. Applied against a $3 per lamp value, the resulting non-energy impact associated with the impacts identified in the Massachusetts study would be $2.23.

A.2.2 New York State Energy Research and Development Authority (NYSERDA)

In 2006, NYSERDA published a study of non-energy impacts that included an analysis of ENERGY STAR® CFLs (NYSERDA, 2006). The report identified non-energy impacts for CFLs and was a key resource used in the Massachusetts study. The NYSERDA findings were based on a relatively small sample of CFL owners and non-owners, but point to key positive and negative non-energy impacts.

Of the CFL owners, identified non-energy impacts directly related to the use of the lamps and included:

- Extended life of CFL lamps over incandescent lamps
- Some respondents felt that the light quality was better with CFLs, while a similar number felt the light quality was worse than incandescent lamps
- Warm-up time or a delay in the time for the lamp to turn on was noted by a small number of respondents

Most CFL owning respondents mentioned an overall positive experience using CFLs. The CFL owners, on average, identified net positive non-energy impacts worth 60 percent of the energy savings. These respondents also indicated that NEIs were a factor in their purchase decision.

The NYSERDA report also presented the findings of a conjoint analysis that queried CFL owners and non-owners regarding their willingness-to-pay for various lighting attributes. These attributes included a longer lamp life, turn on delays, warm up delays, and generated heat (generated heat is an energy related impact). Removing the effect of the heat generating consideration, respondents indicated a willingness-to-pay net value of $2.96 per lamp (net includes the positive and negative impacts). Extended lamp life was given the highest value. Interestingly, those that did not use CFLs indicated a greater willingness to pay ($5.49) than the CFL owners ($1.37) for lifetime non-energy related impacts (lamp life was considered four years in the study). Both values are substantial; though indicate that CFL owners with experience may place lower value of the actual non-energy impacts compared to those discussing the influence at a theoretical level.

The NYSERDA study aligns with the Massachusetts study in terms of the scale of non-energy impacts. Were IPC to use the NYSERDA findings, a value of $2.96 may be appropriate (very close to the $3 in the Massachusetts study). However, some caution may be warranted as the market share of CFLs is growing and experienced CFL users indicated a lower value for the non-energy impacts. An adjustment could be made to account for the market share of CFLs based on the level of prior experience purchasers had with CFLs. However, doing so would require market

research to arrive at a reasonable share of inexperienced and experienced users of CFLs. Alternatively, using the lower value ($1.37) would capture non-energy impacts, but miss the effect of non-electric fuel impacts.

A.2.3 California

The California Public Utilities Commission (CPUC, 2012) identified several approaches that four states take to quantify NEBs. The CPUC notes that it is common for water and fuel savings to be included as part of the benefits of a TRC test. The CPUC found that Colorado, Iowa, Washington, and Oregon use a 10 percent adder to TRC benefits. Maine uses "all quantifiable non-energy benefits" including "deferred replacement costs." (CPUC, p. 5). Massachusetts considers the cost of complying with foreseeable environmental regulations. The identified approaches are diverse, but the simplified approach used by Colorado, Iowa, Washington, and Oregon allows for some inclusion of NEBs, though at a level lower than other research has found.

For IPC, a 10 percent adder to the Energy Efficient Lighting program energy benefits is one solution relatively simple to implement. However, as the Massachusetts and NYSERDA research shows, NEBs may be higher than the energy savings. Additionally, the Maine approach to considering deferred replacement costs, suggests that IPC may want to consider avoided additional incandescent lamp purchase costs if not done already.

A.2.4 Regional Technical Forum

Tetra Tech reviewed the RTF's Residential Lighting CFL savings workbook. The RTF workbook presents several considerations that IPC may want to contemplate for utilizing NEIs.

Depending on the lamp type, the RTF includes a present value of avoided periodic replacement costs associated with each lamp type. For general purpose CFLs distributed via retail sales, those values range from $1.20 to $6.70 per lamp or $0.19 to $0.51 per annual kilowatt-hour (kWh) of savings. These values avoided capital cost factors well exceed the energy savings value, suggesting that this avoided NEI is significant. The avoided capital cost factor metric presented in the RTF workbook appears similar to that used in Maine to account for deferred replacement costs.

Another area of NEIs identified in the RTF workbook relates to fuel cost implications. The RTF savings include heating, ventilating, and air conditioning (HVAC) impacts related to heating and cooling. However, those effects are only directly quantified for CFLs in terms of electricity impacts. The reduced heat production from CFLs reduces air-conditioner electricity use, but increases the heat load on a home's heating system (a negative energy impact). The RTF electricity savings account for the market share of electricity based heating. Natural gas and non-utility fuel consumption could be expected to increase due to heating load increases. Natural gas is estimated to have a 45 percent market share of the heating market in the Pacific Northwest, while other fossil fuel and wood make up an additional eight percent of the residential space heating market. The RTF workbook does present therm loss effects for each lamp type in

supporting worksheets.[4] The per lamp values for general purpose lamps range from -0.04 to -0.11 therms per year.

The RTF NEI metrics show a substantially positive impact. Avoided periodic capital replacement costs substantially exceed the likely value of increased therm usage. Should IPC decide to utilize the RTF values for NEIs, there will be a need to convert the therm value to dollars and apply an adjustment based on market share to avoid double counting the lost heat value already accounted for in the measure electricity savings.

A.3 RECOMMENDATIONS

Based on the literature review and a review of the RTF's Residential Lighting CFL savings workbook, Tetra Tech makes the following recommendations regarding applying NEIs to the Energy Efficient Lighting program.

Consider utilizing a value of $1.00 to $2.25 per lamp to account for NEI associated with CFLs distributed through the retail sales or give-away mechanisms. The lower end of the range is based on the New York study and accounts for the NEIs associated with experienced CFL users, but also discounted by the RTF's sales discounting assumptions and an approximate penalty for slightly increasing heating fuel use. The upper value is based on the Massachusetts study of $3 and discounted for the RTF's sales assumptions. The primary driver of the NEI value is longer lamp life and may also be appropriate to consider for LEDs. At a minimum, using a 10 percent adder to energy benefits would be a conservative approach and in-line with several states, though likely understates NEIs stemming from the program.

Work with the RTF to refine region-wide NEIs. A regional perspective on NEIs and research would likely be a more efficient approach than for IPC to develop and fund its own research into NEIs. Further, such an approach may allow for direct inclusion with the RTF savings workbooks and allow for a menu approach to select which NEIs to consider.

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Tetra Tech and NMR. *Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation*. August 15, 2011.

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Malone, Erin. *Driving Efficiency with Non-Energy Benefits*. Presentation given at the ACEEE National Symposium on Market Transformation. April 1, 2014.

[4] The MeasureAssembly worksheets, column BI, contain this value. For each lamp distribution method there is MeasureAssembly worksheet.

Regional Technical Forum. *Residential: Lighting - CFLs Measure Workbook.* http://rtf.nwcouncil.org/measures/measure.asp?id=141

Process Evaluation of the Home Energy Audit Program

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with

Final Report

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Executive Summary

Idaho Power Company (IPC) offers eligible customers the opportunity to participate in the Home Energy Audit Program. The program was expanded from a pilot of the Boise City Home Audit Project in 2011 and 2012 to a full program in 2014. This program combines a professional in-home energy audit with the installation of a variety of energy savings measures for IPC customers with all-electric, site-built homes located in Idaho.

This report summarizes the findings from a comprehensive process evaluation of the program completed by the Johnson Consulting Group team. The process evaluation gathered data from a variety of sources, including reviews of program materials, the program database, and in-depth interviews with key staff and participating contractors from June through September 2014.

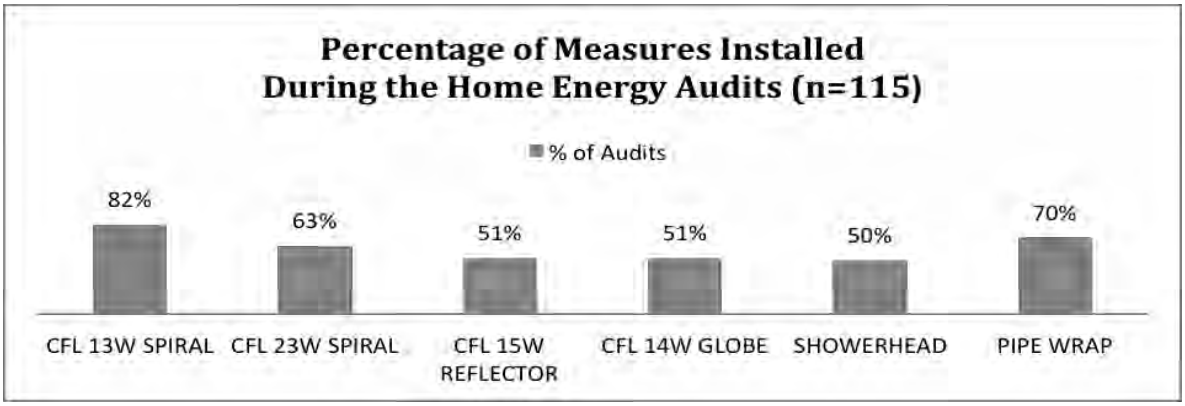
Key Findings

Overall, IPC's Home Energy Audit Program is well designed and well run. This overall conclusion is supported by the following findings from the process evaluation activities:

The program design leveraged the "lessons learned" from the Boise City Audit Project that has contributed to its successful program roll out in its first year.

The Home Energy Audit Program incorporates most of the marketing best practices that have shown to be effective in promoting weatherization, energy audits, and "whole house" program approaches (Johnson & Ambach 2014, p. 30).

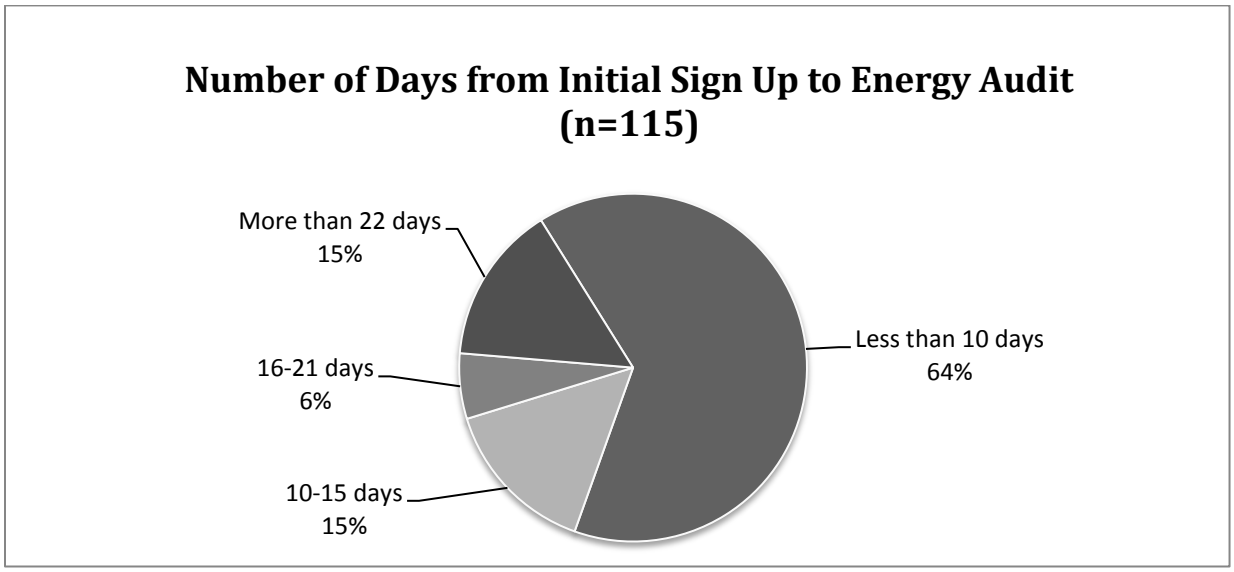
The seven participating contractors installed a total of 1,747 measures during the energy audits from March through July 2014. Most of these were lighting measures as Figure E-1 shows.



(Source: PY2014 Home Energy Audit Database)
Figure E-1: Percentage of Measures installed During the Home Energy Audits

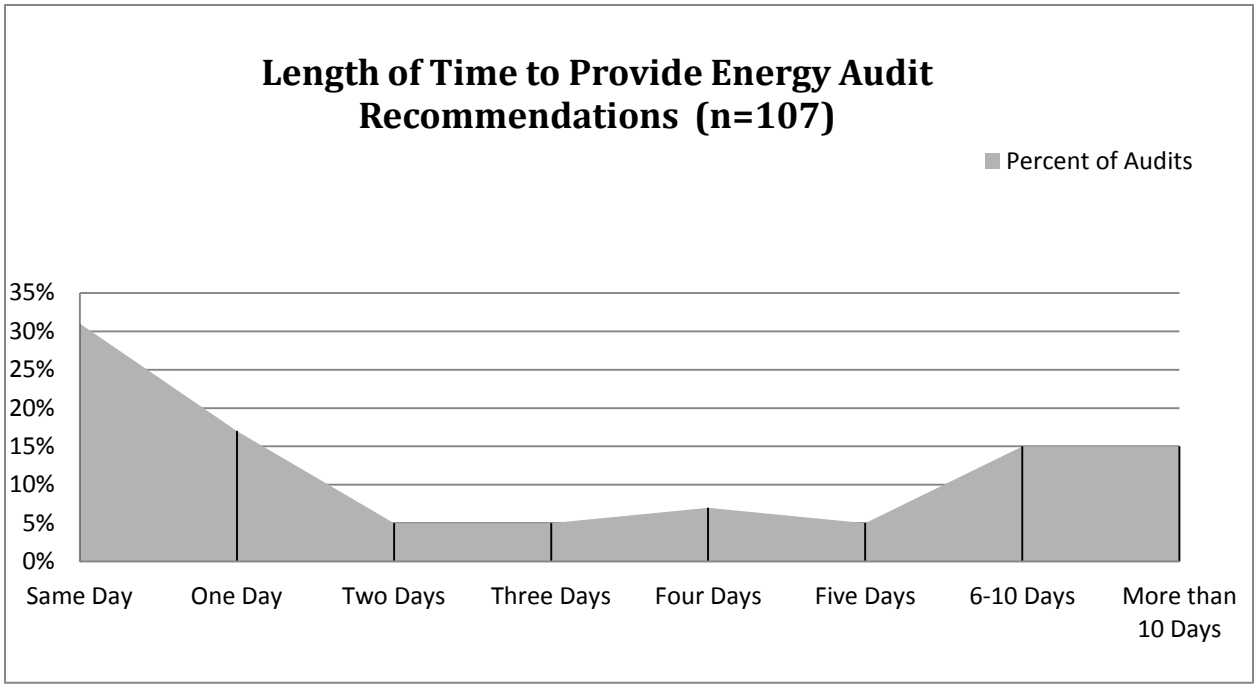
Customer and contractor feedback is positive based on the findings from the in-depth interviews.

The program participation process is quick and easy. As Figure E-2 shows, two-thirds of all audits (64%) are scheduled within 10 days of the customer's initial sign up and 85 percent of all audits are scheduled within three weeks of the initial customer contact.



(Source: PY2014 Home Energy Audit Database)
Figure E-2: Number of Days From Initial Sign Up to Energy Audit

The participating contractors are also prompt in providing the recommendations to the program participants. One-third of the recommendations are provided to the customer the same day as the audit (31%) while more than 50 percent are provided in three days or less (see Figure E-3).



(Source: PY2014 Home Energy Audit Database)
Figure E-3: Length of Time to Provide Energy Audit Recommendations

The participating contractors provided a total of 243 recommended changes and energy efficiency upgrades to the 107 participating customers. However, the evaluators identified some concerns regarding the quality and professionalism of some of the recommendations offered by the auditors.

Currently the program has no process in place to follow up on the energy auditors' recommendations. The literature review of best practices found that several programs are now requiring that contractors follow up on the status of program recommendations within a timely manner following the initial energy audit *(*Nowak, Kushler et al., 2013, pp. 109-112, 123-126; Fuller 2009, cited in Johnson & Ambach 2014, p. 26).

Recommendations

Based on these findings, IPC should consider implementing the following recommendations as a way to enhance overall program operations:

Reconsider the program name since the term "audit" may have negative connotations. Many weatherization programs are replacing the word *"audit"* in their program name to more positive sounding descriptions, such as *home energy solutions, home energy assessments*, or *energy savers program.*

Review the current measure mix to make sure it is still cost-effective and appropriate. Based on the review of industry best practices and customer feedback, IPC should also consider replacing CFLs with LEDs, as these lights are more in tune with changing market conditions (Johnson & Ambach 2014, p. 14). In addition, IPC should consider increasing the size of the pipe wrap, as some contractors reported difficulties in installing it in certain homes.

Conduct a formal customer survey to assess satisfaction levels and to identify barriers preventing customer follow-through on the auditor recommendations. A more formal survey of previous program participants in future process evaluations would provide additional insight into program operations and how to encourage customer follow-through.

Develop a protocol or procedure for reaching out to customers and encouraging them to follow up on the energy efficiency recommendations. This recommendation, based on industry best practices and energy auditor concerns, may lead to participant spillover that will increase overall program cost-effectiveness.

Establish stricter standards and guidelines regarding the energy efficiency recommendations provided to program participants. IPC should consider developing templates to ensure that all recommendations are presented in a similar manner. IPC should also clarify its policy regarding recommendations for fuel switching.

Provide additional education about program guidelines and software capabilities to the energy auditors. The in-depth interviews with the energy auditors identified several areas where these contractors are not fully aware of the program guidelines or requirements. For example, several contractors were not aware that IPC does allow the contractors to follow up directly with customers post-audit.

Reevaluate the role of the energy auditors in the current program. IPC should revisit the current audit fee paid to contractors to determine if it is consistent with market practices. As an alternative to raising the fee, IPC should make it clear to the contractors that they are allowed to follow up directly with customers post-audit as a way to compensate for the lower audit fee.

Overall, IPC's Home Energy Audit Program is well designed and well run. Implementing these recommendations will ensure that the program continues to reflect industry best practices and adapt to the changing market conditions and baselines.

1 Introduction

Idaho Power Company (IPC) offers eligible customers the opportunity to participate in the Home Energy Audit Program. The program was expanded from a pilot of the Boise City Home Audit Project in 2011 and 2012 to a full program in 2014. This program combines a professional in-home audit with the installation of a variety of energy savings measures for IPC customers with all-electric, site-built homes in Idaho.

This report summarizes the findings from a comprehensive process evaluation of the Home Energy Audit Program completed by the Johnson Consulting Group team. The process evaluation gathered primary data from a variety of sources, including reviews of program materials, a review of the program database, and conducting in-depth interviews with key staff and stakeholders from June through August 2014. These primary data activities were supplemented with a secondary literature review of best practices for weatherization programs.

This report begins with an overview of the Home Energy Audit Program and a general discussion of the process evaluation methodologies used. The key findings from the process evaluation are summarized in Section 2. A program flow diagram is provided in Section 3 and key findings and recommendations are provided in Section 4.

1.1 Home Energy Audit Program Overview

To qualify for this program, participants must live in Idaho and be an Idaho Power customer of record for the home. The home must be an existing all-electric, site-built home. Renters may participate with prior-written landlord permission. Single-family homes, duplexes, triplexes and fourplexes qualify. Manufactured homes, new construction, or buildings with more than four units do not qualify. Multifamily homes heated by a central heating unit or that aren't separately metered are not eligible.

Participating customers pay $99 for the audit and installation of measures at the time of the audit, with the remaining costs covered by the Home Energy Audit program. The cost of the materials installed at each home as part of the initial audit is approximately $84.

Customers may sign up for an audit online or by contacting the program specialist at IPC. Program participants receive an energy audit including a personalized, written report with recommendations and information on other programs that could assist them with the costs of implementing additional measures. This information is either emailed or sent via letter to the customer within a few days of completing the energy audit (Home Energy Audit Program Specialist Handbook, 7-29-2014, pp. 4).

The Home Energy Audit includes a blower door test and installation of select low-cost energy-saving measures. The measures for each home include the installation of up to 20 Compact Fluorescent Lamps (CFLs), the insulation of water pipes that are three feet or less between the water heater and the home, and the installation of one high-efficiency showerhead. The auditor also provides information about energy efficiency tips and information about other IPC programs in the *Leave Behind Packet.*

Seven qualified energy auditors currently deliver the program across IPC's territory, which are summarized in Table 1.

Table 1: Home Energy Audit Program's Contractors

Regional Contractor	Locations Served
The Energy Auditor	Eastern Region
H.E.E.T.	Eastern Region
Savings Around Power	Eastern Region
Home Energy Management	Southern Region
Affordable Energy Improvements	Western, Canyon & Capital Regions
On Point	Western, Canyon & Capital Regions
Energy Zone	Western, Canyon & Capital Regions

(Sources: Home Energy Auditor Handbook, 7-29-2014, p. 10, Home Energy Audit Program Database, 7-29-2014)

1.2 Process Evaluation Methodology

Process evaluations focus on ways to improve overall program operations by reviewing critical documents, program databases, and customer contact and follow-up procedures. Process evaluations also include feedback mechanisms from the key groups, usually from in-depth interviews with key program staff, program implementers, and interviews with participating customers.

Table 2 summarizes the process evaluation activities Johnson Consulting Group team members completed as part of this process evaluation. Of note, this process evaluation did not include customer surveys; however, surveys with program participants should be included in future process evaluations in order to more fully assess the participant experience.

Table 2: Comparison of Process Evaluation Objectives to Completed Process Evaluation Methodologies

Process Evaluation Objective	Task 2.1 Review Program Materials	Task 2.2 Review Program Database	Task 2.3 Conduct In-Depth Interviews	Task 2.4 Develop Program Flow Diagram
Program Design (e.g. mission, logic, use of best practices)	✔	✔	✔	✔
Program Implementation (e.g., quality control, operational practice, marketing and outreach)	✔	✔	✔	✔
Customer Education	✔		✔	
Program Administration (e.g., oversight, staffing, management, training, documentation and reporting)	✔	✔	✔	✔
Contractor Satisfaction			✔	
Recommendations for Program Improvement	✔	✔	✔	✔

The Home Energy Audit Program process evaluation addressed the following critical research questions, as summarized in Table 3.

Table 3: Summary of Key Research Questions

Research Area	Key Research Questions
Specific Program Characteristics	What are the installation rates for each measure? What are the installation rates by contractor and region?
Effectiveness of Program Operations & Delivery	What is the average time from initial application to project completion for each program? Has this changed since program launch? Is the program performing as expected based on the perceptions from the staff? What is the feedback from the participating contractors regarding program operations?
Effectiveness of Marketing and Outreach Activities	Which marketing and outreach activities are the most effective? Which ones are least effective? How can these materials and outreach activities be improved?
Participant Decision-Making Process	Please describe the participation process. Why do program participants decide to participate?
Barriers to Program Participation	What are the barriers to program participation? What has been the effect of program changes on reducing identified barriers?
Areas for Area Program Improvement	How can IPC staff improve its programs, in terms of design and delivery? What other types of offerings or delivery strategies should IPC consider?

2 Process Evaluation Key Findings

This section summarizes the key findings from the process evaluation activities which included completing the following primary data research activities: review of program materials, review of the program database, and conducting in-depth interviews with key staff, and contractors involved in program implementation. Where appropriate, the findings from the literature review of weatherization programs[1] best practices are included in this review to illustrate additional best practices that IPC should consider, as appropriate.

2.1 Review of Program Materials

The team reviewed the following materials received from IPC staff:

- Direct Mail Letter
- Customer Enrollment into Account Manager
- Home Energy Auditor Program Handbook (2-20-14 and 7-29-14 versions)
- Copies of advertising materials

IPC provides additional information on the website www.idahopower.com/HomeEnergyAudit and encourages customers to also enroll in Account Manager which provides access to their energy usage information (Home Energy Auditor Program Handbook, 2-20-2014 version, p. 10).

The *Direct Mail letter*, which is sent to eligible customers, provides a clear description of the services provided, identifies the benefits associated with enrolling in the program, and provides a clear call to action.

The Home Energy Audit Program Handbook provides most of the information necessary for a contractor to fully understand the program, the enrollment process, and other pertinent details. However, the 2-20-2014 version of this Handbook is being used for current program operations, while the 7-29-2014 version is being updated to include additional details about the current program year's activities. In making these changes however, it will be important to include the relevant program information, contact information, and contactor performance expectations in the revised Program Handbook.

The Home Energy Audit Program includes several marketing pieces. The first piece (see Figure1) focuses on promoting the benefits of making specific energy efficiency improvements, and the costs of specific energy efficiency improvements are compared against the magnitude of the expected energy savings. The messaging is clear and informative. As Table 4 shows, the Home Energy Audit Program is already incorporating most of the target marketing best practices that have shown to be effective in promoting

[1] Note that the literature review of weatherization best practices included reviewing a full range of energy efficiency delivery models from simple audit and direct install programs, like IPC's Home Energy Program to more comprehensive programs that include both repairs and installation of energy efficiency measures.

weatherization, energy audit, and "whole house" program approaches (Johnson & Ambach 2014, p. 30).

Table 4: Summary of Target Marketing Best Practices Incorporated in IPC's Home Energy Audit Program

Target Marketing Best Practices for Weatherization Programs	IPC's Home Energy Audit Program
Use multiple marketing outreach delivery strategies	✔
Sell something people want	✔
Meet customer needs	✔
Avoid energy jargon	✔
One touch is not enough	NA
Engage the wider community	NA
Encourage customer follow up	✔
Provide customer educational materials	✔

(Source: Modified from Johnson & Ambach 2014, p. 30)

For example, the target marketing approach used by IPC to reach eligible customers via direct mail is consistent with other strategies used by some of the most successful weatherization programs in the United States. The literature review found that some utilities have been successful using customer energy usage data to determine which customers are high energy users and thus target these *high energy users* for program outreach (Johnson & Ambach 2014, p. 23) which is consistent with IPC's approach.

In addition, IPC's strategy to provide information about the Home Energy Audit Program is also consistent with the need to rely on multiple media strategies to recruit program participants (Johnson & Ambach 2014, p. 23).

The Home Energy Audit Program's messaging highlights the potential ways to lower energy costs in a clear and compelling manner consistent with industry best practices. The literature review of weatherization program best practices indicates that saving energy is a higher motivator for making energy efficiency improvements than lowering heating bills or having a more comfortable home, and the lowest motivating factor is to increase the overall value of their home (Peters, 2011 cited in Johnson & Ambach 2014, p. 24).

Another critical best practice is not to rely on "energy jargon" but rather use language that is constructive to earn trust and to avoid turnoffs with customers. The literature review identified the following terms that are preferred when promoting weatherization-related energy efficiency programs:

- *"Improvements," "home improvements,"* and *"home efficiency improvements*" are recommended while *"retrofit"* and *"remodel"* are discouraged because of their suggestion of a more extensive project consuming significant time and money (Johnson & Ambach 2014, pp. 25-26).

- *"Home energy assessment"* suggests opportunity while *"audit"* foreshadows scrutiny of one's worth as a homeowner.

- *"Home"* is warmer than *"residence."* (Johnson & Ambach 2014, p. 26).

IPC incorporates most of these recommendations, with the exception of using the term *"audit"* as part of its program name. Given the potential negative connotation associated with the word "*audit,"* renaming the program may make it more appealing to customers going forward.

Given the participation limits for this program, it is not appropriate for IPC to create a broad awareness campaign or engage in community-wide marketing at this stage. However, if this program is expanded in the future, it may be wise to revisit these two marketing best practices.

Encouraging customer follow-up, specifically regarding implementing the proposed recommendations, is a critical element to successful program implementation. While IPC 's marketing material in Figure 1 provides an excellent summary of the types of benefits offered to customers in an easy to read format, it is currently the only form of customer follow-up used by the program.

To address the challenges associated with customer follow-up, several energy efficiency weatherization[2] programs require that contractors follow up on the status of program recommendations within a timely manner following the initial energy audit (Nowak, Kushler et al., 2013, pp. 109-112, 123-126; Fuller 2009, cited in Johnson & Ambach 2014, p. 26). Therefore, IPC should encourage contractors to follow up on their recommendations with customers. IPC staff should also follow up with participating customers as a way to enhance overall customer savings.

Of note, the Home Energy Audit Program does include customer education as part of the energy audit. Its *Leave Behind Packet* includes both tips on ways to save energy as well as links to other IPC programs (see Figure 2). This is consistent with the Literature Review of Best Practices which found that offering program participants low cost/no cost savings ideas and seasonal tips such as in the form of a calendar, is an effective customer educational strategy (Johnson & Ambach 2014, p. 28).

[2] The Home Energy Audit Program model includes elements of weatherization programs such as an audit and direct install of several low-cost energy savings measures. However, it is not a comprehensive weatherization program that includes a wider range of energy efficient equipment installations and building repairs.

IDAHO POWER
An IDACORP Company

Best Value
for Your Dollar

Many factors weigh into home improvement decisions, including changing lifestyles, comfort, appearance and money.

You may be surprised, however, to find that some small and modest upgrades to your home can provide more energy savings than other, more costly improvements. Compare your home's features to those identified in the chart below to find out where to invest your dollars and get the biggest bang for your buck.

Elements of an **Energy Smart** *Home*

Features are listed in priority order based on expected energy savings

ENERGY SAVINGS: Higher → Lower

	Cost of the upgrade				
	No	Low	Med	Med-Hi	High
Minimum insulation levels: attic R-38 or R-49 depending on climate zone, walls R-19, floors above crawl space R-30*			$		
HVAC systems that meet current ENERGY STAR® standard					$
Ducts insulated and sealed with mastic		$			
Minimal air leakage (openings in walls, floors and ceilings weatherstripped and sealed)		$			
Water heater temperature set at 120 degrees	$				
Exhaust fans working		$			
Low flow, aerating showerheads		$			
Energy efficient light bulbs and fixtures throughout		$			
ENERGY STAR appliances and electronics with powersave settings enabled				$	
Programmable thermostat with ENERGY STAR recommended set points (heat pumps need heat pump thermostat)		$			
Timers installed on block heaters, stock tank heaters, landscape pumps and lighting		$			
Windows with a U-Factor of .30 or less					$
Insulated exterior doors			$		

*Most contractors will assess your insulation levels for free. We recommend getting three bids if work needs to be done.

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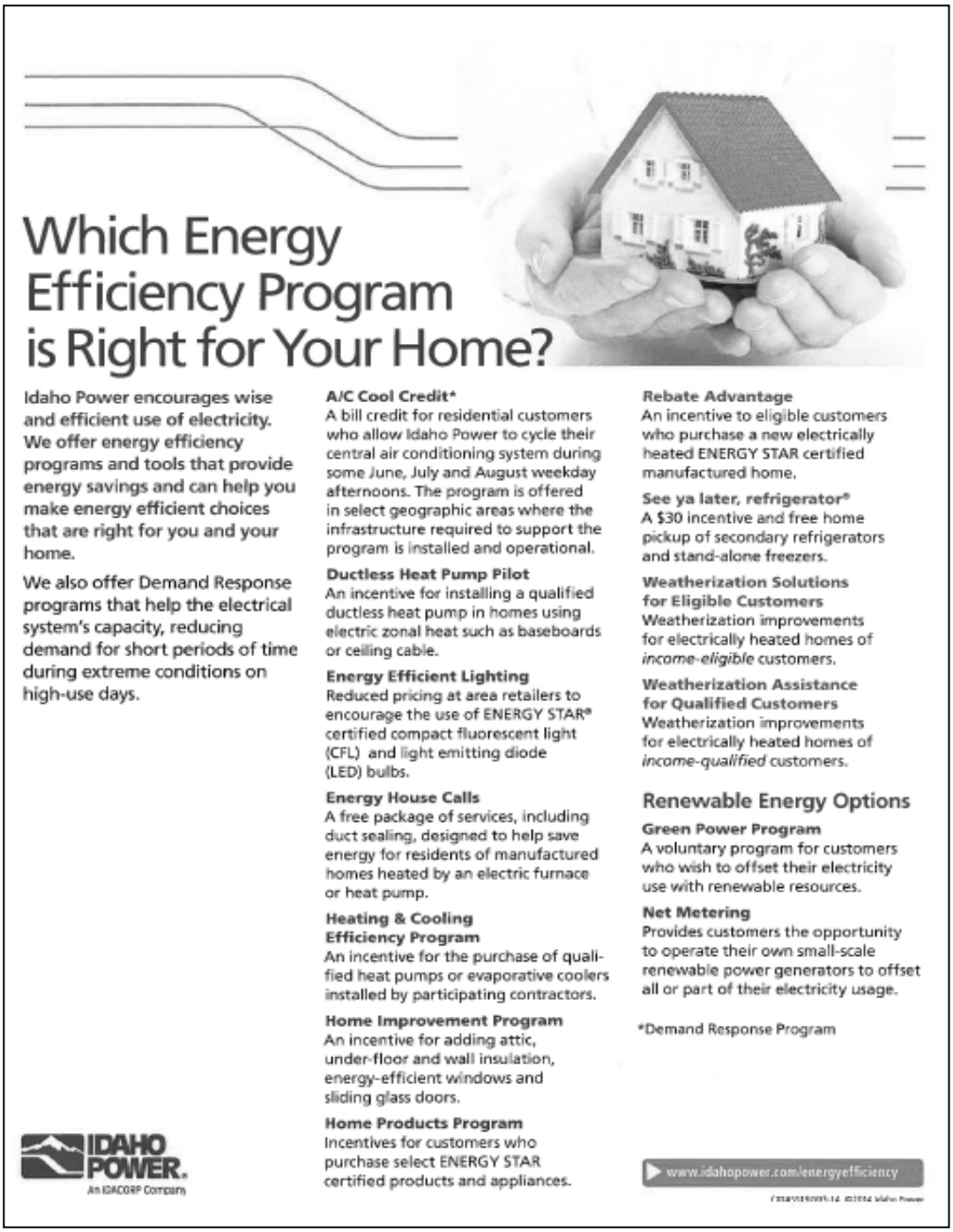
Figure 1: Home Energy Audit Marketing Piece



Which Energy Efficiency Program is Right for Your Home?

Idaho Power encourages wise and efficient use of electricity. We offer energy efficiency programs and tools that provide energy savings and can help you make energy efficient choices that are right for you and your home.

We also offer Demand Response programs that help the electrical system's capacity, reducing demand for short periods of time during extreme conditions on high-use days.

A/C Cool Credit*
A bill credit for residential customers who allow Idaho Power to cycle their central air conditioning system during some June, July and August weekday afternoons. The program is offered in select geographic areas where the infrastructure required to support the program is installed and operational.

Ductless Heat Pump Pilot
An incentive for installing a qualified ductless heat pump in homes using electric zonal heat such as baseboards or ceiling cable.

Energy Efficient Lighting
Reduced pricing at area retailers to encourage the use of ENERGY STAR® certified compact fluorescent light (CFL) and light emitting diode (LED) bulbs.

Energy House Calls
A free package of services, including duct sealing, designed to help save energy for residents of manufactured homes heated by an electric furnace or heat pump.

Heating & Cooling Efficiency Program
An incentive for the purchase of qualified heat pumps or evaporative coolers installed by participating contractors.

Home Improvement Program
An incentive for adding attic, under-floor and wall insulation, energy-efficient windows and sliding glass doors.

Home Products Program
Incentives for customers who purchase select ENERGY STAR certified products and appliances.

Rebate Advantage
An incentive to eligible customers who purchase a new electrically heated ENERGY STAR certified manufactured home.

See ya later, refrigerator*
A $30 incentive and free home pickup of secondary refrigerators and stand-alone freezers.

Weatherization Solutions for Eligible Customers
Weatherization improvements for electrically heated homes of *income-eligible* customers.

Weatherization Assistance for Qualified Customers
Weatherization improvements for electrically heated homes of *income-qualified* customers.

Renewable Energy Options

Green Power Program
A voluntary program for customers who wish to offset their electricity use with renewable resources.

Net Metering
Provides customers the opportunity to operate their own small-scale renewable power generators to offset all or part of their electricity usage.

*Demand Response Program

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Figure 2: Additional Programs Marketing Piece

2.2 Review of Program Tracking Database

As part of the process evaluation, the Johnson Consulting Group team also reviewed the program database that tracked the number of audits completed from March through July 2014. This section summarizes the key findings from this review.

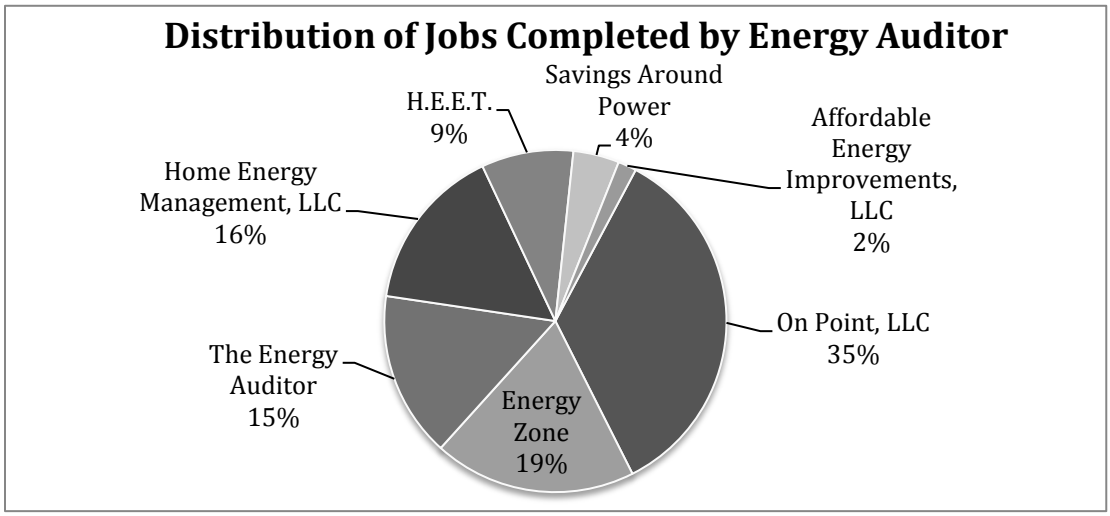
Number of Audits

According to the program database, the seven participating contractors completed a total of 115 audits from March and July 2014. As Table 5 and Figure 3 illustrate, On Point completed approximately one-third of the audits during this time period (i.e., 35%) while the other contractors accounted for less than 20 percent each. Affordable Energy Improvements and Savings Around Power completed the fewest number of audits (i.e., 4% and 2% respectively) during this time period.

Table 5: Distribution of Completed Audits by Organization

Auditor	Number of Jobs Completed
On Point	40
Energy Zone	22
The Energy Auditor	18
Home Energy Management	18
H.E.E.T.	10
Savings Around Power	5
Affordable Energy Improvements	2
Total	**115**

(Source: PY2014 Home Energy Audit Database)



(Source: PY2014 Home Energy Audit Database)
Figure 3: Percentage of Completed Audits by Organization

The energy audits were completed in 32 cities across the state, with the following locations receiving the highest percentage of audits during this evaluation period. The participating contractors completed five or less audits in the other 26 cities, according to the program database.

Table 6: Top Six Locations Receiving Home Energy Audits

City	Number of Audits	% of Total
Salmon	11	10%
Emmett	9	8%
Fruitland	9	8%
Donnelly	7	6%
Blackfoot	6	5%
Gooding	6	5%

(Source: PY2014 Home Energy Audit Database)

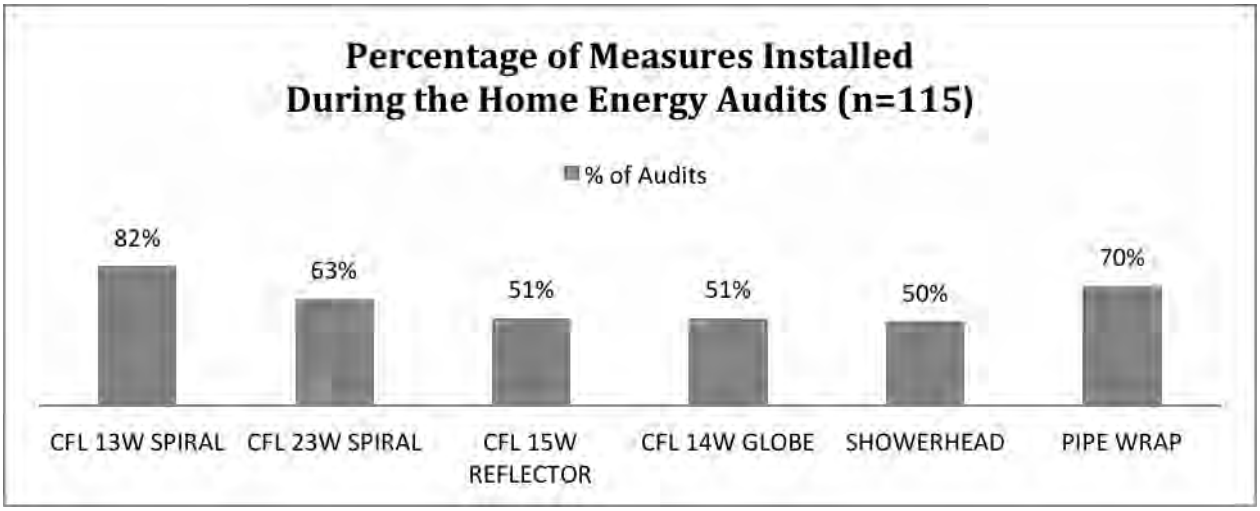
Types of Measures Installed

The seven participating contractors installed a total of 1,747 measures during the energy audits from March through July 2014. Of these measures, not surprisingly CFLs accounted for the majority of all installations (91%). Furthermore, the CFL 13W Spiral Bulbs accounted for 70 percent of all light bulbs and were installed in 94 of the 115 (82%) of all homes audited during this time period (see Table 7 and Figure 4).

Table 7: Distribution of Measures installed During the Home Energy Audits

Audit Measures Installed	Number of Installed Measures	Number of Unique Installations	Average Number Installed
CFL 13W SPIRAL	1,125	94	10.22
CFL 23W SPIRAL	163	72	1.58
CFL 15W REFLECTOR	133	59	1.37
CFL 14W GLOBE	180	59	1.85
SHOWERHEAD	59	57	0.62
PIPE WRAP	87	81	NA
Total	1,747	115	

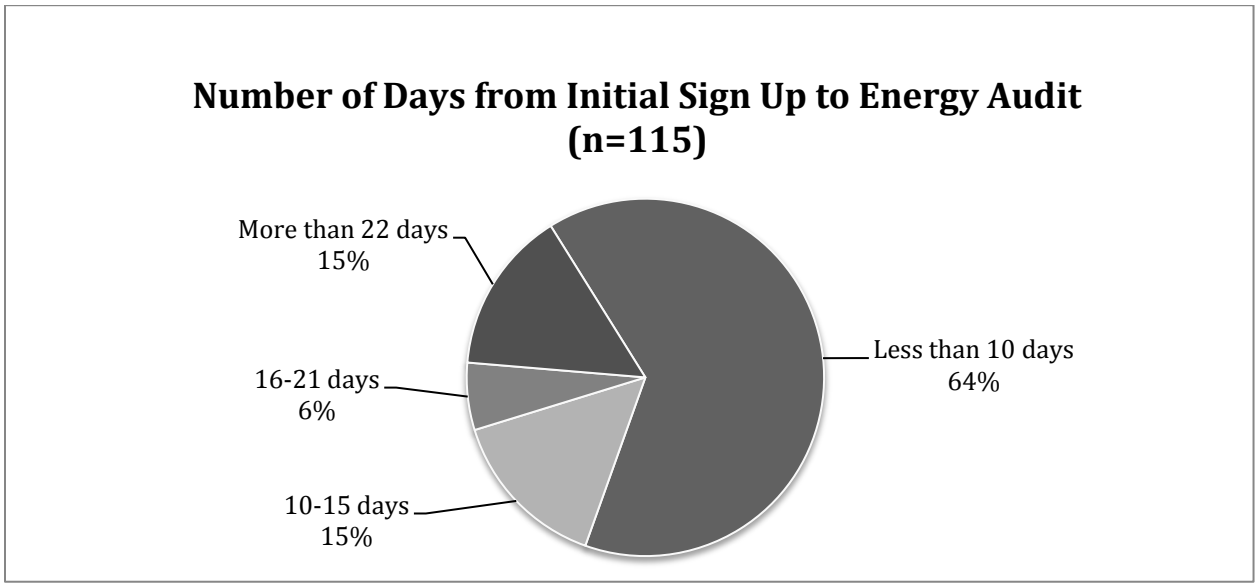
(Source: PY2014 Home Energy Audit Database)



(Source: PY2014 Home Energy Audit Database)
Figure 4: Percentage of Measures installed During the Home Energy Audits

Processing Time

The database review found that the waiting time for interested participants is minimal. As Figure 5 shows, two-thirds of all audits (64%) are scheduled within 10 days of the customer's initial sign up and 85 percent of all audits are scheduled within three weeks of the initial customer contact.



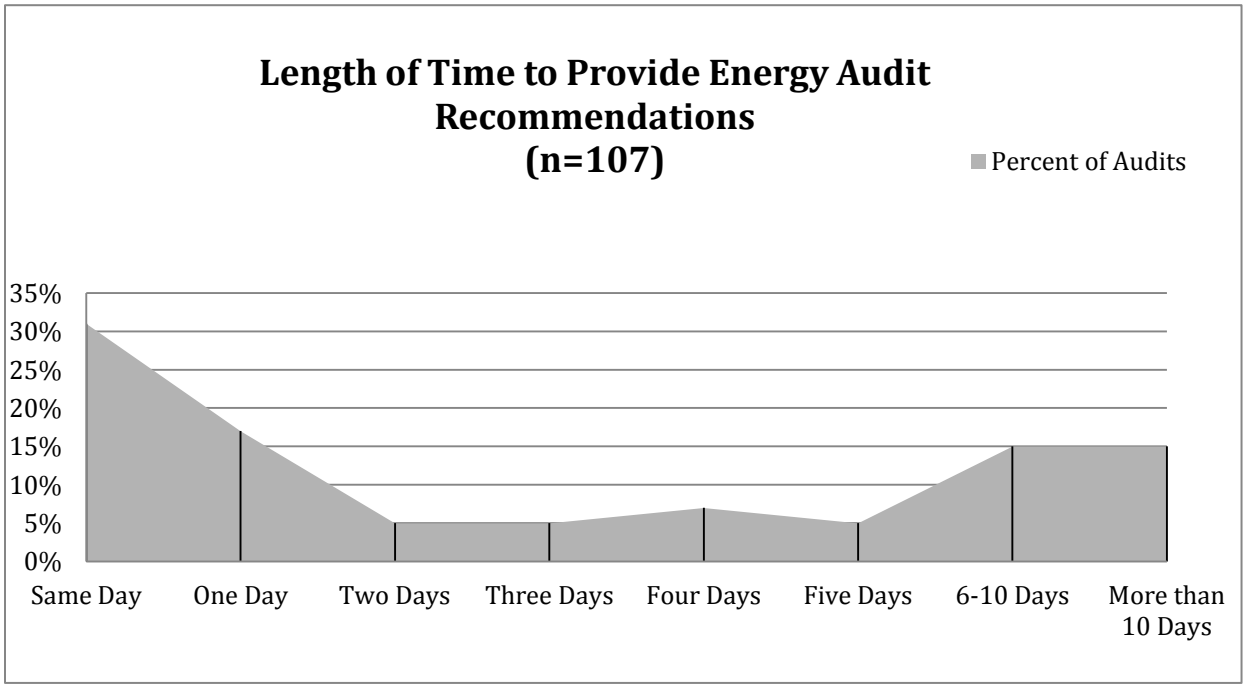
(Source: PY2014 Home Energy Audit Database)
Figure 5: Number of Days From Initial Sign Up to Energy Audit

The participating contractors are also prompt in providing the recommendations to the program participants. As Table 8 shows, one-third of the recommendations are provided to the customer the same day as the audit (31%) while more than 50 percent are provided in three days or less (see Figure 6).

Table 8: Length of Time from Initial Energy Audit to Recommendations

Length of Time to Provide Recommendations	Number of Audits	Percent of Audits	Cumulative Percentage
Same Day	36	31%	31%
One Day	19	17%	48%
Two Days	6	5%	53%
Three Days	6	5%	58%
Four Days	8	7%	65%
Five Days	6	5%	70%
6-10 Days	17	15%	85%
More than 10 Days	17	15%	100%
Total	108	100%	

(Source: PY2014 Home Energy Audit Database)

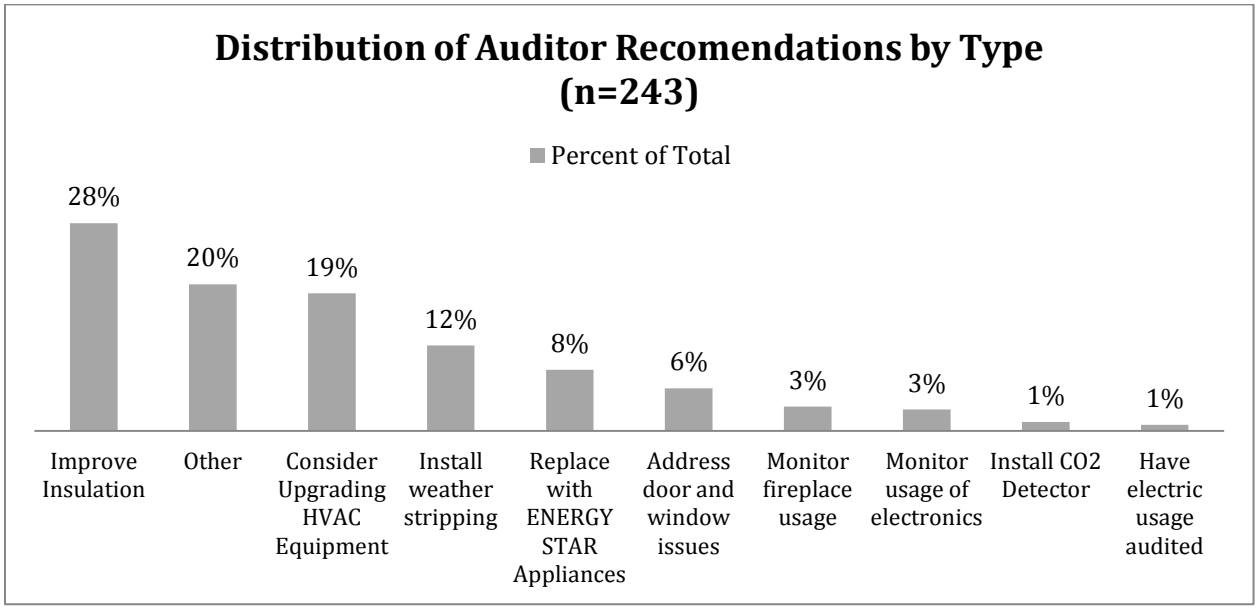


(Source: PY2014 Home Energy Audit Database)
Figure 6: Length of Time to Provide Energy Audit Recommendations

2.3 Auditor Recommendations

As part of the energy audit, the contractors provided individual recommendations to participants regarding ways to improve their homes' energy efficiency. The program database recorded recommendations for 107 of the 115 energy audits completed during this time frame.

The participating contractors made a total of 243 recommended changes and upgrades to the 107 participating customers. Most recommendations focused on increasing insulation levels (64%). Nearly half (42%) of homes were advised to consider upgrading their HVAC equipment. Recommendations under "other" included changing can lights, switching to CFL or LED lights or adding solar shades.



(Source: PY2014 Home Energy Audit Database)
Figure 7: Distribution of Auditor Recommendations by Type

The following are examples of the types of recommendations provided by the contractors.

> *"Attic insulation should be upgraded to R-50, seal and insulate attic access lids, insulate ducts in garage. Make sure dampers on fireplace are tight and shut."*
>
> *"House is in excellent condition. You could bring the attic R- 32 value up to a R-48 insulation level and install R-30 fiberglass in the floor cavity. Mastic the ducts and replace the rusted areas of the ducts in crawler and insulate them with an R-11 duct wrap and secure with tie straps."*
>
> *"Insulation will be the lowest cost improvement in both attic and on all hot water pipes. A good heat pump though expensive, is a much-needed improvement. Also unplugging extra appliances would cut some immediate costs."*
>
> *"Secondary water heater in basement could be replaced with a tankless on demand unit for less energy for occasional hot water use. Old cable ceiling heat was found to still be active throughout most of the home determining to be the primary factor contributing to high electric consumption. Recommend disconnecting all cable ceiling heat throughout home, as backup heat is present in wood stove located in basement. Attic insulation is good but could be added to for additional R-value."*

Based on the review of the energy auditors' recommendations, it was clear that the energy auditors were polite and informative in their communications regarding energy efficiency recommendations. However, the reports from the contractors are inconsistent with several contractors specifically directing customers to the IPC website, while others did not include this information. Going forward, the reports should follow a consistent and uniform template to ensure consistency in program messaging.

> *"Your home is in good shape. The most pressing issues are the attic insulation and the equipment used to heat your home. Look at the Idaho Power website to find quality contractor that can help you with both of these issues."*
>
> *"Idaho Power has programs that can help with cost of some of the upgrades. See their website or call Idaho Power for more information. I don't think the report shows true savings of installing the mini split heat pump vs. using the window ac in the summer months, savings should be more. An HVAC contractor should be able to show true savings. Idaho power has a list of approved contractors on the website for energy improvements."*
>
> *"Idaho Power has programs to help pay for adding insulation see their website."*

A few energy auditors recommended fuel switching[3] to customers as a way to reduce energy usage, as the following findings illustrate.

> *"With gas available in the street, the home would save money by converting to gas heating and water heating … a CO alarm should be installed in home if one does not exist with gas appliances."*
>
> *"If gas is available, converting to gas would save a significant amount of money. Converting the ac to an Energy Star heat pump would also save money but in the colder months below 30 degrees the home will still have to use electric strip heat in the furnace to heat the home…"*
>
> *"Installing heat pump would save on energy costs, however days below 30 degrees home would run on electric furnace. A wood stove option would be affordable way to supplement heat in the winter months…"*
>
> *"I assumed gas is available with the new developments around the home and it would be the most affordable option for heating and cooling. If gas is not available then a mini split heat pump would work very well in this home, another option would be to add an air source heat pump to the existing electric furnace..."*

[3] Determining the appropriateness of recommending fuel switching is beyond the scope of this process evaluation. However, it is important to note that several contractors do recommend fuel switching, so it was important to record this current business practice.

> *"Gas is available so conversion to gas would give the home the best savings on home heating… Summer cooling load can be decreased by installing solar attic fan, solar is recommended over electric because of fire hazards and life span is better with the solar option, tax credits available."*

A few recommendations were clearly inappropriate in terms of recommending that the customers change the current architectural features of the home or install insulation without specifying an appropriate insulation level.

Several contractors provided too much information about the shortcomings of the current software package. While these complaints may be legitimate, including these types of statements is not appropriate for a report focusing on energy efficiency recommendations. However, the auditors did provide some suggestions on ways to compensate for these perceived deficiencies in the software.

2.4 IPC Staff Interview Summary Findings

As part of the process evaluation, the evaluator completed an in-depth interview with the current program specialist. This interview focused on program history and design, program operations, marketing and outreach, and customer feedback. The interview also identified areas for program improvement.

The current program specialist has been involved in the program since it began as a pilot in 2013 and spends about 40 percent of her time managing program operations. Her duties include program development, planning, budgeting, paying invoices, overseeing quality assurance/quality and working with the communications department on marketing and outreach activities.

The program specialist also assists customers enrolling in the program by taking their applications over the telephone.

Program History

The program design was based on the "lessons learned" from the Boise City Audit Project. IPC incorporated this feedback into the program design in 2013 and the new Home Energy Audit program was launched in February 2014.

One of the key outcomes from the Boise City Audit Program was the development of a specially designed software tool. However, the software tool required a lot of editing to the customer reports before they were sent to customers in a hard copy format. Given the labor-intensity of the audit tool, the program specialist explained that instead, IPC decided to use the CAKE software tool developed by Earth Advantage.

> *"Now have a more streamlined consistency and time savings and more professional reports."*

The IPC program also continued to offer CFLs during the audit. As the program specialist observed, customers truly valued this program feature.

> *"We did not understand how important it was to have direct install measures. The CFLs are seen as 'gold' (by the customers) and gives the auditors something physical to install (during the audit)."*

Given the importance of providing CFLs to customers, the program allows up to 20 to be installed per household.

The Home Energy Audit Program also changed the measure mix slightly to make the program more cost-effective. These changes included dropping the water heater jackets, as they were not needed for the newer water heaters.

Another major change was to ensure that the contractors' focus was on providing quality home energy audits and advice about a home's energy efficiency, rather than to market their own home improvement services or make a sale. The program specialist explained that in the Boise City Audit Program some auditors worked for HVAC contractors, so they were viewed as pushing for a sale rather than educating the customer. For the IPC program, all auditors had to be either working strictly as an energy auditor or affiliated with a weatherization program rather than being employed by a HVAC company.

Program Outreach and Marketing

The current program expanded from single-family homes to include single-family, duplex, triplex and fourplex, all-electric homes in Idaho. Most customers are recruited using direct mail targeting homes that qualify for the program.

> "*We have had some success with open houses and a direct mail letter. I was able to pull data on usage based on a code that remains on the account, so I am able to do some target marketing."*

Although the response rate has been smaller compared to Boise City Audit Pilot, averaging one to two percent compared to four percent, it is still enough to meet program participation goals.

> *"We seem to be getting in enough jobs to keep rolling it to the auditor. We are doing fine with our participation goals to complete 200 to 300 jobs for the year."*

Small direct mailings are sent to eligible customers every few weeks as a way to keep the pipeline of jobs flowing, without overwhelming the auditor's capabilities.

Program Implementation

Overall, the participation process moves quickly. Customers may enroll either online or by contacting the program specialist directly. Once the customer is enrolled in the program, the program specialist assigns the customer to an auditor via email. The auditor then calls and schedules the appointment with the customer, usually within two to three business days of receiving the email notification. The appointments are usually scheduled within two weeks of the initial inquiry, based on the homeowner's availability.

In addition, the customer also receives a follow-up letter or email confirming the appointment and explaining the scope and cost of the home energy audit. At the customer's home, the auditor collects the $99 fee and then conducts the energy audit.

As the program specialist explained, the auditor inspects insulation, status of bathroom fans, vapor barrier, condition of the ductwork and HVAC equipment, and determines if the current appliances are ENERGY STAR®. In addition, the auditor also conducts a blower door test to assess the home's air leakage condition. Before concluding, the auditor will also install CFLs, one low-flow showerhead, and pipe wrap around hot water pipes. The number of measures installed in each home will vary depending upon what the resident already has in place and the size of the residence[4].

Upon completion, the energy auditor inputs data and prepares a report, which includes the list of recommendations. This report is usually sent to the customer within three days. If the customer has provided an email address, the report is sent to them electronically. For customers who did not provide an email address, the report is emailed to the program specialist who prints and mails the report to the customer.

The report also provides the customer with additional information about other IPC programs that may be beneficial to them, including incentives for equipment and insulation upgrades.

The CAKE software program has improved the processing time for completing the auditor's recommendations since now the information can be sent in a timely manner to the customer electronically through the system instead of relying on hard copy reports.

Program Follow-Up

Currently no follow-up procedures are in place regarding the energy improvement recommendations made by the energy auditors, either by the auditors themselves, or by IPC.

[4] The number of CFLs installed in the home varies considerably and some of the larger homes may receive up to 20 CFLs while, on average, most homes receive 13 CFLs.

Home Energy Auditors

Of the seven auditing firms implementing the program, one was involved with the Boise City Home Audit Project and three are weatherization contractors who support IPC's Weatherization Solutions Program. The remaining energy auditors are independent contractors who specialize in conducting home energy audits only.

The auditors must meet the same qualification standards required for the Weatherization Solutions program. In addition, they receive training on the CAKE software and must complete all program-training requirements before beginning work.

Program Tracking and Quality Assurance/Quality Control

Through the enrollment process, the CAKE software tries to screen out ineligible homes, specifically those with gas heating or manufactured homes. But occasionally these homes do receive an audit[5].

Ten percent of the homes are Quality Assurance (QA) / Quality Control (QC) inspected and the findings are tracked in the CAKE software. While the QA/QC activities got off to a "slow start" in the beginning, there are no reported issues with the program delivery and the program specialist reported that these activities are completed in a relatively short time frame following the audit.

The program specialist is exploring ways to improve program tracking by merging the individual audit data into a master database and is investigating additional ways to improve program reporting.

Customer Feedback

The program specialist also reported positive customer feedback about both the program and the energy home auditors.

> *" Overall, we have very good feedback. The people were pretty happy. There were definitely areas for improvement, such as challenges with the enrollment process, and we are working to make the process more clear. We are trying to find better ways to get the reports to customers. We have also made it easier for customers to sign up over the phone."*

Barriers to Program Participation

The biggest barrier according to the program specialist is a lack of awareness.

> *"Most people think their houses are really efficient and don't need an audit."*

[5] The review of the energy auditors report found that at least three manufactured homes received energy audits during the past year.

Areas for Program Improvement

The program specialist indicated that the program enrollment process could also be improved.

> *"We need to continue to do refinement to make it more accessible to customers to participate and to know what to do with the information and help the customers easily take action."*

In the future, the program specialist would also like to take advantage of the additional capabilities available in the CAKE software to generate bids or provide more information to help customers follow-though on the energy efficiency recommendations.

> *"I want to make it easier for customers to find contractors."*

Another consideration would be to use the auditor's recommendations to develop targeted lists for additional direct mail follow-up and outreach.

> *"I would like this program to bridge to other programs and provide more specialized information to the customers. We are already testing the report and working with Customer Representatives who meet with the customers directly. We are trying to link the audit program back to our other IPC programs, but that has not been fully developed yet."*

2.5 Contractor Interview Summary Findings

Current Roles/Responsibilities

The program evaluation team interviewed six participating energy auditors to learn about their experiences with the program. Each has been involved with the program since its inception in April 2014. A few of them have current contracts to implement other IPC efficiency programs, or have a history of implementing other IPC programs.

Only one of them had been involved in the Boise City Home Audit Program. He believes one of the major improvements over the Boise City Home Audit Program is the CAKE software.

> *"The software makes it easier for customers to understand the benefits of energy upgrades. In the Boise pilot, they didn't know what the upgrades would cost, or how much money it would save them… this is much better than the Boise pilot; the software program really helps, the website is much better, and has many helpful tools if you can get the customers to use it."*

He also stated that he believes the program has the "*right mix of measures in place."*

Customer Recruitment

The auditors had differing opinions about the types of customers participating in the program. While one said the Home Energy Audit Program attracted customers across all income levels, others tended to believe it appealed more to higher income customers.

> *"A lot of times they are not looking for efficiency, they are really looking for comfort. But it often comes down to balancing their heating systems."*

Marketing and Outreach

The auditors commented that the direct mail piece appeared to be a good approach to generating customer interest. However, the contractors are not directly involved in program marketing outreach.

> *"I don't know how it works, but it seems successful. We get a lot of referrals, so something is working."*

Program Implementation

The actual audit and measure installation process usually takes two hours, but the auditors also spend additional time developing the follow-up recommendations.

> *"It often takes two hours plus in the home, plus travel time, which can be up to an hour or even more each way, and then I spend another 45 minutes or more entering the data and recommendations data into the computers back in the office."*

The recommended improvements are entered through the CAKE software tool.

> *"We use that software to fill out the comments fields and describe the upgrades, etc., which adds some analysis (load calculation), and the report gets sent to (the program specialist) at Idaho Power, who then sends it out to the customer with additional information. We could follow up with them, but we don't."*

Home Energy Audit Fee

The auditors indicated that they had not received any negative feedback from customers regarding the audit fee.

> *"The fee is acceptable to most clients, but I only see the ones who agree in advance."*

> *"I have only had a handful of people complain, but most think it is a very good deal."*

> *"They think it is a great deal. Great value!"*

"The customers love it. It is a great deal for them. They appreciate the light bulbs as well as the information. They receive up to 20 CFLs."

But several auditors think that IPC should raise the fee, or increase its contribution to make the value of the audits to auditors more commensurate with standard industry rates.

"I think the fee should be a bit higher. Charging $300 is an industry wide charge. There is more than just the field work, there is also paperwork."

"Even if they leave the fee at $99, Idaho Power could increase their side."

"In my opinion, the price of the audit could be even a little higher... We usually charge $400 plus for same service."

Barriers to Program Participation

Consistent with the findings from the staff interview regarding program awareness, at least one energy auditor indicated that some of his customers were not aware of what an energy audit means in terms of work scope and recommendations.

Processing Time

The time lag between initial customer sign up and the audit completion varies by customer schedules, but it ranges from 24 hours to three weeks. One auditor explained that it takes three to four weeks to schedule an appointment because the contractor is busy with other projects.

"I don't know when the customers sign up, but once we have been notified by Idaho Power, it just depends on their (homeowners') schedules, but typically 1-2 weeks."

"The average is about 7 business days."

"All I can say is, once we get the contact, we make a phone call, often leave a voice message. We try to schedule as soon as possible."

The time lag between the audit completion and submission of recommendations to the customer (online) is, according to one auditor, roughly three to five days. However, as one auditor observed, since the process is automated, it takes very little time for the customers to receive the recommendations.

The auditors believed that cost is the biggest barrier to implementing the recommended improvements.

"I don't know, but it is usually financial."

"The ones who can afford it don't need it, and the ones who need it can't afford it!"

Follow Up on Recommendations

Currently, there are no follow-up procedures in place to encourage the customers to make recommended energy efficiency improvements.

> *"I don't circle back, and I don't know if Idaho Power does it or not."*

> *"We weren't following up in the beginning, because we weren't supposed to solicit services along with the audit, but then we found out that we could actually call them back, so we have changed our strategy and are starting to call them back (to see if they want us to do the work)."*

> *"We haven't found a lot of work. Seems like the customers want the information, but they might not be motivated to follow up on the recommendations. Are they really concerned about power bills, or are they just taking advantage of the deal?"*

Furthermore, the energy auditors expressed doubts that the customers actually implement the recommended improvements.

> *"I would say almost half of the audits do not result in major recommendations because they are newer homes. A lot of folks are just making sure there are no glaring leaks in their new home."*

> *"… it is difficult to say, because we don't know who is choosing other contractors, and this is all so new. But probably only 5-10% calls us back and ask for work. Also, a lot of the recommendations can be self-implemented by customers."*

This lack of systematic follow-up with customers was also an area for program improvement mentioned by most of the energy auditors.

> *"I would recommend Idaho Power contact the customers and circle back with them. Or turn it over to the list of contractors."*

> *"I think it would be helpful if Idaho Power circled back and asked follow-up questions."*

> *"I believe Idaho Power does follow-up with clients and ask them about how well I served them. They have another person who goes back and inspects the first five homes done by a new auditor, and then they go back and inspect one out of 10 as part of QC process (10%). I have gotten feedback, mostly very good, to help me fine tune my process."*

Customer Feedback

All the auditors reported they had received positive customer feedback about the program.

> *"The customers like the information, and the fee is affordable for most people."*

"Customers in the higher end homes are already energy-conscious (and appreciate the program)."

"Everyone has been really positive, but we don't hear back much from them after we send the report."

Another auditor explained that the customers *"walk along side of us and get to know their own homes. They seem to like it; they volunteer to pay for it, and like learning about their homes."*

The energy auditors commented that the CFLs remain the most popular measure while low-flow showerheads are the least popular.

"They are surprised that they get so many CFLs."

"…They like the CFLs, but would probably prefer LEDs."

"They don't dislike the measures, but older people sometimes do not want the fixed, low-flow showerhead installed."

"…They like the low-flow showerheads, but what is frustrating is they want us to insulate the first few feet of the water heater. The insulation materials provided by Idaho Power do not wrap all the way around the pipes. The wrap is half inch, but the pipes are ¾ inch."

However, one auditor did note that installing 20 CFLs in a single residence is very time-consuming.

"The larger homes (3,000 square feet plus, usually three stores) take more time. And most participating homeowners reside in larger homes"

Leave Behind Packet

All of the auditors believe the materials provided by IPC to be left with the homeowner at the time of the audit are excellent tools.

"It is very good information. Very well-written!"

"This helps with client education, and reinforces messages we start off when we arrive. Very good brochures."

Role of Contractors

Most of the contractors recruited into this program explained that they have previously worked with Idaho Power on other programs. A couple of auditors explained that the minimum training requirements for the energy auditors are sufficient.

"At a minimum, they must have RESNET and they may be accepting BPI as well."

"They must be BPI-certified or equivalent and must be a Home Performance Specialist."

However, some auditors would like the training requirements to be higher as a way to improve the overall quality of the home energy audit. A couple of auditors commented that they think auditors making major recommendations ought to have experience and training in home construction.

"The auditors should have at least five years of experience in the home construction business. I think they should be required to know more about construction techniques. They have to know some building science to make good recommendations."

"It is not just a question of telling them what they need, but also how they should get the job done. And also tell them what they don't need. (e.g., expensive windows, which look nice). Client education is an important aspect of our service."

Energy Auditor Feedback

The auditors generally rated the program very positively:

"It is getting energy audits done for people who probably would never do it."

"The program is great, but there should be more follow-up with customers."

"The entire thing is well-managed and (the program specialist) has been quick to respond and the brochures we leave behind are very excellent. They have asked for our feedback on the brochures, and so we really appreciate the working relationship."

"Good program. It is managed well, especially as a new program. It is getting people familiar with energy audits, so hopefully word of mouth will start to travel."

Program Tracking and QA/QC

The auditors were all familiar with the data tracking required by IPC and the format required in the CAKE software tool. However, the auditors did provide several important ideas about ways to improve the current software. Moreover, it appears that these auditors may not be familiar with the specifics regarding the CAKE software inputs, as one strongly believes that the software program does not provide "Idaho-specific" data.

"*The software asks for the same information over and over again and is thus time-consuming to use; it does not actually calculate/predict the correct baseline home energy and thus is confusing for the customer and does not forecast the correct potential dollar savings; and because it is not Idaho-specific, it makes some wrong energy-savings*

assumptions; and the report to the customer is lengthy without presenting a concise action plan."[6]

Areas for Program Improvement

The energy auditors also provided several recommendations on ways the program could improve. Specifically, these recommendations included expanding the program to include renters[7]; develop a procedure to follow up with customers regarding the energy audit recommendations; improving the software tool, and allowing the audit program to be more profitable for these contractors. The following comments are organized by these specific recommendations.

Several auditors believe that the program should do more to reach out to the rental market (recognizing that this is a challenging market to reach).

"We are not touching the renters market, and those are important segment. But they have no authority to make decisions about the home."

They also believe there should be a protocol in place to follow-up with customers to encourage them to make the recommended improvements.

"There should be more follow-up with customers, and Idaho Power should develop a list of approved contractors who can do whole-house retrofits (rather than piecemeal upgrades by specialist contractors). I get lots of calls from customers who wish they had done things differently."

The energy auditors also had several suggestions on ways to make this program more economically viable for them.

"Maybe Idaho Power should consider increasing the budget for these audits. When we do audits, we charge $300-$400 (but we get paid only $200 for the Idaho Power program, plus mileage). Idaho Power might have thought we would get callbacks to do the work. We have done follow-up work on only two homes."

"We promised Idaho Power that we won't market ourselves during the audit itself, though we may start to do follow-up. We are making very little profit off these, which is tough for a business."

"I make less on these audits than I do in other parts of my business. Is it worth waiting to get paid? Is it worth the risk of people not being home (after driving far)?"

[6] However, the evaluation team did not conduct an independent assessment of the CAKE software to confirm these findings.

[7] The energy auditors incorrectly believe that the program is not targeting renters because they have not completed any audits of rental properties.

Three contractors specifically identified ways in which the CAKE software tool should be enhanced:

> *"The audit software does not capture plug loads and this can be a significant part of the power bill (extra freezers, electric space heaters, etc.). I think this is a big part of things that are missed (by the software)."*
>
> *"Other factors that should be included in CAKE's approach to predicting energy bills are: additional refrigerators/freezers should be added, as most homes have two or three, as well as pools, hot tubs, and pumps for well water."*
>
> *(Only one of the contractors stated): "The CAKE software is redundant. It asks for the same information over and over again. It doesn't seem accurate. It is not specific to Idaho.[8]"*

[8] The evaluation team did not confirm these findings, however. Therefore, IPC staff should focus on contractor education and outreach to address this issue.

3 Program Flow Diagram for Home Energy Audit Program

Based on the information from the staff interviews, the Johnson Consulting Group team developed a flow diagram documenting the program participation process. The program flow diagram differs from logic models in that it focuses on identifying the participation journey for both the customers and the energy auditors. Figure 8 illustrates the current program operations, highlighting the lack of a protocol in place for following up on the energy auditor recommendations. Figure 9 illustrates a proposed approach, developed by IPC, to address this program gap in the future.

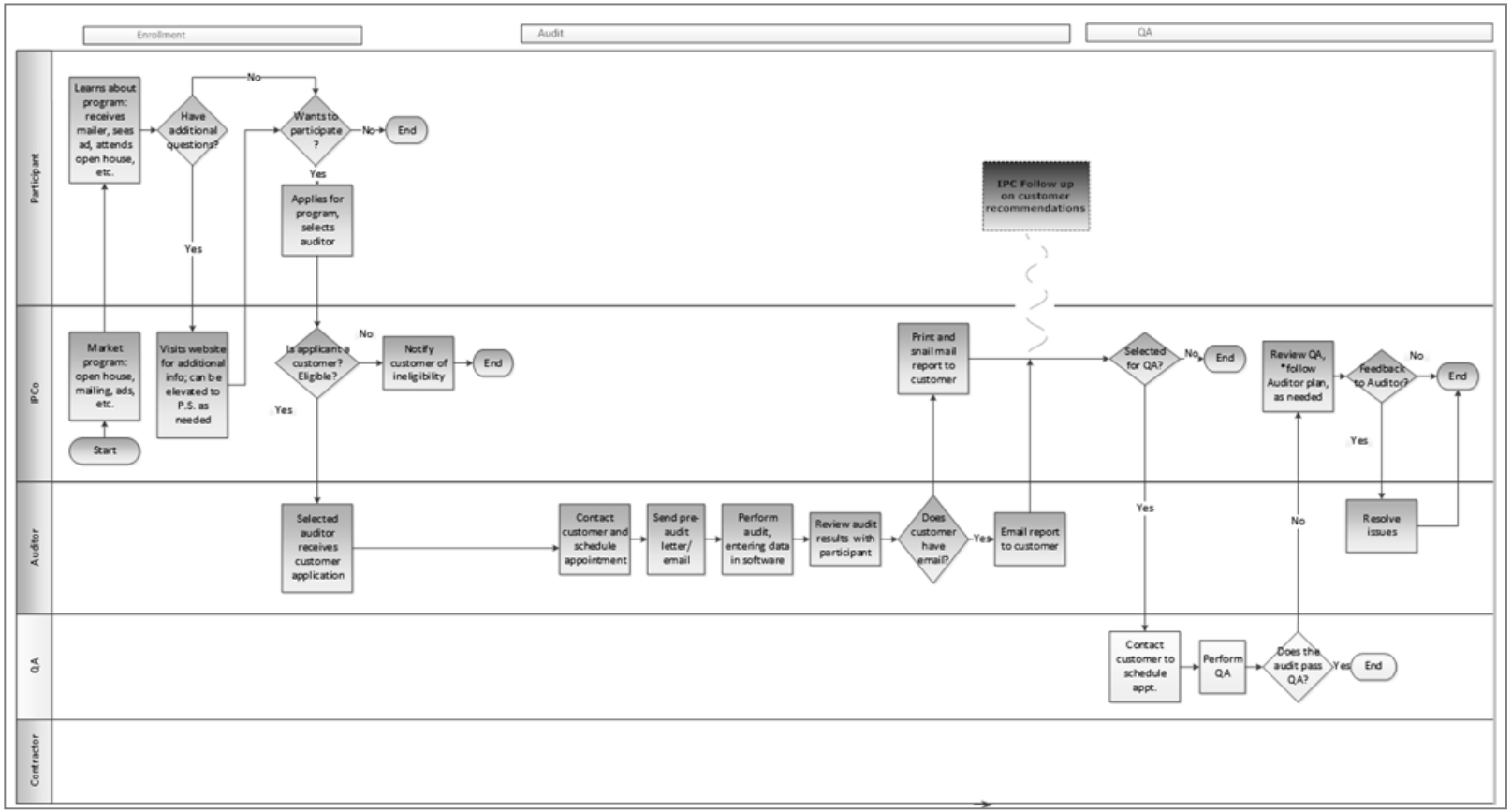


Figure 8: Home Energy Audit Process Diagram

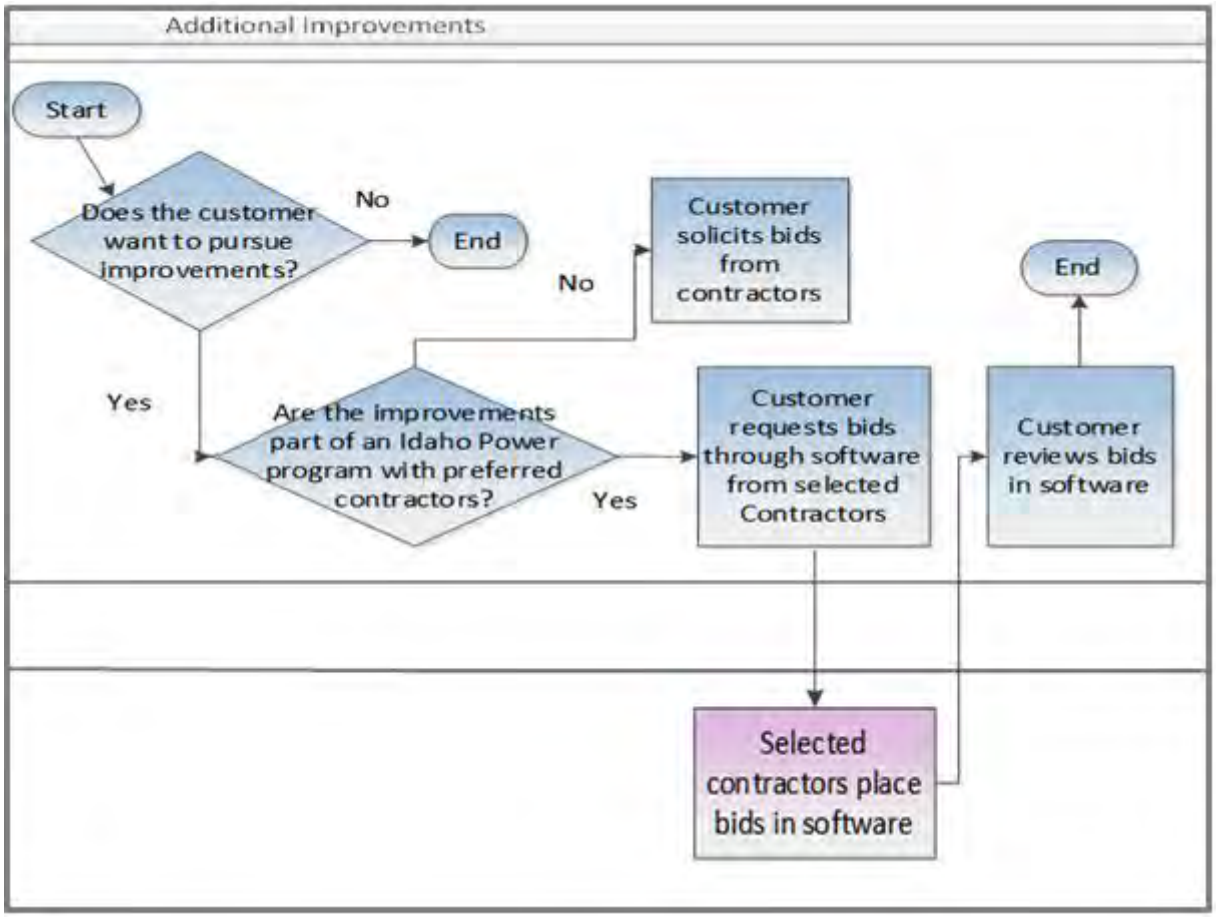


Figure 9: Proposed Approach to Address Process Gap

4 Key Findings and Recommendations

The results from the process evaluations led to the following key findings and recommendations.

4.1 Key Findings

The program design leveraged the "lessons learned" from the Boise City Audit Project that has contributed to its successful program roll out in its first year. These lessons learned include:

- Using a new software tool, CAKE systems from Earth Advantage
- Changing the measure mix to make the program more streamlined and cost-effective
- Ensuring that contractors focused on delivering the home audit and providing objective advice about a home's energy efficiency needs, rather than on marketing or making a sale

The Home Energy Audit Program incorporates most of the marketing best practices that have shown to be effective in promoting weatherization, energy audit, and "whole house" program approaches (Johnson & Ambach 2014, p. 30). These best practices include using targeted marketing, providing information via multiple media strategies, and promoting the value of the energy efficiency improvements to homeowners (Peters, 2011 cited in Johnson & Ambach 2014, p. 24).

The Home Audit Program also incorporates several other best practices by not using "energy jargon" in the marketing materials and providing program participants with information about other energy efficiency programs available through IPC.

However, the program's name does not conform to industry best practices. Specifically, the literature review of weatherization program best practices indicated that the term "*audit*" foreshadows scrutiny of one's worth as a homeowner while the phrase "*home energy assessment*" suggests opportunity (Johnson & Ambach 2014, p. 24).

The seven participating contractors installed a total of 1,747 measures during the energy audits from March through July 2014. CFLs accounted for the clear majority of installed measures, since the energy auditors may install up to 20 CFLs at a home. However, the contractors reported that participating customers would prefer receiving LEDs rather than CFLs.

Customer and contractor feedback is positive based on the findings from the in-depth interviews. Furthermore, the energy auditors reported that the customers seem to be pleased with the energy audit.

The program participation process is quick and easy. Two-thirds (64%) of the energy auditors schedule the audits within 10 days of the initial sign up and 85 percent of all audits are scheduled within three weeks of the initial customer contact.

The participating contractors provided a total of 243 recommended changes and upgrades to the 107 participating customers. Most recommendations focused on increasing insulation levels (64%) while 42 percent of the program participants were advised to consider upgrading their HVAC equipment.

The participating contractors were also prompt in providing the recommendations to the program participants with more than 50 percent providing recommendations within three days of the completed audit. Overall, the energy auditors were polite and informative in their communications with the customers.

Currently the program has no process in place to follow up on the energy auditors' recommendations. This issue was also raised by several of the energy auditors as they are concerned about missed opportunities. In addition, the literature review of best practices found that several programs are now requiring that contractors follow up on the status of program recommendations within a timely manner following the initial energy audit (Nowak, Kushler et al., 2013, pp. 109-112, 123-126; Fuller 2009, cited in Johnson & Ambach 2014, p. 26).

4.2 Recommendations

Based on these findings, IPC should consider implementing the following recommendations as a way to enhance overall program operations.

Reconsider the program name since the term "audit" may have negative connotations. Many weatherization programs are replacing the word "audit" in their program name to more positive sounding descriptions such as home energy solutions, home energy assessments, or energy savers program. This may make the program more appealing to potential program participants.

Review the current measure mix to make sure it still cost-effective and appropriate. The feedback from the current energy auditors indicated that installing up to 20 CFLs per home was time consuming. ENERGY STAR® recommends changing out only the most frequently used light bulbs with CFLs rather than installing CFLs in every socket. [9]

Based on the review of industry best practices and customer feedback, IPC should also consider replacing some CFLs with LEDs as these lamps are more in tune with changing market conditions (Johnson & Ambach 2014, p. 14).

[9] "Best Bang for Your Buck" *By replacing your home's five most frequently used light fixtures or the bulbs in them with models that have earned the ENERGY STAR, you can save $70 each year*. http://www.energystar.gov/index.cfm?c=lighting.pr_lighting_landing.

Of note, IPC has already addressed the issue of increasing the size for the pipe wrap to include ¾ inch options- a recommendation made by the energy auditors.

Conduct a formal customer survey to assess satisfaction and identify barriers preventing customer follow-through on the auditor recommendations. The process evaluation relied on anecdotal evidence about customer satisfaction regarding the program elements. A more formal survey of previous program participants would provide additional insight into program operations as part of the next process evaluation.

Review the CAKE software to address the issues raised by the energy auditors. The energy auditors identified several areas regarding using the CAKE software that need to be clarified with the energy auditors to resolve these concerns. This includes capturing plug-load equipment, streamlining the audit report and providing additional clarity regarding the nature of the Idaho-specific calculations used to create the energy savings estimates.

Develop a protocol or procedure for reaching out to customers to follow up on the energy recommendations. This recommendation, based on industry best practices and energy auditor concerns, may lead to participant spillover that will increase overall program cost-effectiveness.

Establish stricter standards and guidelines regarding the energy efficiency recommendations provided to program participants. The review of the current recommendations revealed several areas for improvement, including using proper grammar and spelling, not providing direct referrals back to IPC for additional information, and making inappropriate comments regarding the program software's capabilities. IPC should also clarify its policy regarding recommendations regarding fuel switching.

IPC should provide examples of well-written recommendations and include these in the Home Energy Audit Handbook

Provide additional education about program guidelines and software capabilities to the energy auditors. The in-depth interviews with the energy auditors identified several areas where these contractors are not fully aware of the program guidelines or requirements. For example, several contractors were not aware that IPC does allow the contractors to follow up directly with customers post-audit.

In addition, it was clear that the energy auditors may not be using the CAKE software tool correctly or have a full understanding of its capabilities.

Overall, IPC's Home Energy Audit Program is well designed and well run. Implementing these recommendations will ensure that the program continues to reflect industry best practices and adapt to the changing market conditions and baselines.

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Irrigation Peak Rewards Program

2014 Impact Evaluation

Prepared for Idaho Power Company | October 2014

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Executive Summary

Idaho Power Company contracted PECI to complete an impact evaluation of the 2014 Peak Rewards program, a voluntary demand response (DR) program that has been available to Idaho Power's agricultural irrigation customers since 2004. There are currently around 2,150 irrigation service locations enrolled in the program. The goals of the impact evaluation were to determine the demand reduction (in MW) during three curtailment events and determine the counterfactual realization rate had an event been called on each business day during the program's June 15th - August 15th season.

The analysis methodology included two distinct approaches to calculate the estimated demand reduction and realization rates for the three curtailment events. The first approach (termed the Load Distribution Method) utilized interval meter data from Idaho Power's Advanced Metering Infrastructure (AMI) system. The Load Distribution Method dealt with estimated meter readings by distributing excess load across non-curtailment event meter readings, to the extent possible. The second approach (termed the Error Code Removal Method) aimed to validate the results of the first approach by removing pumps with estimated meter readings from the analysis dataset and extrapolating the resulting realization rate to the removed pumps' nominated kW reduction. The demand reduction and realization rate estimates from both approaches differed by less than 1%, validating the results using the Load Distribution Method.

PECI completed analyses of curtailment events held on July 2nd, July 10th, and July 14th, 2014, each containing four dispatch groups that curtailed enrolled irrigation pumps in rolling four-hour increments. The results of the curtailment event analyses showed maximum demand reductions of 257.9, 268.9, and 250.5 MW, respectively, for the three events, and an average of 259.1 MW. The events achieved realization rates of 67.2%, 69.8%, and 64.9%, respectively, averaging 67.3%.

The results of the counterfactual realization rate analysis demonstrated that date has a large influence on the expected realization rate. While the first three quarters of the program season (June 15 - July 31) showed an average expected realization rate of 58.8%, the expected realization rate in the last quarter of the season (August 1 -15) drops off significantly, to 26.9%. This is due to a higher percentage of pumps being shut off during the baseline period in the first two weeks of August, potentially due to a significant rain event during this period. The counterfactual realization rate peaks in the first two weeks of July.

The results of the impact evaluation show that Idaho Power's Peak Rewards program functions as intended, and, if properly maintained, can be relied on to provide dispatchable demand reduction to the electricity grid. There are, however, opportunities to maximize the demand reduction benefit that the program delivers to the electricity grid. First, Idaho Power may increase the program's realization rate by working to address device failure problems. Between the three 2014 curtailment events, the average percent of load that was not curtailed due to device failures was 7.1%. If this load was successfully curtailed during the three 2014 curtailment events, it would have increased the average realization rate to 74.4%.

Finally, as seen in the counterfactual realization rate analysis results, Idaho Power may maximize the program's realization rate by choosing to hold curtailment events on days when the percent of pumps that are shut off during the baseline period is minimized. This time period generally equates to the first two weeks of July.

1 Introduction

Background

The Irrigation Peak Rewards Program is a voluntary DR program which has been available to Idaho Power's agricultural irrigation customers since 2004. The program is designed to reduce peak load by turning off participating irrigation pumps during summer peak demand hours in return for a financial incentive. Through this program, Idaho Power has been successful in reducing load during the summer afternoon and early evening hours, the hours driving Idaho Power's potential need for new generation resources.

After the 2012 Peak Rewards program season, Idaho Power elected to suspend the program for the 2013 season due to the 2013 Integrated Resource Plan (IRP) not showing a need for DR resources until 2016. After holding a series of stakeholder engagement sessions in 2013, Idaho Power and the Idaho Public Utilities Commission (IPUC) agreed to reinstate the program in 2014 on a limited basis for the purpose of maintaining the program infrastructure. The program subsequently completed three curtailment events during the June 15 - August 15, 2014 program season, which impacted the ~2,150 irrigation pumps currently enrolled in the program.

Impact Evaluation Goals

Idaho Power contracted PECI to complete an impact evaluation of the 2014 Peak Rewards Program. This 2014 impact evaluation has two primary goals:

1. Determine and verify the demand reduction (MW) during a minimum of three test events
2. Determine counterfactual realization rate had an event been called on each business day during the season

The results contained in this report pertaining to the first goal will enable Idaho Power to better define the impact of the program on the electricity grid and provide more accurate estimates of the program's load reduction to future IRP processes. The findings pertaining to the second goal will inform Idaho Power as to which days of the program season can be expected to provide the highest realization rate and load reduction impact.

Methodology

The section below describes the data used to complete the impact evaluation, the sampling plan, and the methodology for gathering and processing data, determining the baseline, calculating the demand reduction, and the determining the curtailment event and counterfactual realization rates.

Data Sources

PECI conducted the 2014 Peak Rewards impact evaluation through the use of three primary data sources: Automated Meter Infrastructure (AMI) interval data (hourly kW readings), MV-90 meter interval data (hourly kW readings), and a program participant list. The participant list included dispatch group, pump number, maximum kW for summer 2013, nominated kW, meter number, and opt-out status for each enrolled pump and curtailment event day. All interval meter data included error codes for cases where the source data was missing or estimated. See Table 1for a list of error codes included in the data. See the section "Error Code Removal Method" below for an explanation of how PECI addressed each of the error codes.

Table 1. Error Code Key

Error Code	Description
1	Power Outage
9	Missing Reading
Q	Estimated Reading

Sampling Plan

The use of AMI data allowed the impact evaluation's sampling plan to be a census of program participants (i.e. all participants were considered in the analysis).

Data Gathering and Processing

PECI processed all data provided by Idaho Power using the analytics platform SAS®. The use of SAS® created a consistent and appropriate data format for all three curtailment events. PECI employed two different methods for processing (i.e. cleaning) the data. Both methods were completed in order to compare the subsequent realization rates and investigate if Idaho Power's data cleaning method impacted realization rates.

Load Distribution Method

In cases where AMI data had "Q" error codes (i.e. estimated data), the meter reading immediately after the error codes would be significantly higher than the meter's other readings. This higher meter reading represented the load that occurred during the readings that included the error codes and the reading immediately after the error codes. Idaho Power's AMI system rectified this misallocation of load by distributing excess load (i.e. load that exceeded the meter's base load) outside of the curtailment event period. If, after completing this step, there was still excess load, the system evenly distributed the remainder of the load during the curtailment event hours.

When data was missing over the entire curtailment event period, or when the missing data gap was extensive, the interpolation was not performed and the pump was removed from analysis.

Error Code Removal Method

Because the Load Distribution Method involved Idaho Power's AMI system making adjustments to the source data, PECI performed an additional analysis approach to validate the Load Distribution Method results. In the Error Code Removal Method, all AMI data with one or more estimated interval readings during the curtailment period or in the baseline period were removed from the analysis.

Additional Data Cleaning Performed Under Both Methods

To add an additional level of data integrity, PECI removed all meter readings that were five times greater than the pump's maximum use in the summer of 2013. Since irrigation pumps having a relatively flat load profile, these readings were considered erroneous. PECI also removed all values for interval data with a "missing reading" error code (error code 9). When possible, in both of these cases the source data were replaced with linearly interpolated values using the observations before and after the erroneous values. This linear interpolation filled in the missing values by connecting the kW readings before and after the missing values in a straight line with a constant slope. This step was performed on a limited number of pumps: two for the July 2nd and 10th events, and one for the July 14th event. When data was missing over the entire curtailment period, or when the missing data gap was extensive, the interpolation was not preformed and the pump was removed from the analysis entirely.

For more information regarding frequency of pump removal due to error codes, see Table 2 and Table 3 in the Findings section.

Determine Baseline

PECI determined the baseline kW load separately for each pump by averaging the interval readings in the fourth, third, and second hours preceding the beginning of each pumps' curtailment event. The first hour preceding the curtailment event was not included in the baseline determination due to the frequent practice of pump operators manually shutting off the pump prior to the start of the curtailment event. PECI then summed each pump's baseline by dispatch group to arrive at a unique baseline for each dispatch group.

Calculate Demand Reduction

PECI calculated the demand reduction for each pump by subtracting its kW load during each hour of the curtailment event from the pump's baseline load (determined in the previous step). PECI then aggregated the hourly demand reductions for all pumps within a dispatch group to yield a total hourly reduction for each dispatch group. The total program impact (both average and maximum reduction) was calculated by aggregating the dispatch group results.

Note that the demand reduction results presented in this report represent the estimated reduction for all pumps in the program, not just those analyzed. As discussed in the Data Gathering and Processing step, some pumps were removed from the analysis due to lack of data or erroneous readings. PECI applied the realization rate (see section "Determine Realization Rate" below) to the nominated kW of pumps removed as part of the data cleaning process in order to estimate the total demand reduction achieved during each curtailment event.

Determine Curtailment Event Realization Rate

PECI determined the realization rates for each dispatch group by dividing the demand reductions calculated in the previous step (both maximum and average reduction) by the total nominated kW for the pumps included in the analysis.

Determine Counterfactual Realization Rate

PECI also estimated the counterfactual realization rate for each non-weekend and non-holiday day during the program season (Jun 15 - Aug 15). The counterfactual realization rate is the realization rate that Idaho Power likely would have achieved had an event been called on that date. Starting with a realization rate of 100%, PECI subtracted the percent of nominated load that was not present during each pump's baseline period. From that total, PECI subtracted the average opt-out and device failure rates during the three 2014 curtailment events to arrive at the estimated counterfactual realization rate for each day.

2 Findings

The 2014 impact evaluation of the Peak Rewards program includes two primary sets of results: demand reduction and realization rates for the three test events completed and the counterfactual realization rates. The sections below first compare the results from the two analysis approaches discussed in the Methodology section, and then present the results of the curtailment events' demand reduction and realization rate analyses as well as the counterfactual realization rate analysis.

Data Cleaning Method Comparison

As discussed in the Methodology section, this impact evaluation completed separate analyses of two different methods of cleaning estimated data. The two methods were:

- Load Distribution Method
- Error Code Removal Method

Table 2 and Table 3 below detail, for the Load Distribution and Error Code Removal methods respectively, the number of pumps included in the participant list for each curtailment event and the number of pumps removed during the Data Gathering and Processing step. As a result of removing pumps with estimated readings, the Error Code Removal method considered about 100 fewer pumps.

Table 2. Number of Pumps by Processing Step (Load Distribution Method)

Processing Step	2-Jul	10-Jul	14-Jul
Included in Participant List	2,147	2,153	2,165
No AMI data available	19	19	19
Removed due to 'estimated reading' error codes	-	-	-
No AMI data or entire day with 'missing reading' error codes	300	347	310
Removed due to smaller 'missing reading' gaps	11	5	5
Included in final analysis dataset	1,817	1,782	1,831

Table 3. Number of Pumps by Processing Step (Error Code Removal Method)

Processing Step	2-Jul	10-Jul	14-Jul
Included in Participant List	2,142	2,148	2,160
No AMI data available	19	19	19
Removed due to 'estimated reading' error codes	133	4	39
No AMI data or entire day with 'missing reading' error codes	282	341	302
Removed due to smaller 'missing reading' gaps	14	30	3
Included in final analysis dataset	1,699	1,759	1,802

Analysis of the Error Code Removal method was completed to confirm that the results from the Load Distribution Method were reasonable. Table 4 below compares the results from each method, demonstrating that the differences in the results are minimal (less than 1% difference between the estimated demand reduction and realization rates). This finding validates that the results of the Load

Distribution Method analysis are reasonable. Therefore, the results included in this report are based on the analysis using the Load Distribution Method. See the Appendix for results from the analysis using the Error Code Removal Method.

Table 4. Results Comparison between Load Distribution and Error Code Removal Methods

Method	Estimated Max Demand Reduction (MW)	Realization Rate	Opt-Out Rate	Device Failure Rate	Pump OFF in Baseline Rate
Load Distribution	259.1	67.3%	2.2%	7.1%	23.4%
Error Code Removal	260.5	67.7%	2.3%	7.3%	22.8%
Difference	1.4	0.4%	0.1%	0.2%	0.6%

Curtailment Event Results

Table 5 below summarizes the estimated demand reduction achieved during each of the three curtailment events and the resulting realization rate. The maximum demand reduction achieved ranged from a low of 250.5 MW for the July 14th event to a high of 268.9 MW for the July 10th event.

The realization rate ranged from 64.9% to 69.8% across the three curtailment events, averaging 67.3%. Of the factors that drove down the realization rate, pumps being shut off during the baseline period had the highest impact (average of 23.4% of the load), followed by device failures (7.1% of the load) and opt-outs (2.2% of the load).

Table 5. Estimated Demand Reduction & the Resulting Realization Rate

Curtailment Event	Nominated Demand Reduction (MW)	Max Demand Reduction (MW)	Realization Rate	Opt-Out Rate	Device Failure Rate	Pump OFF in Baseline Rate	Total
2-Jul	383.9	257.9	67.2%	0.8%	6.9%	25.0%	100.0%
10-Jul	385.3	268.9	69.8%	3.9%	7.0%	19.2%	100.0%
14-Jul	385.7	250.5	64.9%	1.8%	7.3%	25.9%	100.0%
Average	385.0	259.1	67.3%	2.2%	7.1%	23.4%	100.0%

The sections below present more in-depth results for each curtailment event.

July 2nd Curtailment Event

The results of the individual curtailment event analyses include estimated demand reductions and realization rates, with both metrics reported by dispatch group, as well as the cumulative impact of all dispatch groups combined. Table 6 below presents the maximum and average demand reductions achieved and resulting realization rates for the July 2nd event.

As seen in the table, each dispatch group's contribution to the total demand reduction is not equal. The maximum demand reduction ranged from 45.5 MW for the 4-8 p.m. dispatch group to 76.2 MW for the 2-6 p.m. dispatch group. The 2-6 p.m. dispatch group achieved the highest realization rate of all groups (82.9%), while the 3-7 p.m. dispatch group had the lowest realization rate at 58.5%. The overall

realization rate for all dispatch groups was 67.2%, which was the second highest of the three curtailment events called in 2014.

Table 6. July 2nd Curtailment Event Results

Dispatch Group	Nominated MW	Baseline MW	Max Demand Reduction (MW)	Avg. Demand Reduction (MW)	Realization Rate
2-6 p.m. Dispatch Group	93.0	77.7	72.5	71.6	82.9%
3-7 p.m. Dispatch Group	111.6	75.7	76.2	75.6	58.5%
4-8 p.m. Dispatch Group	82.3	63.0	45.5	45.1	67.7%
5-9 p.m. Dispatch Group	97.0	68.2	64.9	64.4	65.4%
Total (2-9 p.m.)	383.9	284.6	257.9	256.7	67.2%

Notes:
- Realization rate is calculated using maximum demand reduction, not average demand reduction.
- Dispatch group realization rates were calculated using only pumps in the analysis dataset.
- Each dispatch group's baseline, maximum demand reduction, and average reduction values are estimated for the entire pump population (not only the pumps in the analysis dataset), and were scaled up using the "Total 2-9 p.m." realization rate.
- The estimated maximum demand reduction within each dispatch group is limited to each dispatch group's event time period. Because the maximum demand reductions occur at different hours for each dispatch group, the sum of the dispatch groups' maximum demand reductions do not equal the "Total (2-9 p.m.)" maximum demand reduction.

In order to investigate demand reduction on a more granular level, Table 7 below breaks out demand reduction for each hour of the curtailment event by dispatch group. As expected, the hour between 5pm and 6pm experienced the largest total reduction (257.9 MW) as this is the single hour when all dispatch groups are actively curtailing. Interestingly, each dispatch group achieved their maximum demand reduction during the third hour of their curtailment period.

Table 7. July 2nd Curtailment Event Results by Hour

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	284.6	284.6	284.6	284.6	284.6	284.26	284.6
Total Load (MW)	212.7	133.4	87.3	26.7	75.5	136.5	191.4
Total Reduction from Baseline (MW)	71.9	151.2	197.3	257.9	209.1	148.1	93.2
2-6pm DG Reduction from Baseline (MW)	69.8	71.7	72.5	72.5	23.5	4.3	0.4
3-7pm DG Reduction from Baseline (MW)	2.1	74.9	75.9	76.2	75.4	33.7	9.7
4-8pm DG Reduction from Baseline (MW)	0.1	3.9	44.2	45.4	45.5	45.3	18.9
5-9pm DG Reduction from Baseline (MW)	(0.1)	0.7	4.6	63.9	64.7	64.9	64.2

Figure 1 below presents the load profile of the July 2nd curtailment event and its baseline, graphically depicting the results from Table 7 above. The overall demand reduction peaks in the 5-6pm hour and gradually increases as the various dispatch groups' curtailment periods come to an end.

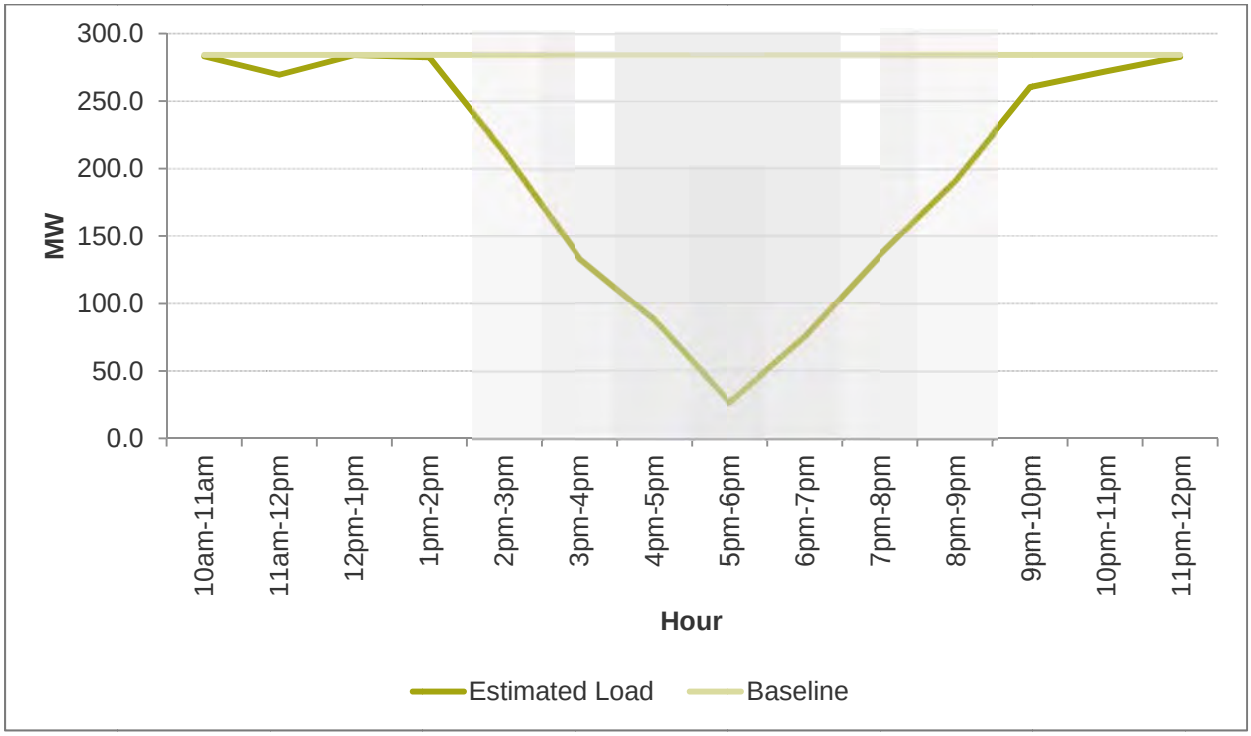

Figure 1. July 2nd Curtailment Event Load Profile (All Dispatch Groups)

Figure 2 below depicts each dispatch group's realization rate, which is the percent of nominated load that was successfully curtailed, as well as the components that make up the remainder of the load that was not curtailed. The reasons for load not being successfully curtailed include customers opting out of the curtailment event, device failures (i.e. the direct load control mechanism not working for unknown reasons), and pumps being shut off during the baseline period and thus not contributing to load reduction.

The 3-7 p.m. dispatch group experienced the highest rate of the pumps being shut off during the baseline period (32.9% of the group's nominated load), while the 4-8 p.m. dispatch group had the highest device failure rate (10.4%). All of the dispatch groups had a relatively low opt-out rate, ranging from 0.5% to 2.2%. Realization rate variability between the dispatch groups was highest during the July 2nd event.

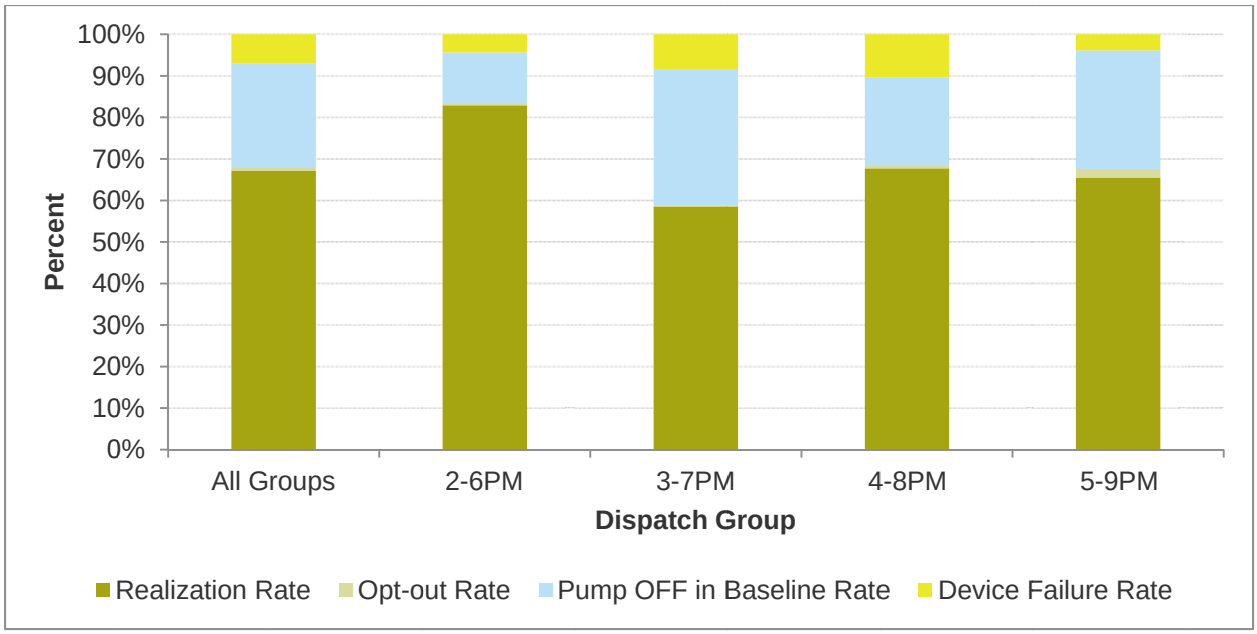

Figure 2. July 2nd Curtailment Event Realization Rate

July 10th Curtailment Event

The July 10th curtailment event was the second event called of the 2014 program season. As in the July 2nd event, the 4-8 p.m. dispatch group achieved the lowest maximum demand reduction of all dispatch groups (49.0 MW). The highest maximum demand was 84.4 MW from the 3-7pm dispatch group. Even though the highest maximum demand reduction was achieved by the 3-7 p.m. dispatch group, the 2-6 p.m. dispatch group achieved the highest realization rate of all dispatch groups (79.6%). The overall realization rate for all dispatch groups was 69.8%, which was the highest of the three curtailment events called in 2014.

Table 8. July 10th Curtailment Event Results

Dispatch Group	*Nominated MW*	*Baseline MW*	*Max Demand Reduction (MW)*	*Avg. Demand Reduction (MW)*	*Realization Rate*
2-6pm Dispatch Group	94.3	77.6	71.7	69.7	79.6%
3-7pm Dispatch Group	111.6	85.6	84.4	83.7	69.0%
4-8pm Dispatch Group	82.4	64.5	49.0	48.4	68.8%
5-9pm Dispatch Group	97.0	68.6	65.9	65.4	64.7%
Total (2-9PM)	385.3	296.3	268.9	267.2	69.8%

Notes:
- Realization rate is calculated using maximum demand reduction, not average demand reduction.
- Dispatch group realization rates were calculated using only pumps in the analysis dataset.
- Each dispatch group's baseline, maximum demand reduction, and average reduction values are estimated for the entire pump population (not only the pumps in the analysis dataset), and were scaled up using the "Total 2-9 p.m." realization rate.

- The estimated maximum demand reduction within each dispatch group is limited to each dispatch group's event time period. Because the maximum demand reductions occur at different hours for each dispatch group, the sum of the dispatch groups' maximum demand reductions do not equal the "Total (2-9 p.m.)" maximum demand reduction.

In order to investigate demand reduction on a more granular level, Table 9 below breaks out demand reduction for each hour of the curtailment event by dispatch group. As expected, the hour between 5 and 6 p.m. experienced the largest total reduction (268.9 MW), as this is the single hour when all dispatch groups are actively curtailing. The July 10th curtailment event had the highest baseline (296.3 MW) of all three curtailment events.

Table 9. July 10th Curtailment Event: Baseline Results by Hour

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	296.3	296.3	296.3	296.3	296.3	296.3	296.3
Total Load (MW)	227.2	141.0	89.9	27.5	73.9	142.0	197.4
Total Reduction from Baseline (MW)	69.2	155.3	206.4	268.9	222.4	154.4	98.9
2-6pm DG Reduction from Baseline (MW)	66.7	68.9	71.5	71.7	23.3	6.2	5.5
3-7pm DG Reduction from Baseline (MW)	3.0	82.4	83.9	84.4	84.2	33.5	9.5
4-8pm DG Reduction from Baseline (MW)	(1.0)	3.9	47.1	48.6	49.0	48.9	18.1
5-9pm DG Reduction from Baseline (MW)	0.5	0.1	3.9	64.3	65.9	65.8	65.7

Figure 3 below presents the load profile of the July 10th curtailment event and its baseline, graphically depicting the results from Table 9 above. The overall demand reduction peaks in the 5-6pm hour and gradually increases as the various dispatch groups' curtailment periods come to an end.

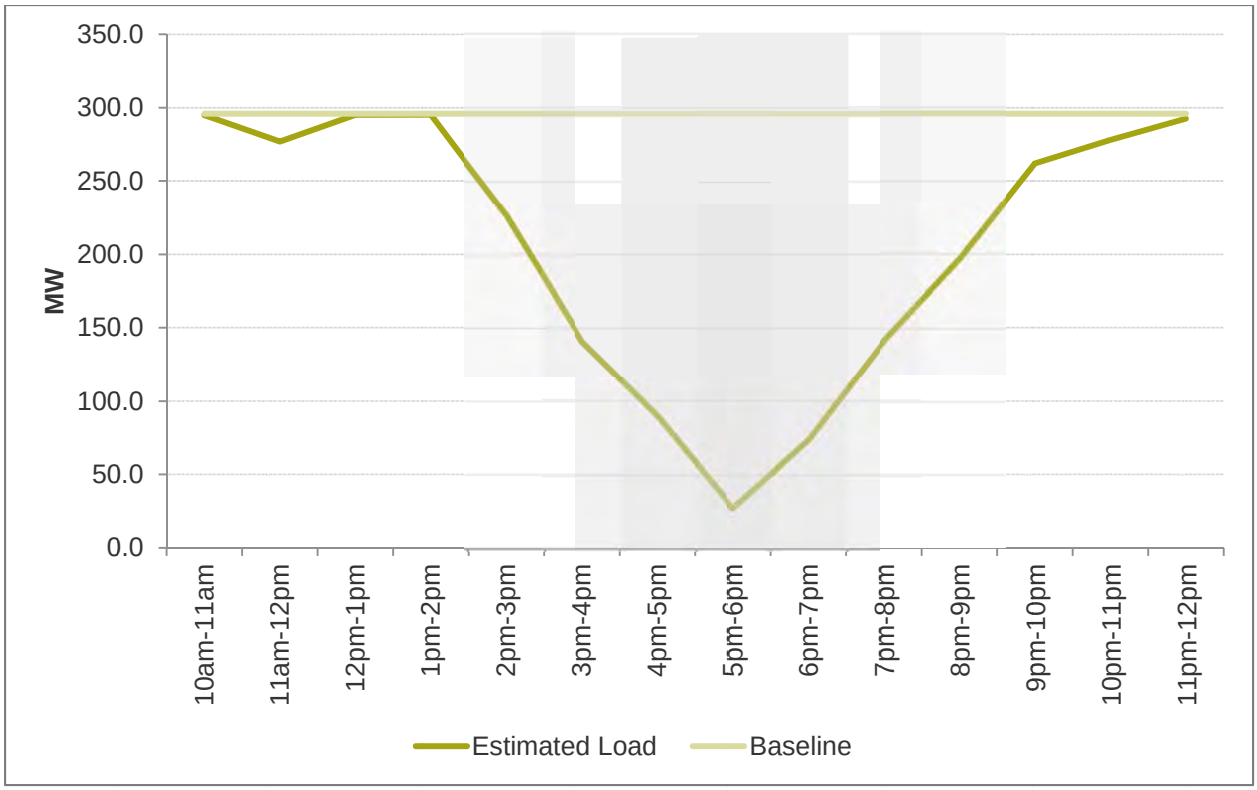

Figure 3. July 10th Curtailment Event Load Profile (All Dispatch Groups)

Figure 4 below depicts each dispatch group's realization rate for the July 10th event. The 5-9 p.m. dispatch group experienced the highest rate of the pumps being shut off during the baseline period (25.9% of the group's nominated load), while the 4-8 p.m. dispatch group again had the highest device failure rate (10.3%). Interestingly, even though the July 10th curtailment event had the highest overall realization rate among all the events, its opt out rate (3.9%) was nearly five times that of the July 2nd event, and was over twice as large as the July 14th event.

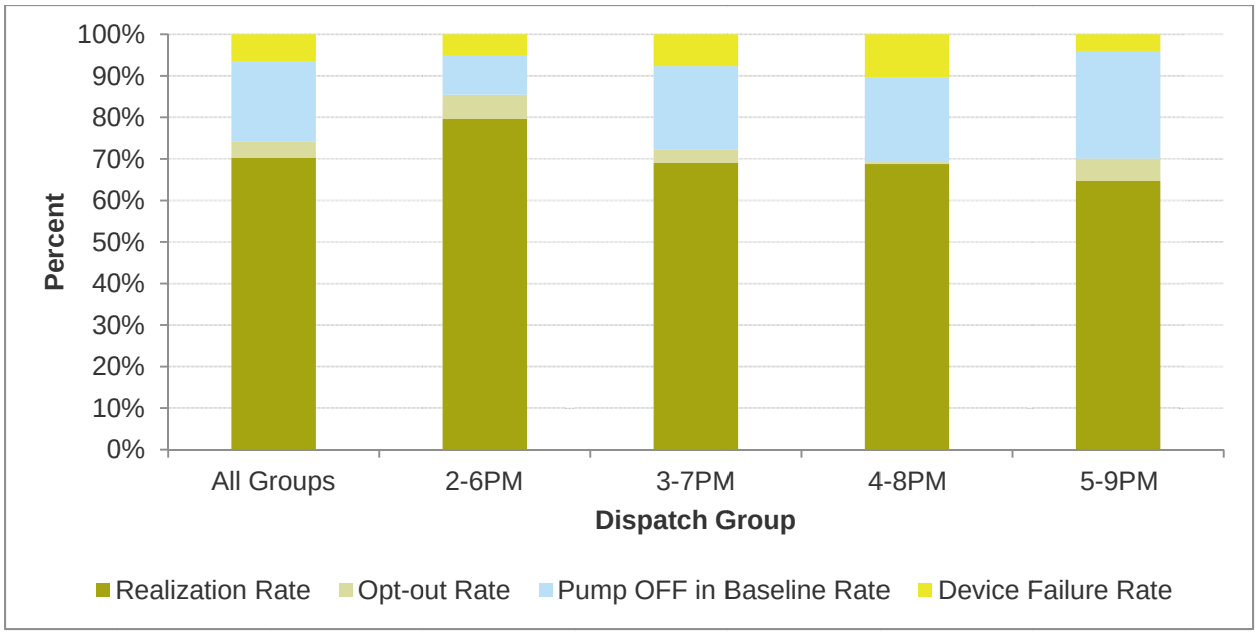

Figure 4. July 10th Curtailment Event Realization Rate

July 14th Curtailment Event

As with the previous two curtailment events, the highest maximum demand reduction occurred in the 3-7 p.m. dispatch group (77.2 MW) and the lowest maximum demand reduction occurred in the 4-8 p.m. dispatch group (46.8 MW). The 4-8 p.m. group, consistently across all curtailment events, performed the worst in the maximum demand reduction metric. The realization rates were fairly consistent across all dispatch groups, with a high of 68.2% for the 2-6 p.m. dispatch group and a low of 61.6% for the 5-9 p.m. dispatch group. The overall realization rate for all dispatch groups was 64.9%, which was the lowest of the three curtailment events.

Table 10. July 14th Curtailment Event Results

Dispatch Group	Nominated MW	Baseline MW	Max Demand Reduction (MW)	Avg. Demand Reduction (MW)	Realization Rate
2-6pm Dispatch Group	94.8	68.8	63.7	60.3	68.2%
3-7pm Dispatch Group	111.6	82.0	77.2	76.5	64.3%
4-8pm Dispatch Group	82.4	61.9	46.8	46.5	67.9%
5-9pm Dispatch Group	96.8	66.0	63.7	63.4	61.6%
Total (2-9PM)	385.7	278.6	250.5	246.7	64.9%

Notes:

- Realization rate is calculated using maximum demand reduction, not average demand reduction.

- Dispatch group realization rates were calculated using only pumps in the analysis dataset.

- Each dispatch group's baseline, maximum demand reduction, and average reduction values are estimated for the entire pump population (not only the pumps in the analysis dataset), and were scaled up using the "Total 2-9 p.m." realization rate.

- The estimated maximum demand reduction within each dispatch group is limited to each dispatch group's event time period. Because the maximum demand reductions occur at different hours for each dispatch group, the sum of the dispatch groups' maximum demand reductions do not equal the "Total (2-9 p.m.)" maximum demand reduction.

In order to investigate demand reduction on a more granular level, Table 11 below breaks out demand reduction for each hour of the curtailment event by dispatch group. As expected, the hour between 5 and 6 p.m. experienced the largest total reduction (250.5 MW), as this is the single hour when all dispatch groups are actively curtailing. The July 14th curtailment event had the lowest baseline (278.6 MW) of all three curtailment events.

Table 11. July 14th Curtailment Event Results by Hour

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	278.6	278.6	278.6	278.6	278.6	278.6	278.6
Total Load (MW)	220.1	139.2	92.2	28.2	69.6	136.2	197.0
Total Reduction from Baseline (MW)	58.5	139.4	186.5	250.5	209.0	142.5	81.6
2-6pm DG Reduction from Baseline (MW)	57.0	58.9	61.5	63.7	21.4	6.2	2.8
3-7pm DG Reduction from Baseline (MW)	1.6	75.1	76.7	77.2	77.1	25.9	1.1
4-8pm DG Reduction from Baseline (MW)	0.1	5.4	45.7	46.8	46.7	46.7	14.3
5-9pm DG Reduction from Baseline (MW)	(0.0)	0.0	2.6	62.8	63.7	63.7	63.4

Figure 5 below presents the load profile of the July 14th curtailment event and its baseline, graphically depicting the results from Table 11 above. The overall demand reduction peaks in the 5-6pm hour and gradually increases as the various dispatch groups' curtailment periods come to an end.

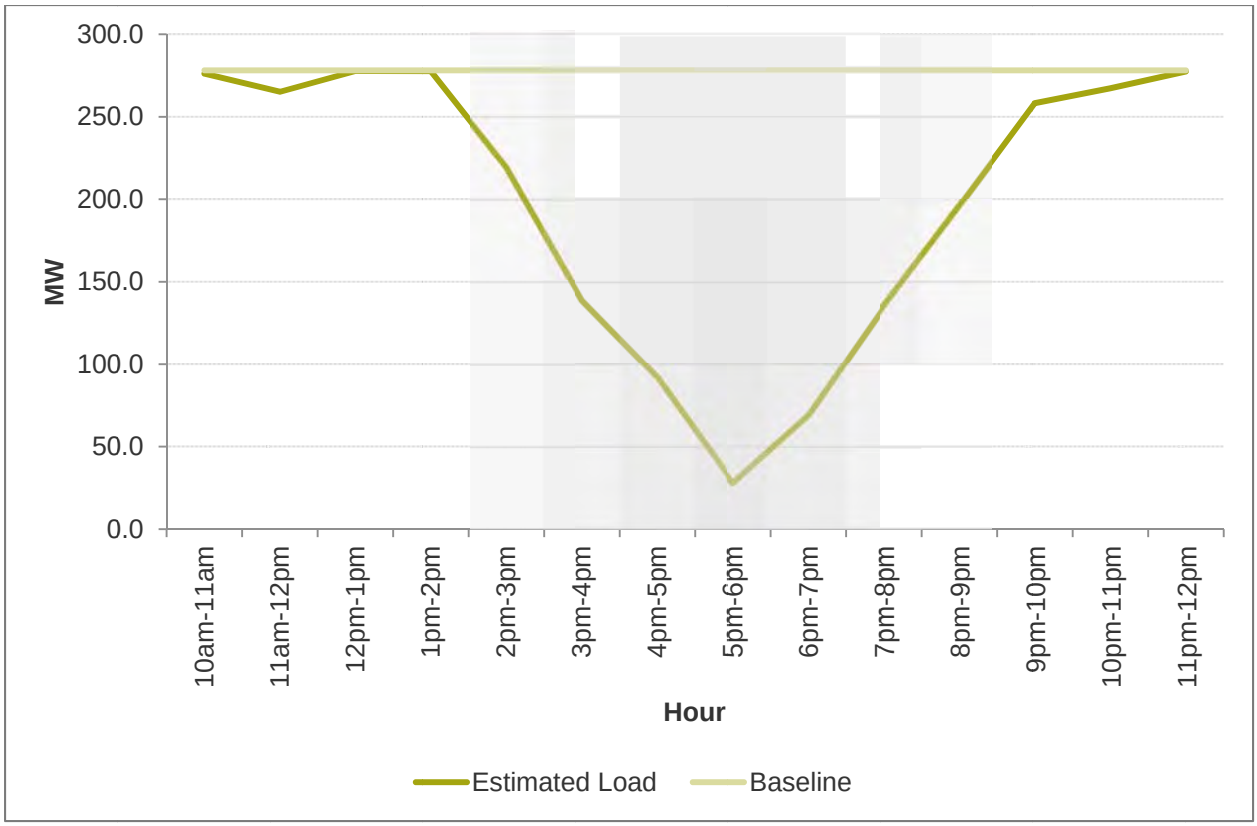

Figure 5. July 14th Curtailment Event Load Profile (All Dispatch Groups)

Figure 6 below depicts each dispatch group's realization rate for the July 14th event. The 2-6 p.m. dispatch group experienced the highest realization rate of all the dispatch groups at 68.2%, which was over 3% higher than the overall average for the event of 64.9%. Realization rate variability between the dispatch groups was lowest in the July 14th event out of all three 2014 events.

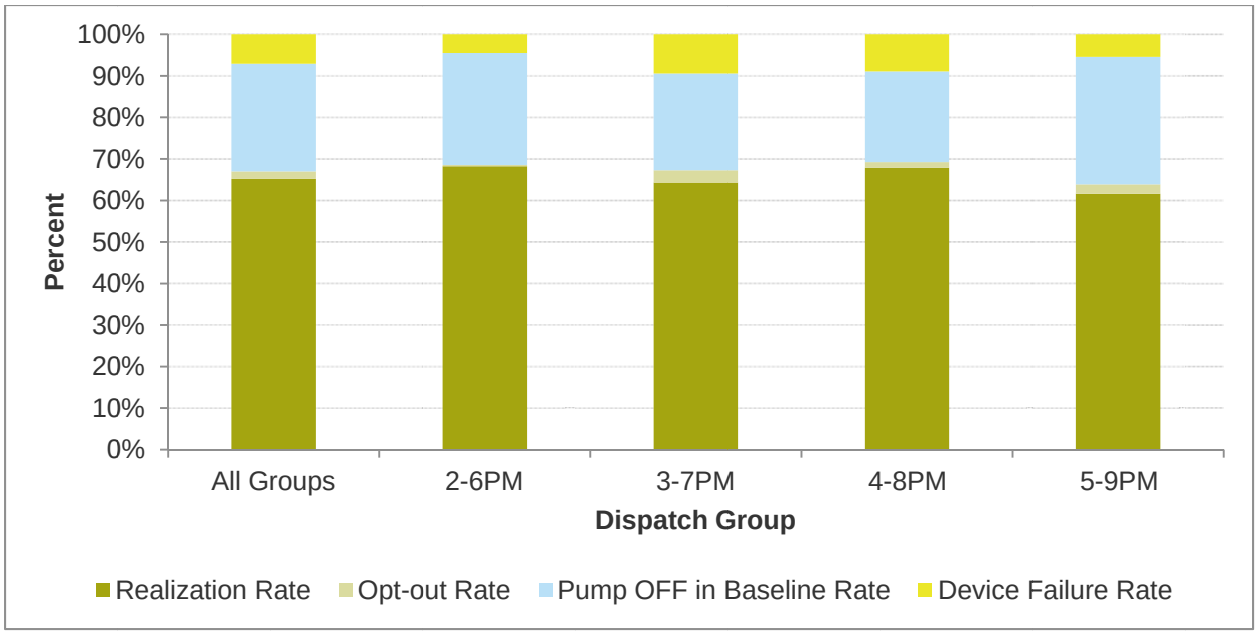

Figure 6. July 14th Curtailment Event Realization Rate

Counterfactual Realization Rate Results

The 2014 impact evaluation also included an investigation into the counterfactual realization rate, or the realization rate that would have been achieved had an event been called on each day of the program season. The results of the counterfactual realization rate analysis will inform Idaho Power on how date impacts expected realization rate, leading to more informed decisions on when to call curtailment events.

Table 12 below demonstrates that date has a large influence on the expected realization rate. While the first 75% of the program season averages an expected realization rate of 58.8%, the expected realization rate in the last quarter of the season drops off significantly, to 26.9%. This is due to a higher percentage of pumps being shut off during the baseline period in the first two weeks of August, potentially due to a significant rain event across southern and eastern Idaho during this period.

Table 12 Counterfactual realization rates for 15-day summer periods in 2014

Date Range	Average Pump OFF in Baseline Rate	Average Opt-Out Rate	Average Device Failure Rate	Counterfactual Realization Rate	Total
Jun 15 - 30	33.1%	2.2%	7.1%	57.7%	100.0%
Jul 1 - 15	24.2%	2.2%	7.1%	66.6%	100.0%
Jul 16 - 31	38.5%	2.2%	7.1%	52.3%	100.0%
Aug 1 - 15	63.9%	2.2%	7.1%	26.9%	100.0%

Figure 7 below graphically presents the expected realization rate for all non-holiday and non-weekend days of the 2014 program season. The expected realization rate peaks on July 10th at 71.6%. This result differs from the actual July 10th curtailment event results reported above (realization rate of 69.8%) due

to the counterfactual realization rate analysis utilizing the average opt-out and device failure rates between the three 2014 events.

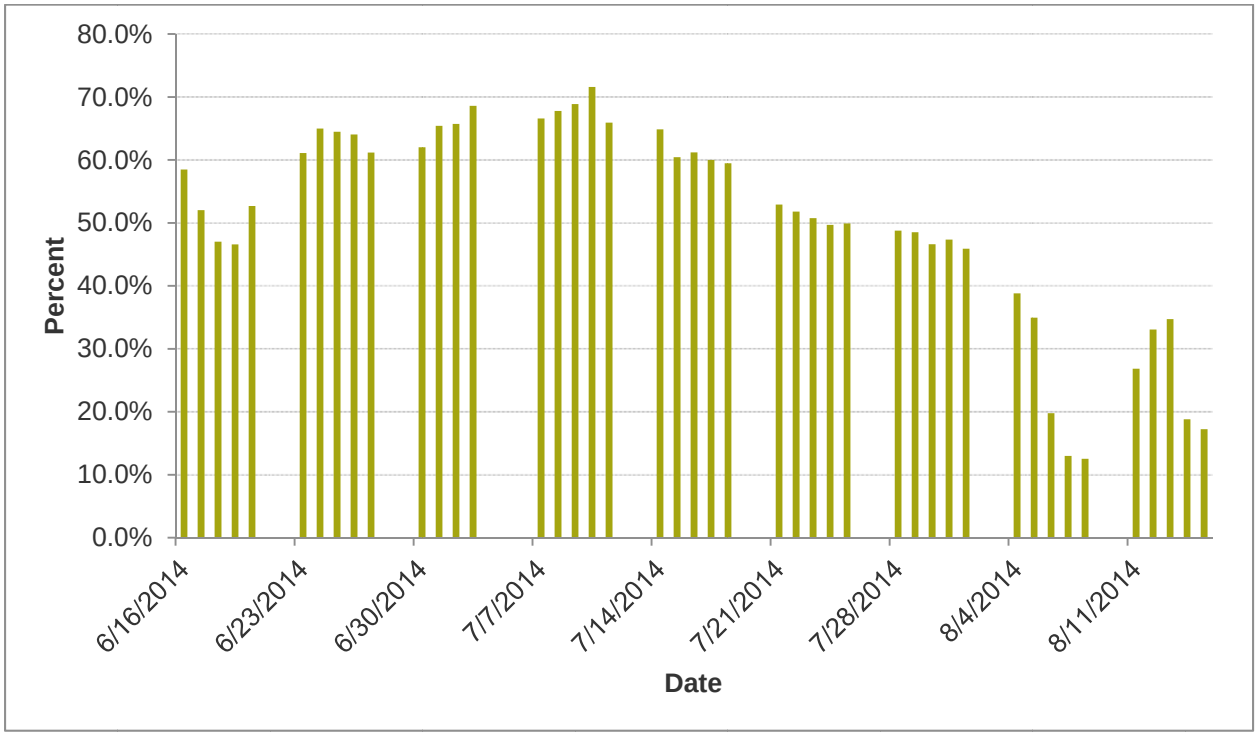

Figure 7. Counterfactual Realization Rate by Date

3 Conclusions and Recommendations

The goals of the 2014 Peak Rewards impact evaluation were to determine the demand reduction (MW) during three test events and determine the counterfactual realization rate had an event been called on each business day during the program's June 15th - August 15th season.

The analysis methodology included two distinct approaches to calculate the estimated demand reduction and realization rates for the three curtailment events: the Load Distribution Method and the Error Code Removal Method. The demand reduction and realization rate estimates from both approaches differed by less than 1%, validating the results using the Load Distribution Method.

PECI completed analyses of curtailment events held on July 2nd, July 10th, and July 14th, 2014, each containing four dispatch groups that curtailed enrolled irrigation pumps in rolling four hour increments. The results of the curtailment event analyses showed maximum demand reductions of 257.9, 268.9, and 250.5 MW, respectively, for the three events, and an average of 259.1 MW. The events achieved realization rates of 67.2%, 69.8%, and 64.9%, respectively, averaging 67.3%.

The results of the counterfactual realization rate analysis demonstrated that date has a large influence on the expected realization rate. The counterfactual realization rate peaks in the first two weeks of July and significantly drops off in the first two week of August.

The results of the impact evaluation show that that Idaho Power's Peak Rewards program functions as intended, and, if properly maintained, can be relied on to provide dispatchable demand reduction to the electricity grid. There are, however, steps that can be taken to maximize the demand reduction benefit that the program delivers to the electricity grid. First, Idaho Power may increase the program's realization rate by working to address device failure problems. Between the three 2014 curtailment events, the average percent of load that was not curtailed due to device failures was 7.1%. If this load was successfully curtailed during the three 2014 curtailment events it would have increased the average realization rate to 74.4%.

Finally, as seen in the counterfactual realization rate analysis results, Idaho Power may maximize the program's realization rate by choosing to hold curtailment events on days when the percent of pumps that are off during the baseline period is minimized. This time period generally equates to the first two weeks of July.

Appendix

The results from the Error Code Removal analysis method are included below.

July 2nd Curtailment Event

For the July 2nd event, both the maximum demand reduction and the realization rate across all dispatch groups was 0.2% higher using the Error Code Removal method than the Load Distribution method.

Table 13. July 2nd Curtailment Event Results (Error Code Removal)

Dispatch Group	Nominated MW	Baseline MW	Max Demand Reduction (MW)	Avg. Demand Reduction (MW)	Realization Rate
2-6pm Dispatch Group	93.0	77.5	73.6	72.6	83.0%
3-7pm Dispatch Group	111.6	76.5	73.8	73.1	58.5%
4-8pm Dispatch Group	82.3	63.4	46.8	46.4	68.0%
5-9pm Dispatch Group	97.0	68.6	65.4	65.0	65.2%
Total (2-9PM)	383.9	286.0	258.4	257.1	67.3%

Notes:
- Realization rate is calculated using maximum demand reduction, not average demand reduction.
- Dispatch group realization rates were calculated using only pumps in the analysis dataset.
- Each dispatch group's baseline, maximum demand reduction, and average reduction values are estimated for the entire pump population (not only the pumps in the analysis dataset), and were scaled up using the "Total 2-9 p.m." realization rate.
- The estimated maximum demand reduction within each dispatch group is limited to each dispatch group's event time period. Because the maximum demand reductions occur at different hours for each dispatch group, the sum of the dispatch groups' maximum demand reductions do not equal the "Total (2-9 p.m.)" maximum demand reduction.

Table 14. July 2nd Curtailment Event Results by Hour (Error Code Removal)

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	286.0	286.0	286.0	286.0	286.0	286.0	286.0
Total Load (MW)	213.3	136.5	88.8	27.6	77.9	139.0	192.6
Total Reduction from Baseline (MW)	72.7	149.5	197.2	258.4	208.1	147.0	93.4
2-6pm DG Reduction from Baseline (MW)	70.8	72.7	73.6	73.5	23.1	4.1	0.5
3-7pm DG Reduction from Baseline (MW)	1.9	72.2	73.5	73.8	72.9	30.9	8.1
4-8pm DG Reduction from Baseline (MW)	0.1	3.9	45.5	46.7	46.8	46.6	20.0
5-9pm DG Reduction from Baseline (MW)	(0.1)	0.7	4.7	64.4	65.2	65.4	64.9

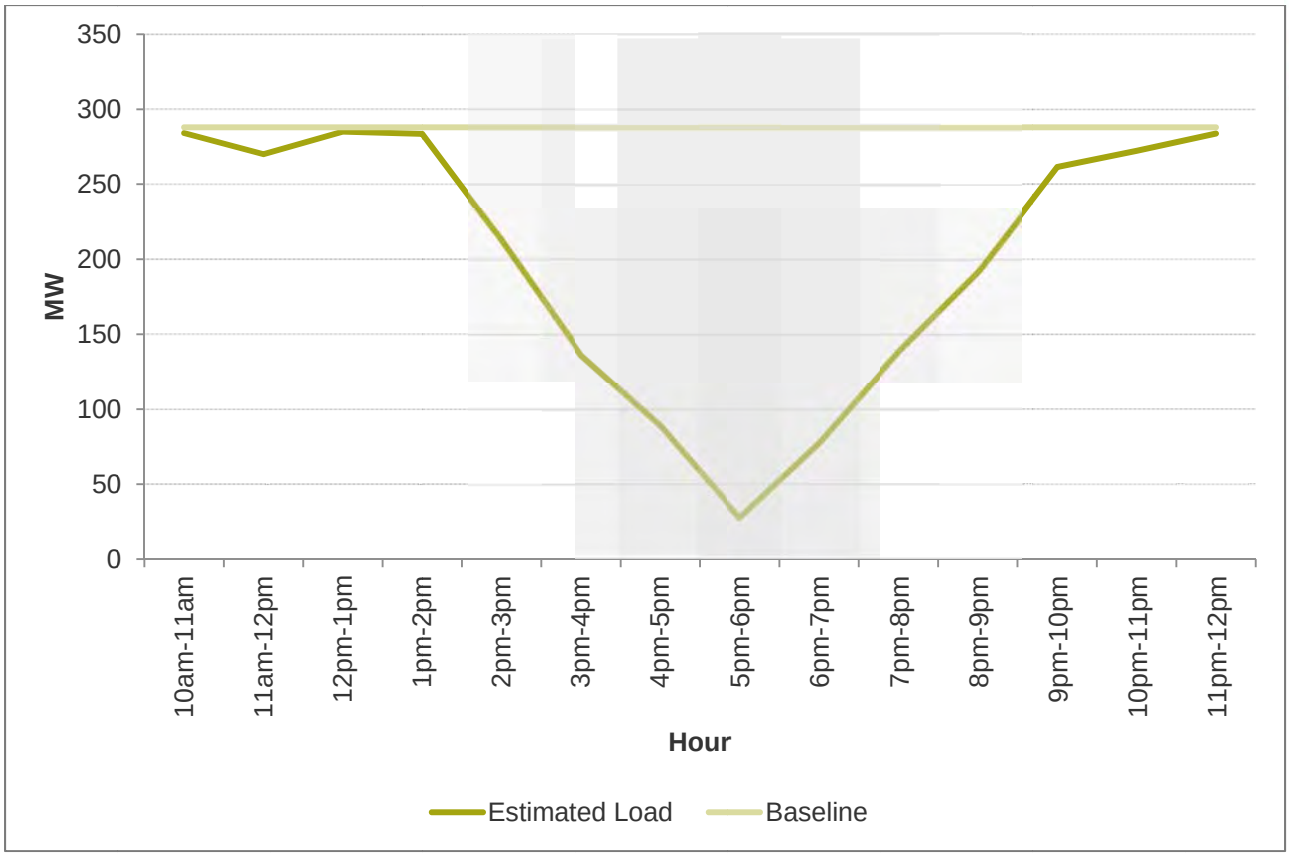

Figure 8. July 2nd Curtailment Event Load Profile (All Dispatch Groups) (Error Code Removal)

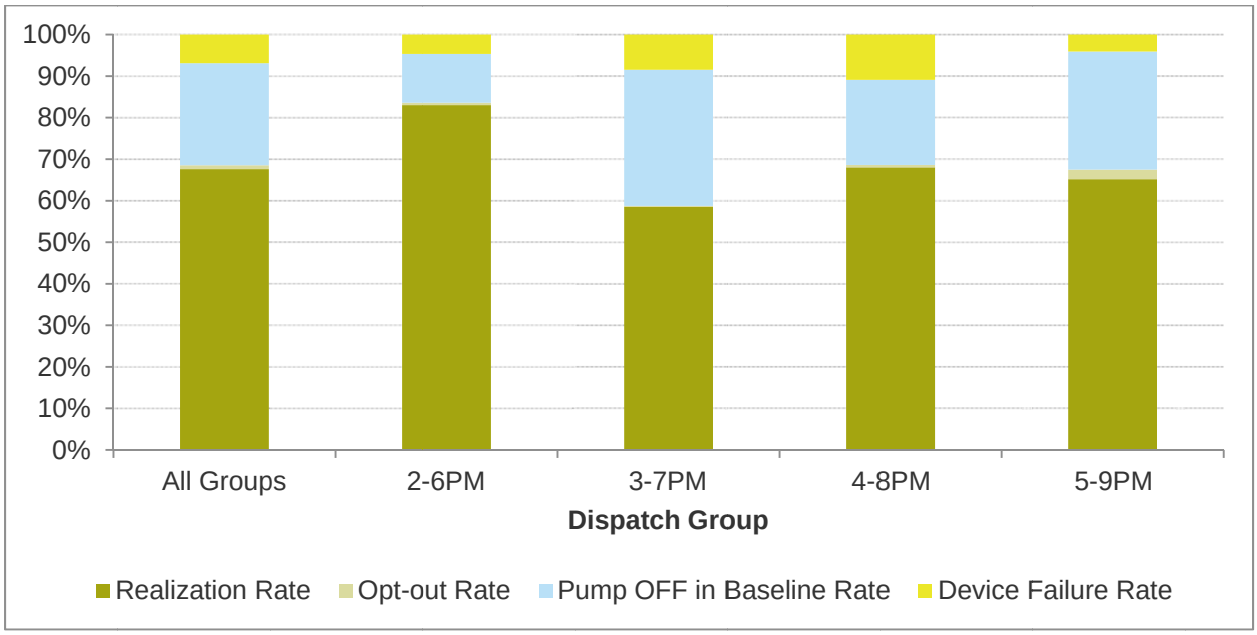

Figure 9. July 2nd Curtailment Event Realization Rate (Error Code Removal)

July 10th Curtailment Event

For the July 10th event, both the maximum demand reduction and the realization rate across all dispatch groups was 0.8% higher using the Error Code Removal method than the Load Distribution method.

Table 15. July 10th Curtailment Event Results (Error Code Removal)

Dispatch Group	Nominated MW	Baseline MW	Max Demand Reduction (MW)	Avg. Demand Reduction (MW)	Realization Rate
2-6pm Dispatch Group	94.3	78.0	73.3	71.1	80.0%
3-7pm Dispatch Group	111.6	86.8	84.5	83.9	70.1%
4-8pm Dispatch Group	82.4	64.9	48.6	48.0	69.4%
5-9pm Dispatch Group	97.0	68.8	66.7	66.1	64.6%
Total (2-9PM)	385.3	298.5	270.9	269.1	70.3%

Notes:
- Realization rate is calculated using maximum demand reduction, not average demand reduction.
- Dispatch group realization rates were calculated using only pumps in the analysis dataset.
- Each dispatch group's baseline, maximum demand reduction, and average reduction values are estimated for the entire pump population (not only the pumps in the analysis dataset), and were scaled up using the "Total 2-9 p.m." realization rate.
- The estimated maximum demand reduction within each dispatch group is limited to each dispatch group's event time period. Because the maximum demand reductions occur at different hours for each dispatch group, the sum of the dispatch groups' maximum demand reductions do not equal the "Total (2-9 p.m.)" maximum demand reduction.

Table 16. July 10th Curtailment Event Results by Hour (Error Code Removal)

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	298.5	298.5	298.5	298.5	298.5	298.5	298.5
Total Load (MW)	228.0	142.1	90.9	27.6	75.1	142.7	198.8
Total Reduction from Baseline (MW)	70.5	156.4	207.6	270.9	223.4	155.8	99.7
2-6pm DG Reduction from Baseline (MW)	67.9	70.2	73.0	73.3	23.8	6.3	5.7
3-7pm DG Reduction from Baseline (MW)	3.2	82.5	84.1	84.5	84.4	34.5	9.8
4-8pm DG Reduction from Baseline (MW)	(1.1)	3.7	46.7	48.1	48.6	48.5	17.8
5-9pm DG Reduction from Baseline (MW)	0.5	0.1	3.8	65.0	66.7	66.5	66.5

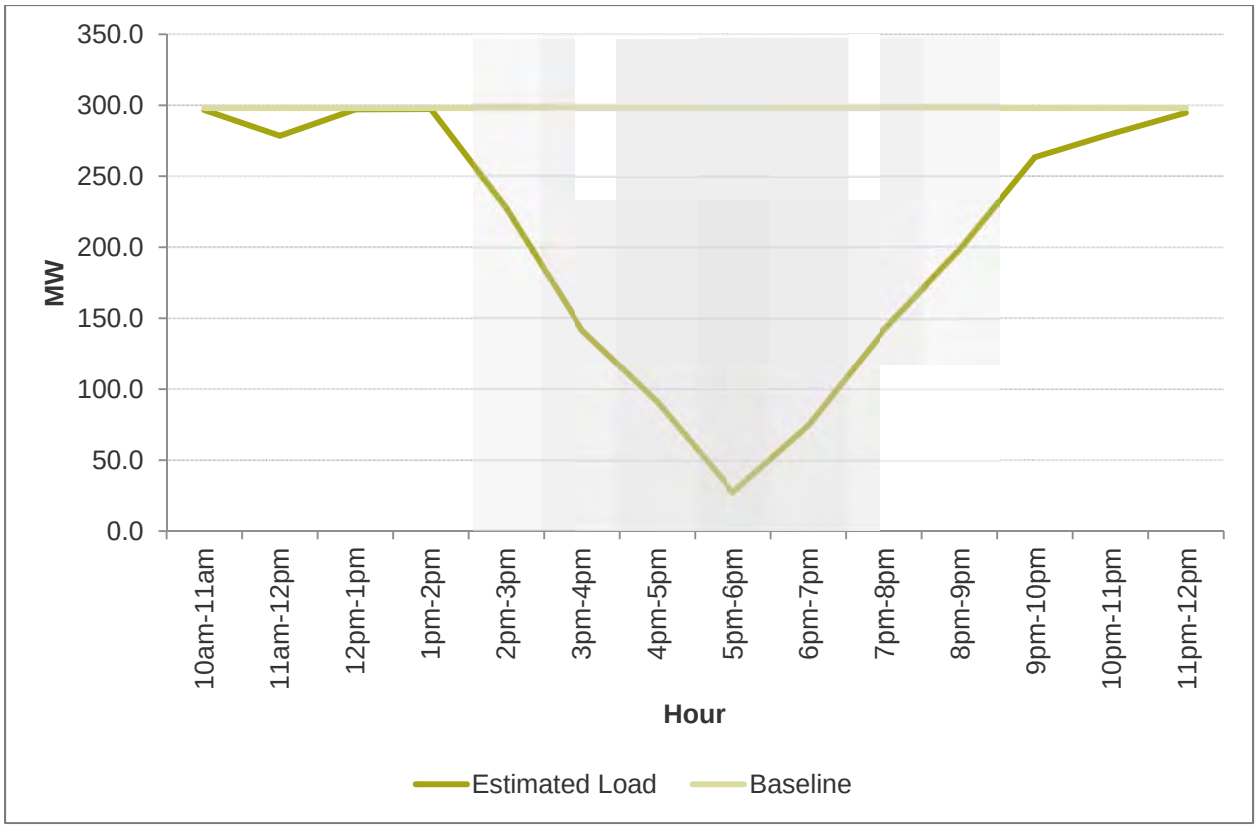

Figure 10. July 10th Curtailment Event Load Profile (All Dispatch Groups) (Error Code Removal)

Figure 11. July 10th Curtailment Event Load Profile (All Dispatch Groups) (Error Code Removal)

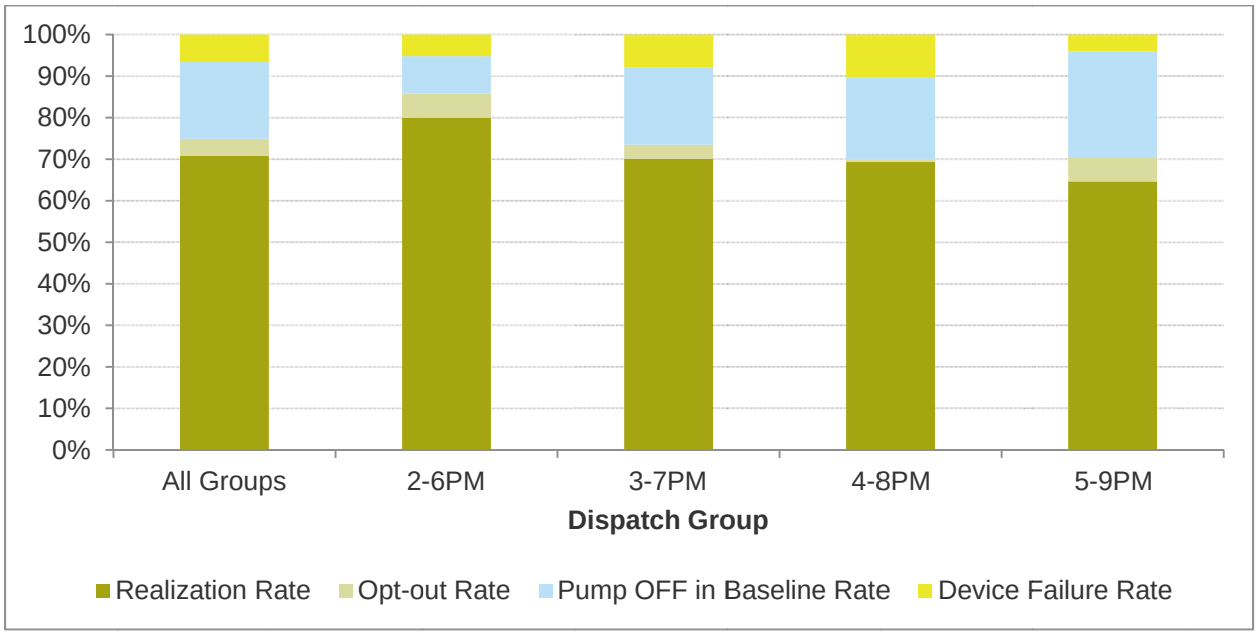

Figure 12. July 10th Curtailment Event Realization Rate (Error Code Removal)

July 14th Curtailment Event

For the July 14th event, both the maximum demand reduction and the realization rate across all dispatch groups was 0.7% higher using the Error Code Removal method than the Load Distribution method.

Table 17. July 14th Curtailment Event Results (Error Code Removal)

Dispatch Group	Nominated MW	Baseline MW	Max Demand Reduction (MW)	Avg. Demand Reduction (MW)	Realization Rate
2-6pm Dispatch Group	94.8	69.4	64.0	60.5	68.6%
3-7pm Dispatch Group	111.6	83.2	77.8	77.1	65.3%
4-8pm Dispatch Group	82.4	62.2	47.2	46.9	68.0%
5-9pm Dispatch Group	96.8	66.2	64.0	63.7	61.6%
Total (2-9PM)	385.7	280.9	252.2	248.2	65.4%

Notes:
- Realization rate is calculated using maximum demand reduction, not average demand reduction.
- Dispatch group realization rates were calculated using only pumps in the analysis dataset.
- Each dispatch group's baseline, maximum demand reduction, and average reduction values are estimated for the entire pump population (not only the pumps in the analysis dataset), and were scaled up using the "Total 2-9 p.m." realization rate.
- The estimated maximum demand reduction within each dispatch group is limited to each dispatch group's event time period. Because the maximum demand reductions occur at different hours for each dispatch group, the sum of the dispatch groups' maximum demand reductions do not equal the "Total (2-9 p.m.)" maximum demand reduction.

Table 18. July 14th Curtailment Event Results by Hour (Error Code Removal)

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	280.9	280.9	280.9	280.9	280.9	280.9	280.9
Total Load (MW)	222.1	140.7	93.3	28.7	70.1	137.3	198.4
Total Reduction from Baseline (MW)	58.7	140.1	187.6	252.2	210.8	143.5	82.5
2-6pm DG Reduction from Baseline (MW)	57.1	59.0	61.7	64.0	21.8	6.2	2.8
3-7pm DG Reduction from Baseline (MW)	1.7	75.6	77.3	77.8	77.8	26.2	1.5
4-8pm DG Reduction from Baseline (MW)	0.0	5.4	46.2	47.2	47.2	47.2	14.5
5-9pm DG Reduction from Baseline (MW)	(0.0)	0.0	2.5	63.1	64.0	64.0	63.7

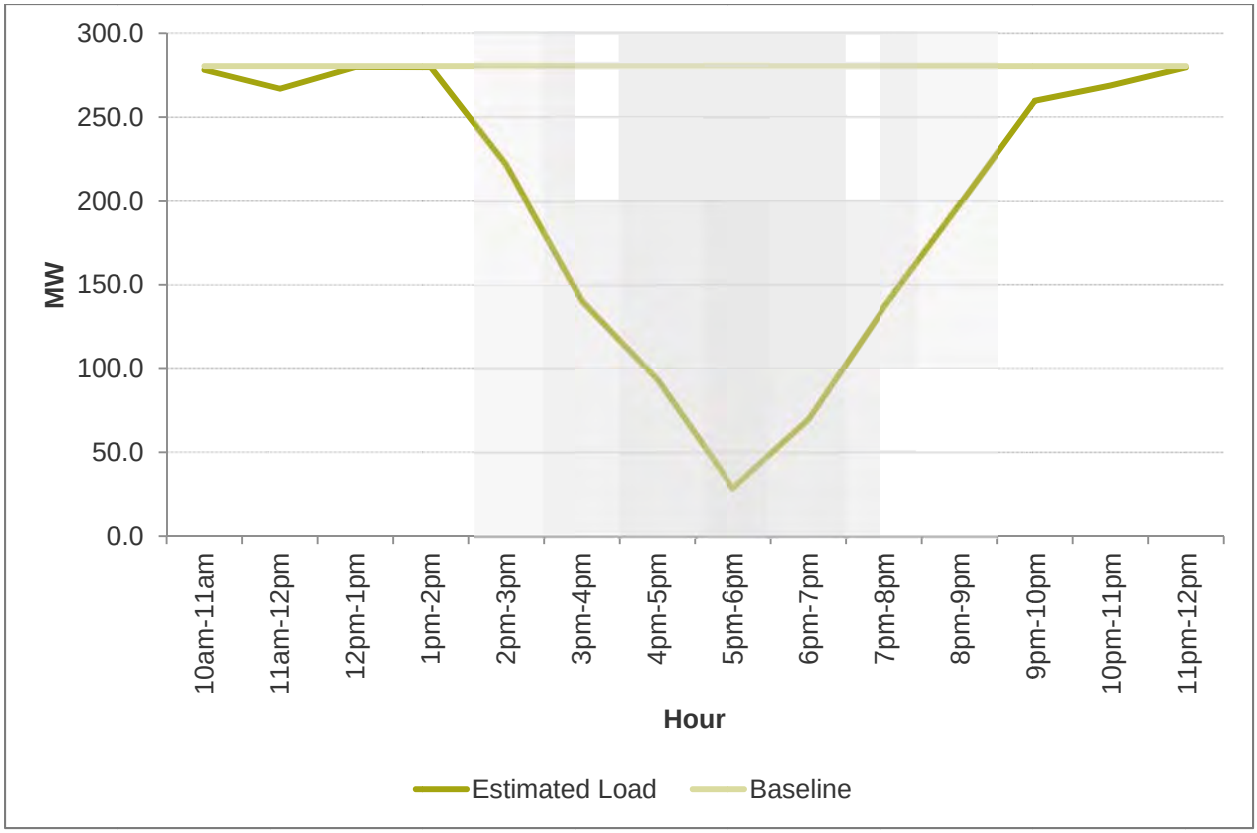

Figure 13. July 14th Curtailment Event Load Profile (All Dispatch Groups) (Error Code Removal)

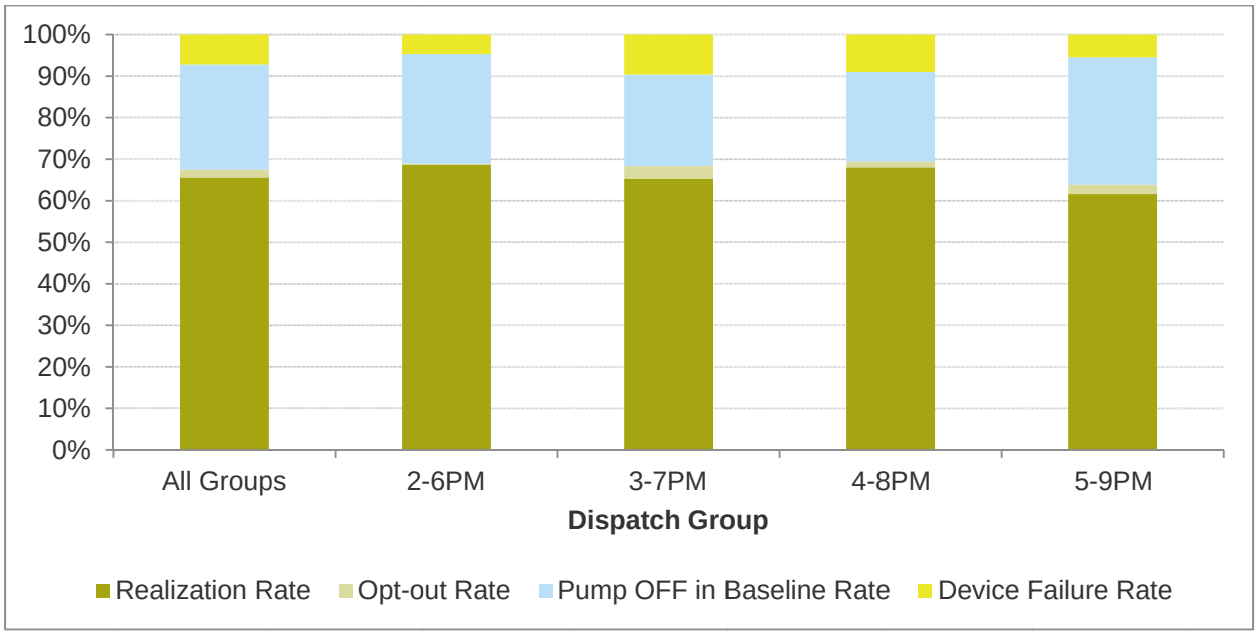

Figure 14. July 14th Curtailment Event Realization Rate (Error Code Removal)

2014 Irrigation Peak Rewards Program Report

March 15, 2014

Idaho Power 2014

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Executive Summary

The Irrigation Peak Rewards program (the program) is a voluntary demand response program that has been available to Idaho Power's agricultural irrigation customers since 2004. The program pays irrigation customers a financial incentive for the ability to turn off participating irrigation pumps at potential high system load periods. The program is designed to minimize or delay the need to build new supply-side resources. The company estimates future capacity shortfalls through the Integrated Resource Plan (IRP) and then plans resources to mitigate these shortfalls. The Irrigation Peak Rewards program is a result of this planning process. The program is measured by the amount of demand reduction, in MW, available to the company during potential system peak periods.

The program continually increased peaking resource capacity to 340 MW's in 2012. Following the 2012 program season, Idaho Power determined through the 2013 IRP load and resource balance, that there would be no capacity shortfalls until 2016. In 2013, Idaho Power filed IPUC Case No. IPC-E-12-29 to temporarily suspend the program to allow time to work with stakeholders and interested parties to determine how the program should operate in the future. These workshops resulted in settlement agreements reached in Case No. IPC-E-13-14 and UM 1653. The Irrigation Peak Rewards program was again offered as a demand response program in 2014, with some modifications. Under the terms of the settlement agreement, the program was only available to service locations that currently had a load-control device installed or that participated in the Manual Incentive Option in 2012. This report provides a review of the program's activities and expenditures for 2014 and is a supplement to the 2014 DSM Annual Report.

Summary of Program Results

The following items summarize the key components of the 2014 Irrigation Peak Rewards program.

- In 2014, the program had an estimated generation level load reduction of 295 MW.
- Four hundred thirty two (432), or 70% of the 614 eligible customers, chose to participate in 2014.
- Two thousand two hundred twenty five (2,225), or 81% of the 2,760 eligible service points, were enrolled in 2014.
- The program achieved a total billing demand enrollment of 397,299 kilowatts (kW).
- The total program costs for 2014 were $7,596,058.

Program Details

Timer Option (Discontinued)

Prior to the 2013 program suspension, the pre-programmed Timer Option was made available to all irrigation customers. This option allowed customers who preferred a consistent turn-off schedule rather than the unpredictability associated with the Automatic Dispatch Option. The level of participation in the Timer Option has decreased each year as customers move to participate in the Dispatch Option for the higher incentive. In 2014, previously enrolled Timer Option participants had the option to shift enrollment to the Automatic Dispatch Option as the Timer Option was discontinued.

Dispatch Option

Idaho Power irrigation customers taking service under Schedule 24 in both Idaho and Oregon, and had service locations that currently had a load-control device installed or that had participated in the Manual Incentive Option in 2012, were eligible to participate. The Dispatch Option allowed Idaho Power to initiate load control events that prevented pumps from operating at participating metered service locations. Participants could choose between three Dispatch Options:

- Have one-way communication with each device installed that allowed only Idaho Power to control all the customer's pumps at a single metered service point.
- Have two-way communication with each device installed that allowed both Idaho Power and the customer to control all the pumps at a single service point.
- Service points with multiple pumps and over 1,000 cumulative Hp were eligible to participate in the Manual Option. Customers under this classification could choose to manually control which pumps were controlled during a load control event. Manual Option participants are required to nominate the amount of kilowatts (kW) available to dispatch during load control events.

The parameters of the Dispatch Option included the following:

- Idaho Power would initiate control (dispatch) events on a customized EnerNOC Web site.
- A minimum of three (3) load control events would occur each program season.
- Dispatch load control events could occur any weekday or Saturday, excluding July 4, between the hours of 1 p.m. and 9 p.m.
- Load control events could occur up to 4 hours per day and up to 15 hours per week, but no more than 60 hours per program season.

- Idaho Power would give notification to Manual Option participants four hours prior to the initiation of a control event. Idaho Power may not provide prior notification of a load control event for Automatic Dispatch Option participants.

- If prior notice of a load control event had been sent, Idaho Power could choose to cancel the event and notify participants of cancellation.

- Idaho Power would give up to 30 minutes notice prior to start of all actual events and 30 minutes prior to the end of all actual events.

- The provisions for this program did not apply to system emergencies or events outside the control of Idaho Power.

Program Incentives

A customer's incentive appeared as a demand credit and energy credit applied to the monthly bills for the period of June 15th through August 15 th. The demand credit is calculated by multiplying the monthly billing kW by the demand-related incentive amount. The energy credit is calculated by multiplying the monthly billing kilowatt-hour (kWh) usage by the energy-related incentive amount. Credits were prorated for periods when reading/billing cycles did not align with the program season dates from June 15 to August 15. The incentive structure includes a 'Fixed' and 'Variable' payment, with an increased variable credit amount for service points that voluntarily participate in the 'Extended' 9 p.m. late interruption period. All customers' 'Fixed' incentives in the Automatic and Manual Dispatch options are calculated using Idaho Power metered billing data. Idaho Power's Customer Information System (CIS) calculates the bill credits and applies it to the bill. Manual Dispatch Option customers' incentives were calculated using billing kW from 2014 metering data and nominated kW. The incentives were calculated through a manual process, and customers received the incentives in the form of a check. Any 'Variable' incentive payments (applied to events occurring after the first three) would be paid by check no more than 45 days after the end of the program season. The incentives offered in 2014 are listed in Table 1.

Table 1. 2014 Incentives.

Option	Fixed Demand Credit ($/billing kW)	Fixed Energy Credit ($/billing kWh)	Variable Energy Credit ($/billing kWh)	Extended hour Variable Energy Credit ($/billing kWh)
Automatic and Manual Options	$5.00	$0.0076	$0.148	$0.198

Program Opt-out

Under the rules of the Dispatch Option, participants had the ability to opt-out of dispatch events up to five times per service point. Each opt-out incurred a fee. The opt-out fee was $5.00 per kW for the first three events, and $1.00 per kW for remaining events based on the current month's billing demand (kW). The opt-out penalty fee was prorated to correspond with the dates of program operation. Opt-out penalty fees would never exceed the incentive amount. Large Service Locations were charged opt-out penalty fees based on the nominated kW that was not turned off during a load control event.

In 2014, ninety five (95) service points opted out 112 times, some service points opting out of multiple events.

Review of Program Results

Participation

Idaho Power presented the program details at irrigation workshops across Idaho Power's service area, and each year Idaho Power staff participates in four agriculture shows. After the Irrigation Peak Program suspension in 2013, Idaho Power utilized workshops, trade shows, and direct customer mailings to make a concerted effort in encouraging past participants to re-enroll in 2014. Additionally, Idaho Power agriculture representatives answered specific customer's questions by phone, email, and face to face contact which helped inform customers about the program details.

In March 2014, program enrollment mailings were sent to all customers that currently had a load-control device installed or that participated in the Manual Incentive Option in 2012. Contents of this mailing included program details, a program application, the program's incentive structure, listing of the customer's eligible service points, and a potential incentive estimate for each program option based on the customer's previous year's usage.

Despite reinstating the program with a reduction in incentive amounts and modifications to the event notification, most past participants re-enrolled to participate in 2014. The number of service points enrolled to participate in the program for 2014 was 2,225. This accounted for approximately 81 percent of the eligible service points

Figure 1 portrays Idaho Power's service area divided into five regional areas; Western, Canyon, Capital, Southern, and Eastern. These areas are used throughout this report in reference to program information.

Figure 1. Idaho Power service areas.

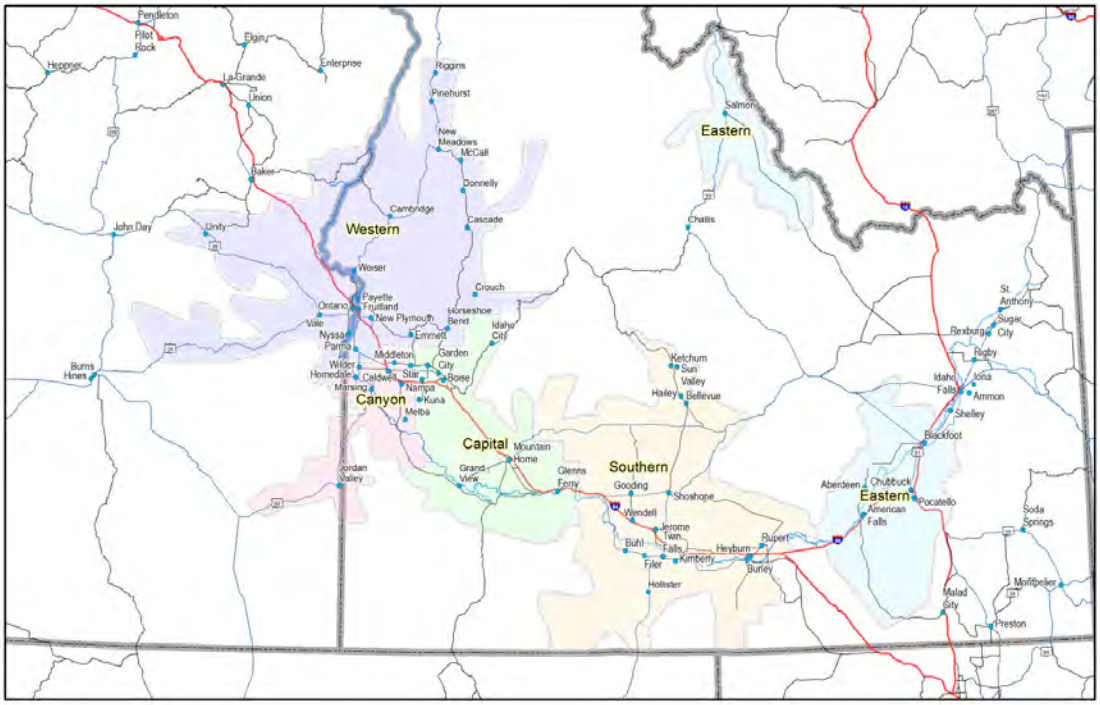

Figure 2 represents the 2,225 irrigation service points that participated in 2014 and their distribution by Idaho Power's regional service areas.

Figure 2. Distribution of participants 2014.

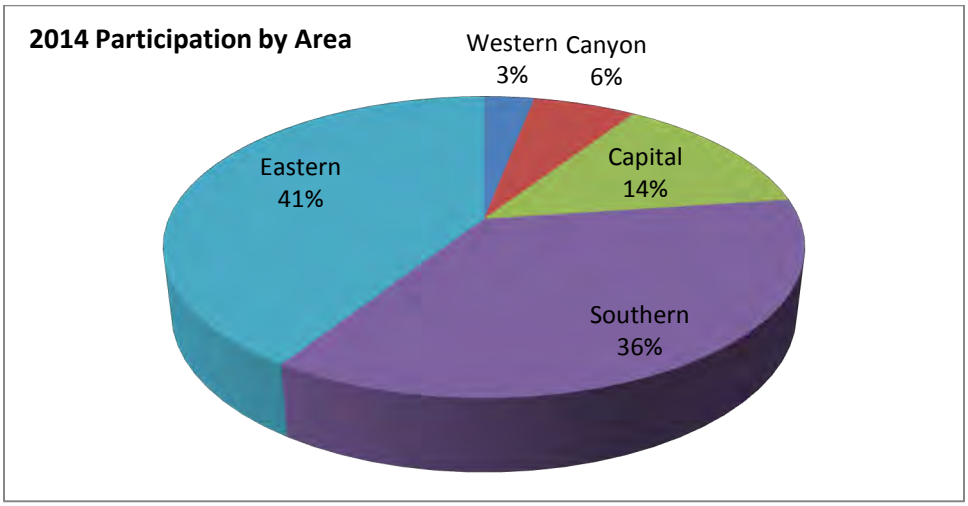

Table 2 lists the total number of eligible service points and the participation levels for each area in 2014.

Table 2. 2014 Eligible service locations and participation levels by area.

2014-Idaho Power Area		Eligible Service Locations	Automatic Device	Manual	Total Enrolled by Area	Percent of eligible enrolled
Western	Idaho	63	40	0	40	63%
	Oregon	55	27	0	27	49%
Canyon	Idaho	153	126	8	134	88%
	Oregon	4	4	0	4	100%
Capital		372	296	7	303	81%
Southern	Twin Falls	525	413	3	416	79%
	Mini-Cassia	457	391	0	391	86%
Eastern		1127	910	0	910	81%
	Total Service Points	**2756**	**2,207**	**18**	**2225**	**81%**

Operations

Equipment and Monitoring

Dispatch Option

At the inception of the Dispatch Option, Idaho Power contracted with Irrigation Load Control, LLC (ILC), who had formed a joint venture between M2M Communications and Spartan Energy Control Systems to provide installation and service for this portion of the program. In the winter of 2010, M2M Communications was purchased by EnerNOC. Idaho Power contracted with EnerNOC to provide equipment, installation, and service for the Irrigation Peak Rewards Dispatch Option. Idaho Power initiates Irrigation Peak Rewards dispatch control events on a customized EnerNOC Web site. The Web-to-wireless remote control system, developed by M2M Communications utilizes the Loadstar® Model M101control device installed in customers' pump motor control circuit to turn off or prevent the pump from running during an interruption event. This equipment provides remote cellular communication or remote satellite communication. The Web service allows Idaho Power to dispatch, schedule and carry-out interruption events. Two-way communication from the device can provide feedback to determine the status of the customers' equipment surrounding an interruption event. Customers also have the option of using the equipment for their own remote control purposes outside of interruption events.

Idaho Power has also been expanding the use of our power line carrier technology used for its automated metering system and air conditioning cycling program for turning off pumps within the Irrigation Peak Rewards program. This technology utilizes an Aclara Demand Response Unit (DRU) Model Y99700, installed in the customers' pump motor control circuit to turn off or prevent the pump from running during a load control event. The DRU receives commands via Idaho Power owned power line carrier technology.

Idaho Power's Automated Metering Infrastructure (AMI) technology allows Idaho Power to monitor the majority of participating irrigation pumps during load control events by supplying hourly usage reports. These reports provide useful information in determining which service locations had devices that either worked or failed to turn off pumps during events.

Program Analysis

Load Reduction Analysis

Estimated load reduction impacts in 2014 were determined in an impact evaluation performed by a third party contractor. In 2014, Idaho Power contracted PECI to complete an impact evaluation of the 2014 Peak Rewards program. The goals of the impact evaluation were to determine the demand reduction (in MW) during three test events and determine the counterfactual realization rate had an event been called on each business day during the program's June 15 through August 15 season. This information was used to determine and verify realization rates used to estimate load reduction potential.

For the purposes of this report, realization rate is defined as the likelihood an irrigation service point is operating during the interrupt period and includes program equipment failures, and is used to determine program impacts. The realization rate can be characterized as the percentage of monthly billing demand expected to result in an actual load reduction on the system during a given interruption period in a typical summer. This rate is highest at the end of June and the beginning of July when many irrigation pumps are operating nearly 24 hours per day and 7 days per week. The realization rate is lower later in the irrigation season when many irrigation pumps are turned off due to crop maturity. Hourly data used for the evaluation was acquired and analyzed using information from IPC's Automated Metering Infrastructure (AMI) technology.

Past program realization rate analysis using hourly data for both the Automatic Dispatch Option and Manual Dispatch Option indicate that the highest realization rates occur during the last two weeks of June and the first two weeks of July. In 2012, Idaho Power analyzed hourly data on 2,030 or 88 percent of Automatic Dispatch Option enrolled service locations, and all 35 Manual Option participants. Results suggest a 74 percent peak realization rate and an overall average program realization rate of 68 percent.

PECI completed analyses of curtailment events held on July 2, July 10, and July 14, 2014, each containing four dispatch groups that curtailed enrolled irrigation pumps in rolling four-hour increments. The results of the curtailment event analyses showed maximum demand reductions of 257.9 MW, 268.9 MW, and 250.5 MW, respectively, for the three events at the meter level which does not include system losses of 9.7 %.

Using AMI data, PECI developed a counterfactual realization rate analysis that demonstrated similar results with what past analysis have shown, that the time period within an irrigation season has a large influence on the expected realization rate. With 2014 device failures excluded, realization rates ranged from 65 percent at the beginning of the program season to a peak realization rate of 74 percent during the first two weeks of July. Due to the Irrigation Peak Rewards program suspension in 2013, annual device maintenance did not occur for nearly two years resulting in 7 percent device failure rate, as reported by PECI, lowering the overall

realization rates. The past analysis of the program realization rates indicate that they would be higher if device maintenance were at normal levels resulting in fewer device failures. The counterfactual realization rate in the last quarter of the season (August 1 -15) dropped off significantly to 34 percent with device failures included. This was due to a high percentage of pumps being shut off during the first two weeks of August due to crop maturity and uncharacteristically extreme rainfall of 2-4 inches in Southern and Eastern Idaho. This resulted in a skewed realization rate that was an exception to what has been determined in past analysis. A copy of this evaluation report can be found in *Supplement 2: Evaluation*. Table 3 shows program realization rates from analysis for 2012 and 2014.

Table 3: Program realization rates

	Idaho Power Realization Rates		
Period	**2012 Automatic Dispatch Option**	**2012 Manual Dispatch Option**	**2014 Automatic & Manual Option**
2nd half of June	74%	73%	65 %
1st half of July	72%	74%	74 %
2nd half of July	60%	68%	59 %
1st half of August	57%	65%	34 % **
Average	**66%**	**70%**	**58 %**

** Due to extremely abnormal precipitation

The results of the 2014 impact evaluation showed Idaho Power's Peak Rewards program functioned as intended, and, if properly maintained, can be relied on to provide dispatchable demand reduction to the electricity grid. These realization rates are used to calculate program performance from total enrolled billing demand and used to forecast load reduction potential in the future.

Program Costs

In 2014, this program had a total cost of $7,596,058 with the incentive credit being the largest expenditure at 80 % of total costs. The program was not marketed to new participants in 2014.

Table 4 displays the annual program costs by category.

Table 4. Annual program costs 2014.

Item	**2014 Program Costs**
Materials and Equipment	$243,626
Installation and Contract Services	$1,131,223
Incentive payments	$6,107,828

Marketing and Administration	$113,381
Total	**$7,596,058**

Benefit-Cost Analysis

The methodology used to determine the cost-effectiveness of the demand response programs was updated in 2014. As part of the public workshops in conjunction with Case No. IPC-E-13-14, Idaho Power and other stakeholders agreed on a new methodology for valuing demand-response. The settlement agreement, as approved in IPUC Order No. 32923, defined annual cost of operating the three demand-response programs for the maximum allowable 60 hours must be less than $16.7 million. This $16.7 million value is the levelized annual cost of a 170 MW deferred resource over a 20 year life. In 2014, the cost of operating the three demand response programs was $10.6 million. It is estimated that if the three programs were dispatched for the full 60 hours, the total costs would have been approximately $13.8 million and remain cost-effective.

Conclusions

- Despite being suspended during 2013, reduced incentives, and modifications to event notification, the Irrigation Peak Rewards program retained over 80% of past participating service locations.
- The program had a total of 2,225 service locations reducing peak demand by 295 MW's.
- When looking at the program at the generation level, irrigation customers have made significant contributions to Idaho Power's demand response programs. The Irrigation Peak Rewards program currently contributes approximately 83 % of Idaho Powers overall demand response portfolio.
- The cost of having this resource available was $25.75 per kW in 2014

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Idaho Power Company

Impact Evaluation Report for ENERGY STAR® Homes Northwest—Program Year 2013 (Final)

October 20, 2014

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1. EXECUTIVE SUMMARY

This report presents the results of the independent impact evaluation for Idaho Power Company's (IPC) ENERGY STAR® Homes Northwest (ENERGY STAR Homes) program for activity corresponding to the 2013 program year. The ENERGY STAR Homes program is part of a regional initiative between IPC and the Northwest Energy Efficiency Alliance (NEEA) to promote the construction of energy efficient homes using the guidelines set forth by the US Environmental Protection Agency (EPA). IPC offers the ENERGY STAR Homes program to homebuilders within its Idaho and Oregon service areas.

The key objectives of the impact evaluation for the ENERGY STAR Homes program were to:

- Verify the 2013 program energy and quantifiable non-electric impacts
- Provide credible and reliable ex-post program energy savings along with associated realization rates and quantifiable non-electric impact estimates
- Report findings and observations and provide recommendations that would enhance the effectiveness of future analysis and the accurate and transparent reporting of program savings

The impact evaluation kicked off in June 2014. The impact evaluation work plan, finalized on July 14, 2014, outlines the program impact evaluation goals, methods, schedule, and sampling approach based on discussions with Idaho Power staff and Tetra Tech's understanding of IPC's priorities and data availability. Tetra Tech gathered program tracking system data and documentation, interviewed staff, and reviewed the basis of program savings calculations. The results from the analysis of this data and information allowed Tetra Tech to develop program ex-post energy savings and realization rates. In addition, Tetra Tech developed recommendations to enhance the effectiveness of future analyses, the accuracy and transparency of reporting of program savings, and non-electric impacts for IPC to consider.

The impact evaluation approach emphasized compliance with the Regional Technical Forum (RTF) energy savings as the basis for verifying savings. The approach Tetra Tech took to verify RTF compliance included the following:

- A review of 100 percent of program tracking data that led to reported savings using RTF metrics
- A documentation review of a census (7) of participating single family homes Northwest ENERGY STAR database reports
- A documentation review of a sample of participating townhomes Northwest ENERGY STAR database reports
- A review of 100 percent of 2013 Northwest ENERGY STAR Homes Quality Assurance Data for Idaho Power Territory
- Interviews with program staff and other research to verify methods and address variances

As part of the ENERGY STAR Homes program impact evaluation, Tetra Tech reviewed existing literature to identify quantified non-electric impacts (NEIs) estimated or used in other regions of the United States. The review did not consider societal benefits or utility related emissions benefits, focusing on participant and utility non-electric benefits related specifically to a new home built to the ENERGY STAR program standards. The NEI literature review and recommendations are presented in Appendix A.

Table 1-1 shows the claimed and evaluated energy savings for the ENERGY STAR Homes program for program year 2013. Total ex-post verified savings were 353,828 kWh compared to 365,370 kWh ex-ante claimed savings resulting in a gross realization rate of 96.8 percent. The driver of the difference in the overall kWh realization rate from 100 percent were adjustments primarily made to seven townhomes removed from the program savings. The table also provides a summary of the ex-ante versus ex-post savings and realization rates by state. In 2013, program participation only took place in IPC's Idaho service territory, with the Oregon service territory having no reported projects or savings.

Table 1-1. Program Year 2013 Ex-Ante and Ex-Post Energy Savings

State	2013 Ex-Ante Energy Savings (kWh)	2013 Ex-Post Energy Savings (kWh)	Realization Rate (%)
Idaho	365,370	353,828	96.8 %
Oregon	0	0	N/A
Total	365,370	353,828	96.8 %

The impact evaluation found that the ENERGY STAR Homes program has well-established program design and delivery processes, supported by the program tracking systems, program documentation, and savings tools. The healthy realization rate of the program supports this finding. At the same time, the objective of the impact evaluation is to facilitate more accurate, transparent, and consistent savings calculation and program reporting as well as provide feedback on improvement opportunities. Tetra Tech identified the following key findings and recommendations for the ENERGY STAR Homes program as a result of the impact evaluation.

Continue use of the program tracking system for savings assignments with automated functionality where possible: During the evaluation, IPC made improvements to their energy efficiency programs database to improve database functionality, accuracy, and user interface to allow automatic look-up and other similar functions within the database. IPC was proactive to improve database reliability. These improvements should reduce the potential for data entry error, enhance the quality of future review processes, and help facilitate ad hoc reviews by program managers. The changes implemented to IPC's data tracking system occurred while the program evaluation was underway and the database used for the evaluation did not include those updates. Tetra Tech recommends that the "going-forward" database be evaluated in future evaluation cycles.

Investigate methods for obtaining project-level documentation: The program and a future evaluation effort may benefit by having greater access to project level details covering project eligibility and greater technical details. For the benefit of the program and evaluators, we recommend that IPC work with NEEA and their contractors to improve the level of detail captured for each project and made available to IPC regarding the Builder Option Package (BOP) inspection results for each home.

Work to increase quality assurance inspections within IPC territory: Work with NEEA and their contractors to better understand the protocols and information obtained and documented during quality assurance (QA) inspections in IPC's service territory. This will ensure appropriate home parameters are captured for the current and future needs of IPC evaluations and that a minimum number of IPC ENERGY STAR certified homes are QA inspected each year. Absent the ability of IPC to ensure a minimum level of service for quality assurance, IPC should consider conducting and documenting its own quality assurance process, utilizing the same protocols as the NEEA initiative.

2. INTRODUCTION

This report presents the third-party impact evaluation results for Idaho Power Company's (IPC) ENERGY STAR® Homes Northwest (ENERGY STAR Homes) program implemented in program year 2013 (PY2013). The purpose of the impact evaluation is to verify energy and non-electric program impacts, along with providing observations and recommendations to enhance the effectiveness of future analysis and the accurate and transparent reporting of program savings.

2.1 PROGRAM DESCRIPTION

The ENERGY STAR Homes program is part of a regional initiative between IPC and the Northwest Energy Efficiency Alliance (NEEA) to promote the construction of energy efficient homes using the guidelines set forth by the US Environmental Protection Agency (EPA).

NEEA oversees the regional Northwest ENERGY STAR Homes initiative, with support from the initiative's implementer, CLEAResult. CLEAResult works with NEEA throughout the Pacific Northwest to set participation standards, maintain the initiatives database, and provide customized training to builders, raters, and realtors. IPC has access to the initiatives database for retrieving home rater inspection reports and notification when certification is complete. Under the NEEA initiative, quality assurance inspections are completed by Building Energy, Inc. or Washington State University. These quality assurance inspection reports are provided to IPC quarterly.

IPC incentivized 260[1] homes through the ENERGY STAR Homes program in 2013. Builders involved in the program received a $1,000 incentive per home built to the Northwest Builder Options Package heat pump technology standard. Builders who participate in a Parade of Homes receive an additional $500 marketing incentive payment.

2.2 REPORTED PROGRAM SAVINGS

IPC relies on the Northwest Power & Conservation Council (NPCC) for savings estimates for new home construction built to ENERGY STAR version 3, using heat pump technology. NPCC's Regional Technical Forum (RTF) develops energy savings for a wide range of energy efficiency measures based on technology performance, market conditions, and distribution methods. The RTF develops "proven" savings values that serve as deemed savings for IPC for all homes found in the IPC program.

IPC reported 365,370 kWh savings for the ENERGY STAR Homes program for 2013. Table 2-1 reports the breakout of reported energy savings based on the IPC Demand-Side Management 2013 Annual Report.

[1] 260 homes reflect the ex-post results.

Table 2-1. Reported ENERGY STAR Homes Program Savings[2]

Home Type	Number of Homes
Single Family Homes	7
Townhomes	260
Total	267
Total Reported kWh	365,370 kWh

2.3 EVALUATION APPROACH

The purpose of the impact evaluation was to verify reported gross energy savings, document evaluation activities, and provide recommendations to enhance the effectiveness of the program. The approach emphasizes compliance with the RTF energy savings as the basis for verifying savings, with variations relying on other methods as needed.

The approach Tetra Tech took to verify RTF compliance included the following:

- A review of 100 percent of program tracking data that led to reported savings using RTF metrics
- A documentation review of a census (7) of participating single family homes Northwest ENERGY STAR database reports
- A documentation review of a sample of participating townhomes Northwest ENERGY STAR database reports
- A review of 100 percent of 2013 Northwest ENERGY STAR Homes Quality Assurance Data for Idaho Power Territory
- Interviews with program staff and other research to verify methods and address variances

2.4 REPORT ORGANIZATION

The report describing the impact evaluation for PY2013 includes the following sections:

- Chapter 2 presents the evaluation methodology
- Chapter 3 describes the analysis, findings, and verified energy savings along with recommendations for savings adjustments or program considerations
- Chapter 4 presents a discussion of non-electric benefits that may be associated with the program
- Chapter 5 presents the evaluation recommendations and conclusions emerging from the evaluation activities and findings

[2] Data developed from the IPC Demand-Side Management 2013 Annual Report.

- Appendix A provides a discussion of non-electric impacts that may be associated with the ENERGY STAR Homes program

3. EVALUATION METHODOLOGY

The purpose of the evaluation was to verify the reported savings of IPC's ENERGY STAR Homes program. Additionally, IPC asked Tetra Tech to investigate non-electric benefits that may be associated with the program, providing quantifiable results as available. Tetra Tech reviewed a number of program documents, taking a census approach where possible and sampling where needed.

The overall methodology focused on three topics:

1) Verifying savings based on RTF savings values
2) Confirming tracking system accuracy based on ENERGY STAR reports and other factors related to validating home characteristics and certifications
3) Reviewing quality assurance procedures and results

Tetra Tech began the evaluation with a meeting with the IPC evaluation lead to outline goals for the evaluation and identify key issues and IPC personnel for subsequent interviews. Tetra Tech interviewed the program specialist to understand data tracking, data availability, and program policies and to develop an ongoing dialogue to discuss questions that may emerge from the initial data review and findings.

To review tracking data, Tetra Tech applied a census approach to the review of per-home savings tracked in the program's tracking system. The census approach avoids sampling error, resulting in an outcome that exceeds the minimum 90 percent ± 10 percent confidence required of the evaluation findings. For specific points of inquiry, Tetra Tech conducted desk reviews using sampled data to verify practices and metrics. These points included a verification of home type and relevant heating and cooling climate zone associated with RTF savings categories and a review of ENERGY STAR reports to verify program compliance and data entry accuracy.

Tetra Tech based the desk reviews and verification of home certifications on a census of single-family homes and a final sample of 23 townhomes. The townhome sample was based on a random selection from the list of participating townhomes involved in the program. Tetra Tech found that the townhome population was represented in 10 separate townhome developments. Tetra Tech based the sampling on 10 strata, representing the 10 developments. Each stratum contained between four and 126 townhomes. Tetra Tech randomly selected between one and seven sample townhomes from each site/stratum depending on the number of units at each location and potential for duplicates at a site.

Additionally, Tetra Tech reviewed additional Quality Assurance (QA) procedures and documentation to understand program policies and practices and the method for ensuring verification of homes. The purpose of the quality assurance review was to better understand how the program managed quality assurance, how that may influence the evaluation findings in terms of certainty, and whether opportunities may exist for improvements in quality assurance to enhance future program energy savings and evaluation findings.

As part of the impact evaluation of IPC's ENERGY STAR Homes program, Tetra Tech reviewed existing literature to identify quantified non-electric impacts (NEIs) estimated or used in other regions of the United States. The review did not consider societal benefits or utility related emissions benefits, focusing on participant and utility non-electric benefits related specifically to a new home built to the ENERGY STAR program standards. Such a focus aligns with the Total Resource Cost test approach to viewing program cost effectiveness. The literature review focused on work conducted in California, Massachusetts, and New York, though some of the literature referenced related to NEIs and approaches in other regions of the United States as well. Tetra Tech also reviewed the RTF worksheets to identify how NEIs may be used within the RTF savings calculation methods. The results of the literature review of non-electric impacts that may be associated with the program are presented in Appendix A.

4. ANALYSIS, FINDINGS, AND VERIFIED SAVINGS

This chapter discusses the methodology and results of the impact evaluation of the 2013 ENERGY STAR Homes program. Each section in this chapter includes recommendations that emerged through the process of completing the analysis and the impact or risk to IPC's energy savings. Tetra Tech presents the analysis in four main sections: tracking system review, verification of RTF savings compliance, desk reviews, and review of quality assurance procedures and results.

4.1 TRACKING SYSTEM REVIEW

IPC tracks energy savings and participant information for the ENERGY STAR Homes program in a portfolio-level tracking database. IPC provided Tetra Tech with a Microsoft Excel® workbook extract from the tracking database for a review of project level data. A separate spreadsheet was provided to Tetra Tech to present project level savings, matched to a common identifier with the program tracking extract. This second spreadsheet was used to develop the reported 2013 program energy savings.

The participant tracking spreadsheet contains individual home information including ENERGY STAR identifier, service point identifier, home address/city/state/ZIP/subdivision, home size, home type, builder, rater, incentive payment, and ENERGY STAR certification date. The data spans incentives paid from January through November 2013. The participant tracking spreadsheet described 267 homes, of which seven were identified as single family homes and 260 as townhomes, matching the counts reported in the 2013 Annual Report. Savings values for each home were not present in the participant tracking spreadsheet.

In conducting the review of the participant tracking spreadsheet, Tetra Tech identified seven of the townhomes as having duplicate addresses and service point identifiers. Tetra Tech confirmed with IPC that seven townhomes were indeed duplicates. IPC explained that this issue had been identified and addressed prior to the evaluation but after the annual report had been published. All the duplicate homes were townhomes. IPC described the problem as an issue with the program database. The database was only screening out those participants who had the same account/service point/contract combinations, when it should be screening out participants based on service point identifier alone. In essence, the original constraint would allow multiple entries of the same service point as long as the account or contract was different (which happens when new people move into a house). With new logic in place, once a service point has participated in the program, it cannot be entered into the program database again. To account for the effect of the duplicates, Tetra Tech's ex-post savings were adjusted downward by 9,058 kWh (1,294 kWh x 7 townhomes). IPC confirmed that seven duplicate incentives were returned to IPC from the builder.

Tetra Tech used the RTF's savings values for each single family home and townhome to develop an independent tally of savings. Using the participant tracking worksheet, Tetra Tech found that the program total savings, including the duplicate townhomes, totaled 362,886 kWh. This is 2,484 kWh less than the reported total savings.

With the difference in total energy savings between IPC's reported savings and Tetra Tech's calculation, Tetra Tech reviewed the energy savings spreadsheet provided by IPC. Tetra Tech confirmed that the IPC reported savings matched the total savings from the IPC savings spreadsheet and that the count of homes (267) matched. Further review revealed that in the IPC energy savings worksheet, a townhome had been incorrectly identified as a single family home and assigned the single family savings value. The difference in the RTF savings between one single family home and one low-rise multifamily home is 2,484 kWh, the same difference in values Tetra Tech found between the IPC participant tracking spreadsheet and IPC energy savings spreadsheet. IPC explained that recent updates to their program database will allow for updating and calculating savings for each program home based on active RTF savings criteria. Doing so will prevent the need to conduct savings calculations outside the database. As a significant improvement for the program specialist, the database will ensure internal consistency and reduce the potential for such errors.

Through the ENERGY STAR identifier, service point identifier, and detailed address information within the participant tracking spreadsheet, Tetra Tech was able to confirm the misidentified home. As a result, ex-post savings are lower than ex-ante savings by 2,484 kWh to account for the difference between single family and townhome savings.

Table 4-1 describes the total adjustments made to ex-ante kWh savings to arrive at ex-post kWh savings, accounting for the mischaracterization of one home and seven duplicate entries.

Table 4-1. Energy Savings and Ex-Post Results for ENERGY STAR Homes

Adjustment Factor	Ex-Ante Adjustment
Mischaracterization of home type	-2,484 kWh
Duplicate entries	-9,058 kWh
Total	-11,542 kWh

Recommendation 1: IPC should continue its quality review process to avoid duplicate entries, but also carefully review each project to ensure that other factors are entered correctly. Data checks across several fields can provide a further quality review screen between participant and energy savings and will help avoid future misalignment between participating homes and the assigned savings values.

4.2 REGIONAL TECHNICAL FORUM COMPLIANCE

IPC used version 2.2 of the RTF's Residential New Construction Single Family ENERGY STAR Homes (Single Family RTF) savings workbook to develop 2013 savings for the ENERGY STAR Homes program for single family homes. For townhomes, IPC used version 1.1 of the RTF's Residential New Construction Multifamily (Multifamily RTF) savings workbook to develop 2013 savings for the ENERGY STAR Homes program for townhomes. The RTF periodically updates savings values, with IPC using the latest version to report savings for the entire year in which the latest savings values are developed. Tetra Tech utilized the program tracking system and RTF workbooks to verify compliance with RTF savings based on this policy.

At the start and end of the 2013 program year, version 2.2 of the Single Family RTF workbook was active and in use. At the start and end of the 2013 program year, version 1.1 of the Multifamily RTF workbook was active and in use. Since 2013, neither RTF workbook has made significant changes to the residential new construction ENERGY STAR program savings. IPC used these savings workbooks to report savings for the 2013 program year.

The RTF workbooks provide "proven" savings values for new home construction built to Northwest ENERGY STAR version 3 through calibrated engineering estimation procedures. Homes are grouped by heating equipment type and heating/cooling zone combination. Tetra Tech reviewed each participating home address and mapped each home to its corresponding county and heating/cooling zone. All homes incented by IPC's ENERGY STAR Homes program in 2013 used electric heat pump technology and were located in heating zone 1 and cooling zone 3. Table 4-2 presents the RTF's corresponding savings assignments for residential new construction ENERGY STAR homes.

Table 4-2. ENERGY STAR Home Type and their RTF Savings Assignment

Home Type	Heating/Cooling Zone	RTF Savings Assignment Value (kWh)
Single Family Home	HZ1 / CZ3	3,778[3]
Townhome	HZ1 / CZ3	1,294[4]

Tetra Tech confirmed that IPC is using the RTF savings values for each new construction home type (single family and townhome). Notwithstanding the previously addressed mischaracterization of one townhome, Tetra Tech found that IPC is following the RTF savings to develop program savings. The energy savings tracking spreadsheet bases savings on the heating and cooling zones as identified by the RTF workbooks.

Although IPC is using the RTF savings values and is generally assigning them correctly based on heating and cooling zones and market segments, Tetra Tech notes that the current system creates potential for future data errors. Across two states and potentially with additional heating and cooling zones, the complexity of program participation and savings assignments could increase. Heating and cooling zones are defined by county, a factor not tracked in the participant tracking spreadsheet. It was unclear whether the energy savings spreadsheet is part of a larger workbook that may have look-up functions that correspond to RTF savings values. Regardless, a unified participant tracking and energy savings spreadsheet combined with documentation from the RTF savings workbooks may help reduce the risk that savings are misassigned based on home location or mis-referencing the RTF savings values.

Recommendation 2: Continue to use the RTF "proven" measure savings. The current savings process is efficient and helps manage limited IPC program resources.

[3] Residential New Construction Single Family ENERGY STAR Homes Idaho RTF version 2.2.
[4] Residential New Construction Multifamily ENERGY STAR Homes Idaho RTF version 1.1.

Recommendation 3: Develop savings assignments and calculations in clear alignment with the RTF savings values for single family and multifamily homes. Recent improvements to the IPC program database provides for this functionality. The database improvements will allow for unifying participant tracking and savings. In addition, the upgrades will provide an efficient and standardized approach that can address regional program complexity and ongoing RTF savings changes.

4.3 DESK REVIEWS

Tetra Tech completed desk reviews of individual single family and townhomes. The desk reviews were used to review the accuracy and completeness of inspection documentation for home certification and verify that the homes had, in fact, been ENERGY STAR certified. This more comprehensive review compared available parameters provided within the certification reports to ensure participant homes were within the range of the ENERGY STAR version 3 program requirements. Additionally, the reports were used to verify that key IPC program requirements were met—confirming IPC electrical service and electrical space heating requirements.

Tetra Tech collected inspection reports for a census of seven single family homes and a sample of townhomes that represented a census of all 10 townhome developments. A subsample of 30 individual townhome units was used to request and review certification reports. The townhome subsample was based on a random selection from the list of participating homes involved in the program and on 10 strata representing the 10 townhome developments. Each stratum contained between four and 126 townhomes. Tetra Tech randomly selected between one and seven sample townhomes from each site/stratum depending on the number of units at each location and potential for duplicates at a site. The certification reports that Tetra Tech received provided a number of parameters to validate that the homes met Northwest ENERGY STAR standards. Table 4-3 presents the parameters and key metrics Tetra Tech was able to view and verify.

Table 4-3. Desk Review Parameters and Metrics

Parameter	Metric	Implications
Electric utility	Idaho Power Company	IPC electric service
Gas service	No gas service	No gas heating (if gas service, confirmation of heat pump)
Current status	Certified inspection	Home had been inspected and certified
Certification date	In 2013 or end of 2012	Reasonable to claim for 2013 program year
ACH50	<=4 ACH50	Meets leakage test
Duct leakage	Greater of <= 75CFM 50 or <=0.06 CFM50 per sq. ft.	Meets duct leakage test
Conditioned space	Square footage	Matches tracked square footage
Home is certified	Yes/No	Home meets or exceeds program standards

The home certification documentation IPC receives from the Northwest ENERGY STAR Homes initiative provides major parameters that define home eligibility and energy efficient performance. However, detailed information regarding other Builder Option Package (BOP) requirements were not present. Information considered absent were details regarding the building shell, heating and cooling system efficiency and controls, water heater, and lighting information. The information that was provided allowed for a reasonable verification that the homes meet program standards. As IPC does not directly manage the quality assurance of the Northwest ENERGY STAR Homes initiative, these additional parameters and the quality of the inspections by the Home Performance Specialist (HPS) is a responsibility of NEEA. While Tetra Tech sees value in gathering and reviewing additional information, those activities were viewed as beyond the current evaluation needs as they are already captured in the quality assurance review, and were otherwise beyond the scope of the evaluation effort.

Recommendation 4: Work with NEEA and their contractors to better understand the protocols and information obtained and documented during QA inspections in IPC's service territory to ensure appropriate home parameters are captured for the current and future needs of IPC evaluations.

Recommendation 5: IPC is limited in the documentation currently provided by NEEA and the Home Energy Specialists as part of each home certification. We recommend that IPC have its own documentation of IPC funded new homes projects. This data could come from the NEEA program database or directly from the HPS. We recommend that IPC work with NEEA and their contractors to improve the level of detail captured for each project and made available to IPC regarding the Builder Option Package inspection results for each home.

4.4 QUALITY ASSURANCE REVIEW

The Northwest ENERGY STAR Homes program has many levels of oversight that provide installation verification assurance. An independent, third-party HPS conducts the ENERGY STAR certification inspections. The HPS is certified by the Washington State University Extension Energy Program. Two HPSs (otherwise known as raters), Building Energy, Inc. and Momentum, LLC., provided all the inspections for IPC's ENERGY STAR Homes program in 2013. Once the certification is complete, the HPS enters the results directly into the Northwest ENERGY STAR Homes initiative database that is managed by NEEA. IPC has direct access to this database and is able to obtain the ENERGY STAR certification reports for each home. IPC also relies on Washington State University and Building Energy, Inc., under the Northwest ENERGY STAR Homes initiative, to provide additional quality assurance inspections for IPC's territories.

Tetra Tech intended to review IPC participants' quality assurance reports developed as part of the NEEA Northwest ENERGY STAR Homes program process. IPC explained to Tetra Tech that five to ten percent of the ENERGY STAR participants received a quality assurance review by the Northwest ENERGY STAR Homes program. Tetra Tech felt that reviewing these reports would shed additional light on the program, expand the sample receiving desktop reviews, and potentially lead to program recommendations.

IPC provided the 2013 Northwest ENERGY STAR Homes Quality Assurance Data (QA Data) tracking spreadsheet to Tetra Tech. This spreadsheet lists all QA inspections that took place in IPC territory in Idaho in 2013. The QA Data tracking spreadsheet contains individual home and certification/test information including site identifier, home address/city/state/ZIP/subdivision, home size, major equipment information, builder, rater, QA inspector, and date of QA review. The QA Data tracking spreadsheet described 28 unique site identifiers and addresses. Tetra Tech found that none of the homes listed in the QA Data tracking spreadsheet were homes that participated in IPC's ENERGY STAR Homes program in 2013.

According to www.energystar.gov, 1,150 ENERGY STAR homes were built in Idaho in 2013. Based on the 260 homes that were confirmed unique participants, IPC represents 23 percent of ENERGY STAR certified homes in Idaho. As IPC is a significant portion of ENERGY STAR certified homes within Idaho, Tetra Tech expected that a portion of IPC participant homes would have received the QA review

IPC relies on the processes of the Northwest ENERGY STAR Homes program to help deliver the program and ensure quality. That zero IPC homes were selected by the Northwest ENERGY STAR Homes program for a QA review is highly unlikely and points to a potential missed opportunity for IPC to learn more about its population of program homes. Therefore, Tetra Tech was unable to utilize the QA reports to enhance the evaluation, pointing to a significant gap in the program. Tetra Tech notes that this issue is *not* related to IPC, but the larger Northwest ENERGY STAR Homes program as it serves IPC and IPC's program participants.

Recommendation 6: Work with NEEA and their contractors to better understand the protocols for selection of QA inspections in IPC's service territory to ensure that a minimum number of IPC ENERGY STAR certified homes are QA inspected each year.

Recommendation 7**:** Absent the ability of IPC to ensure a minimum level of service for quality assurance, IPC should consider conducting and documenting its own quality assurance process, utilizing the same protocols as the NEEA initiative.

5. CONCLUSIONS AND RECOMMENDATIONS

This chapter of the report describes Tetra Tech's overall conclusions and recommendations. Overall, Tetra Tech found only minor points for adjusting savings. Tetra Tech recommends total program savings be adjusted downward, but only by less than four percent. In reviewing program documentation and processes, Tetra Tech found that the program is operating efficiently. IPC should not view Tetra Tech's recommendations as significant deficiencies in the program's operations but as points for potential improvement that will help drive greater confidence in reported savings values and future evaluation efforts. However, the recommendations do point to areas of potential risk that, if left unaddressed, could create future challenges for the program.

5.1 VERIFIED SAVINGS

Table 5-1 shows the claimed and evaluated energy savings for the ENERGY STAR Homes program for program year 2013. Total ex-post verified savings were 353,828 kWh compared to 365,370 kWh ex-ante claimed savings, resulting in a gross realization rate of 96.8 percent. The driver of the difference in the overall kWh realization rate from 100 percent was adjustments primarily made to seven townhomes removed from the program savings. The table also provides a summary of the ex-ante versus ex-post savings and realization rates by state. In 2013, program participation only took place in IPC's Idaho service territory, with the Oregon service territory having no reported projects or savings.

Table 5-1. Program Year 2013 Ex-Ante and Ex-Post Energy Savings

State	2013 Ex-Ante Energy Savings (kWh)	2013 Ex-Post Energy Savings (kWh)	Realization Rate (%)
Idaho	365,370	353,828	96.8 %
Oregon	0	0	N/A
Total	365,370	353,828	96.8 %

5.2 RECOMMENDATIONS

The impact evaluation found that the ENERGY STAR Homes program has well-established program design and delivery processes, supported by the program tracking systems, program documentation, and savings tools. The healthy realization rate of the program supports this finding. At the same time, the objective of the impact evaluation is to facilitate more accurate, transparent, and consistent savings calculation and program reporting as well as provide feedback on improvement opportunities. Tetra Tech identified the following findings and recommendations for the ENERGY STAR Homes program as a result of the impact evaluation.

Continue use of the program tracking system for savings assignments with automated functionality where possible: During the evaluation, IPC made improvements to their energy efficiency programs database to improve database functionality, accuracy, and user interface to allow automatic look-up and other similar functions within the database. IPC was proactive to

improve database reliability. These improvements should reduce the potential for data entry error, enhance the quality of future review processes, and help facilitate ad hoc reviews by program managers. The changes implemented to IPC's data tracking system occurred while the program evaluation was underway and the database used for the evaluation did not include those updates. Tetra Tech recommends that the "going-forward" database be evaluated in future evaluation cycles.

Continue use of RTF categories: Continue to use the RTF "proven" measure savings, but develop savings assignments and calculations with a clear alignment with the RTF savings values for single family and multifamily homes. A unified participant tracking and savings workbook could contain such information and provide an efficient and standardized approach that can address potential future program regional complexity.

Investigate methods for obtaining project-level documentation: The program and a future evaluation effort may benefit by having greater access to project level details covering project eligibility and greater technical details. For the benefit of the program and evaluators, we recommend that IPC work with NEEA and their contractors to improve the level of detail captured for each project and made available to IPC regarding the Builder Option Package (BOP) inspection results for each home.

Work to increase quality assurance inspections within IPC territory: Work with NEEA and their contractors to better understand the protocols and information obtained and documented during QA inspections in IPC's service territory. This will ensure appropriate home parameters are captured for the current and future needs of IPC evaluations and that a minimum number of IPC ENERGY STAR certified homes are QA inspected each year. Absent the ability of IPC to ensure a minimum level of service for quality assurance, IPC should consider conducting and documenting its own quality assurance process, utilizing the same protocols as the NEEA initiative.

APPENDIX A: NON-ELECTRIC IMPACTS

A.1 INTRODUCTION

As part of the evaluation of Idaho Power Company's (IPC) ENERGY STAR® Homes Northwest (ENERGY STAR Homes) program, Tetra Tech reviewed existing literature to identify quantified non-electric impacts (NEIs) estimated or used in other regions of the United States. For IPC, non-electric impacts are defined as non-energy impacts plus fuel impacts. Other regions and studies use the term non-energy impacts to address the positive or negative impacts of energy efficiency programs outside of energy impacts, while non-energy benefits are also considered, but only include the benefit side of non-energy impacts. The review did not consider societal benefits or utility-related emissions benefits, focusing on participant and utility non-electric impacts related specifically to a new home built to the ENERGY STAR program standards. Such a focus aligns with the Total Resource Cost test approach to viewing program cost effectiveness. The literature review focused on work conducted in California, Massachusetts, and New York, though some of the literature referenced non-energy impacts and approaches in other regions of the United States as well. Tetra Tech also reviewed the Regional Technical Forum (RTF) worksheets to identify how NEIs may be used within the RTF savings calculation methods.

Our recommendation provides two options for metrics and approaches that IPC could consider in the short term for the ENERGY STAR Homes program as they relate to non-*energy* impacts:

- Apply a dollar value to the annual benefits in the range of $100 to each participating home to account for non-*energy* impacts
- Increase program benefits by 10 percent to account for non-*energy* impacts in the Total Resource Cost test

Additionally, Tetra Tech recommends that IPC consider including heating fuel savings of ENERGY STAR Homes program participants that do not use electricity as the primary space heating energy source. Current program eligibility requires that homes be heated with electricity as the primary heat source. However, the RTF calculates electricity savings for gas heated homes and provides metrics for therm savings of gas heated ENERGY STAR homes. Additional research is needed regarding how the RTF may address homes with electric space heating but gas water heating, and may provide additional incremental gas savings benefits without changing program eligibility requirements.

Tetra Tech further recommends that IPC consider researching NEIs specific to the IPC service territory, identifying the attributes that program participants recognize. Additionally, utility-related NEIs, such as reduced arrearages, should also be researched and would enable IPC to quantify specific utility benefits.

These options each have their own benefit-cost calculation considerations, discussed below. Tetra Tech notes that including non-energy benefits (NEBs) is becoming more common for energy efficiency programs. NEBs are "sometimes more important than the energy benefits" and "many efficiency programs are successfully promoted to customers because of the non-energy benefits." (Malone, 2014). The results of the literature review for ENERGY STAR new homes

programs support this view. If IPC develops an approach to include NEIs for the ENERGY STAR Homes program, IPC would be in-alignment with emerging industry practices.

A.2 LITERATURE REVIEW

The literature review focused on three reports from Massachusetts, New York, and California. Additionally, Tetra Tech reviewed the RTF measure savings workbooks. In Massachusetts in 2011, Tetra Tech and NMR researched non-energy impacts referenced and quantified in existing energy efficiency literature for the residential and low-income segments. NYSERDA provided the second report, discussing non-energy impacts across energy efficiency programs and with a section specific to the New York ENERGY STAR Homes program. In California, the California Public Utilities Commission provided a report with foundational perspectives on NEBs for demand side management programs, as well as a discussion on approaches and issues taken in other states.

Tetra Tech found that there are quantified NEIs used in other regions. However, the approaches and metrics differ substantially. In comparing work conducted in Massachusetts and New York, specific dollar values are noted. In other regions, a default percentage approach is used to avoid the complexity of calculating (and potentially miscalculating) those NEIs. A direct application of the Massachusetts and New York quantified values to IPC's programs may miss regional differences, requiring research to adjust those savings to the IPC regulatory and market context. A default percentage approach may be simple to apply, but may also miscalculate the actual NEIs. The RTF calculations capture NEIs, but converts and aggregates those values to a per kilowatt-hour (kWh) present value. The specific metrics used by the RTF (e.g., discount rate) may or may not align with an IPC specific approach.

A.2.1 Massachusetts

In Massachusetts, Tetra Tech and NMR (Tetra Tech & NMR, 2011) identified an extensive list of non-energy impacts related to utility, participant, and societal perspectives. This report noted that a key challenge for identifying the non-energy impacts is that a significant amount of work has been done for low-income housing, but less so for the general population and residential new construction. For IPC, the significant participation of multifamily buildings may suggest an income level consideration that could enable low-income related benefits to be applied, but is speculative at this point, absent demographic research on participant property occupant household incomes. Therefore, some of the low-income benefits identified in the Massachusetts study could be reasonably applied to the general multifamily properties in IPC's ENERGY STAR Homes program.

From the Massachusetts study, the following values have a correlation with the IPC ENERGY STAR Homes program. Most of the values are treated as annual benefits, though several are identified as one-time benefits. The Massachusetts study developed the metrics from a wide range of literature, suggesting that the specific values are not unique to just Massachusetts or otherwise regionally biased. To utilize the annual values, a present value will need to be calculated using appropriate discount rates.

Table A-1. Non-Energy Impacts of New Homes Programs, Massachusetts Study

Non-Energy Impact	Beneficiaries	Value	Timeframe	Applicable Sectors
Reduced arrearages	Utility, Ratepayers	$2.61 per dwelling	Annual	MF only (LI specific in literature)
Reduced bad debt write-offs	Utility, Ratepayers	$3.74 per dwelling	Annual	MF only (LI specific in literature)
Reduced terminations and reconnections	Utility, Ratepayers	$0.43 per dwelling	Annual	MF only (LI specific in literature)
Customer call reductions	Utility, Ratepayers	$0.58 per dwelling	Annual	MF only (LI specific in literature)
Fewer collection notices	Utility, Ratepayers	$0.34 per dwelling	Annual	MF only (LI specific in literature)
Higher comfort	Participant	$77 per dwelling	Annual	SF, MF
Quieter interior	Participant	$40 per dwelling	Annual	SF, MF
Lighting quality and lifetime[5]	Participant	$3.50 per fixture $3.00 per bulb	One time	SF, MF
Increased housing property value	Participating home owners	$72 per dwelling	Annual	SF only
Reduced water usage and sewer cost	Participant	$3.70 per dwelling	Annual	SF, MF
Marketability, ease of finding renters	Rental housing owners	$0.96 per unit	Annual	MF only (LI specific in literature)
Property value	Rental housing owners	$17.03 per unit	One time	MF only (LI specific in literature)
Durability of property	Rental housing owners	$36.85 per unit	Annual	MF only (LI specific in literature)
Tenant complaints	Rental housing owners	$19.61 per unit	Annual	MF only (LI specific in literature)

Notes: Low Income (LI), Multifamily (MF), Single Family (SF)

Most non-energy impacts identified in the Massachusetts study are based on per dwelling savings annual values. The research behind the selected applicable sectors is not explicit in the

[5] Per lamp and per fixture valuation are not additive. Compact fluorescent lamp (CFL) specific fixtures provide the same benefit as CFL lamps, but with a dedicated CFL socket. Additionally, CFL lamp benefits would be double

Massachusetts research, but applied to each sector based on relevance of the impact benefit. For example, research on the value of higher comfort for participants may be heavily weighted toward single family homes, but is an attribute that reasonably extends to multifamily dwellings. In the case of the multifamily only (low-income specific in literature) attributes, the literature specifically mentioned low-income studies. The selected attributes from the Massachusetts study in Table A-1 may be reasonably extended to general multifamily dwellings.

In general, the Massachusetts study did not specify multifamily new construction non-energy impacts, which appears to be a general gap in the literature, but particularly relevant to IPC. Where general multifamily non-energy impacts are mentioned in the Massachusetts study, the attributes are not specific to new construction and not included in the above table. For example, a benefit of "reduced equipment maintenance (HVAC)" is not included as new construction buildings are not subject to the same level of HVAC equipment maintenance as existing multifamily buildings.

Table A-2 summarizes the values from Table A-1 for non-lighting and non-energy impacts identified in the Massachusetts study that may be applicable to IPC's ENERGY STAR Homes program. If the value of lighting non-energy impacts were included, 50 percent of the lamps should be assumed to be high efficacy as a baseline, with only the remaining percentage counted for NEIs.

Table A-2. Massachusetts Non-Energy and Non-Lighting Impacts for New Homes

Sector	Annual Impact	One Time Impact
Single Family	$192.70	NA
Multifamily	$202.85	$17.03

IPC should consider whether the value of NEIs for multifamily units should include benefits related to serving low-income customers. However, applying the single family homes value to general multifamily units may be appropriate absent IPC or region-specific research into costs for each sector. Tetra Tech recommends some caution in assuming that approximately $192 per unit per year is appropriate to IPC as code changes since the Massachusetts study and regional differences may suggest a lower value is more appropriate. Absent this research, an assumption of $100 per year may be reasonable. Even with discounting, such a value will accrue substantial NEIs to the IPC program.

A.2.2 New York State Energy Research and Development Authority (NYSERDA)

In 2006, NYSERDA published a study of non-energy impacts that included an analysis of the New York ENERGY STAR Labeled Homes program (NYSERDA, 2006). The report identified non-energy impacts similar to those in the Massachusetts study, based on a survey of participating and non-participating single family homes. The surveys identified values for non-

counted if new homes utilized upstream sales promotions to fill the lamps and had benefits also counted from those sales as part of a lighting program. Further, high efficacy lighting is part of the 2009 IECC, with 50 percent of fixtures required to be high efficacy. The 2012 IECC requires 75 percent of lamps be high efficacy.

energy impacts and that a substantial portion of the single family home new construction market were motivated to purchase a more energy efficient home due to the non-energy impacts. While the incremental effect of the program was not identified, the relative value of energy savings compared to the non-energy impacts was identified. Participants reported no negative values for non-energy impacts. Additionally, the research identified a willingness-to-pay for non-energy impacts (in Table A-3, below), which differed substantially from the value of NEIs relative to energy savings.

Table A-3. NYSERDA Results for ENERGY STAR Homes Non-Energy Impacts (NYSERDA, 2006), Annual Values

Non-Energy Impact	Value Relative to Energy Savings (participants)[6]	Willingness-to-Pay (all respondents)
Durability	17%	$202
Thermal Comfort	45%	$191
Safety	34%	$181
Indoor Air Quality	52%	$156
Noise Level	43%	$ 72
Total Value	50%	$801

Energy savings were estimated to be approximately $600 per year for participants. All respondents who thought their home was more energy efficient than their last home estimated their savings as $644. Thus, NYSERDA's approach to valuing non-energy impacts at $300 at the time of the study was consistent with the survey results (see Total Value in Table A-3). However, the willingness-to-pay research results identified in Table A-3, suggest that non-energy impacts may be valued more highly when considered on their own and as part of a specific value proposition.

The NYSERDA research may not be directly applicable to IPC due to energy cost and housing market differences. However, the implication may be important for the single family home market, suggesting that non-energy impacts well exceed energy savings value and may be a key motivation for the value propositions of more energy efficient homes. Tetra Tech does not recommend applying the NYSERDA results to the multifamily sector as the decision making and value propositions are likely different.

If the NYSERDA approach is used, there are two potential methods. First, IPC could apply the present value of these non-energy impacts to the benefit side of the cost-effectiveness test. This approach is typical and would likely show some significant increase in cost-effectiveness. Second, IPC could subtract the present value of the benefits from the cost side –the willingness to pay approach implies that absent the energy efficient construction, participants would be willing to pay more to achieve the non-energy impacts, with the incremental cost of the home

[6] Percentages are approximate due to conversion from a chart.

being lowered as a result. However, this approach could result in a negative incremental cost and create a level of confusion for program planners or regulators.

A.2.3 California

The California Public Utilities Commission (CPUC, 2012) identified several approaches that four states take to quantify NEBs. The CPUC notes that it is common for water and fuel savings to be included as part of the benefits of a TRC test. The CPUC found that Colorado, Iowa, Washington, and Oregon use a 10 percent adder to TRC benefits. Maine uses "all quantifiable NEBs" including "deferred replacement costs" (CPUC, p. 5). Massachusetts considers the cost of complying with foreseeable environmental regulations. The identified approaches are diverse, but the simplified approach used by Colorado, Iowa, Washington, and Oregon allows for some inclusion of NEBs, though at a level lower than other research has found.

For IPC, a 10 percent adder to the ENERGY STAR Homes program energy benefits is one solution relatively simple to implement. However, as the NYSERDA research shows, NEBs may be higher than the energy savings, with a 10 percent adder to benefits being an overly conservative estimate.

A.2.4 Regional Technical Forum

Tetra Tech reviewed the RTF's single family and multifamily Residential New Construction savings calculation workbooks. The RTF multifamily savings workbook identifies O&M present benefits of $0.059 per kWh for heating zone 1 and cooling zone 3. This value is fairly minor relative to the $1.09 per kWh of capital costs. If IPC is not currently using these benefits in its TRC calculation, using the RTF's value may be a reasonable approach and increase the benefit-cost ratio at the margins. No such savings are identified by the RTF for single family homes (a $0 value is given).

One gap in the RTF workbooks' presentation of NEIs is related to avoided fuel costs. Although the RTF workbook includes estimated therm savings in a supporting worksheet (Measure_InputOutput), these savings are not presented explicitly in the summary "Measure Table" worksheet. For gas heated homes that meet ENERGY STAR standard in heating zone 1 and cooling zone 3, the RTF workbooks indicate an estimated 48 therms per year for single family homes and 19 therms per year for multifamily homes of space heating savings. In the case of the RTF's savings workbooks, the primary focus of savings are electricity savings, in following from the RTF's activities under the NPCC. "Nonelectric system benefits" are calculated on a per kWh basis, but may include many different non-electric benefits. The RTF workbook calculates a present value of regional gas energy savings, though the value is generic to the RTF and may not apply to IPC. However, the values of $422.79 for single family homes and $160.32 for multifamily homes are substantial.

It is less clear from the RTF, whether the savings are adjusting for domestic water heating fuels. In Tetra Tech's review of the impact savings, several homes were shown to have gas utility service, but are electrically heated. It is not clear whether such a cross-fuel analysis is considered by the RTF or how it is considered. Secondly, non-utility fuels are not addressed by the RTF's workbook calculations. However, such an approach could be taken to account for propane, fuel

oil, or wood fuel heating sources by converting the therm savings to a British Thermal Unit (BTU) basis and adjusting for efficiencies of different systems. Such sources may provide back-up heat for very cold weather and may provide water heating.

A.3 RECOMMENDATIONS

Based on the literature review and a review of the RTF single family and multifamily savings workbooks, Tetra Tech makes the following recommendations regarding applying NEIs to the ENERGY STAR Homes program.

Consider utilizing a value of $100 per year per dwelling to account for non-energy impacts associated with the ENERGY STAR Homes program. Such a value is substantially less than that found in the literature and may help account for regional differences or uncertainties regarding IPC specific non-electric impacts. At a minimum, using a 10 percent adder to energy benefits would be a conservative approach in-line with several states, though may understate non-energy impacts stemming from the program.

Conduct survey research specific to IPC's service territory regarding ENERGY STAR Homes' participant NEIs. While the literature review identified dollar values to NEBs, the specific benefits and dollar amounts may differ for IPC's program participants. In particular, the significant participation of multifamily dwellings differs from most programs that focus on single family homes.

Review the income status of multifamily dwelling tenants to understand whether the program may be benefiting a low-income or near low-income population. The literature review indicated that energy efficient dwellings may provide the low-income population greater benefits than the general population.

Work with the RTF to develop fuel savings benefits. To ensure calculation consistency, fuel savings should align with existing RTF savings calculation methodologies. By working with the RTF, fuel savings may be quantified on a British Thermal Unit or similar basis, allowing for conversion to the IPC specific fuels market. Such an approach would need to be mindful of baseline assumptions to avoid double counting energy saving benefits.

Consider utilizing a space heating savings of 48 therms per year for single family homes and 19 therms per year for townhomes if program eligibility expands to include non-electric heated homes. These values align with the currently active RTF savings workbooks for each residential segment for heating zone 1 and cooling zone 3. Metrics for other climate zones are included in the RTF workbooks.

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Process Evaluation of the Shade Tree Project

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Final Report

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Executive Summary

Idaho Power Company (IPC) began an innovative energy efficiency pilot program to test the viability of offering shade trees to customers in two Idaho counties. This project began modestly in 2013, but has grown substantially during the past year.

This report summarizes the findings from a process evaluation completed by the Johnson Consulting Group team. The process evaluation gathered primary data from a variety of sources, including reviews of program materials, the program database, in-depth interviews with key staff and secondary research regarding similar program best practices.

Key Findings

The findings from the process evaluation activities indicated that overall the Shade Tree Project is well designed and well managed. The key findings supporting this conclusion are presented next, followed by recommendations on ways to further enhance overall program operations.

IPC successfully leveraged industry best practices to design and develop the Shade Tree Project. The Shade Tree Project's program design was developed by combining internal resources from a diverse group of IPC staff with input from critical external stakeholders involved in urban forestry projects throughout the region.

IPC staff incorporated the findings from the *i-Tree Ecosystem Analysis: Treasure Valley, Urban Forest Effects and Values,* and the *Plan-it GEO, Treasure Valley Urban Tree Canopy Assessment, October 2013 Update (Plan-it GEO,)* (i.e., Treasure Valley Urban Tree Canopy Assessment) for the Department of Lands, Idaho Community Forestry (CF) Program to win a $300,000 federal grant to help implement the program starting in 2015. This shrewd approach provides IPC with a way to refine the program model while using ratepayer funds wisely.

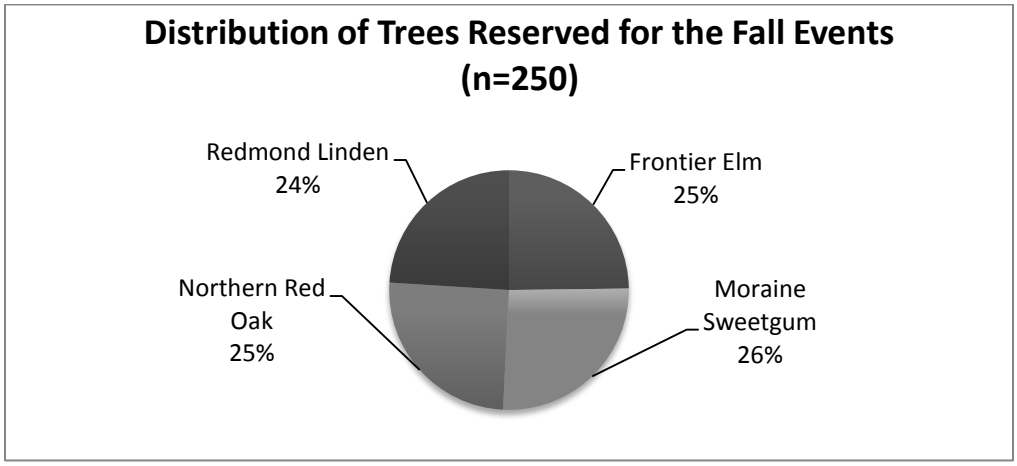
IPC staff are responsive and flexible and have adapted this project based on both experience and customer feedback. The staff continues to refine the program delivery model, increasing the number of trees offered to customers, and improving the program marketing and educational materials, as Table E-1 illustrates. In addition, the Shade Tree Project delivery strategy is consistent with most industry best practices for shade tree programs.

Table E-1: Summary of Shade Tree Project Changes from Fall to Spring Offerings

Event	Fall 2013	Spring 2014
Total Trees Available	250	1,162[1]
Maximum Number of Trees per Customer	1	2
Reminders to Customers About Pickup Event	1 (letter)	2 (letter and email)
Event Scheduling	4 events over 3 consecutive days	4 events over 10 days
Arbor Day Tool	Emphasized west/ northwest planting	Emphasized west/east planting (used more accurate summer electric rate)
Workshops Held After Events to Distribute Unclaimed Trees	None	3

Source: Program Handbook, Section 6

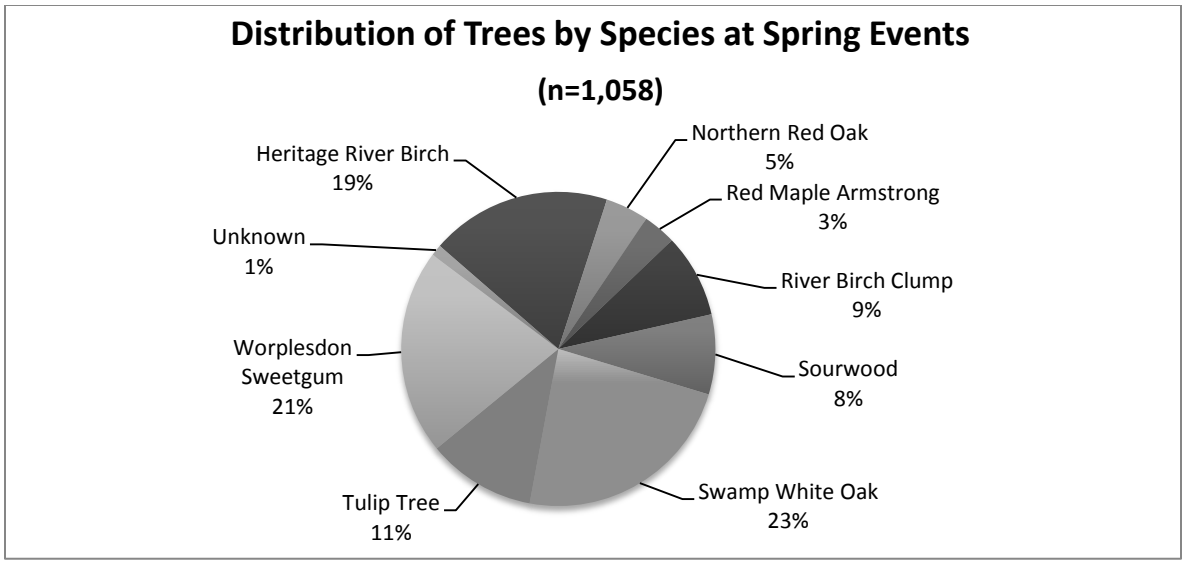
A total of 1,278 trees have been distributed to the program participants during the Fall 2013 and Spring 2014 offerings. There were a total of 220 trees distributed to participants during the Fall 2013 offering according to the program database. IPC significantly increased tree distribution for the Spring 2014 offering where a total of 1,058 trees were distributed, according to program records. Figures E-1 and E-2 highlight the distribution of tree species during both time periods.



(Source: PY2014 Shade Tree Project Database)
Figure E-1: Distribution of Trees Reserved for the Fall Events

Figure E-2 illustrates both the wider variety as well as larger quantities of trees that were available during the Spring 2014 offering.

[1] This number differs from the information provided in the program handbook as it identifies the total number of trees that were actually available for distribution, which was revised downward from the 1,200 original estimate.



(Source: PY2014 Shade Tree Project Database)
Figure E-2: Distribution of Trees by Species at Spring Events

Overall, these events had an outstanding turnout and most of the trees were distributed to the customers during these planned events. The overall no-show rate for these events was between 10 and 12 percent.

Most customers followed through on their plans to plant the free trees in a westerly direction. However, IPC is not tracking the actual planting locations for all the trees, and this could adversely affect the overall cost-effectiveness of this project.

Seventy-four percent of the Fall events survey respondents reported planting trees with West (25%), the Southwest (19%) or Northwest (30%) [2] orientations. The results were similar for the Spring events, in which two-thirds (66%) of the survey respondents reported that they planted trees either with West (37%), Southwest (17%) or Northwest (12%) orientations. These locations all offer significant energy savings.

However, there is a strong minority of program participants (27% for the Fall participants and 33% for the Spring participants) who are not planting trees in locations that optimize energy savings. Although IPC offers program participants flexibility in selecting the location for planting these trees, these findings suggest that this project may be at risk for lower than expected cost-effectiveness results.

***The online program enrollment was quick and easy*.** Nearly two-thirds (60%) of survey respondents were able to enroll in the program in ten minutes or less. Nearly three quarters (72%) of survey respondents found the online enrollment tool very easy to use.

[2] Note: Idaho Power's definition of "West" is based on the energy-savings tree tools identified that Northwest, West and Southwest locations all provide maximum energy savings.

Overall, the participants reported high satisfaction rates for the Shade Tree Project. The participants were very satisfied with both the planting care and education they received at the distribution events. A few respondents were dissatisfied with the quality of the trees provided from IPC because they thought the trees were young and immature.

The gaps in the program database may adversely impact the overall cost-effectiveness of this project. The current program database does not track key program metrics in a consistent manner that conforms to both industry standards and best practices for program evaluation.

Currently there is no Quality Assurance/Quality Control (QA/QC) process in place. This is also one of the few areas in which the program does not follow industry best practices. However, the program specialist is currently developing a QA/QC approach that will be implemented in 2015.

The Best Practices Review identified that these programs may be subject to high free ridership rates. While the IPC model does address free ridership through an improved delivery model and promoting trees in a specific geographic area, free ridership is an ongoing concern with shade tree program designs.

Recommendations

Based on the process evaluation findings, the Johnson Consulting Group evaluation team has also developed the following recommendations to improve current program operations.

IPC staff should standardize the current program evaluation questionnaires to allow for consistent feedback and tracking across all program events. This includes asking questions to all program participants to assess satisfaction, determine the actual planting locations for all trees provided, and probing more fully into reasons for participation.

IPC staff should develop a pre-screening tool to maximize energy savings potential at the initial application stage. Given both the survey responses and the experience with other shade tree program designs, IPC staff should try to minimize free ridership at the initial screening by incorporating the strategies used by other shade tree programs such as not approving customer's planned planting locations unless they maximize energy savings (i.e., West, Southwest or Northwest).

Secondary research indicated that free ridership rates are high for these types of program designs. *Therefore,* IPC staff should also assess actual free ridership rates through customer surveys in future program evaluations.

IPC staff should implement a QA/QC process to provide ongoing tracking of the distributed trees. This QA/QC process should include follow up with all program participants via a customer survey and a sample of on-site visits to verify planting orientation and tree health. This QA/QC process can also help to fill in the gaps by confirming estimates of actual tree planting locations, which will provide a more accurate estimate of overall program savings and cost effectiveness.

The Shade Tree Project should develop a standard database that consistently tracks the disposition of trees, and tracks key program metrics in a standard manner. As this program evolves from a pilot to a full-scale program, it is critical to develop a standardized program tracking tool that tracks key program milestones, customer feedback, and electric and non electric savings.

IPC staff should try to quantify the non-electric benefits associated with this program as a way to enhance its overall cost-effectiveness. The technical assessments included detailed models demonstrating the significant non-electric benefits that shade tree programs provide. Therefore, IPC staff should include these estimates in calculating the overall program benefits, such as of reductions in carbon emissions, carbon sequestration and other benefits quantified in the i-Tree Analysis.

1 Introduction

In 2013, Idaho Power Company (IPC) began the Shade Tree Project. The goal of this project was to encourage customers living in the Treasure Valley (TV) area to plant trees as a way to reduce the heat island effect and shade homes to reduce energy used for summer cooling (Project Handbook 2014, Section 3, p. 1).

This report summarizes the findings from a process evaluation of the Shade Tree Project completed by the Johnson Consulting Group team. The process evaluation gathered primary data from a variety of sources, including reviews of program materials, the program database, and in-depth interviews with key staff from June through September 2014. Johnson Consulting Group also conducted secondary research regarding similar program best practices.

This report begins with an overview of the Shade Tree Project and a general discussion of the process evaluation methodologies used. The key findings from the process evaluation are summarized in Section 2. A program flow diagram is provided in Section 3 followed by a review of industry best practices in Section 4. The key findings and recommendations are provided in Section 5.

1.1 Shade Tree Project Overview

The Shade Tree Project began in 2013. The program design leverages findings and resources from a state-sponsored study, the Treasure Valley Urban Tree Canopy Analysis, and the Arbor Day Foundation's Energy Saving Trees program (RFP p. 1).

To qualify for this program, IPC customers must live in Ada or Canyon County in the Treasure Valley Area (Project Handbook 2014, Section 1, p. 13). Program participants must also have the legal right to plant trees on the property and have enough space for a mature, large tree.

1.2 Process Evaluation Methodology

Process evaluations focus on ways to improve overall program operations by reviewing critical documents, program databases, and customer contact and follow-up procedures. Process evaluations also include feedback mechanisms from the key groups, usually from in-depth interviews with key program staff.

Table 1 summarizes the process evaluation activities Johnson Consulting Group team members completed to evaluate the Shade Tree Project. Of note, this process evaluation reviewed the survey feedback from customers. However, no formal customer surveys for this program have been fielded; this is a research methodology that should be used in future process evaluations.

Table 1: Comparison of Process Evaluation Objectives to Completed Process Evaluation Methodologies

Process Evaluation Objective	Task 2.1 Review Program Materials	Task 2.2 Review Program Database	Task 2.3 Conduct In-Depth Interviews	Task 2.4 Develop Program Flow Diagram
Program Design (e.g., mission, logic, use of best practices)	✔	✔	✔	✔
Program Implementation (e.g., quality control, operational practice, marketing and outreach)	✔	✔	✔	✔
Customer Education	✔		✔	
Program Administration (e.g., oversight, staffing, management, training, documentation and reporting)	✔	✔	✔	✔
Participant Satisfaction	✔		✔	
Recommendations for Program Improvement	✔	✔	✔	✔

The process evaluation addressed the following critical research questions, as summarized in Table 2.

Table 2: Summary of Key Research Questions

Research Area	Key Research Questions
Specific Program Characteristics	What types of trees were provided to the customers? How many trees were not picked up at the events?
Effectiveness of Program Operations & Delivery	Has this changed since program launch? Is the program performing as expected based on the perceptions from the staff? Overall, how satisfied are customers with the program delivery methods and educational materials?
Effectiveness of Marketing and Outreach Activities	How effective was the targeted marketing approach? How effective were the materials in identifying the key messages regarding tree planting and care? How can these materials and outreach activities be improved?
Participant Decision-Making Process	Please describe the participation process. Why do program participants decide to participate?
Barriers to Program Participation	What are the barriers to program participation?
Areas for Area Program Improvement	How can IPC staff improve its programs, in terms of design and delivery?

2 Process Evaluation Key Findings

This section summarizes the key findings from the process evaluation activities that included the review of program materials, review of the program database, and in-depth interviews with key staff involved in program implementation as well as secondary research regarding similar program best practices.

2.1 Review of Program Materials

The team reviewed the following materials received from IPC staff:

- Shade Tree Project Handbook, updated June 2014
- Participation Contracts
- Federal Grant Application
- i-Tree Ecosystem Analysis: Treasure Valley, Urban Forest Effects and Values, October 2011
- Treasure Valley Urban Tree Canopy Assessment, October 2013 Update (Plan-it GEO,) for the Department of Lands, Idaho Community Forestry (CF) Program
- Examples of Educational Handouts
- Results from the customer surveys conducted after the Fall 2013 and Spring 2014 offerings
- Samples of Marketing Materials
- Sample Tree Cards

Technical Assessments Regarding Shade Tree Potential

The TV region is located in the southwestern region of Idaho. It is an arid valley. The project spans two counties, Ada and Canyon, and includes nine municipalities and 40 percent of the state's total population (i.e., 600,000 residents) (TV Canopy Assessment, p. 1, Federal Grant Application, p. 1).

The key findings from the tree canopy survey[3] found that the TV region was ideal for a shade tree project. Currently, trees cover 7.3 percent of the area while the avoided carbon emissions are 1,280 carbon emissions, valued at $23,600 annually (i-Tree Analysis, 2011, pp. 2, 9).

In addition, the ecosystem analysis provided useful benchmarks for IPC to consider when developing the Shade Tree Project, as summarized in the following two tables from this report (pp. 15-16).

[3] This specifically refers to the findings from the *i-Tree Ecosystem Analysis: Treasure Valley, Urban Forest Effects and Values,,* which was part of the overall study described as the Treasure Valley Urban Tree Canopy Assessment)for the Department of Lands, Idaho Community Forestry (CF) Program.

Table 3: City Totals for Trees

City	% Tree Cover	Number of trees	Carbon storage (tons)	Carbon Sequestration (tons/yr)	Pollution removal (tons/yr)	Pollution Value (USD)
Calgary, Canada	7.2	11,889,000	445,000	21,422	326	1,611,000
Atlanta, GA	36.8	9,415,000	1,345,000	46,433	1,662	2,534,000
Toronto, Canada	20.5	7,542,000	992,000	40,345	1,212	6,105,000
New York, NY	21.0	5,212,000	1,351,000	42,283	1,677	8,071,000
Baltimore, MD	21.0	2,627,000	596,000	16,127	430	2,129,000
Philadelphia, PA	15.7	2,113,000	530,000	16,115	576	2,826,000
Washington, DC	28.6	1,928,000	523,000	16,148	418	1,956,000
Boston, MA	22.3	1,183,000	319,000	10,509	284	1,426,000
Woodbridge, NJ	29.5	986,000	160,000	5561.00	210	1,037,000
Minneapolis, MN	26.5	979,000	250,000	8,895	305	1,527,000
Syracuse, NY	23.1	876,000	173,000	5,425	109	268,000
Morgantown, WV	35.9	661,000	94,000	2,940	66	311,000
Moorestown, NJ	28.0	583,000	117,000	3,758	118	576,000
Jersey City, NJ	11.5	136,000	21,000	890	41	196,000
Freehold, NJ	34.4	48,000	20,000	545	21	133,000

(Source: i-Tree Analysis)

Table 4: Per Acre Values of Tree Effects

City	No. of trees	Carbon storage (tons)	Carbon sequestration (lbs/yr)	Pollution removal (lbs/yr)	Pollution Value (USD)
Calgary, Canada	66.7	2.5	0.120	3.6	9.0
Atlanta, GA	111.6	15.9	0.550	39.4	30.0
Toronto, Canada	48.3	6.4	0.258	15.6	39.1
New York, NY	26.4	6.8	0.214	17.0	40.9
Baltimore, MD	50.8	11.5	0.312	16.6	41.2
Philadelphia, PA	25.0	6.3	0.190	13.6	33.5
Washington, DC	49.0	13.3	0.410	21.2	49.7
Boston, MA	33.5	9.0	0.297	16.0	40.4
Woodbridge, NJ	66.5	10.8	0.375	28.4	70.0
Minneapolis, MN	26.2	6.7	0.238	16.4	40.9
Syracuse, NY	54.5	10.8	0.338	13.6	16.7
Morgantown, WV	119.7	17.0	0.532	23.8	56.3
Moorestown, NJ	62.0	12.5	0.400	25.2	61.3
Jersey City, NJ	14.3	2.2	0.094	8.6	20.7
Freehold, NJ	38.5	16.0	0.437	33.6	106.6

(Source: i-Tree Analysis)

Table 5 highlights some of the urban forestry best practice strategies that helped to guide the development of the Shade Tree Project.

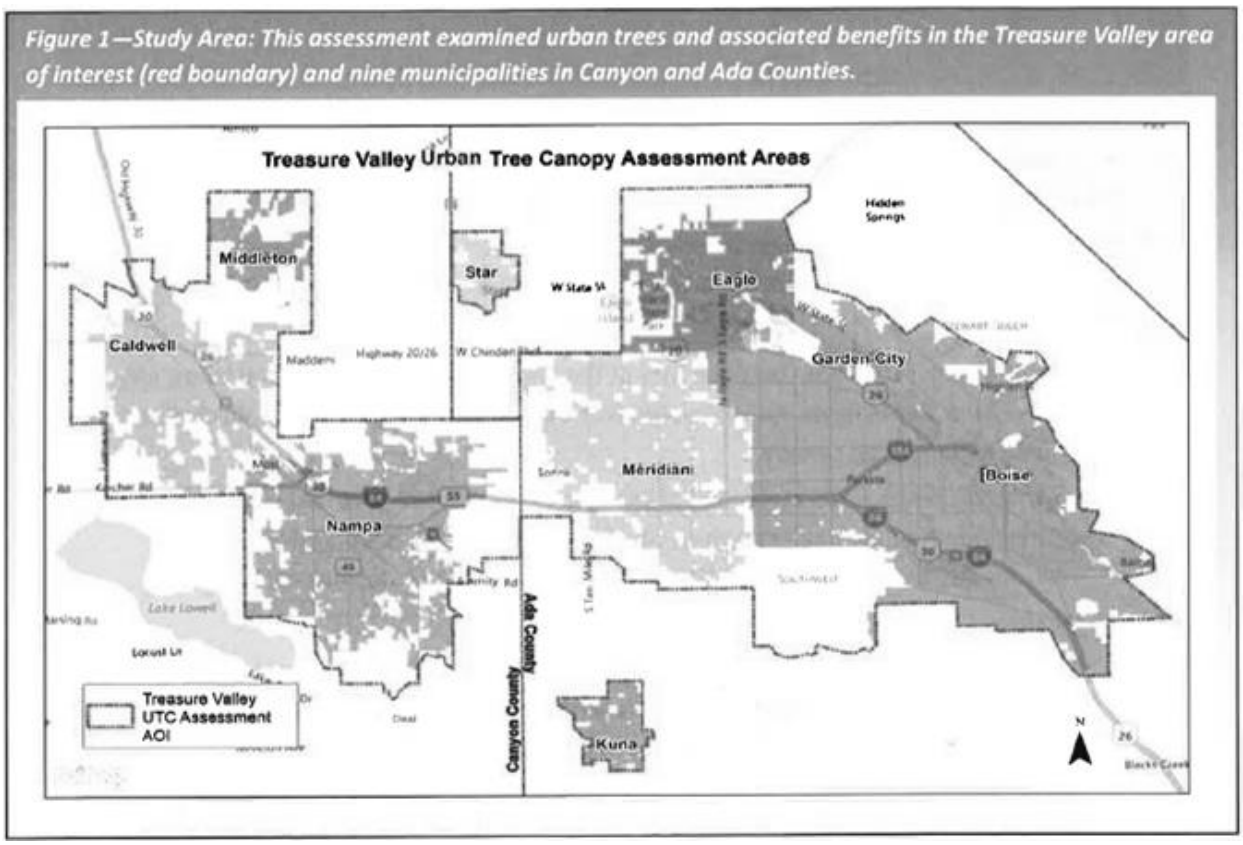
Table 5: Urban Forestry Management Best Practice Strategies and Results

Strategy	*Result*
Increase the number of healthy trees	Increase pollution removal
Sustain existing tree cover	Maintain pollution removal levels
Maximize use of low VOC-emitting trees	Reduces ozone and carbon monoxide formation
Sustain large, healthy trees	Large trees have greatest per-tree effects
Use long-lived trees	Reduce long-term pollutant emissions from planting and removal
Use low maintenance trees	Reduce pollutants emissions from maintenance activities
Reduce fossil fuel use in maintaining vegetation	Reduce pollutant emissions
Plant trees in energy conserving locations	Reduce pollutant emissions from power plants
Plant trees to shade parked cars	Reduce vehicular VOC emissions
Supply ample water to vegetation	Enhance pollution removal and temperature reduction
Plant trees in polluted or heavily populated areas	Maximizes tree air quality benefits
Avoid pollutant-sensitive species	Improve tree health
Utilize evergreen trees for particulate matter	Year-round removal of particles

(Source: i-Tree Analysis)

The Treasure Valley Urban Tree Canopy Assessment also included a second technical study[4] that was used to inform IPC staff, (see Figure 1). This report provided significant and detailed information about the viability of targeting the TV area to increase the number of tree plantings (pp. 1-2).

[4] This specifically refers the following report: *Plan-it GEO, Treasure Valley Urban Tree Canopy Assessment, October 2013 Update*



(Source: Treasure Valley Urban Tree Canopy 2013)
Figure 1: Treasure Valley Urban Tree Canopy Assessment Areas

The Tree Canopy Assessment included a sample of 250 one-tenth acre plots across the 266 square mile study and a geo-spatial Urban Tree Canopy Assessment (p. 2). The study found that tree cover was at 10 percent, slightly higher than the 7.3 percent estimated by i-Tree. It also identified significant differences in these geographic areas that demonstrate the viability of planting trees in this region (Tree Canopy Assessment 2013, p. 4).

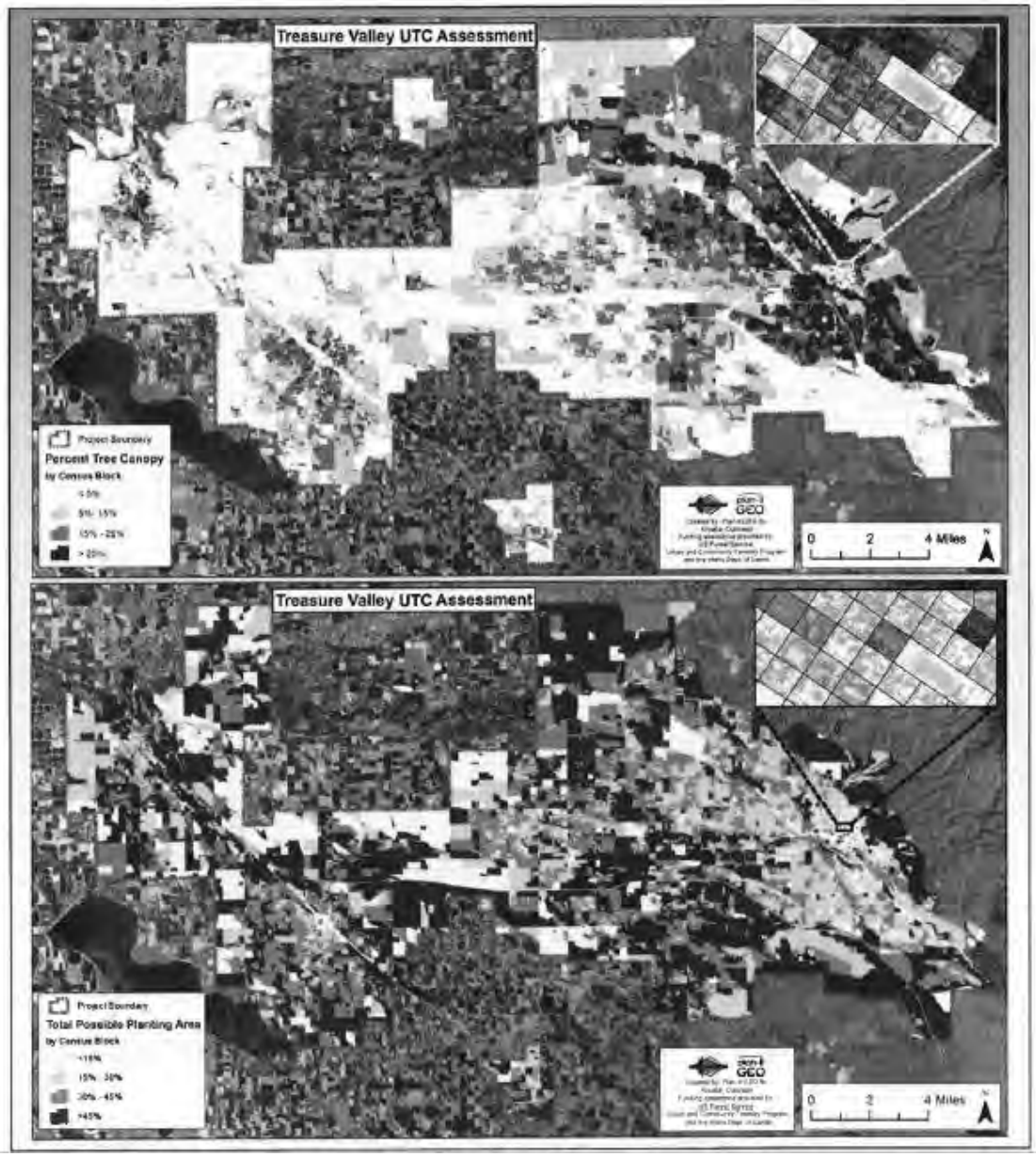
More importantly, this assessment provides the documentation needed to ensure that this region had both the capability of supporting a shade tree program as well as offer sizable energy benefits. According to the assessment, 52 percent of the potential planting locations in the TV area are within 50 feet of residential buildings. The study also estimated that each tree could yield approximately $48/year in energy savings (Tree Canopy Assessment 2013, p. 4). The total number of potential western exposure tree planting locations identified in the assessment was 110,692, representing a significant potential for tree planting to promote energy conservation (Tree Canopy Assessment, 2013, p. 48).

Table 6 compares the available acreage for tree planning in the TV, while Figure 2 provides an aerial view of the available planting locations.

Table 6: Comparison of UTC in Acres for Cities in the Treasure Valley

City	Boise	Caldwell	Eagle	Garden City	Kuna	Meridian	Middleton	Nampa	Star	Total
Tree Canopy Acres	7,149	735	1,423	523	157	1,125	136	1,441	110	12,801
Tree Canopy %	16%	6%	16%	20%	6%	7%	5%	8%	6%	10% (avg.)

(Source: Treasure Valley Urban Tree Canopy 2013)



(Source: Treasure Valley Urban Tree Canopy 2013)

Figure 2: Existing UTC and Total PPA for Census Blocks Federal Grant Materials

A second key component of the Treasure Valley Urban Tree Canopy Assessment was the development of ArcGIS-based model that maps land use and current tree cover. IPC used these data to identify residential properties with tree planting space to the west (i.e., West, Northwest and Southwest) of the home and thereby it could geotarget its marketing efforts to customers who would receive greatest benefit from a shade tree.

IPC staff also worked with key community partners to develop and win a Federal Grant to refine this project going forward. The $300,000 grant was awarded to a project partner, the Southwest RC&D, and will be available in 2015 to help align Idaho Power's energy saving goals with those of its partners. The grant application provided a summary of the key objectives of the Shade Tree Project.

The Shade Tree Project was promoted as a way to partner with key community groups including energy producers, air quality experts, planners and forecasters to design and implement a cost-effective, sustainable, and replicable energy conservation/education program. The goal of the federal grant is to plant 7,500 trees throughout the project and provide a model of the program benefits over time (Federal Grant Application, p. 1).

The trees will be planted on sites identified with the highest benefit potential within 240 miles of the TV area (Federal Grant Application p. 5).

Shade Tree Project Handbook Materials

The program specialist included the findings from the Treasure Valley Urban Tree Canopy Assessment (which included both reports) and the federal grant application in the project handbook materials.

The project handbook includes information on how customers participate in the program. For example, customers enroll online using the Arbor Day Energy Savings Tree tool (www.arborday.com/idahopower) and then pick up their trees in person at events organized by IPC staff and staffed by volunteer arborists (Section 1 Project Handbook p. 1).

Since customers are responsible for planting their own trees, the project handbook also provides an informative *Frequently Asked Questions* section which is available at the project website.

It also provides an excellent summary of the program rationale, considerations, and basis for offering this program to IPC customers in the TV area (p. 7). In addition, the *Program Design Utility Models* Section provided a summary of the pros and cons of other utility shade tree project models, which were then used to inform the design of the Shade Tree Project (Section 1b Project Handbook 2014).

The project handbook also includes the most recent program modifications designed to lessen the impact of no-shows based on the experiences from the pilot program. These new tactics, as described in the project handbook include (p. 9):

- Offering a variety of pick up locations, days and times
- Sending out reminder letters one week prior to the event, and reminder emails one day prior to customer pick up
- Calling no-shows from previous events and informing them of the other events during that offering

It also describes a recommended approach to minimize leftover trees while maximizing potential energy savings (Section 1a, p. 11).

In addition, the project handbook provides detailed descriptions of each key task related to the program. This included a detailed program timeline (Section 4), which listed key milestones beginning with project initiation through the distribution of the trees to participating customers (Project Handbook 2014, p. 1).

Marketing and Outreach

According to the Project Handbook, IPC will send out direct mail to 15,000 eligible participants in Ada and Canyon Counties in one mailing. The goal is to enroll 750 program participants. The following text box summarizes the types of information provided to interested customers about this project.

Is a shade tree right for your home?

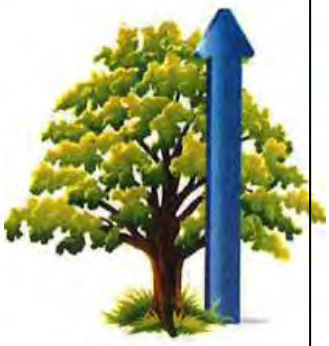
This offer is open to Ada and Canyon county residential customers of Idaho Power. You must have the legal right to plant trees on your property and have enough space for a mature, large tree.

Is there enough space on the west to northwest side of your property for a large shade tree? Trees grow. The trees offered through this program will grow from 25 to more than 60 feet tall, with a canopy spread of 15 to more than 45 feet.

Canopy Spread

For best summer energy savings, follow these guidelines:

- Plant on the west to northwest side of your home.
- Plant close enough to your home so the mature canopy will provide the shade you need. However, to prevent branches from impacting your home, plant the tree about half the distance of the mature canopy width from your home.
- Ensure trees planted near streets comply with local ordinances, generally about 5 feet from streets and 40 feet from corners.
- Ensure trees will not interfere with overhead or underground utilities. Idaho Power recommends planting shade trees at least 35 feet from any overhead power lines.
- Consider how the tree might affect visibility, shade nearby flower gardens or impact a neighbor's home.



Tree Height

Do you have the resources to plant and care for the tree?

- Can you dig a shallow but broad hole, follow proper planting instructions and provide mulch for the tree? Holes should be two to three times the width of the root ball and as deep as the root ball. (Local nurseries and landscapers may provide planting services for an additional fee.)
- Do you have the ability to irrigate the planting site to ensure your new tree gets enough water and prune the tree as needed?

How much energy will I save?

According to the U.S. Department of Energy, a well-positioned tree can save 15 percent or more on energy used for summer cooling. However, savings depends on a variety of factors, including tree height, canopy width and density of canopy. Savings also depends on where the tree is planted, how much of your home is already shaded and how much of your home the new tree shades. The online enrollment tool will help you estimate potential energy savings for your home. Remember, for summer cooling benefits, planting on the west to northwest side of your home is best.

For more information, visit www.idahopower.com/shadetree **or call 208-388-5948.**

Shade trees offer many benefits, including energy savings, comfort and enhanced property values. According to the U.S. Department of Energy, shade trees can reduce energy used for summer cooling by about 15 percent or more. Trees also help improve air and water quality.

The Shade Tree Project is a limited-time, demonstration project to encourage homeowners to plant shade trees for energy savings. A limited number of trees will be distributed to homeowners to help shade homes and reduce energy use. Idaho Power will evaluate the results and future energy impacts from this demonstration project.

The project is open to Idaho Power residential customers living in Ada and Canyon counties. You must have the right to plant trees on the property.

How to Participate

Consider whether you have an open space on the west to northwest side of your home and if you have the means to plant, water and care for your tree,

Enroll

Idaho **Power has partnered with the Arbor Day Foundation to bring you the Energy Saving Trees** online enrollment tool. **With it, you'll be able to do the following:**

Select a tree: There are several species to choose from.

Plant smart: Get information on the best planting sites for energy efficiency. You will be asked to map your home to see how energy savings change depending on which **side** of the home the tree is placed. Although the decision about where to plant is ultimately yours, the future of this program depends on the energy savings, choose the location wisely.

Schedule a pickup date: Trees will be available for pick up on the following dates:

Thursday, April 17, noon to 7:00 p.m.,
FarWest Landscape and Garden Center, 5728 State Street, Boise
Friday, April 18, noon to 7:00 p.m.,
Stephens Nursery, 325 N. Middleton Rd, Nampa
Friday, April 25, 3:00 p.m. to 7:00 p.m., Bernie Fisher Park, Main Street, Kuna
Saturday, April 26, 9:00 a.m. to noon,
Kleiner Memorial Park, 1900 N. Records Ave, Meridian

Pick up your shade tree at the designated time and location. When you arrive, you'll be able to talk with an arborist, participate in planting demonstrations and get planting and care instructions.

Plant your tree as soon as possible to give it the best chance at a long and healthy life.
Enjoy the natural beauty and energy savings for years to come.

Handouts

For the Fall Event, the Shade Tree Project provided comprehensive information on a variety of topics designed to educate program participants about proper tree planting techniques. The information also included several brochures developed by the International Society of Arboriculture (ISA), a non-profit organization dedicated to the care and preservation of shade and ornamental trees. These materials included in-depth discussions on the following topics:

- New Tree Planting
- Avoiding Tree and Utility Conflicts
- Proper Mulching Techniques
- Pruning Young Trees

The materials delivered detailed information in easy to follow-step-by-step manner complete with illustrations demonstrating the proper techniques.

To complement these materials, IPC also developed a brochure explaining why planting trees on the western side of a home offers the highest potential energy savings. The brochure also reinforced several key takeaways from the ISA materials including reminders to plant trees at least 35 feet away from overhead lines and how best to position the tree to provide sufficient shading.

Figure 3: Handout - West is Best

The handout materials also included a flyer on other IPC energy efficiency programs as part of the overall customer educational materials.

For the Spring offering, the staff made slight adjustments to the educational materials and the informational materials were bundled together to allow easier distribution at the event.

Events

IPC staff used two separate strategies to distribute trees to the program participants. The main delivery model used scheduled events for both the Fall and Spring offerings.

Program participants could pre-reserve trees and select a scheduled event to pick up their trees as part of the enrollment process. The events were offered at several different times and locations to facilitate program participation. When participants arrived, they were "checked in" for the event, and given a "tree card" for each tree reserved to ensure they picked up the selected tree.

Professional arborists were on hand to assist the customer with the tree and to offer tree and planting care advice. The program participant also received the additional handouts about tree care to reinforce the information provided by the arborist.

Based on the experience from the Fall offering, the Shade Tree Project was modified in several important ways as Table 7 illustrates.

Table 7: Summary of Shade Tree Project Changes from the Fall to the Spring Offering

Event	Fall 2013	Spring 2014
Total Trees Available	250	1,162[5]
Maximum Number of Trees per Customer	1	2
Reminders to Customers About Pickup Event	1 (letter)	2 (letter and email)
Event Scheduling	4 events over 3 consecutive days	4 events over 10 days
Arbor Day Tool	Emphasized west/ northwest planting	Emphasized west/east planting (used more accurate summer electric rate)
Workshops Held After Events to Distribute Unclaimed Trees	None	3

(Source: Project Handbook, Section 6)

Overall, these events had an outstanding turnout and most of the trees were distributed to the customer during these planned events.

As described more fully in Section 2.2, the overall no-show rate for these events was between 12 and 14 percent. Table 11 compares the no-show rates and unclaimed tree rates for the Spring events.[6] As a way to minimize the overall unclaimed tree rate, IPC staff offered several smaller follow-on workshops, which are described next.

Workshops

Despite follow-up reminders including a reminder letter and follow-up email, 12 to 14 percent of the participants did not pick up their trees at the assigned event that meant that 10 to 12 percent of the reserved trees were not claimed.

[5] This number differs from the information provided in the program handbook as it identifies the total number of trees that were actually available for distribution, which was revised downward from the 1,200 original estimate.
[6] This comparison was not available for the fall events.

Unclaimed trees will reduce the overall energy benefits for this project. Furthermore, since trees are living organisms, they need to be cared for and are not easily moved. They also cannot be stored indefinitely and need to be planted within a short window in the Spring or Fall.

As a way to minimize the number of unclaimed trees, IPC staff offered a series of workshops after the main offering concluded in Spring 2014. The workshops were announced via Facebook and through community partners (i.e., cities, counties etc.) Customers pre-registered for the workshop by telephone.

For the workshops IPC staff developed a MS PowerPoint presentation (PPT) that summarized information from the ISA brochures as well as provided additional examples of each salient fact. The PPT also provided pictures of tree planting "do's and don'ts" throughout the presentation to further reinforce the key messaging regarding proper tree care. The PPT also provided summary facts about each eligible tree, including its growth patterns, shape of the tree canopy and coloring (Spring PPT slides, 2014).

Figure 4: Workshop Material - Save with Shade

After the presentation, workshop participants were invited to choose up to two trees from the unclaimed selection of trees.

The workshops had some limited success. A total of 31 customers registered and 21 attended; including five participants who had missed their original tree pickup event.

However, the no-show rate was substantially higher for the workshops (32%) compared to the previously planned events.

Since IPC offered a variety of tree species, it was not possible to anticipate which trees would go unclaimed. Since these were "leftover trees," the selection was more limited. Despite being told about the participation process, several workshop participants were upset that they could not get their first choice of tree species.

In addition, the participants were impatient with the selection process. Since the IPC staff was focused on addressing customer questions and managing the event, not all trees distributed at this workshop were recorded. This created some gaps in the program tracking database.

Each workshop also provided an opportunity for customer feedback. A small workshop evaluation form was given to participants to gauge the effectiveness of this option and the value of the information provided. This evaluation was different from the main program evaluation focusing just on the workshop content and structure (Project Handbook Section 6, Evaluation pp. 9-10).

2.2 Summary of the Shade Tree Project Customer Surveys

At the end of the Fall and Spring offerings, customers participating in the main program (i.e., Arbor Day enrollment tool, event pickup) were emailed a survey. The survey assessed the participants' satisfaction with the Shade Tree Project components, identified reasons for participation, and gathered information about their intentions regarding planting the trees they received. A total of 129 participants completed an evaluation of the Fall offering; 349 participants of the Spring 2014 offering provided feedback.

Program Awareness

The direct mail piece was highly effective in generating program awareness between both groups with 77 percent of the Fall participants and 61 percent of the Spring participants recalling receiving a letter from IPC. Table 8 summarizes these findings.

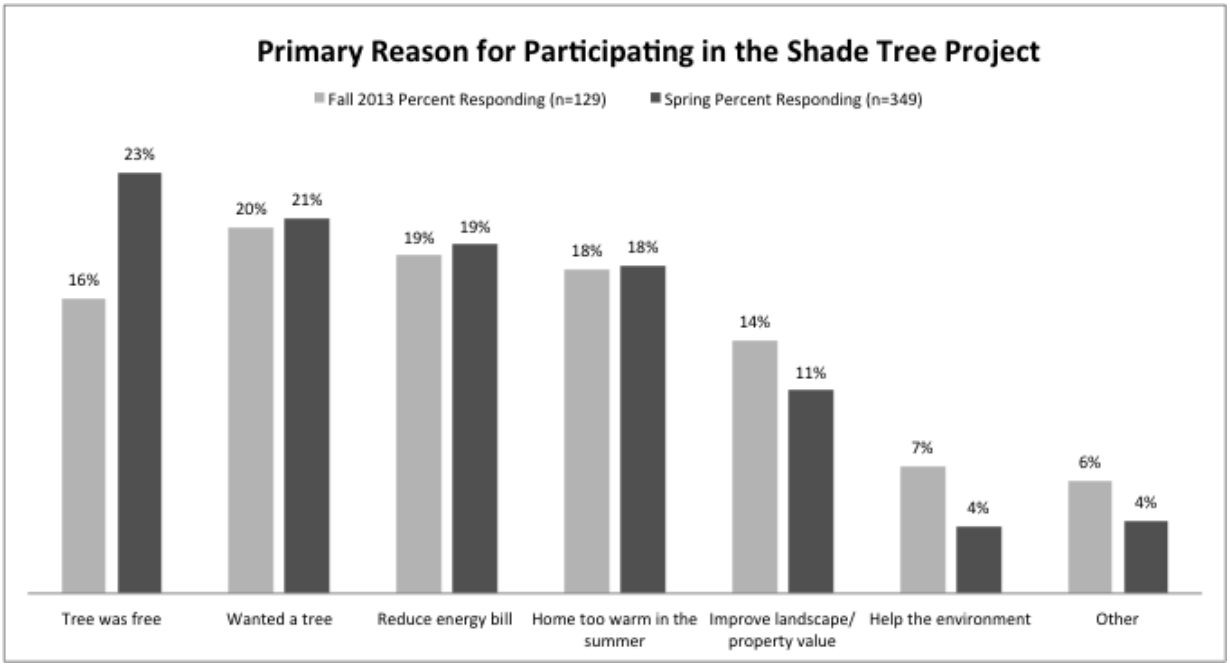
Table 8: Comparison of Ways Attendees Heard about the Program

	Fall 2013		**Spring 2014**	
Method	**Number Responding**	**Percent Responding**	**Number Responding**	**Percent Responding**
Letter from Idaho Power	99	77%	214	61%
Friend or relative	17	13%	101	29%
Idaho Power Employee	12	9%	9	3%
Neighbor	1	1%	7	2%
Other	2	2%	22	6%
Total Respondents	129	100%	349	100%

(Sources: Fall 2013 and Spring 2014 Survey)

Reasons for Participation

As Figure 5 shows, the primary reason motivating program participation was to receive a free tree (mentioned by 39% of the total respondents) or they wanted a tree (41% of the total respondents). In addition, 38 percent of all the respondents reported that they wanted to reduce their energy bills.



(Sources: Fall 2013 and Spring 2014 Surveys)
Figure 5: Primary Reason for Participating in the Shade Tree Project

These comments further illustrate this finding:

> *"I've been wanting a shade tree for a very long time and yes, it was free."*
>
> *"I was hoping to add more shade to my property along with wanting to already purchase a tree. Getting offered one for free was an awesome deal"*
>
> *"We have been wanting to add shade trees to our property"*

Barriers to Tree Planting

Cost remains the biggest barrier to planting shade trees on their own, according to the feedback from the participants (see Table 9).

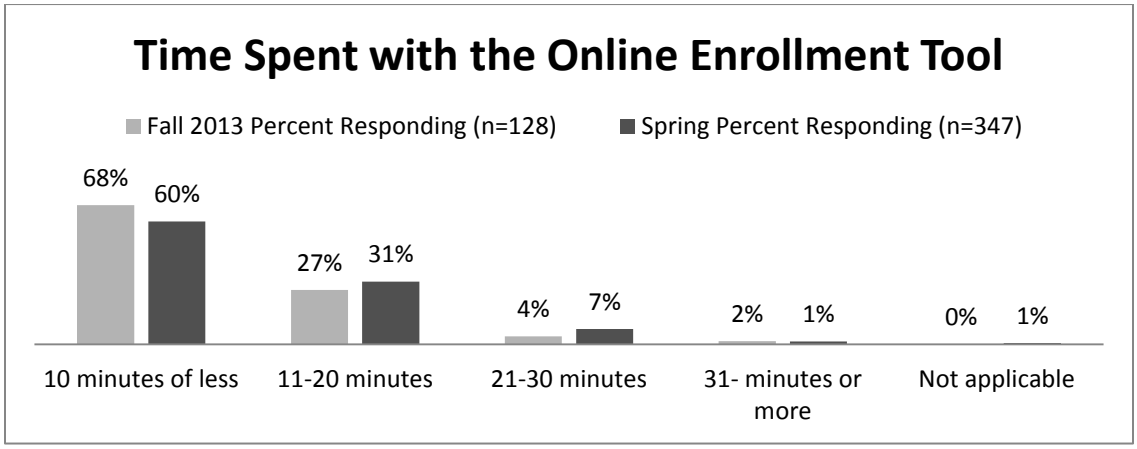
Table 9: Barriers to Planting Trees Earlier

	Fall 2013		Spring 2014	
	# of Responses	% Responding	# of Responses	% Responding
Cost	68	53%	185	53%
Lack of knowledge	10	8%	52	15%
Time	24	19%	37	11%
Other	26	20%	73	21%
Total Respondents	128	100%	347	100%

(Sources: Fall 2013 and Spring 2014 Surveys)

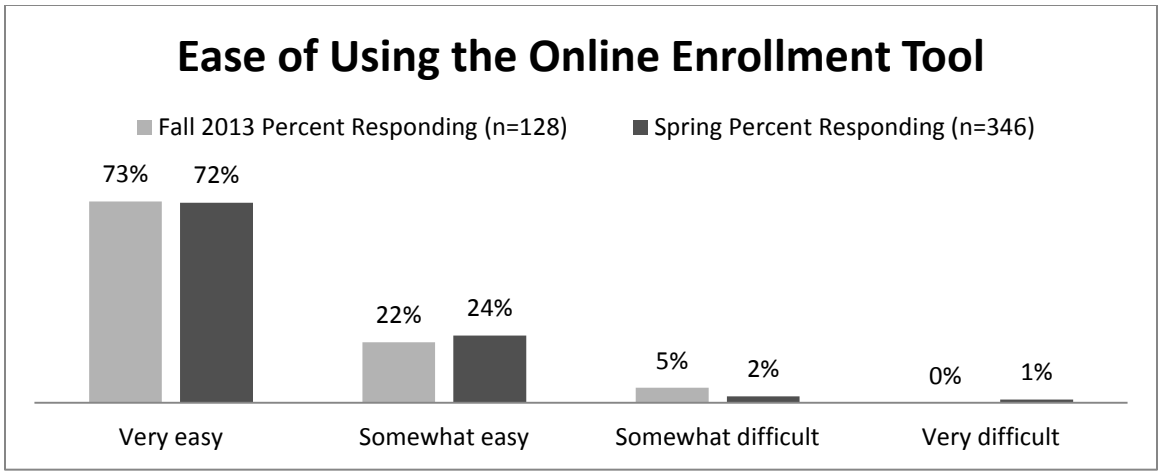
Assessment of Online Enrollment

Overall feedback for the online enrollment tool was positive. Nearly two-thirds (62%) of all the survey respondents reported spending 10 minutes or less with the online enrollment tool (see Figure 6).



(Source: Fall 2013 and Spring 2014 Survey)
Figure 6: Time Spent with the Online Enrollment Tool

Furthermore, nearly three quarters of survey respondents from the Fall and Spring time periods reported that the online enrollment tool was very easy to use (see Figure 7).



(Source: Fall 2013 and Spring 2014 Survey)
Figure 7: Ease of Using the Online Enrollment Tool

Program Satisfaction

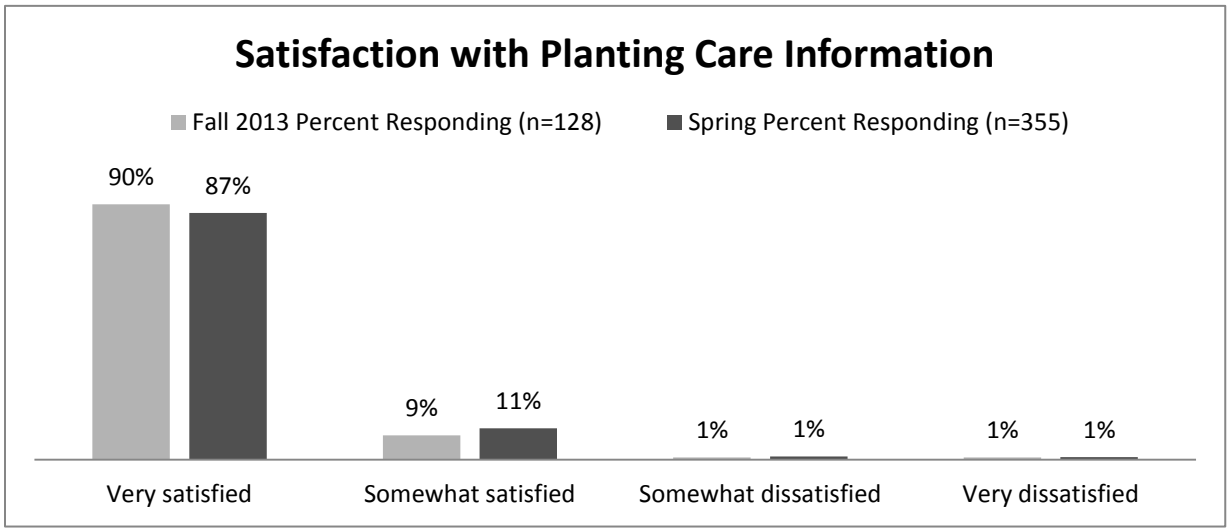
Overall, the project participants reported high satisfaction rates for the Shade Tree Project. However, the satisfaction questions were inconsistent across events so it is not possible to compare the results. Table 10 summarizes the satisfaction rates captured for both offerings from the surveys.

Table 10: Satisfaction with Program Components

Fall 2013					
How much do you agree with the following statements:	**Strongly agree**	**Somewhat agree**	**Somewhat disagree**	**Strongly disagree**	**Total Respondents**
I am satisfied with the Shade Tree Project pickup event	93%	7%	0%	0%	340
It was easy to plant my shade tree	90%	10%	0%	0%	339
I would recommend the Shade Tree Project to a friend or relative	95%	4%	0%	0%	339
I am satisfied with my overall experience with the Shade Tree Project	93%	6%	1%	0%	337
Total Number of Respondents					340
Spring 2014					
Survey Question	**Very satisfied**	**Somewhat satisfied**	**Somewhat dissatisfied**	**Very dissatisfied**	**Total Respondents**
Overall, how satisfied were you with the Shade Tree Project pickup event?	85%	12%	3%	0%	130
Survey Question	**Very Easy**	**Somewhat Easy**	**Somewhat difficult**	**Very difficult**	**Total Respondents**
Overall, how easy was it for you to plant your shade tree?	69%	28%	3%	0%	127

(Source: Fall 2013 and Spring 2014 Surveys)

The participants were also very satisfied with the planting care education they received at the pickup events (see Figure 8). During both the fall and spring periods, half (48% and 56% respectively) of respondents felt that the planting depth was the more valuable piece of information they received.



(Sources: Fall 2013 and Spring 2014 Surveys)
Figure 8: Satisfaction with Planting Care Information

Most participants provided positive feedback regarding the pickup events, as the following excerpts illustrate.

> *"The pickup event was very well organized and informative. The software tool for tree placement was great."*
>
> *"Tree was free and in an easy location to pick up. Also able to pick from several varieties and the people were very knowledgeable and helpful."*
>
> *"Thrilled to have a free tree to shade my very sunny back yard! I liked the informative education I received when picking up the tree. Thank you so very much!"*

However a few respondents were dissatisfied with the quality of the trees provided from IPC.

> *"The trees were too small and will take forever to grow."*
>
> *"I was disappointed with the maturity of the tree. To be considered for energy conservation shading the tree would need to mature 10-15 more years."*

Database Review

Another critical task for this process evaluation was to carefully review the program database to determine if it is adequately capturing the key components necessary to document important program metrics.

Fall 2013 Key Results

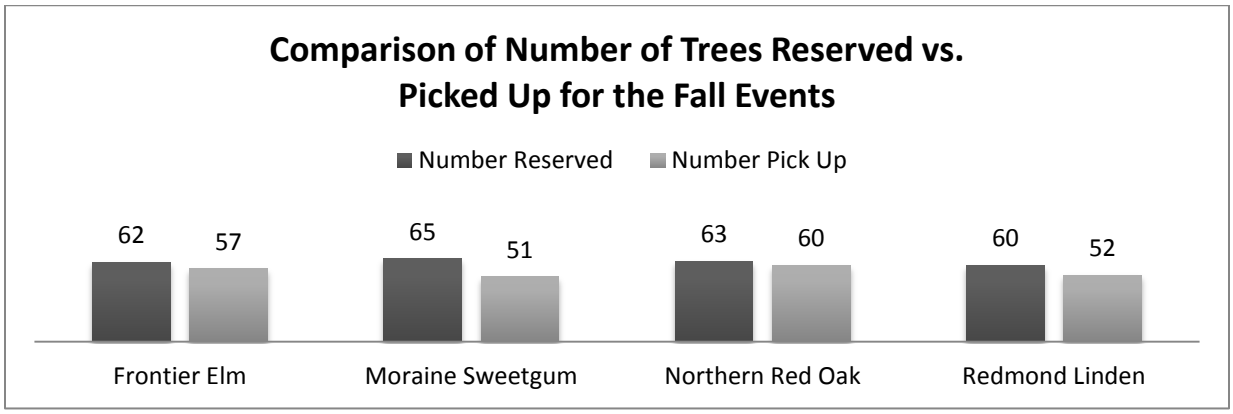
There were a total of 250 trees reserved by participants at the Fall 2013 offering. Each participant could reserve one tree.

The disposition of the trees reserved at the Fall 2013 events were recorded inconsistently in the program database. However, the review confirmed that while there was initially a total of 37 trees that were not picked up by customers at the planned events, seven of these trees were later retrieved by the customers at a subsequent event. Therefore, there were a total of 30 trees that were not claimed by the participants during the Fall event and were subsequently donated. Table 11 and Figure 9 summarize these findings.

Table 11: Disposition of Trees at the Fall 2013 Events

Event Location	Number of Trees Reserved	No-Show at the Events
Boise	79	9
Kuna	29	3
Meridian	83	16
Nampa	59	9
Total	250	37
Number of customers that picked up tree at a later event		7
Total No Show		30

(Source: PY2014 Shade Tree Project Database)



(Source: PY2014 Shade Tree Project Database)

Figure 9: Comparison of Number of Trees Reserved vs. Picked Up for the Fall Events

As Table 12 shows, about one-half of the program participants self-reported their tree planting locations in the follow-up survey.[7] These results were compared to the original planting locations recorded in the online enrollment tool. Therefore, these findings represent only 50 percent of the trees that were actually planted; however they do provide some important trends that should be confirmed in subsequent on-site verification.

Most of the survey respondents reported planting trees in locations that would optimize energy savings, such as the West (25%), the Southwest (19%) or Northwest (30%) [8] orientations.

However, these survey respondents reported some variances from their original location with a notable percentage of the trees now being planted with Southwest orientation (19%) compared to the original estimate (4%).

Table 12: Comparison of Planned vs. Actual Planting Directions from the Fall Events

Direction of Tree Planted	Planned Location From Home	% of Total	Actual Planted from Self-Report Customer Surveys	% of Total
East	5	2%	7	6%
North	37	15%	4	3%
Northeast	12	5%	7	6%
Northwest	97	39%	38	30%
South	5	2%	8	6%
Southeast	14	6%	7	6%
Southwest	9	4%	24	19%
West	71	28%	31	25%
Total	250	100%	126	100%

(Source: PY2014 Shade Tree Project Database)

While the other locations do provide some energy savings benefits, maximum energy savings come from those locations with a western orientation, as highlighted in IPC's customer educational materials. Therefore, it will be important for IPC to verify these locations through follow-up site visits to ensure that these trees are planted in locations that maximize energy savings.

Spring 2014 Key Results

Unlike the Fall offering, program participants could reserve up to two trees at the Spring offering thus increasing the overall potential number of shade trees planted for this project. Ninety-eight percent of the trees were distributed at events held at various locations throughout the two-county area and accounted for the majority (n=619) of participants during the spring 2014 timeframe.

[7] Planting locations were also reported in the program database; however there were several gaps in this information and therefore was not viewed as a reliable source to document post-planting location.
[8] Note: Idaho Power's definition of "West" is based on the energy-savings tree tools identified that Northwest, West and Southwest locations all provide maximum energy savings.

IPC staff also held three other workshops that distributed a total of 27 trees to 16 participants (see Table 13).

Table 13: Comparison of Planned vs. Actual Attendance Rates at the Spring Events

Event Location	Number Participants Enrolled	Number Participants Attended	Difference	% Difference
Boise	271	225	46	17%
Kuna	89	74	15	17%
Nampa	177	159	18	10%
Meridian	158	140	18	11%
Total		619		
Customers Who Attended a Later Event*		21		
Total	695	640	55	8%

*These are customers that missed their designated event but then attended a later event or workshop and ultimately got their tree.

Table 14 summarizes the number of trees that were both planned and actually distributed at the Spring events.

Table 14: Comparison of Planned vs. Actual Tree Distribution at the Spring Events

Event Location	Trees Reserved	Trees Distributed	Difference	% Difference
Boise	435	370	65	15%
Kuna	146	125	21	14%
Nampa	298	277	21	1%
Meridian	258	231	27	10%
Total at Events		999		
Trees Picked up at a Later Event*		32		
Total	1,137	1031	138	12%

*These are customers who missed their designated event but then attended a later event or workshop and ultimately got their tree.

As Table 15 shows, one-third of the Spring participants received one tree while two-thirds received two trees.

Table 15: Distribution of Number of Trees Picked Up by Customers at the Spring Events

Number of Trees	Number of Customers
1	206
2	413
Grand Total	**619**

(Source: PY2014 Shade Tree Project Database)

The Spring Events offered a much wider variety of trees to distribute to participants, thus giving them more options in selecting either one or two trees as Table 16 shows. This also led to an uneven distribution of trees, which created some frustration at the follow-up workshops as described in Section 2.1.

Table 16: Types of Trees Distributed Spring 2014 by Species

Tree Species	Tree 1	Tree 2	Total
Heritage River Birch	136	61	197
Northern Red Oak	16	31	47
Red Maple Armstrong	28	8	36
River Birch Clump	77	14	91
Sourwood	33	54	87
Swamp White Oak	113	133	246
Tulip Tree	72	46	118
Worplesdon Sweetgum	152	72	224
Unknown	6	6	12
	633	425	1,058

(Source: PY2014 Shade Tree Project Database)

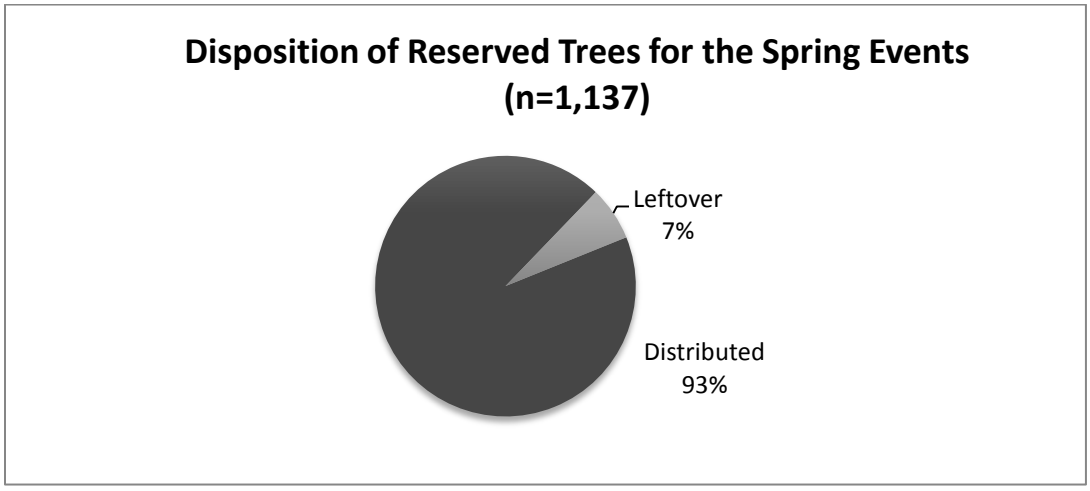
After the planned events, IPC had a total of 103 trees remaining from the original reserved total of 1,134. Of these, 27 were distributed after the offering through the additional workshops as Table 17 shows.

Table 17: Distribution of Additional Trees at Follow-Up Workshops

Workshop Location	# Registered	# Attended	# Trees Distributed
Boise	7	4	5
Nampa	12	10	18
Kuna	4	2	4
Total	23	16	27

(Source: PY2014 Shade Tree Project Database)

Figure 10 summarizes the total number of reserved trees that IPC distributed (n=1,058), either during a planned event or at a follow-up workshop while 76 (7%) were donated to municipalities and local public schools for planting.



(Source: PY2014 Shade Tree Project Database)
Figure 10: Distribution of Reserved Trees at the Spring Events

Table 18 summarizes the location in which the Spring 2014 participants who registered via the main program model (Arbor Day Enrollment tool and pick up at event) planned on planting their trees. These data are based on evaluating the property map used during program enrollment. However, a small percentage of these tree locations (5%) were not identified and therefore should be verified through either customer follow-up surveys or on-site verification.

As this table shows, most participants (51%) planned on locating their trees with a western orientation, either by planting the trees with West (37%), Northwest (7%) or Southwest (7%) orientation. But there were a significant number of customers (46%) who did not plan on locating their trees to maximize energy savings, including customers who planned on planting their trees with East (15%), South (10%), Southeast (4%) or Northeast (3%) orientation.

Table 18: Summary of Participants' Planned Planting Directions from Program Database

Planned Tree Planting Direction	Tree 1	Tree 2	Total	% of Total
East	94	66	160	15%
North	61	1	62	6%
Northeast	27	8	35	3%
Northwest	36	36	72	7%
South	62	44	106	10%
Southeast	24	14	38	4%
Southwest	42	27	69	7%
West	249	147	396	37%
Unknown	15	37	52	5%
Total	633	425	1058	100%

(Source: PY2014 Shade Tree Project Database)

Although IPC offers program participants flexibility in selecting the location for planting these trees, these findings suggest that this project may be at risk for lower than expected savings and cost effectiveness results. Therefore, IPC should continue to promote the "West is Best" planting locations in its program outreach messaging while monitoring closely the actual planting locations of these trees to ensure that IPC is generating as much energy savings as possible from this project.

An email survey was sent to participants approximately one month after the last distribution event. A total of 338 participants responded to this survey that included questions about the actual location in which the trees were planted. Since the survey did not identify the number of total trees planted by these respondents, the actual planting locations of the majority of trees distributed during the spring events (n=720) were not confirmed in this survey (see Table 19).

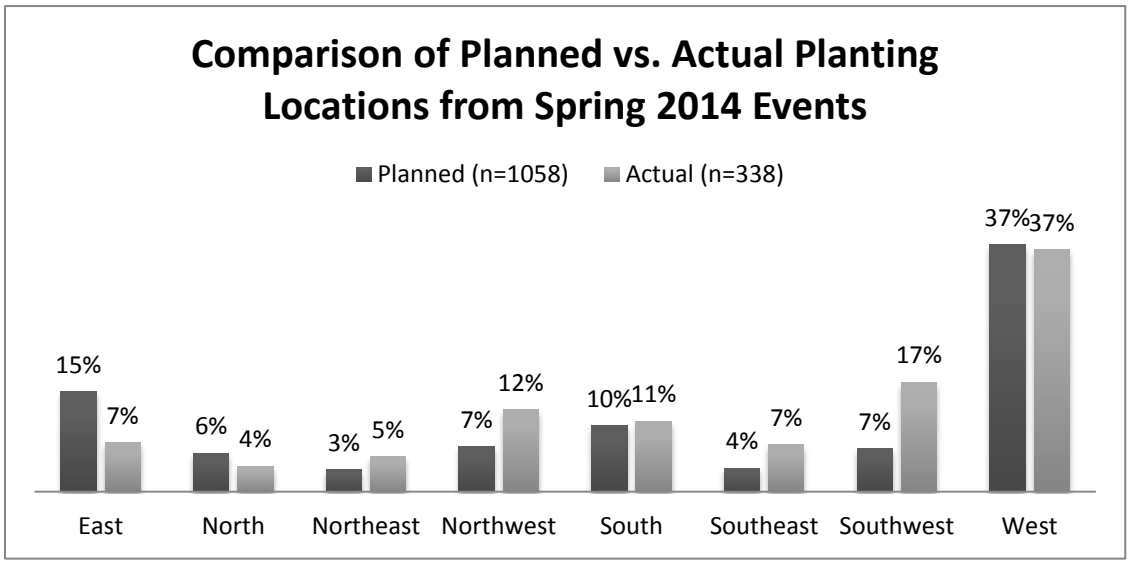
Table 19: Summary of Participants' Actual Planting Directions from Follow-Up Surveys

Actual Tree Planting Direction	Total	% of Total
East	25	7%
North	13	4%
Northeast	18	5%
Northwest	42	12%
South	36	11%
Southeast	24	7%
Southwest	56	17%
West	124	37%
Grand Total	338	100%

(Source: PY2014 Follow-Up Surveys)

For the program participants who did respond to the online survey, the majority indicated that the trees were planted West (37%), Southwest (17%) or Northwest (12%) direction. These locations all offer significant energy savings. Similar to the results from the Fall Events, about one-quarter of the participants (27%) planted their trees in locations that will not maximize energy savings.

Qualitatively, these results suggest that some program participants are heeding IPC's guidance by changing their planned locations to put the trees in a more westerly orientation as illustrated by the slight decline in the percentage of trees actually planted in the East and the slight increase of the percentage of trees planted in the Southwest (see Figure 11).



(Sources: PY2014 Shade Tree Project Database and PY2014 Follow-Up Surveys)
Figure 11: Comparison of Planned vs. Actual Planting Locations from the Spring 2014 Events

However, these results do not account for the majority of trees distributed at the Spring 2014 events, so IPC should follow up with all customers to determine the actual location of these trees. These follow up activities, which should include specific survey questions

designed to identify the disposition of *each tree* received by the program participant, could be supplemented with a statistically valid sample of on-site visits to verify the tree locations. In this way, IPC would have greater insight into the actual energy savings that the Shade Tree Project is contributing to achieving IPC's overall DSM goals.

2.3 IPC Staff Interview Summary Findings

As part of the process evaluation, the Johnson Consulting Group team interviewed the program specialist responsible for the Shade Tree Project.

Program History

This program was developed based on the programs specialist's previous experience with air quality work so she was aware of the energy and environmental issues created during hot summer days. She also learned that the Idaho Department of Lands was conducting a tree canopy study to determine environmental impacts of trees including energy savings.

As part of this survey, the Department of Lands also developed a GIS mapping tool that identified all potential areas for tree planting including parks, lots, roads, and housing tracts. This information was then incorporated into identifying the customers with the best planting locations and targeting the marketing and outreach activities toward them.

The Shade Tree Project design was developed through an internal working group at IPC, which included staff from several departments including rates and regulatory, energy efficiency, sustainability, and marketing. The group also included external stakeholders who are municipal arborists involved in urban forestry projects throughout the region. Many of the external stakeholders who are trained arborists later helped out at the pickup events.

The program specialist also researched other shade tree program designs currently used by electric utilities throughout the United States such as those used by Arizona Public Service (APS) and San Diego Gas & Electric. However, these utilities rely on a different model that would not fit with the specific IPC program requirements.

The program specialist also discovered that the program run by Sacramento Municipal Utilities District (SMUD) is not cost-effective as they allow customers to receive up to 10 trees but few of these trees are actually planted, leading to high tree mortality rates. The SMUD staff also hand delivers trees, increasing program costs.

Therefore, the program specialist explained that the IPC program was designed to be more cost-effective by using an event delivery model and limiting the number of trees available to program participants.

In addition, the APS Shade Tree Program reported a higher no show rate for pickup events compared to the rate for the IPC program. IPC staff took a proactive approach to minimizing the no-show rates by calling customers who reserved trees and inviting them to pick up their trees at an alternative event. This diligent follow-up increased the overall

number of trees that were given to customers and minimized the number of no-shows significantly[9].

Using feedback from local experts, and the information gained from the review of other programs and best practices, IPC's Shade Tree Project launched its first offering in the fall of 2013.

Marketing and Outreach

As a way to identify potential program participants as well as ensure that the program targeted the two-county area, the program specialist modified the GIS tool to incorporate customer account data. This change made it easy to identify eligible customers.

> *"The Department of Lands developed this GIS tool that had these layers that indicated where trees could still be planted in the two-county area. Then, ICP created an overlay with customer data to identify customers with space on the west side of their homes, with irrigated land and have a lot with the proper dimensions to plant trees."*

The program specialist used this information to create a targeted mailing list. For fall 2013, 6,000 pieces were mailed to recruit 250 participants. A total of 167 customers enrolled as a result of that mailing, yielding an average response rate of 2.8 percent.

Based on the experience gained during the first year of the program operation, IPC staff fine-tuned the direct mail approach to generate more potential customers in the first mailing. The Spring 2014 mailing was significantly larger, with IPC sending out direct mail letters to approximately 13, 769 customers in three batches. The goal was to attract approximately 500 customers who combined, could plant up to 1,000 trees.

However, limiting the target market was challenging as the Shade Tree Project generated interest from customers who were not identified as prime candidates by the GIS study.

Enrollment Process

The enrollment process is scheduled to begin approximately six weeks prior to the events, in the fall and spring every year. Similar to other shade tree programs, IPC uses the enrollment tool developed by the Arbor Day Foundation. This tool, based on the U. S. Forest Service model called i-Tree, calculates the total benefits that trees provide beyond energy savings, such as improved air quality, and reduced carbon emissions.

Customers may enroll either online or call the program specialist directly and she will enroll them in the program over the telephone.

[9] The results of these additional follow up efforts are documented in Tables 13 and 14.

Customer Events

In both the Fall and Spring offerings, customers were required to pick up trees at one of three to four prescheduled events that were heavily staffed with volunteer arborists. Each event attracted 300 to 400 customers.

> *"Arborists helped participants identify what type of tree goes to each customer and then spent about 10-15 minutes explaining to the customer everything they needed to know about how to plant a tree successfully*."

The arborists provided detailed information about how deep to plant the tree, watering guidelines, staking and other critical information. The information was consistent with the ISA's Planting and Care Guidelines.

Customer Education

The Shade Tree Project incorporates community-based social marketing tactics by combining the tree delivery with customer education. In addition, the social cues from the events further reinforced the "prestige factor" because these participants were able to participate in a socially important program.

Lessons Learned from the Project

Based on the experience gained from the first year, the Shade Tree Project was modified to address the issues regarding tree oversubscription that resulted in some customer frustration at the follow-up workshops. Going forward, IPC staff will offer a broader selection of trees as well as ensure that each type of tree is offered in the same quantity.

However, ordering equal number of trees for each species requires considerable advance planning. The tree growers require orders of at least three years in advance and the trees selected for this program must be well suited for the soil type and condition in the TV area.

Quality Assurance/Quality Control (QA/QC)

Currently the program does not have a QA/QC component in place. However, the program specialist hopes to address this program gap by conducting site visits in 2015.

The QA/QC plan includes hiring a horticultural intern who would be responsible for following up on the trees planted in the program.

Another critical issue is to ensure that all of the trees ordered by IPC for the program are eventually planted by IPC customers. Last year, the Shade Tree Project donated all of the extra trees to the City of Boise and other local municipalities for planting.

Areas for Program Improvement

The program specialist has identified several areas for program improvement. These include streamlining the online enrollment tool even further to make it easier for customers to participate in the project.

The Shade Tree Project is making adjustments to ensure that there will be equal amounts of trees available by sending out one mailing to all eligible customers at once.

In addition, the program specialist is investigating the best way to calculate the carbon credits associated with the program.

3 Program Flow Diagram

Based on the information from the staff interviews, the Johnson Consulting Group team developed a program flow diagram documenting the customer participation process. It also highlights in red areas the recommended program enhancements regarding QA/QC and program tracking.

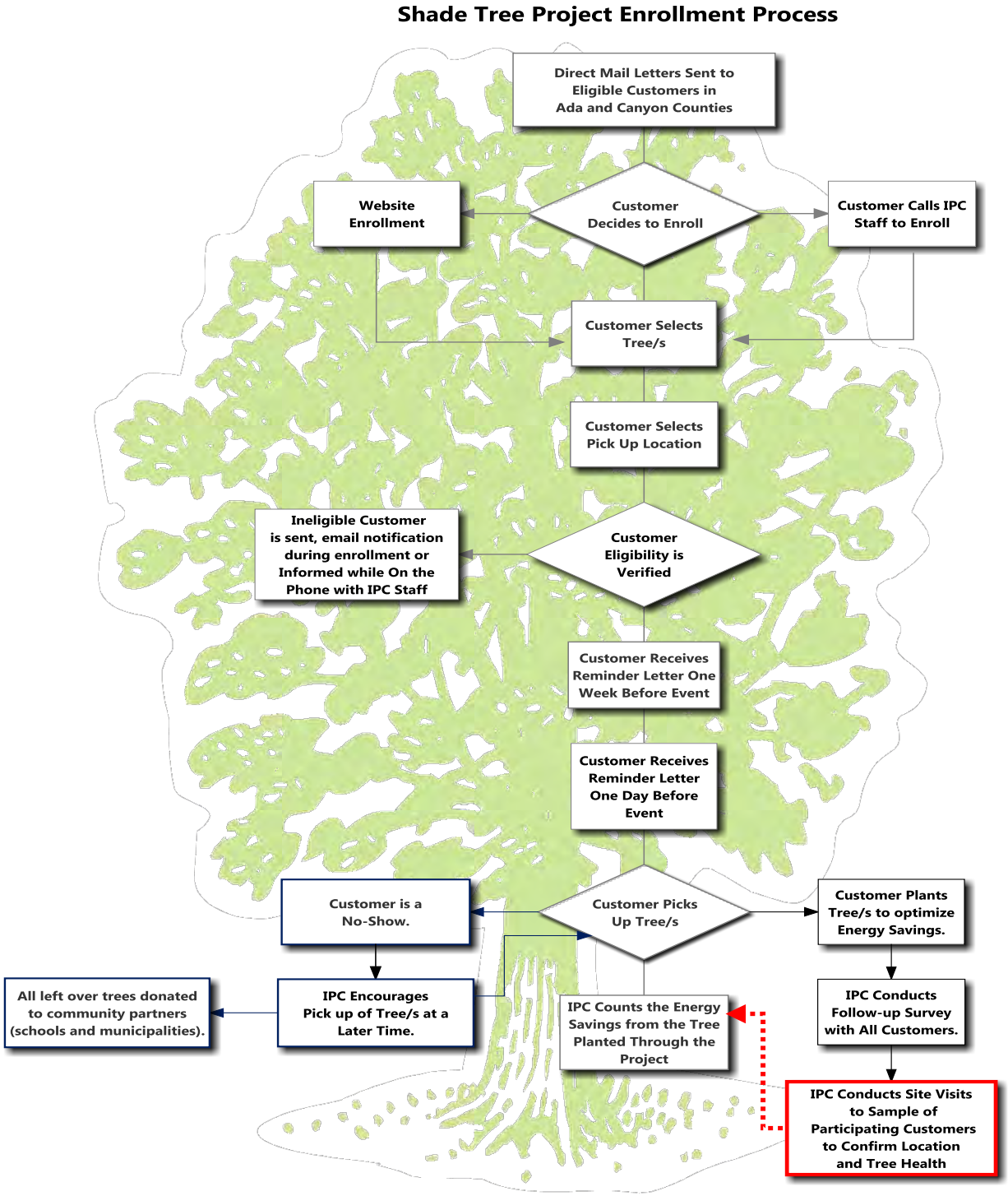


Figure 12: Program Flow Diagram

Assessment of the Program Enrollment Process

As part of the process evaluation, the evaluation team tested the online enrollment process. The IPC staff provided test data so the evaluators could experience the entire enrollment process from the participant's perspective.

The online enrollment tool developed by the Arbor Day Foundation is impressive. Adding in the layering to identify a specific house was most helpful. The online tool allows the user to experiment with different scenarios in both selecting different tree species and placing them at various locations on the property.

The messaging "West is Best" was reinforced throughout the online experience both regarding potential tree placement and in the estimated energy savings provided to the program participant.

Once the trees are selected, the participant receives an online verification message within a few minutes.

Overall, the online enrollment tool is easy to use and is a valuable feature of the Shade Tree Project.

4 Comparison with Urban Planting Program Best Practices

As part of the process evaluation, the Johnson Consulting Group team also reviewed several urban planting best practices and EM&V reports on shade tree programs in other jurisdictions. Table 20 compares the best practices identified in the literature review with the current program operations used in IPC's Shade Tree Project.

As this table shows, IPC has implemented the majority of these program best practices both in the initial design and through ongoing program operations.

Table 20: Summary of Shade Tree Best Practices

Program Best Practice	Incorporated into IPC's Shade Tree Project
Establish a core group to plan, build coalitions, and forge partnerships	✔
Develop program objectives that are measurable in real time	✔
Foster direct participation among community members to develop local partnerships	✔
Nurture volunteers to maintain long-term commitment	✔
Obtain high-quality nursery stock in order to enhance retention	✔
Develop a list of recommended trees that perform best in alternative situations	✔
Commit to long-term stewardship (inspection, maintenance to maximize survival and growth)	✔
Pre-screen applicants to minimize free riders	■
Plant trees in every vacant tree-planting lot	✔
Plant larger scale shade-tree varieties	✔
Provide diversity in tree inventory	✔
Properly maintain trees to current ISA standards	■
Well-developed program materials and marketing	✔
Offer a required workshop or video presentation to learn about tree planting, care & maintenance	✔
Provide efficient transfer of trees	✔
Conduct follow up evaluation of program effectiveness	✔
■ = does not comply with best practices	

(Sources: Modified and expanded from i-Tree Analysis, Redwood City Tree Best Practices & Zeebee Associates 2006)

This review identified only two areas in which the current Shade Tree Project operations could improve: pre-screen applicants to minimize free riders and implement an ongoing QA/QC tracking system to monitor planting practices and tree health.

Of note, Zeebee & Associates (2006)'s evaluation of the San Diego Cool Communities Shade Tree Program identified high rates of free ridership[10] and tree mortality, which significantly lowered the energy savings estimates from the program.

[10] Zeebee & Associates calculated two different high free ridership rates between 73 to 89 percent but the findings were likely to have measurement error and could not be validated independently. However, these programs do have a potential for high free ridership and therefore the program should include strategies to screen out potential participants who plan on planting trees on their own (Zeebee & Associates 2006, pp. 26-28).

Therefore, it is important that the Shade Tree Project develops a strategy to pre-screen the proposed planting location during the online enrollment period. In addition, the Shade Tree Project should implement an ongoing QA/QC process to verify tree planting locations and monitor tree health.

By implementing these two recommendations, the Shade Tree Project will be operating in a manner consistent with the best practices for shade tree programs.

5 Key Findings and Recommendations

The findings from the process evaluation activities indicated that overall, the Shade Tree Project is well designed and well managed. The key findings supporting this conclusion are presented next, followed by recommendations on ways to further enhance overall program operations.

5.1 Key Findings

IPC successfully leveraged industry best practices to design and develop the Shade Tree Project. The Shade Tree Project's program design was developed by combining internal resources from a diverse group of IPC staff with input from critical external stakeholders involved in urban forestry projects throughout the region. This shrewd approach provides IPC with a way to refine the program model while using ratepayer funds wisely.

IPC staff are responsive and flexible and have adapted this project based on both experience and customer feedback. The staff continues to refine the program delivery model, increasing the number of trees offered to customers, and improving the program marketing and educational materials. In addition, the Shade Tree Project delivery strategy is consistent with the industry best practices for shade tree programs.

A total of 1,278 trees have been distributed to the program participants during the Fall 2013 and Spring 2014 offerings. There were a total of 220 trees distributed to participants at the Fall 2013 offering according to the program database. IPC significantly increased tree distribution at the Spring 2014 offering and a total of 1,058[11] trees were distributed, according to program records.

Most customers followed through on their plans to plant the free trees in a westerly location. However, IPC is not tracking the actual planting locations for all the trees, and this could adversely affect the overall cost-effectiveness of this project.

The Fall events survey respondents reported planting trees with West (25%), the Southwest (19%) or Northwest (30%) [12] orientations. The results were similar for the Spring events, in which two-thirds (66%) of the survey respondents reported that they planted trees either facing West (37%), Southwest (17%) or Northwest (12%) location. These locations all offer significant energy savings.

However, there is a strong minority of program participants (27% for the Fall participants and 37% for the Spring participants) who are not planting trees to optimize energy savings.

[11] This number differs from the information provided in the program handbook as it identifies the total number of trees that were actually available for distribution, which was revised downward from the 1,200 original estimate.

[12] Note: Idaho Power's definition of "West" is based on the energy-savings tree tools and include Northwest, West and Southwest locations that all provide maximum energy savings.

Although IPC offers program participants flexibility in selecting the location for planting these trees, these findings suggest that this project may not achieve all of the planned energy savings.

***The online program enrollment was quick and easy*.** Nearly two-thirds (60%) of the survey respondents were able to enroll in the program in ten minutes or less. Nearly three quarters (72%) of survey respondents found the online enrollment tool very easy to use.

Overall, the participants reported high satisfaction rates for the Shade Tree Project. The participants were very satisfied with both the planting care and education they received at the distribution events. A few respondents were dissatisfied with the quality of the trees provided from IPC because the trees were young and immature.

The gaps in the program database may adversely impact the overall cost-effectiveness of this project. The current program database did not track key program metrics consistently. The data are not organized in a manner that is consistent with industry standards and best practices.

Currently there is no Quality Assurance/Quality Control (QA/QC) process in place. This is also one of the few areas in which the program does not follow industry best practices. However, the program specialist is currently developing a QA/QC approach that will be implemented in 2015.

The Best Practices Review identified that these programs may be subject to high free ridership rates. While the IPC model does address free ridership through an improved delivery model and promoting trees in a specific geographic area; free ridership is an ongoing concern with shade tree program designs.

5.2 Recommendations

Based on the process evaluation findings, the Johnson Consulting Group evaluation team has also developed the following recommendations to further improve current program operations.

IPC staff should standardize the current program evaluation questionnaires to allow for consistent feedback and tracking across all program events. This includes asking questions to all customers assessing satisfaction, determining the actual planting locations for all trees provided, and exploring more fully the reasons for participation.

IPC staff should develop a pre-screening tool to maximize energy savings potential at the initial application stage. Given both the survey responses and the experience with other shade tree programs, IPC staff should try to maximize energy savings at the initial screening by incorporating the strategies used by other shade tree programs such as pre-screening out customers who do not intend to plant trees facing West, Northwest or Southwest on their property. IPC staff should also assess actual free ridership rates through customer surveys in future program evaluations.

IPC staff should implement a QA/QC process to provide ongoing tracking of the distributed trees. This QA/QC process should include follow up with all program participants a sample of on-site visits to verify planting orientation and tree health. This QA/QC process can also help to fill in the gaps by providing more accurate estimates of actual tree planting locations, and therefore provide a more accurate estimate of overall program effectiveness.

The Shade Tree Project should develop a standard database that consistently tracks the disposition of trees, and tracks key program metrics in a standard manner. As this program evolves from a pilot to a full-scale program, it is critical to develop a standardized program tracking tool that tracks key program milestones, customer feedback, and electric and non-electric savings and allows easy comparison between offerings. In this way, IPC will be able to track this program more in a more transparent manner, which may further enhance its overall cost-effectiveness.

IPC staff should try to quantify the non-electric benefits associated with this program as a way to enhance its overall cost-effectiveness. The technical assessments included detailed models demonstrating the significant non-electric benefits that shade tree programs provide. Therefore, IPC staff should leverage this information and include the quantification of program non-electric benefits attributed to this project, including reductions in carbon emissions, carbon sequestration and other benefits quantified in the i-Tree Analysis.

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SUCCESS STORIES

Table 5. 2014 Success Stories

Title	Program	Author*
A chilling story of ON Semiconductor and Idaho Power incentives	Custom Efficiency	Idaho Power
Commercial Creamery of Jerome sees the light on saving energy	Custom Efficiency	Idaho Power
CSHQA architects and engineers design sustainability into their own offices	Building Efficiency	Idaho Power
Future brightens, energy savings soar for Boise's Riverside Hotel	Custom Efficiency	Idaho Power
How to make your lighting system more energy efficient without changing your lights	Custom Efficiency	Idaho Power
Industrial detergent manufacturer cleans up with Idaho Power Easy Upgrades incentive	Easy Upgrades	Idaho Power
A lesson in saving energy courtesy of the Notus School District	Custom Efficiency	Idaho Power
More efficient lighting allows Blake Trailers to pull less electricity	Custom Efficiency	Idaho Power
North Star Charter School graduates to a better lighting system	Easy Upgrades	Idaho Power
Teaming up to save money and improve lighting at the Public Safety Building	Custom Efficiency	Idaho Power
Using less energy to create better lighting is a win/win for Riverstone International School	Easy Upgrades	Idaho Power

*All success stories written under contract with Writers, Ink. LLC.

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Custom Efficiency

For Commercial and Industrial Projects

A chilling story of ON Semiconductor and Idaho Power incentives

A "clean room" in a semiconductor (computer chip) maker is one of the most tightly controlled manufacturing environments on the planet. Workers must wear "clean suits" so their bodies do not emit particles (i.e., hair, sodium, skin cells) that contaminate the microscopic circuitry on the chips. The amount of dust in the air is limited to one particle per cubic meter. And the temperature and humidity are maintained at very specific levels.

"We keep our clean rooms tightly controlled for temperature and humidity," said Bretton Hoffer, the facility mechanical engineer at ON Semiconductor's Pocatello fabrication facility.

What kind of technology allows ON Semiconductor to maintain these unwavering temperature and humidity levels 24/7/365? "We have three 1,200-ton chillers connected in parallel that provide chilled water to our process cooling water and HVAC systems," Hoffer explained. "We run our new 19XR chiller 93 percent of the time. During those few times of the year when outside humidity is high, we'll put a second chiller online to handle the greater latent load."

The project

As part of the qualification process related to a project for one of their new customers, ON Semiconductor added the 19XR chiller to support the increase in production capacity. The energy savings associated with this project qualified it for an Idaho Power Custom Efficiency incentive.

"The incentive was for the energy we saved by running the new 19XR chiller instead of our old chillers," Hoffer noted. "To achieve the energy savings the incentive is based on, we agreed to run the new chiller more than 93 percent of the time. We still run our old, 1997-vintage 19EX chillers once a month, just to make sure they're fully functional, since we keep them on-line as backups."

Why chillers are such a hot topic

The equipment used to create the cold water is known as a chiller, and the water that comes out of it not only regulates temperature and humidity but is used to cool the wafer processing equipment in the clean room. "Basically, if we lost our chilled water system," Hoffer explained, "we'd have to shut the plant down."

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"The incentive process was straightforward, and the Idaho Power people were easy to work with. It was a great experience."

– Bretton Hoffer, Pocatello Facility Mechanical Engineer, ON Semiconductor

The savings

The new chiller is 20 percent more efficient than the two older chillers, reducing the plant's annual chiller-based energy expenditure by 774,822 kilowatt-hours (kWh).

Purchase and installation costs for the project, which included harmonic mitigation equipment, totaled $473,211, of which $286,927 qualified for the Custom Efficiency incentive. The latter figure reflects the difference between the costs of a standard chiller ($193,671) and the premium chiller ON Semiconductor installed. As a result, it received an incentive payment of $92,979.

Estimated savings for ON Semiconductor's chiller upgrade project

Estimated kWh Savings/Year	Project Cost	Estimated $ Savings/Year	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
774,822	$289,540	$42,615	$92,979	$196,561	4.6

Source: Idaho Power ON Semiconductor Chiller Replacement Report IND0949

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to use energy wisely and reduce their utility costs.

- The **Custom Efficiency** program offers incentives to large commercial and industrial customers who invest in energy-saving improvements in their facilities.
- **Easy Upgrades** provides financial incentives to commercial and industrial customers who implement qualified energy-saving measures in their facilities.
- The **Building Efficiency** program helps offset the additional capital costs when a company upgrades its planned lighting, cooling, controls, and building shell designs in favor of more efficient components.

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to idahopower.com/business or call us at 208-388-2323 within the Treasure Valley or 1-800-488-6151 outside of the Treasure Valley. We'll show you how you can save energy like ON Semiconductor.

The above success story was produced in cooperation with, and approval from, ON Semiconductor.

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Custom Efficiency

For Commercial and Industrial Projects

Commercial Creamery of Jerome sees the light on saving energy

To say Commercial Creamery is a family-run business is an understatement. "My grandfather started working for the company in Spokane in 1920," said Earl Gilmartin, the corporate engineer at the company's Jerome, Idaho, plant.

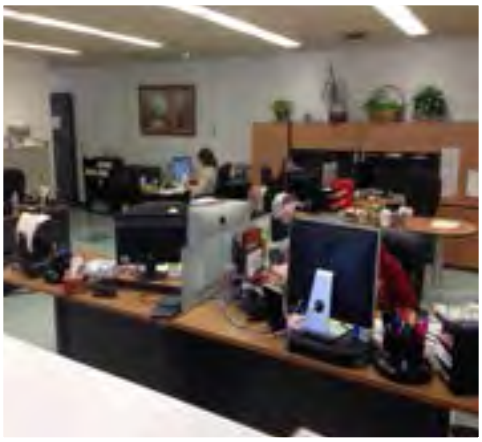
"My dad started working for his dad in 1952. Today, you've got me; my two sons, William and Bradley, who run things here in Jerome; my kid brother, Peter, who's VP (vice president) of operations in Spokane; my younger sister, Megan, who's VP of sales and works out of San Francisco; and my older brother, Michael, who runs the whole company from the Spokane office."

Incentives that get noticed

Commercial Creamery manufactures powdered cheese, cream, and butter at plants in Spokane and Jerome. "We don't do just straight cheeses but usually spice blends," Earl explained. "Like mac-and-cheese sauce and prepackaged au gratin and scalloped potato mixes. Altogether, we make maybe 1,000 different products."

The company's Jerome facilities were ready for a lighting retrofit. "Along with the processing plant, we have giant warehouses, coolers, and freezers here," Earl said. "Some with 30-foot ceilings, and virtually all of them had anything from incandescent lights, to T-12 fluorescents, to metal halide fixtures before we started the retrofit."

It took years, but Leo Sanchez, a customer representative for Idaho Power, convinced Earl to take advantage of the utility's Easy Upgrades incentive program. The results were gratifying. "Corporate saw that if we spent $10,000 for a lighting project, we'd get a check back for a couple grand or so," said Earl. "It wasn't just a $50 gift certificate. That got noticed."



Persistence pays

Earl agrees that Idaho Power customer service representatives can be a source of "found revenue" for their clients—no matter how long it takes. "Leo Sanchez, our Idaho Power rep, never gave up telling us about the advantages of this rebate program," he admitted. "'We're going to give you cash back to upgrade your facility,' he'd say. 'It'll save both you and us energy.'"

But Earl had concerns about the time and money the projects would take. "Finally, when we were putting in 100 horsepower of refrigeration screw compressors, it hit me: I should talk to Leo. The rest, as they say, is a happy ending."

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"Corporate saw that...we'd get a check back for a couple grand or so. It wasn't just a $50 gift certificate."

–Earl Gilmartin, Corporate Engineer, Commercial Creamery

Commercial Creamery phased out most of its less-efficient incandescent fixtures, replacing them with high-efficient T-8, T-5, and compact fluorescent lights, along with a full array of motion sensors. "There might be a janitor's closet somewhere we missed," Earl said, "but we've converted pretty close to 90 percent of the plant."

The savings

The final tally for the nine retrofit projects was $38,482.00. "By the time we were finished, Idaho Power's Easy Upgrades program had reimbursed us $11,732.00," Earl pointed out. "So our out-of-pocket was just $26,750.00." The project saves the company 114,135 kilowatt-hours (kWh) annually. "That's $5,444.00 per year. So, yeah, we're pretty happy with the investment," Earl acknowledged.

Commercial Creamery's estimated savings from participating in Idaho Power's Easy Upgrades program.

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
114,135	$38,482	$5,444	$11,732	$26,750	5

Uncommon savings are quite common

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The above success story was produced in cooperation with, and approval from, Commercial Creamery.

How much can your company save?

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Building Efficiency

For New Construction and Major Remodels

CSHQA architects and engineers design sustainability into their own offices

In 1889, William Campbell arrived in Boise, Idaho, from Edinburgh, Scotland, and opened a one-man, one-room architectural firm where he designed such iconic landmarks as the Idanha Hotel. Today, Campbell's tiny office has grown to 85 talented professionals in six cities who complete hundreds of projects every year.

One of their most recent efforts is the conversion of a 20,000-square-foot, brick and cinder-block warehouse in downtown Boise to the firm's gleaming, new, state-of-the-art office building.

Sustainable building design is in CSHQA's genes

"CSHQA was at the forefront of integrated, energy efficient construction when it became a building design factor 30 years ago," said Ted Isbell, senior project manager at CSHQA and the project's lead architect. "And we still make our projects as sustainable as possible, which led to our own building."

In CSHQA's offices you'll find geothermal heating and radiant cooling, skylights, a heat exhaust system for the computers, thick wall and ceiling insulation, double-pane windows with low-emissive glass, a reflective roof, low-water-use plumbing and landscaping, and—of course—high-efficiency lighting.

The Project

As they did with all the systems in their renovation, CSHQA looked at a number of different lighting options. "We settled on a combination of passive and active elements," Ted explained, "that enhance sustainability while qualifying for Idaho Power's incentives."

Smart building design wins awards

CSQHA's new offices received the City of Boise Building Excellence awards for Best Sustainable Commercial Project and Best Overall Project for 2014.

The building is also registered with the U.S. Green Building Council (USGBC). The firm hopes the project can earn the organization's Leadership in Energy & Environmental Design (LEED™) Platinum certification, the highest rating for sustainability a building can receive.

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"We want this building to be a showpiece for sustainable, high-performing design."

– Ted Isbell, LEED AP BD+C Senior Project Manager, CSHQA

The firm installed T8 fluorescent fixtures in the central studio, 27 different types of LED fixtures throughout the structure, 14 skylights to augment the artificial lighting with natural light, and automated control systems. "The lighting turns off automatically at 6:00 in the evening and on the weekends," Ted pointed out. "If people want to work after 6:00, they can hit a switch, and the lights come on for another hour."

The savings

CSHQA's energy efficient lighting system includes an overall reduction of installed lighting, more efficient lighting, natural lighting from skylights, and occupancy sensors. The lighting improvements alone will reduce CSHQA's annual electricity consumption by approximately 43,171 kilowatt-hours (kWh), which will save them more than $2,000 a year in electricity costs.

Idaho Power's Building Efficiency incentives covered $18,107 of the total project cost. "Idaho Power really worked with us to maximize the Building Efficiency incentive we were able to receive," Ted said. "They didn't just say 'No, we can't cover that expense.'"

Estimated savings from Idaho Power's Building Efficiency projects for CSHQA

Estimated Savings (kWh/year)	Estimated Savings ($/year)	Idaho Power Incentive
166,925	$8,300.00	$18,107.00

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This success story was produced in cooperation with, and approval from, CSHQA.

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Custom Efficiency

For Commercial and Industrial Projects

Future brightens, energy savings soar for Boise's Riverside Hotel

In October 2011, Boisean David Johnson and his local investment partners purchased the Riverside Hotel from its previous Texas-based owners. "Being out-of-area owners," David said, "they hadn't paid much attention to the property. We've been focused on restoring the hotel's past glory, and it's paying off."

One of the main areas that hotel management is focusing on is the property's 14-acre lighting system.

Energy savings are just one of the cool benefits

In the hotel's elegant Sapphire Room, David pointed up at the grand overhead lights, each of which used to require between 45 and 88 incandescent bulbs. "When this room was the disco, it was a massive power sucker," he noted. "So when we converted it to the Sapphire Room, we changed these overheads to LED lights, which draw only about one-tenth the power."

But saving on lighting costs is only one advantage of these new LEDs. "They don't put out the heat the incandescents did," David said, "so we're saving on cooling the room, as well. They don't burn out either, so we don't have to change out the bulbs nearly as often."

The project

The hotel's lighting upgrade was comprised of five projects: the exterior lighting, the Sapphire Room, the Ballroom, public restrooms, and the Liberty Room conference area. Energy savings of the first three areas alone averaged almost 150,000 kilowatt-hours (kWh) per year.

The savings were achieved by replacing existing incandescent and metal halide fixtures with modern LED and T8 lighting. "This has just been amazing for us," David exclaimed. "Besides the energy savings and longer bulb life, the quality of the light is amazing. I could go on and on about it."

A helping hand from the Integrated Design Lab

Helping David and his team visualize how such a complex project could come together was the University of Idaho's Integrated Design Lab (IDL), which created a 3D computer model of the hotel.

"The 3D model helped us visualize the project and estimate the cost savings," David pointed out. "For example, it can tell us if it's more cost-effective to place an insulating film over our single-pane windows or replace them with double-panes."

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"This has just been amazing for us. I could go on and on about it."

– David Johnson, Managing Partner
Johnson Brothers Hospitality

The savings

Combined, the five projects reduced the Riverside Hotel's annual electricity consumption by 457,231 kWh—enough energy to serve about 36 homes in Idaho Power's service area—and saved the hotel over $25,000 a year in power costs.

The total cost of the combined upgrades was $99,772, of which incentives from Idaho Power's Custom Efficiency program covered $53,255. The estimated payback time for the hotel's $46,517 out-of-pocket cost is less than two years.

Estimated savings on the five lighting upgrade projects for the Riverside Hotel

Estimated kWh Savings/Year	Project Cost	Estimated $ Savings/Year	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
457,231	$99,772	$25,147	$53,255	$46,517	1.8

Source: Idaho Power Riverside Hotel's Custom Efficiency project summaries IND1098, IND0859, and IND1044 and other reports

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How much can your company save?

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The above success story was produced in cooperation with, and approval from, the Riverside Hotel.

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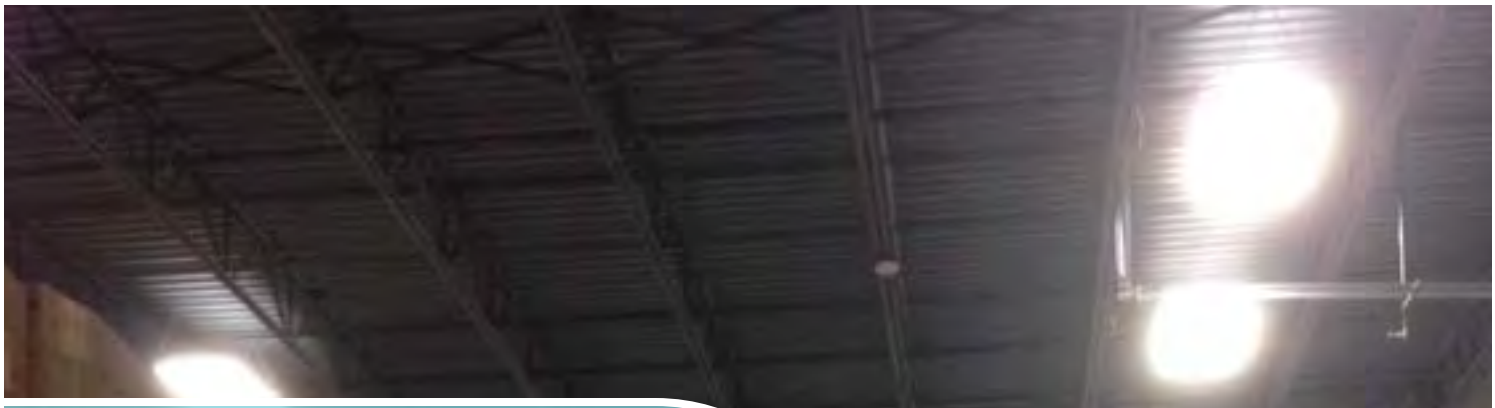

Custom Efficiency

For Commercial and Industrial Projects

How to make your lighting system more energy efficient without changing your lights

The most common way to reduce energy usage in a commercial lighting system is to replace less-efficient fixtures. Sometimes, you can find savings even when you already have high-efficiency lights.

Turning the lights on as you go

Steve Hix is the manager of Idaho Package Company's 60,000-square-foot warehouse in Caldwell, Idaho. "We sell packing materials," Steve said. "Boxes, bags, tape, bubble wrap. That sort of stuff."

The company was founded in Idaho Falls in 1983 by Steve's father. The Caldwell facility was built in 2009, so its lighting system already had high-efficiency bulbs and ballasts installed. However, there was room for improvement.

"It's a distribution center, not a production facility," Steve pointed out. "So not all the lights need to be on in the entire building. Some days there are entire banks of lights in the back that never see the flip of a switch. And if we can keep those lights off, it saves us money on our power bill."

The goal of the project was relatively simple: add motion sensors to the existing lighting system so an individual bank of lights turns on when a worker enters an area and turns off when they leave the area. "Every individual ballast has its own sensor," Steve explained, "so if you drive down one particular aisle, the lights just turn on as you go. The first time you see it, it's kind of fun to watch."

Saving on your power bill is easy

Many electrical contractors participate in the Easy Upgrades incentive program. A local electrician introduced Steve Hix to the opportunity. "Dan came in one day and told me about this Idaho Power incentive program," Steve said. "I wasn't sure how to go about applying for it, but Dan said they'd take care of everything. He worked up the bid, filed the paperwork with Idaho Power, and went through the whole process for me."

Continued on back

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"For me, the process was really easy, which is another reason I did it."

–Steve Hix, Co-owner,
Manager, Idaho Package Company
Caldwell distribution center

The savings

Installing 126 sensors in Idaho Package's Caldwell distribution center cost $9,362.00, of which $6,300.00 was covered by an Easy Upgrades incentive from Idaho Power, meaning the company's out-of-pocket expense totaled $3,062.00. The new sensors are saving Idaho Package 34,688 kilowatt-hours (kWh) and $1,726.00 per year. "We estimate it'll take us about two years to recoup our investment," Steve said, "but after that it's all perpetual savings."

Idaho Package Company's estimated savings from participating in Idaho Power's Easy Upgrades program.

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
34,688	$9,362	$1,726	$6,300	$3,062	1.8

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The above success story was produced in cooperation with, and approval from, Idaho Package Company.

Saving on your power bill is easy (continued)

Talk to your electrical contractor about Idaho Power incentives and how much you might be able to save. "For me," Steve adds, "the entire process was really easy, which was another reason I did it."

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Easy Upgrades

For Simple Retrofits

Industrial detergent manufacturer cleans up with Idaho Power Easy Upgrades incentive

Brian Rencher's business card identifies him as president, janitor & mad scientist at Technichem Corporation. "We're a detergent formulator, and I do most of the formulating," he says proudly. "We make industrial-grade soaps for washing everything from hands to really dirty equipment."

Founded by Brian's father in 1968, Technichem has grown from a small cinder-block building behind a Stinker gas station in downtown Boise to a 12,500 square-foot building near the corner of Maple Grove and Franklin Road on the west end of town. "We've been here for 30 years," Brian said, "but then, so has our lighting."

Lights that are cooler, quieter, and more efficient

Most Idaho Power customers who take advantage of our Easy Upgrades incentives focus on the energy savings. Brian appreciates another aspect of modern lighting. "Those 30-year-old lights were hot, and they whined, and made lots of noise. The new lights are cool and quiet. So from that standpoint alone, it's been a really good upgrade."

The project

Technichem replaced 91 T12 fixtures in its warehouse, offices, restrooms, and shop with high-performance T8 lighting. They also converted their exterior metal halide lights to more efficient light-emitting diode (LED) lights and added motion sensors in the offices and restrooms to further increase the efficiency. The lighting contractor kept the project's costs in line by relamping/reballasting instead of replacing the entire system.

"They didn't change out the basic fixtures," Brian pointed out. "They just pulled out the old tubes and ballasts and installed new electronic ballasts and lights. Saved us time and money."

Energy savings you can be comfortable with

Normally, a person doesn't like to say they're working in the dark, but in Brian Rencher's case, it bordered on a matter of necessity.

"Before the upgrade, I would leave the old lights in the office turned off because they were so hot, and I'd just work in the dark with a desk lamp. But the new lights don't give off all that heat, so I can just leave them on, and now I have all kinds of light in here."

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"I would recommend the Easy Upgrades program to anyone who has been hesitant about it, or has an old building. Or even a not-so-old building."

– Brian Rencher, President, Technichem Corporation

And Brian didn't have to devote a lot of his work hours to the project. "The lighting contractor took care of everything," he said, "from putting the estimate together to working with the power company. Then the Idaho Power contractor came in, looked over the new lighting, signed off on it, and we were done."

The savings

The total bill for Technichem's lighting upgrade was $8,683.09. Idaho Power's Easy Upgrades incentive covered $5,448.00 of the cost. Besides being quieter and cooler than the old lighting system, the new T8 lights cut Technichem's energy usage by 22,084 kilowatt-hours (kWh) per year and shaved $1,098.00 off its annual electric bill.

Estimated savings from Idaho Power's Easy Upgrade projects for Technichem

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
22,084	$8,683.09	$1,098.00	$5,448.00	$3,235.09	2.9

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This success story was produced in cooperation with, and approval from, Technichem.

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Custom Efficiency

For Commercial and Industrial Projects

A lesson in saving energy courtesy of the Notus School District

When the first wing of Notus Elementary School was built in 1926, the parents and administrators of the tiny farming town east of Parma were proud of its state-of-the-art construction. Today, they're just as proud of their efforts to upgrade the district's middle and high school buildings with state-of-the-art energy efficiency equipment.

"We're upgrading our heat pumps," said Craig Woods, who pulls double duty as the school district's superintendent and the high school's principal. "And we've received a Solar 4R Schools grant from Idaho Power."

Smarter lighting projects

Using funds from Idaho Power's Easy Upgrades incentive program, the school district changed the metal halide lights in its Mid High Gymnasium (it serves both the high school and middle school) to more efficient T-8 fixtures. It also installed motion sensors to improve efficiency and replaced the incandescent fixtures in the Mid High Café with more T-8 fixtures.

"The new lighting is so much brighter, too," Craig said, "and with fewer lights. You get quite a bit more with quite a bit less."

Feeling at home in the Lower Boise Valley

Notus, Idaho, is located on the Boise River six miles west of Caldwell on U.S. Highway 20/26. While many an emigrant passed through here on the Oregon Trail; but until 1904, the only indications of civilization were a railroad siding, a water tank, a windmill, and the homestead of Mary and Tommy Burns.

Continued on back

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"The new lighting is so much brighter with fewer lights. You get quite a bit more with quite a bit less."

–Craig Woods, Superintendent, Notus School District

The savings

Combined, the three lighting projects save the Notus School District approximately 39,667 kilowatt-hours (kWh) and $1,879.00 per year. Of the $9,964.00 final cost, $4,310.00 was covered by an Easy Upgrades incentive from Idaho Power. "Our school board understands that you have an initial cost," Craig explained, "but it pays itself off down the road, and the incentive helps a lot. That's what you have to look at."

Notus School District's estimated savings from participating in Idaho Power's Easy Upgrades program:*

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
39,667	$9,964	$1,879	$4,310	$5,654	4.6

*Source: Idaho Power Easy Upgrades projects 121006, 121007, and 121446

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The above success story was produced in cooperation with, and approval from, the Notus School District.

Feeling at home in the Lower Boise Valley (continued)

Then the new postmaster moved the Lower Boise Post Office to land east of the siding, and two brothers opened a saloon and a lumberyard, and things really took off. Today, this quiet, pleasant community serves the Lower Boise Valley's agricultural industry between Caldwell and Parma.

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Custom Efficiency

For Commercial and Industrial Projects

More efficient lighting allows Blake Trailers to pull less electricity

Blake Trailers, Inc., was founded in the tiny hamlet of Star, Idaho, "around 1970, when we were on the edge of town." said owner Montry Smith.

"We have two niches," he said, "really well-built horse and specialty trailers and custom metal work."

The "really well-built trailer" part is well known throughout the West. "They're one of the best," says a ranch wife from North Powder, Oregon. "You could ask for a better trailer, but you won't get it."

The custom metal work, which expands the business beyond trailer manufacturing, service, and repair, is also gaining a quality reputation. In fact, Idaho's World Trade Center Memorial is one of Blake's many metal fabrication projects.

Better light from fewer bulbs

Today, Blake Trailers operates out of "one, big sprawling building," now in the middle of town. "Star kind of grew up around us," explained Tana Smith, Montry's business and life partner. A building that large draws a lot of power, especially its lights. Tana and Montry knew they could cut their energy use by upgrading their lighting system, but they faced challenges.

"As a small business, it's hard to afford a project like that," Montry said. "But the Idaho Power incentive allowed us to do the whole building at once."

By replacing the building's T-12 lighting fixtures with T-8 fixtures, Blake Trailers reduced its energy use in two ways. The T-8s pull less electricity and emit more light, so the company needed fewer fixtures. A factory that once required 110 lights now has 100. They also installed motion sensors in the offices and replaced their exterior lighting with new LED fixtures.

Putting the savings to work

Like many businesses who take advantage of Idaho Power's incentive program, Montry and Tana reinvested their energy savings in the business to help increase sales. "We bought new equipment," Montry said. "That has really expanded what we can do and how fast we can do it."

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"The lower electric bills have allowed us to get better equipment, like our plasma table."

– Tana Smith, Co-owner, Blake Trailers, Inc.

Those fixtures are more efficient, and they produce better light. "Never has our paint room been so well lit," Montry bragged, "which is a real boost for safety and quality control."

The savings

The electrician's cost for taking out the old T-12 lights and installing new T-8 technology was $8,673.00. However, the Easy Upgrades incentive from Idaho Power covered $4,321.00 of the costs, reducing Blake Trailers' out-of-pocket expense for the project to just $4,352.00.

The power bills are lower, too. The newer, fewer lights reduced Blake Trailers' electric usage by about 43,141 kilowatt-hours (kWh) and $2,041.00 per year. "The savings have allowed us to get better equipment," Tana pointed out. "So we can do more specialized work at the same cost of operations."

Blake Trailer's estimated savings from participating in Idaho Power's Easy Upgrades program

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
43,141	$8,673	$2,041	$4,321	$4,352	2.1

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The above success story was produced in cooperation with, and approval from, Blake Trailers, Inc..

How much can your business save?

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Easy Upgrades

For Simple Retrofits

North Star Charter School graduates to a better lighting system

The gymnasium at North Star Charter School hosts many more activities than just basketball games and pep rallies. "We've had ballroom dances in here," said Dan Conti, the school's athletic director. "Chess tournaments, volleyball tournaments, a huge quilt show, even a wedding. And then there's all the normal school activities, like gym classes, school dances, and choir and band performances. This gym definitely earns its keep."

Reducing energy use and maintenance costs

When the school was built in 2009, the project team thought construction costs could be controlled without compromising the building's structural integrity by installing a less expensive lighting system in the gymnasium. And while it saved money at the outset, it had some serious maintenance challenges.

"Replacing each bulb is a two-man job," Dan pointed out. "There are 56 fixtures and 8 bulbs per fixture, so it's a pretty costly project. I wanted to find better fixtures that would be appropriate for our use and less costly to maintain."

That's when he decided to look into Idaho Power's energy efficiency incentive programs.

The Project

The school replaced the 448 original 42-watt (W) compact fluorescent lamps (CFL) with 336 high-performance 32-W T8 lamps and fixtures, which, to Dan's delight, reduced the number of lights that had to be replaced while increasing the energy savings as well as the quality of the light.

"Even with the lower wattages and fewer lamps," Dan pointed out, "the lighting level is a lot better now. Plus we've got tremendous control because we have three levels of light. We can bring it up for a volleyball game and bring it down for a concert."

Getting your incentive from Idaho Power is fast and easy

For the customer, taking advantage of Idaho Power's incentive program is a snap. "I found that the electrical contractors we talked to were already tuned in to it," Dan explained. "They work directly with Idaho Power, do the evaluation, the planning, and most of the paper work. Any forms we have to fill out are all online, so we don't have to worry about mailing them in.

"And then there's the incentive check. We got ours less than two weeks after the project was completed, so we could use the money to pay the contractor. It worked out nice."

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"We got our [incentive check] less than two weeks after the project was completed. It worked out nice."

– Dan Conti, Athletic Director
North Star Charter School

The savings

The lighting replacement project at North Star Charter School cost $17,640 to complete, of which the Idaho Power Easy Upgrades incentive covered $4,200. The change-out has cut the school's energy consumption by an estimated 27,295 kilowatt-hours (kWh) per year, reducing its annual power bill by $1,358 and reducing the costs for replacing burned out bulbs.

Estimated savings for the North Star Charter School upgrade project

Estimated kWh Savings/Year	Qualifying Project Cost	Estimated $ Savings/Year	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
27,295	$17,640	$1,358	$4,200	$13,440	9.9

Source: Idaho Power North Star Charter School Gymnasium Easy Upgrades Lighting Project Report 140590

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Custom Efficiency

For Commercial and Industrial Projects

Teaming up to save money and improve lighting at the Public Safety Building

Collaboration was the name of the game when it came to upgrading the lighting at the Vernon L. Bisterfeldt Public Safety Building in west Boise. Ada County employees Rich Rice, Staff Electrician, and Selena O'Neal, Energy Specialist, combined their expertise to improve the facility's lighting, reduce its energy use, cut down on maintenance costs, and qualify for an Idaho Power Custom Efficiency incentive.

"We wanted to modernize the lighting," Selena noted, "and take advantage of the Idaho Power incentive programs, so we developed a lighting plan and a budget that made economic sense in order to get Commissioners' approval."

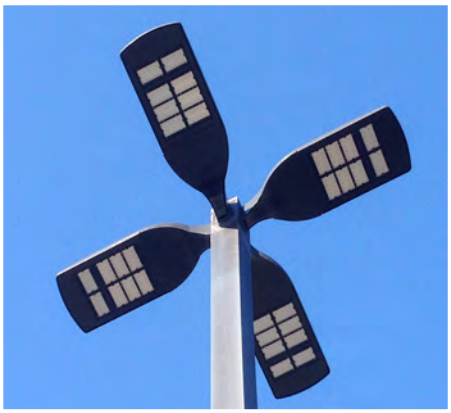
They both had high ambitions for the project. "I was looking to not only improve the lighting," Rich said, "but also cut our energy and maintenance costs."

The project

The project affected the facility's metal halide and incandescent lighting. "We replaced all the exterior lights on the entire campus with more efficient LED lights," Selena explained.

"All the wall lights, parking lot lights, walkway lights, and even the street lights along Barrister from Cole Road to the end of the property, everything." Rich said. "Plus the high-bay fixtures inside the vehicle maintenance shop," Selena added.

The effects of the new lighting go beyond saving energy. ""This is a public safety building that operates 24/7, so the parking lot must be well lit for employees and the public," Selena said. Best of all, maintenance costs are reduced because LEDs can last up to 50 times longer. "The old incandescent walkway lights we replaced a couple times a year will now last 10 years! The pole lights were especially critical because changing them requires



A good habit to get into

Ada County is no stranger to Idaho Power's incentive programs. "Over the past seven years, we've averaged $20,000 to $24,000 a year in incentives from the many projects we've completed," Selena said.

Ada County's incentivized projects vary and include upgrading the lighting in the Expo Building at the Fairgrounds, to installing variable-speed drives at the courthouse, to choosing roofing material and air conditioning (A/C) equipment that qualify for the incentive program when building new paramedics stations.

"These incentive programs help us to 'green' our buildings while minimizing the financial impact these improvements have on taxpayers," Selena added.

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"These incentive programs help us to 'green' our buildings while minimizing the financial impact these improvements have on taxpayers."

– Selena O'Neal, Ada County Energy Specialist

a bucket truck," said Rich. "The new LED pole lights are rated for 100,000 hours, cutting down change-outs by 90 percent."

The savings

The final cost to Ada County for the complex's qualifying lighting upgrades was $77,062. However, the Custom Efficiency incentive of $24,007 reduced the county's out-of-pocket expense for the project by more than 30 percent to $53,055.

The project saves the county 200,056 kilowatt-hours (kWh) per year, which amounts to an annual reduction to its power bill of approximately $11,000 and a payback of 58 months.

The Vernon L. Bisterfeldt Public Safety Building's estimated savings from participating in the Custom Efficiency program.*

Savings (kWh/ year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
200,056	$77,062	$11,003	$24,007	$53,055	4.8

* Source: Idaho Power Ada County public safety complex project summary IND1006

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

- The **Custom Efficiency** program offers incentives to large commercial and industrial customers who invest in energy-saving improvements in their facilities.
- **Easy Upgrades** provides financial incentives to commercial and industrial customers who implement qualified energy-saving measures in their facilities.
- The **Building Efficiency** program helps offset the additional capital costs incurred as a result of more efficient systems incorporated in the construction of new buildings and major remodels.

The above success story was produced in cooperation with, and approval from, Ada County.

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624 within the Treasure Valley or 1-800-488-6151 outside of the Treasure Valley. We'll show how you can join smart organizations like Ada County, saving energy and money.

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Easy Upgrades

For Simple Retrofits

Using less energy to create better lighting is a win/win for Riverstone International School

The International Baccalaureate (IB) program taught at schools around the world, including Riverstone International School in Boise, is known as an exceptional education system.

What's more, Riverstone International School is one of only 17 IB World Schools in the U.S. (out of 1,550) that offer all three program levels: Primary Years, Middle Years, and Diploma Programmes.

It's also the only one of these prestigious schools to take advantage of Idaho Power's Easy Upgrades Incentive program.

With a little help from your lighting contractor

Todd Predovich is the school's facilities manager. With the help of local electricians, he got the Easy Upgrades ball rolling. "The electricians actually told me that the T12 lighting we used to have was soon going to be obsolete," he explained, "and that we needed to change it out to the more efficient T8 fixtures."

That's when Todd was introduced to Idaho Power's energy efficiency incentive programs.

"When I got the proposal," Todd said, "and I saw what Idaho Power's incentive was going to be, it felt like a win/win kind of deal."

Two bulbs are better than four

Riverstone International replaced T12 lights and fixtures in the high school's classrooms, hallways, warehouse, offices, restrooms and shop with T8s. "And here's what's crazy," Todd noted, "each T12 fixture had four bulbs, but the T8 fixtures only have two bulbs. And those two T8s put

The art of energy savings

The school's business director isn't the only one noticing the benefits of Riverstone International School's lighting upgrade.

"The first day of class after we installed the new lights," Todd recalled, "the middle school art teacher asked what I had done to her classroom." The teacher noticed the difference in the quality of the light, which, in the case of new lighting technologies, can resemble daylight.

"It's like sunshine in there," she gushed.

"We literally took out half the bulbs," Todd said, "and still got brighter classrooms. Amazing."

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"We literally took out half the bulbs and still got brighter classrooms. Amazing."

– Todd Predovich,
Facilities Manager,
Riverstone International School

out more and better light than four T12s. Plus they last longer."

The savings

Riverstone International spent $4,189.50 on the lighting upgrade project, of which $2,508.00 was covered by an Idaho Power Easy Upgrades incentive. The new lighting has reduced the school's energy usage by 16,906 kilowatt-hours (kWh) per year while saving it $841.24 annually. "And here's the kicker," Todd said, "some Idaho Power guys were telling me that all the electricity we're not using can be used by somebody else, which means Idaho Power can put off building new generation facilities. Again, it's a win/win deal."

Estimated savings from Idaho Power's Easy Upgrade projects for Riverstone International School

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out-of-Pocket	Payback (years)
16,906	$4,189.50	$841.24	$2,508	$1,681.50	2

Uncommon savings are quite common

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How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624 within the Treasure Valley or 1-800-488-6151 outside the Treasure Valley. We'll show how you can save energy like Riverstone International School.

The above success story was produced in cooperation with, and approval from, Riverstone International School.

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WEATHERIZATION ASSISTANCE FOR QUALIFIED CUSTOMERS 2013 ANNUAL REPORT

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Weatherization Assistance
for Qualified Customers

2013 Annual Report
April 1, 2014

2013

Printed on recycled paper

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DESCRIPTION

The Weatherization Assistance for Qualified Customers (WAQC) program provides financial assistance to regional Community Action Partnership (CAP) agencies in Idaho Power's service area. This assistance helps fund weatherization costs of electrically heated homes occupied by qualified customers who have limited incomes. The WAQC program also provides a limited pool of funds for the weatherization of buildings occupied by non-profit organizations serving primarily special-needs populations, regardless of heating source, with priority given to buildings with electric heat. Weatherization improvements enable residents to maintain a more comfortable, safe, and energy-efficient home while reducing their monthly electricity consumption. Improvements are available at no cost to qualified customers who own or rent their homes. These customers also receive educational materials and efficiency ideas on using energy wisely in their homes. Local CAP agencies determine program eligibility according to federal and state guidelines.

BACKGROUND

In 1989, Idaho Power began offering weatherization assistance in conjunction with the State of Idaho Weatherization Assistance Program (WAP). Through the WAQC program, Idaho Power provides supplementary funding to state-designated CAP agencies for the weatherization of electrically heated homes occupied by qualified customers and buildings occupied by non-profit organizations that serve special-needs populations. This allows CAP agencies to leverage their federal Low Income Home Energy Assistance Program (LIHEAP) weatherization funds and serve more people with special needs.

Idaho Power has an agreement with each CAP agency for the WAQC program. The agreement specifies the funding allotment, billing requirements, and program guidelines. Currently, Idaho Power oversees the program in Idaho through five regional CAP agencies. The five regional CAP agencies include CCOA—Aging, Weatherization and Human Services (CCOA), Eastern Idaho Community Action Partnership (EICAP), El Ada Community Action Partnership (El Ada), South Central Community Action Partnership (SCCAP), and Southeastern Idaho Community Action Agency (SEICAA). In Oregon, Community Connection of Northeast Oregon, Inc. (CCNO) and Community in Action (CINA) provide weatherization services for qualified customers in Idaho Power's service area.

Idaho Power provides this *Weatherization Assistance for Qualified Customers 2013 Annual Report* in compliance with the Idaho Public Utilities Commission's (IPUC) Order No. 29505. This report includes the following topics:

- Review of weatherized homes and non-profit buildings by county
- Review of measures installed
- Overall cost-effectiveness
- Customer education and satisfaction
- Plans for 2014

REVIEW OF WEATHERIZED HOMES AND NON-PROFIT BUILDINGS BY COUNTY

The 2013 total utility cost (UC) for the WAQC program was $1,391,677. In 2013, Idaho Power provided a total of $1,300,168 to Idaho CAP agencies. Of the funds provided, $1,210,093 were dispersed to those CAP agencies in 2013, while $90,075 were accrued for future funding. Of the funds dispersed in 2013, $1,060,549 directly funded audits, energy efficiency measures, and health and safety measures for qualified customers' homes (production costs) in Idaho, and $106,055 in administration costs were dispersed to Idaho CAP agencies for those homes weatherized. Idaho Power funding provided for the weatherization of 243 Idaho homes and 2 Idaho non-profit buildings in 2013. The cost of those non-profit building weatherization measures was $39,535, while $3,954 in administrative costs were dispersed for the Idaho non-profit building weatherization jobs. In Oregon, Idaho Power dispersed $33,146 in production costs for 8 qualified homes and $3,315 in CAP agency administrative costs for homes in Malheur County. Due to the small amount of Idaho Power customers in Baker County, the CCNO was unable to weatherize a home this year. One building housing a non-profit agency serving special-needs customers was weatherized in Oregon during 2013, with $10,860 in production costs and $1,086 in administration fees for a total of $11,946 from the Oregon non-profit fund. Table 1 shows the CAP agency, number of homes weatherized, production costs, average cost per home, administration payments, and total payments per county made by Idaho Power.

Table 1
2013 WAQC weatherization activities and Idaho Power expenditures by agency and county

Agency	County	Number of Homes	Production Cost	Average Cost[1]	Administration Payment to Agency	Total Payment
Idaho						
CCOA	Adams	2	$ 12,574	$ 6,287	$ 1,257	$ 13,831
	Boise	3	17,880	5,960	1,788	19,668
	Canyon	34	187,060	5,502	18,706	205,766
	Gem	1	5,694	5,694	569	6,263
	Payette	6	35,923	5,987	3,592	39,515
	Valley	2	13,699	6,850	1,370	15,069
	Washington	4	21,001	5,250	2,100	23,101
	Agency Total	**52**	**$ 293,829**	**$ 5,651**	**$ 29,383**	**$ 323,212**
EICAP	Lemhi	4	11,625	2,906	1,163	12,788
	Agency Total	**4**	**$ 11,625**	**$ 2,906**	**$ 1,163**	**$ 12,788**
El Ada	Ada	91	442,628	4,864	44,263	486,891
	Elmore	7	41,823	5,975	4,182	46,006
	Owyhee	6	32,348	5,391	3,235	35,582
	Agency Total	**104**	**$ 516,799**	**$ 4,969**	**$ 51,680**	**$ 568,479**
SCCAP						
	Cassia	1	1,714	1,714	171	1,886
	Gooding	7	30,784	4,398	3,078	33,862
	Jerome	6	23,986	3,998	2,399	26,385
	Lincoln	2	4,905	2,453	491	5,396
	Minidoka	2	5,499	2,749	550	6,049
	Twin Falls	31	85,298	2,752	8,530	93,828
	Agency Total	**49**	**$ 152,186**	**$ 3,106**	**$ 15,219**	**$ 167,405**
SEICAA	Bannock	18	41,505	2,306	4,150	45,655
	Bingham	15	41,978	2,799	4,198	46,176
	Power	1	2,626	2,626	263	2,889
	Agency Total	**34**	**$ 86,109**	**$ 2,533**	**$ 8,611**	**$ 94,720**
Total Idaho Homes		**243**	**$ 1,060,549**	**$ 4,364**	**$ 106,055**	**$ 1,166,604**
Idaho Non-Profit Buildings	Lemhi	1	11,374	11,374	1,137	12,512
	Adams	1	28,161	28,161	2,816	30,977
Total Idaho Non-Profit Buildings		**2**	**$ 39,535**	**$ 19,768**	**$ 3,954**	**$ 43,489**
Total Idaho		**245**	**$ 1,100,085**		**$ 110,008**	**$ 1,210,093**

Table 1 (continued)

Agency	County	Number of Homes	Production Cost	Average Cost[1]	Administration Payment to Agency	Total Payment
Oregon						
CCNO	Baker	0	0	0	0	0
	Agency Total	**0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**
CINA	Malheur	8	33,146	4,143	3,315	36,460
	Agency Total	**8**	**$ 33,146**	**$ 4,143**	**$ 3,315**	**$ 36,460**
Total Oregon Homes		**8**	**$ 33,146**	**$ 4,143**	**$ 3,315**	**$ 36,460**
Oregon Non-Profit Buildings	Malheur	1	10,860	10,860	1,086	11,946
Total Oregon		**9**	**$ 44,006**		**$ 4,401**	**$ 48,406**
Total Program		**254**	**$ 1,144,090**	**$ 4,504**	**$ 114,409**	**$ 1,258,499**

Note: Dollars are rounded.
[1] Agency average cost total is equal to the production cost divided by the number of jobs.

The base funding for Idaho and Oregon CAP agencies is $1,257,534 annually, which does not include any carryover from the previous year. Idaho Power's agreements with CAP agencies include the provision allowing a maximum annual average cost per home up to a dollar amount specified in the agreement between the CAP agency and Idaho Power. The intent of the maximum annual average cost is to allow CAP agency flexibility to service some homes with greater or fewer weatherization needs. It also provides a monitoring tool for Idaho Power to forecast year-end outcomes. The average cost per home served is calculated by dividing the total annual Idaho Power production cost of homes weatherized per CAP agency by the total number of homes weatherized that the CAP agency billed to Idaho Power during the year. The maximum annual average cost per home the CAP agency was allowed under the 2013 agreement was $6,000. In 2013, Idaho CAP agencies had a combined average cost per home served of $4,364. Oregon CAP agencies averaged $4,143 per home. There is no maximum annual average cost for the weatherization of buildings occupied by non-profit agencies.

CAP agency administration fees are equal to 10 percent of Idaho Power's per-job production costs. The average administration cost paid to agencies per Idaho home weatherized in 2013 was $436, and the average administration cost paid to Oregon agencies per Oregon home weatherized during the same period was $414. Not included in this report's tables are additional Idaho Power staff labor, marketing, evaluation, home verification, and support costs for the WAQC program totaling $130,737 for 2013. These expenses were in addition to the WAQC program funding requirements in Idaho specified in IPUC Order No. 29505.

In compliance with IPUC Order No. 29505, WAQC program funds are tracked separately, with unspent funds carried over and made available to CAP agencies in the following year. In 2013, $87,634 in unspent funds from 2012 were made available for expenditures in Idaho. In Oregon, $16,000 were made available in Oregon's non-profit fund. Table 2 details the funding base and available funds from 2012 and the total amount of 2013 spending.

Table 2
2013 WAQC base and available funds

Agency	2013 Base	Available Funds from 2012	Total 2013 Allotment	2013 Spending
Idaho				
CCOA	$ 302,259	$ 20,953	$ 323,212	$ 323,212
EICAP	12,788	0	12,788	12,788
El Ada	568,479	0	568,479	568,479
SCCAP	167,405	0	167,405	167,405
SEICAA	111,603	21,328	132,931	94,720
Non-profit buildings	50,000	45,353	95,353	43,489
Idaho Total	**$ 1,212,534**	**$ 87,634**	**$ 1,300,168**	**$ 1,210,093**
Oregon				
CINA	36,550	0	36,550	36,460
CCNO	6,450	0	6,450	0
Non-profit buildings	2,000	14,000	16,000	11,946
Oregon Total	**$ 45,000**	**$ 14,000**	**$ 59,000**	**$ 48,406**

Note: Dollars are rounded.

REVIEW OF MEASURES INSTALLED

Table 3 details home counts for which Idaho Power paid a portion of the measure costs during 2013. The Home Counts column represents the number of times any percentage of that measure was billed to Idaho Power during the year. If totaled, measure counts would be higher than total homes weatherized because the number of measures installed in each home varies. Consistent with the Idaho WAP, the WAQC program offers several measures that have costs but do not necessarily save energy or for which the savings cannot be measured. Included in this category are health and safety measures, vents, furnace repairs, other, and home energy audits. Health and safety measures are necessary to ensure weatherization activities do not cause unsafe situations in a customer's home or compromise a home's existing indoor air quality. Other non-energy saving measures are allowed under this program because of their interaction with the energy-saving measures. Examples of items included in the "other" measure category include vapor barriers, dryer vent hoods, and roof cement. The EA5 energy audit program (EA5) is a software program approved for use by the Department of Energy (DOE) and used by the Idaho CAP agency weatherization managers. The EA5 includes material costs, labor costs for installation, agency and contractor support costs, and estimated savings for individual measures.

Table 3
2013 WAQC review of measures installed

	Home Counts	Production Costs
Idaho Homes and Non-Profit Measures		
Windows	118	$ 178,078
Doors	131	78,053
Wall insulation	76	11,428
Ceiling insulation	116	95,001
Vents	15	663
Floor insulation	101	88,145
Infiltration	154	35,333
Ducts	67	26,621
Health & safety	37	9,447
Other	31	6,878
Water heater	10	4,998
Pipes	40	2,864
Furnace repair	48	9,703
Furnace replace	141	539,479
Compact fluorescent lamp/light (CFL)	86	2,471
Audit	138	10,923
Total Idaho Homes and Non-Profit Measures		**$ 1,100,085**
Oregon Homes and Non-Profit Measures		
Windows	2	5,419
Doors	1	280
Wall insulation	4	5,195
Ceiling insulation	8	6,790
Floor insulation	4	7,447
Infiltration	9	3,940
Ducts	1	416
Health & safety	4	3,429
Pipes	1	143
Furnace replace	3	10,780
Audit	1	168
Total Oregon Homes and Non-Profit Measures		**$ 44,005**

Note: Dollars are rounded.

Annually, Idaho Power physically verifies approximately 10 percent of the homes weatherized under the WAQC program. This is done through two methods. The first method includes the Idaho Power program specialist participating in Idaho's and Oregon's state peer-review process

that reviews weatherized homes. The process involves utility representatives; weatherization personnel from the CAP agencies; Community Action Partnership Association of Idaho, Inc. (CAPAI); and the Idaho Department of Health and Welfare (IDHW) or Oregon Housing and Community Services (OHCS) reviewing homes weatherized by each of the CAP agencies. CAP agency weatherization departments weatherize homes in accordance with federal guidelines.

The second method involves Idaho Power contracting with two companies—The Energy Auditor, Inc., and Momentum, LLC—that employ certified building performance specialists to verify installed measures in customer homes. Energy Auditor, Inc., verifies homes weatherized for the WAQC program in Idaho Power's eastern and southern Idaho regions. The owner of Energy Auditor is certified by Performance Tested Comfort Systems and is an ENERGY STAR® home performance specialist. Momentum verifies weatherization services provided through the WAQC program in the Capital and Canyon regions of Idaho. The owner of Momentum is a Residential Energy Services Network (RESNET®) certified home energy rater. After these companies verify installed measures, any required follow-up is done by the CAP agency personnel.

OVERALL COST-EFFECTIVENESS

Prior to 2012, the cost-effectiveness of the WAQC program was determined using the energy-savings estimates from Idaho WAP EA4 energy audit tool (EA4). In 2012, the Idaho WAP, and therefore the WAQC program, upgraded to the EA5. The EA5 is used for the WAQC program in conjunction with the Idaho WAP for leveraging funds by weatherization managers who are billing the state and Idaho Power for each home weatherization job. In the field,

the weatherization auditor uses the EA5 to conduct the initial audit of potential energy savings for a home. The EA5 compares the efficiency of measures prior to weatherization to the efficiency after the proposed improvement. The output of the EA5 savings-to-investment ratio (SIR) is similar to the participant cost test (PCT) ratio. If the EA5 computes an SIR of 1.0 or higher, the CAP agency completes the proposed measures. In addition to the individual measure SIR, the entire job is required to show an SIR of 1.0 or higher.

In 2012, Idaho Power contracted with D&R International, Ltd., to conduct an impact evaluation of the WAQC program. The impact evaluation was completed and provided to Idaho Power in February 2013. Results indicated significantly lower realized energy savings for the WAQC program compared with initial EA4 savings estimates from 2011. For the 2013 program savings estimate of 681,736 kilowatt-hours (kWh), Idaho Power again used D&R International's average annual energy savings estimate of 2,684 kWh per home that resulted from the billing analysis of homes weatherized in 2011. Even though the WAQC program used the EA5 audit program in 2013, Idaho Power believes the average annual savings per home estimate provided by D&R International is applicable until another billing analysis is completed. The results of this cost-effective analysis showed a total resource cost (TRC) ratio of 0.74 and a utility cost (UC) ratio of 0.95. These ratios are up slightly from 2012, when the TRC ratio for the WAQC program was 0.71 and the UC ratio was 0.84.

In 2013, Idaho Power administered a process evaluation of the WAQC program through the third-party contractor Johnson Consulting Group. The contractor gathered data from a variety of sources, including reviews of program materials, the program database, and in-depth interviews with key staff and stakeholders from May through August 2013. In addition, Johnson Consulting

Group conducted a literature review about low-income program non-energy benefits (NEB) and cost-effectiveness policies used in other jurisdictions.

The recommendations from IPUC staff's report and IPUC Order No. 32788 are used for cost-effectiveness analysis for 2013. These recommendations include the following:

- Applying a 100-percent net-to-gross (NTG) value to reflect the likelihood that WAQC weatherization projects would not be initiated without the presence of a program
- Claiming 100 percent of project savings
- Including an allocated portion of the indirect overhead costs
- Applying the 10-percent conservation preference adder
- Claiming one dollar of benefits for each dollar invested in health, safety, and repair measures
- Amortizing evaluation expenses over a three-year period

A review of the WAQC program was discussed with Idaho Power's Energy Efficiency Advisory Group (EEAG) twice during 2013. On September 18, a review of WAQC impact and process evaluations was discussed. On November 14, WAQC program improvement ideas were presented to EEAG. The impact evaluation of the program showed the home energy audit tool was overestimating energy savings. The process evaluation recommended using NEBs in determining the cost-effectiveness.

CUSTOMER EDUCATION AND SATISFACTION

Idaho Power provides materials to each CAP agency to help educate qualified customers who receive weatherization assistance on using energy efficiently. Included in the materials are copies of the Idaho Power booklet *30 Simple Things You Can Do to Save Energy and Energy Saving Tips*, which describes energy conservation tips for the heating and cooling seasons, and a two-sided card that describes the energy-saving benefits of using CFLs and other helpful information. Idaho Power actively informs customers about weatherization assistance through energy and resource fairs and other customer contacts.

To stay current with new programs and services, the Idaho Power program specialist overseeing the WAQC program attends state and federal energy assistance/weatherization meetings and other weatherization-specific conferences, such as the National Energy and Utility Affordability Conference. Idaho Power is also active in the Policy Advisory Council, helping advise and direct Idaho's state weatherization application to the DOE.

As described in the Review of Measures Installed section above, Idaho Power used independent, third-party verification companies across its service area to randomly check approximately 10 percent of the weatherization jobs submitted for payment by the program. These home verifiers ensure that the stated measures are installed in the homes of participating customers and discuss the program with these customers. Home verifiers visited 40 homes, requesting feedback about the program in 2013. When asked how much customers learned about saving electricity, 29 customers answered they learned "a lot" or "some." When asked how many ways they tried to save electricity, 28 customers responded "a lot" or "some."

PLANS FOR 2014

As in previous years, unless directed otherwise, Idaho Power will continue to provide financial assistance to CAP agencies while exploring program changes to improve program cost-effectiveness in 2014. Idaho Power will continue to apply recommendations from the impact evaluation conducted by D&R International that was completed in early 2013.

Idaho Power will also apply recommendations from a third-party process evaluation of the WAQC program completed by Johnson Consulting Group in October 2013. Recommendations from this process evaluation were to begin the development of a new energy audit tool and to create a new customer satisfaction survey to distribute to all CAP agencies. This new survey will provide consistent feedback from all agencies to Idaho Power. Idaho Power plans to include additional data entry points in an updated home audit tool for additional information as well as update calculation inputs, such as heating degree days and lives of individual measures. These updates may be accepted by the State of Idaho WAP to incorporate into the current energy audit tool, EA5.

In Oregon, Idaho Power filed an updated tariff for the program that moved funds from the non-profit pooled fund to funds used to weatherize homes. This funding shift started in 2014 and allows additional funds to be spent on efficiency improvements in qualified customers' homes in Oregon.

Idaho Power will continue to participate in the Idaho and the Oregon state peer-review process of weatherized homes and will continue to verify approximately 10 percent of the homes weatherized under the WAQC program via certified home-verification companies.

Idaho Power continues to wait for the final results of an evaluation from the Applied Public Policy Research Institute for Study and Evaluation (APPRISE), which is conducting a nationwide evaluation of low-income weatherization programs for the Oak Ridge National Laboratory and the DOE. In 2012, Idaho Power participated in this study by providing requested information to APPRISE.

Idaho Power will continue its involvement with the State of Idaho's Policy Advisory Council that serves as an oversight group for weatherization activities in Idaho as well as review state grant applications for federal funding.

While Idaho Power incorporates evaluation results, it plans to selectively market the WAQC program throughout 2014. The program is promoted at resource fairs, community special-needs populations' service-provider meetings, and CAP agency functions to reach customers who may benefit from the program. Marketing for this program is conducted in cooperation with weatherization managers.

Idaho Power will continue working in partnership with the IDHW, OHCS, CAPAI, and individual CAP agency personnel to maintain the targets and guidelines and improve the cost-effectiveness of the WAQC program.

In 2014, Idaho Power will support the whole-house philosophy of the WAQC program and the Idaho and Oregon WAP by contracting a $6,000 annual maximum average per-home cost. Based on the required funding, Idaho Power estimates 180 homes and 6 non-profit buildings will be weatherized in Idaho in 2014. In Oregon, an estimated 8 homes will be weatherized.

In Idaho during 2014, Idaho Power expects to fund the base amount plus available funds from 2013 to total $1,302,609 in weatherization measures and agency administration fees. Of this amount, $101,864 will be provided to the non-profit pooled fund to weatherize buildings housing non-profit agencies that primarily serve qualified customers in Idaho.

Through the WAQC program, Oregon CAP agencies have a 2014 budgetary amount of $55,594 to manage weatherization services for Idaho Power customers. Service-area wide, Idaho Power will provide the WAQC program $1,358,203 in funding in 2014 for the weatherization of homes and buildings of non-profit agencies serving qualified customers.

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