March 15, 2016

IDAHO POWER®
An IDACORP Company

Supplement 2: Evaluation

Demand-Side Management

2015 ANNUAL REPORT

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Evaluation and Research Summary

EVALUATION AND RESEARCH SUMMARY

Idaho Power considers program evaluation and research an essential part of its demand-side management (DSM) operational activities. 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 2015, Idaho Power completed program impact and process evaluations of the Home Improvement, See ya later, refrigerator® and Ductless Heat Pump programs using third-party contractor Applied Energy Group. CLEAResult was chosen to provide impact evaluations for the A/C Cool Credit, Flex Peak, and Irrigation Peak Rewards programs.

Idaho Power administered surveys on several programs in 2015 to measure program satisfaction. Participant surveys were conducted for Easy Upgrades, Home Energy Audit, Shade Tree Project, Weatherization Assistance for Qualified Customers (WAQC), and Weatherization Solutions for Eligible Customers.

In addition to these program satisfaction surveys, Idaho Power sent energy efficiency-related surveys to its online community of residential customers. Energy efficiency-related survey topics in 2015 included residential laundry habits, recall of the spring 2015 energy efficiency marketing campaign, and holiday lighting.

Throughout 2015, ADM Associates, Inc. (ADM) made several small revisions to the technical reference manual (TRM) for Building Efficiency and Easy Upgrades. These revisions include additional system types to the heating, ventilation, and air conditioning (HVAC) controls section and expanding the description of eligible equipment for air conditioning and heat pump systems.

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

Additionally, ADM updated the savings for measures impacted by the International Energy Conservation (IECC) 2012 code.

Final reports from all evaluations, research, and surveys completed in 2015 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

EVALUATION PLAN

Customer Relations and Energy Efficiency 2012–2016 Program Evaluation Plan

	2012			2013			2014			2015			2016		
Residential Programs	Impact	Process	Other	Impact	Process	Other	Impact	Process	Other	Impact	Process	Other	Impact	Process	Other
Ductless Heat Pump Pilot[a]										✓	✓				
Educational Distributions[b]															
Energy Efficient Lighting					✓		✓								
Energy House Calls															
ENERGY STAR® Homes Northwest					✓		✓								
Heating & Cooling Efficiency Program	✓				✓										
Home Energy Audit								✓							
Home Improvement Program										✓	✓				
Rebate Advantage													✓	✓	
Residential Energy Efficiency Education Initiative														✓	
See ya later, refrigerator®	✓									✓	✓				
Shade Tree Project								✓							
Simple Steps, Smart Savings™[c]															
Weatherization Solutions for Eligible Customers	✓				✓				✓						
Weatherization Assistance for Qualified Customers	✓				✓				✓						
Commercial/Industrial Programs															
Building Efficiency	✓												✓		
Custom Efficiency							✓	✓							
Easy Upgrades	✓				✓								✓		
Irrigation Programs															
Irrigation Efficiency Rewards			✓	✓					✓				✓	✓	
Demand Response Programs															
A/C Cool Credit		✓	✓			✓	✓			✓					
Flex Peak Program[d]			✓		✓	✓				✓			✓		
Irrigation Peak Rewards			✓			✓	✓			✓					

[a] Became part of Heating and Cooling Efficiency Program in 2015.

[b] Designated as a specific program in 2015, the Educational Distributions effort is administered through the Residential Energy Efficiency Education Initiative.

[c] Simple Steps, Smart Savings™ includes promotional based appliances, showerheads, and Home Products Program 2015 savings.

[d] The program originated in 2009 as the FlexPeak Management program. In 2015, the program became fully implemented by Idaho Power. The program name was changed to Flex Peak Program.

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Energy Efficiency
Advisory Group Minutes

ENERGY EFFICIENCY ADVISORY GROUP MINUTES

The following pages include minutes from EEAG meetings held on February 19, May 6, August 26, and November 5, 2015.

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Energy Efficiency Advisory Group (EEAG)
Meeting Notes February 19th, 2015

Present:

Catherine Chertudi–City of Boise, Public Works Dept.
Ken Robinette–South Central Comm. Action Partnership
Stacey Donohue–Idaho Public Utilities Commission
Diego Rivas–Northwest Energy Coalition
Tami White–Idaho Power
Ben Otto-Idaho Conservation League
Don Strickler–Simplot
Lynn Young–AARP
John Chatburn–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Kent Hanway-CSHQA
Quentin Nesbitt*–Idaho Power

Not Present:

Tom Eckman–Northwest Power & Conservation Council
Michael Breish-Public Utility Commission of Oregon

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Gary Grayson–Idaho Power
Shelley Martin–Idaho Power
Zeke VanHooser–Idaho Power
Robert Everett–Idaho Power
Jay Jeffries-Resource Action Programs
Mindi Shodeen-Idaho Power
Darlene Nemnich*-Idaho Power
Julie Stutts-Baker-Idaho Power
Susan Klein-Idaho Power
Krista West-Idaho Power
Denise Humphreys-Idaho Power
Roberta Rene-Idaho Power
Ty Hardin- Idaho Public Utilities Commission
Todd Greenwell–Idaho Power
Theresa Drake–Idaho Power
Andrea Simmonsen–Idaho Power
Ken Miller-Snake River Alliance
Cheryl Paoli-Idaho Power
Patti Best-Idaho Power
Andy Healy-CLEAResults
Becky Arte-Howell-Idaho Power
Kevin Winslow-Idaho Power
Anne Alenskis-Idaho Power
Donn English-Idaho Public Utilities Commission
Sheree Willhite-Idaho Power
Bill Shawver*-Idaho Power
Randy Thorn-Idaho Power

Meeting Facilitator:

Rosemary Curtin (RBCI)

Recording Secretary:

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

Meeting Convened at 9:30am

Quentin introduced Rosemary Curtin, who is the new EEAG Facilitator, to the group. She gave an overview of her professional background and then asked each EEAG member to introduce themselves and state the reason(s) why they participate in this group. Quentin then introduced Diego Rivas of Northwest Energy Coalition as a new EEAG member replacing Nancy Hirsh. The notes from the November EEAG meeting were reviewed and there was one clarification requested regarding the bullet point on the top of page 4. There was agreement that the November meeting notes will be updated to reflect the clarification. A few members commented that the new format and summarization of the meeting notes makes them easier and quicker to review.

9:45am-2014 Portfolio Financial/Savings Picture (Preliminary)—Pete Pengilly

Pete reviewed the 2014 preliminary DSM expenses to be included in Appendix 1& 2 of the Demand-Side-Management 2014 Annual Report. He also presented charts from the report showing portfolio saving and expense categories.

Key points presented:

- Appendix 1 highlights the Idaho and Oregon Rider balances and the Northwest Energy Efficiency Alliance (NEEA) payment amounts for 2014. Appendix 2 highlights 2014 DSM expenses by funding source (dollars).

- As of January, there was a $1.8 million positive balance in the Idaho Rider. There was a $3.9 million negative balance in the Oregon Rider.

- The presentation highlighted how the DSM funds were spent and the energy savings for the year in comparison to the Integrated Resource Planning (IRP) targets from a portfolio perspective.

There were questions and discussion about:

- What is the comparison of funding allocation to geographic area in regards to the NEEA savings? Idaho Power answered that it is a close comparison.

- Do any NEEA savings carry over from the previous year or does it start at zero each time? Idaho Power responded that NEEA provides an annual and cumulative look at savings. NEEA is still counting savings from the first funding cycle if it believes that the savings are still applicable.

- In regards to Demand Response, how much of the difference in cost savings from 2012 to 2014 is due to reduced participation or improved metrics? Idaho Power responded that the difference is primarily due to lower incentives and a drop in participation for irrigation customers.

10:08am-Commercial/Industrial/Irrigation Programs—Quentin Nesbitt

Quentin highlighted savings and participation for the commercial, industrial, and irrigation programs. He presented a comparison of 2013 and 2014 participation and savings.

Key points presented:

- The Easy Upgrades Program shows overall energy savings are about the same even though participation is lower for 2014.

- Irrigation Efficiency had higher participation in 2014 with about the same energy savings.

- Building Efficiency participation increased in 2014 and Custom Efficiency has had a large increase in participation as well as energy savings.

There were questions and discussion about:

- Whether participation numbers were by participant or by measure. Idaho Power stated that it is by project.

- If the big jump in participation for Custom Efficiency was because some of the larger projects were finally completed. Idaho Power answered that is part of the reason, but that a lot of those increases have to do with the new Custom Efficiency Streamlined offering. These are smaller in savings but there are a lot of them. Idaho Power then explained what the streamlined offering is and how the company works with Cascade Energy to identify these projects. Cascade Energy provides the measurement and verification along with project management and then submits them to Idaho Power. It would be interesting to see a trend over numerous years instead of just a year to year. There are some great lessons to be learned here, especially with this streamlined offering. Maybe this could be applied to the other programs by having a dedicated person to drive projects to Idaho Power, reaching out to the trade allies. This would allow Idaho Power employees to focus on doing what they do best. One EEAG member noted that he has received feedback from clients that the Building Efficiency process can be cumbersome. If the process was streamlined it could be helpful for customers.

- What the level of participation was for the Waste Water Energy Efficiency Cohort (WWEEC)? Idaho Power stated that for the cohort it was limited to the larger cities. One EEAG member mentioned that the feedback she has received was that initially there was some skepticism around whether or not they would learn anything. After the operators had gone through the cohort training they realized there was much to learn and it has been very helpful. She stated that something like this could be really impactful for the smaller cities as well.

Quentin asked the group for feedback in combining the commercial & industrial programs. The idea is to have a single application to make it easier for customers to participate in these programs. This has already been done for lighting and customers seem to like it.

- Three EEAG members stated that they like the idea of one application. Having multiple applications can be confusing for participants, so having one application to market internally would be nice. Additionally, more assistance that can be provided to the small business the better.

- One EEAG member suggested having applications that target the different commercial customer segments.

- Idaho Power noted that from a reporting perspective it might look a little different. It would be bundled for savings and goal setting so the numbers wouldn't be broken out by program.

10:40am-Residential Programs—Billie McWinn

Before the presentation, Billie recognized the effort and hard work her staff put in to these programs. She then highlighted the energy savings and participation by program for 2013-2014.

Key points presented:

- Idaho Power is looking to add new measures to the Energy House Calls (EHC) program. These ideas came from the New Ideas Team. These items would be LED's, showerheads, faucet aerators, and water heater pipe wrap for the first three feet.

- The new tool has been launched for Weatherization Solutions and recommendations from previous meetings and evaluations have been incorporated. There will be a 10% cost share with landlords and they have agreed to not raise tenant rent for a year. Marketing efforts are being increased with emphasis on publications targeting senior citizens.

- Billie went over the Simple Steps (Appliances) options that are being evaluated. The upstream and midstream incentive model look the most promising.

There were questions and discussion about:

- If Idaho Power has received feedback from the EHC contractors on installing or implementing these new measures. The concern is the showerheads and water pipe wrap. The plumbing in some of the older and low income homes is not the greatest and you could see a decline in those items being installed because of the liability of the leaky pipe. Also, Idaho Power should continue to buy showerheads from Niagara because they are high quality and customers seem to like them. One EEAG member asked why Idaho Power isn't wrapping the water heater. Another EEAG member answered that most tanks are already insulated and wrapping them can damage the newer ones.

- What about CFL disposal and how are the contractors handling that? Idaho Power explained that contractors are targeting incandescent bulbs, but that contractors are responsible for proper disposal if they change out a CFL.

- When will this program become obsolete because it is at about 50% market penetration? Idaho Power stated that it will watch trends and as long as it is cost-effective it will continue to offer the program.

- Discussion around the Weatherization Solutions program and the landlord cost-sharing. It will be interesting to see how this works out. One EEAG member stated that the landlord cannot raise tenants rent because of the weatherization work, but they can raise rents for other reasons like taxes.

- The feedback on the Simple Steps Appliance options is that filling the marketplace with high quality products is great, but getting the customer to purchase these items will be the challenge. Upstream manufacturer option just fills the pipeline but doesn't incent the customer to purchase. The direct customer incentive is probably better. One EEAG member stated that in her experience with working for a water utility, if an incentive was given to the customer it forced the retailer to stock that item. The retailer would put the savings sticker on the appliance then they would sell more of that appliance. It changed what the retailer emphasized and drove customers to the more efficient machines. Another EEAG member added that in Montana the manufacturer option failed.

11:17am- Break

11:24am-Bill Shawver & Roberta Rene—Marketing presentation

Bill started off by introducing the support staff in the Corporate Communication Department and thanked them for the hard work they do on a daily basis. He then passed around a binder that contained marketing collateral sent out to customers during the period of November 19th 2014 thru February 19th, 2015. He stated that in previous EEAG meetings the company heard from members that it wasn't doing a great job at marketing. The company wants to look forward and wants feedback from EEAG in this area.

Key points presented:

- Idaho Power opted out of some of the NEEA marketing initiatives which will save around $794,000 over the 5 year contract term. NEEA's 2015 marketing plan for the Ductless Heat Pump will be out later this month

- The marketing tactics and 2014 integrated campaign results were shared with the group along with the integrated campaign plan for 2015.

- Bill will come back to EEAG and share marketing strategies by program. The recent video's and the KTVB earned media spots were shown to the group.

There were questions and discussion about:

- How dates for marketing the programs are chosen along with questions around the print ads in the major daily newspapers. Idaho Power explained that it is a coordinated effort between the Program Specialists and the Marketing Specialists. Marketing all the programs at once is avoided, but rather look at what makes the most sense for each program taking into consideration the potential high bill months. Having a presence throughout the year for a program such as DHP is important. Customer's usually purchase these items when they breakdown, not before. Each program has its own marketing plan and each plan has its own target audience. Idaho Power addressed the newspaper ads and explained that in the last few years, the company has reduced the number of ads run in the rural areas. However, the company has since realized that these areas rely more on these papers instead of digital, it is their version of social media.

- Clarification on the video shown for the Home Improvement Program. The impression was that it was for new construction. Idaho Power explained that in the video they were just using a cleaner space to make it more obvious what was being done.

- One EEAG member stated that she doesn't disagree with general marketing as it can be very useful and effective. Her concern is around behavioral change and how marketing needs to be more targeted and focused in order to achieve that. Idaho Power stated that the trick to marketing is having it be present when the motivation to purchase an item occurs.

- There was discussion about the recent JD Power Small Business survey and the Residential survey that is currently being conducted. A question was asked about how that information would look on a trend line and if it is improving if you go back 5 years. Idaho Power answered that they would provide that information to the group later.

12:18pm Lunch

1:00pm Meeting Reconvened

1:00pm-New Program Ideas Update—Billie McWinn/Quentin Nesbitt

Billie and Quentin provided an update on the new ideas that have been discussed at prior meetings and the status of each.

Key points presented:

- Heating & Cooling Efficiency-Idaho Power took the feedback from EEAG and the whole house fan, prescriptive duct sealing, and the ECM residential blower motor will be under the Heating & Cooling Efficiency program. These will be launched in quarter 2 so that there is just one change to forms, the website and regulatory filings.

- LED's as Promotional Giveaways-Originally the issue for this was cost-effectiveness. The feedback from EEAG was positive and to move forward. Some of the issues being worked through are the regulatory considerations, fairness and perception. The company is trying to determine how to file this in Oregon.

- Energy Efficiency Kits-CLEAResult came to Idaho Power to discuss the mail by request kits. Customers would go to Idaho Power's website, fill out a form, and a kit would be mailed to them. The contents of the kit are predetermined but other options are being explored. Idaho Power is soliciting feedback and ideas from EEAG as to what other ala carte options could be included in those kits.

- The drying rack was displayed. This came out of the New Ideas team and is similar to the LED's as a giveaway. The idea is that there is an opportunity to give these out and educate people about energy savings. The agreement would be that customers would provide Idaho Power with an email address and take a short survey. This would probably remain as an event type giveaway to promote behavioral changes.

- Smart Thermostat technology, installation options, and eligibility options were discussed.

- Some of the small business options that Idaho Power is looking into were presented and Idaho Power asked for feedback on how best to reach these customers.

There were questions and discussion about:

- Provide kits to low income residents that have electrically heated homes. These customers will come in for high bill and heating assistance, go through some education and receive their kit. A crew will go into their homes 6-8 months later and the kit will still be sitting on their table. This EEAG member likes the ala carte option because if a customer is ordering something they want, then they will be more likely to use those items.

- A suggestion to have some sort of post card in the kit for the customer to mail back to Idaho Power once the items have been installed. It would be a sort of accountability to Idaho Power.

- Will there be any follow-up with customers if they received the kit or have any questions or issues with installation? That might be something to consider doing.

- Would Idaho Power be measuring the energy savings received from the kits? Idaho Power answered that there would be energy savings assumptions attached to the kits, but that a QA follow up could be done.

- If a teacher advisory group has been formed for the high school kits. One EEAG member stated that educator's would know the best way to deliver these in a way that causes the most behavioral changes. Idaho Power answered that this will happen in the spring. Another EEAG member suggested Idaho Power not limit these kits just high schools, but could also look at College of Western Idaho.

- Use social media as way to get customers engaged. Have them take a picture of the installations and tag Idaho Power. Another EEAG member added that City of Boise does that with the Curb It Program and there is a theme associated with it: "I Make a Difference by…."and then post to Facebook.

- Consider having a YouTube video on how to install a showerhead or some other item in the kit.

- One EEAG member likes the idea of the drying racks. It brings to mind that we do in fact use a dryer and that uses electricity, it gets people thinking. Another EEAG member followed-up and stated that this is a very powerful message of not just using less energy, but using no energy.

- The City of Boise distributes compost bins which are even bulkier than the drying rack. They use the "fire sale" approach. People have to sign up and come down during a specified day and time to pick them up.

- There was some discussion around a follow-up survey after the drying racks are distributed and how that could be structured.

- The company was encouraged to look at the thermostats that make programming easy for the customers.

- A few of the EEAG members suggested looking at both models; DIY and using a contractor. There are a few issues such as wiring or mercury in the older thermostats that could require a contractor. If the company required that a contractor install it might alienate those folks that like the "do-it-yourself" option. Idaho Power was commended for looking into this program.

- It was noted that time is a factor in reaching the small business customers. The initial engagement is very important. Getting incentives to these customers faster is important since many of them rely on month to month cash flow. One EEAG member stated that as a small business owner himself, he likes the idea of Idaho Power showing up at a business to talk about options for energy efficiency improvements.

- Finding ways to dispel the barriers that it is complicated to receive an incentive is something that could be looked at. Another EEAG member added that she is glad Idaho Power is looking at ways to target the small businesses. Streamlining these processes with other programs might free up some head room on the cost effectiveness.

2:05pm Shade Tree/Home Energy Audit Process Evaluation—Dr Katherine Johnson

Dr. Katherine Johnson of Johnson Consulting Group presented the results of process evaluations that were performed on the Shade Tree project and Home Energy Audit program. Dr. Johnson noted that process evaluations are most helpful when transitioning from a pilot to a full program. Idaho Power is in line with best practices. Both of these programs are doing very well.

Key points presented:

- Dr Johnson gave examples of marketing materials, customer messaging, and the online process for the Shade Tree project.

- Overall program operations are smooth and effective. Customers liked the project and love the education.

- Key recommendations would be to streamline the database, standardize the program evaluation questionnaires, develop a pre-screening tool for maximum energy savings potential, and implement a QA process to provide ongoing tracking of the trees. The Idaho Power Program Specialist commented on some of the things that are being done to address these recommendations.

- The Home Energy Audit program is a gateway program to help customers move on to larger energy efficient measures and improvements. An overview of program processes, marketing materials and key findings were presented.

- Key recommendations were to reconsider the program term "audit", review current measure mix to make sure it is still cost-effective, conduct formal customer survey's to assess satisfaction, develop a protocol for reaching out to customers and encouraging them to follow up on recommendations, review the CAKE software, reevaluate the role of the auditors. The Idaho Power Program Specialist commented on some of the things that are being done to address these recommendations.

3:15 pm-Time of Day—Darlene Nemnich

Darlene presented the final results of the Time of Day (TOD) impact study. She provided an overview of the basic structure of the TOD pricing plan. The primary goal of the study was to evaluate how the TOD pilot pricing plan impacted energy consumption.

There were questions and discussion about:

- If the customers that participated in the program were given any type of coaching or strategies. Idaho Power answered that in the original pilot solicitation, information was provided to direct customers to Idaho Power's website. Every year before the summer season a postcard or packet of information is provided reminding them that their TOD rates will change on June 1st. Clings and tip cards have also been provided

- If this will now be an opt-in plan for customers. Idaho Power answered that yes, it is an open plan and customers can choose to participate.

3:43 pm-Online Residential Community—Kathy Yi

Kathy explained that Idaho Power is launching an online community called Empowered Community.

Key points presented:

- The target is to have around 1500 Idaho Power customers made up of a representative sample from across the company's service area that will participate in monthly surveys.

- The goal is to have easily accessible and reliable respondents that can quickly provide feedback for smaller research projects.

- This community was launched this month and as of today there are around 340 participants.

- Primary recruitment is via bill insert. This method was chosen because it is the lowest cost option. Small subsets of customers do not receive a paper bill, so a postcard was sent.

- The web portal landing page that explains how customers can join was presented. This also serves as verification to customers that this is a legitimate web page and not a scam.

- This is funded by rider and base rates. The surveys will not just be energy efficiency related. There will be two $100 incentives awarded to randomly selected community members that participated in monthly research projects.

At the conclusion of the presentation, the meeting facilitator asked for EEAG member feedback on today's meeting and if there were any final thoughts, questions or concerns. EEAG member feedback was as follows:

- The opening remarks were appreciated and Idaho Power has heard the interest in looking forward on new programs.

- This is probably the best EEAG meeting one EEAG member has attended. Another EEAG member also stated that this was the best meeting he has been to.

- It was a great meeting with a lot of information. However, having a couple less agenda items would be helpful because the agenda was very full.

- One EEAG member commented that she is impressed and it appears that the company is moving in the right direction.

- Another EEAG member enjoyed hearing the evaluation results.

Kent McCarthy then introduced himself and his role in the company. He will be providing information on the company's newest fleet of Electric Vehicles.

4:06 Meeting Adjourned

Energy Efficiency Advisory Group (EEAG)
Meeting Notes dated May 6th, 2015

Present:

Quentin Nesbitt*-Idaho Power
Ken Robinette–South Central Comm. Action Partnership
Stacey Donohue–Idaho Public Utilities Commission
Diego Rivas–Northwest Energy Coalition
Tami White–Idaho Power
Ben Otto-Idaho Conservation League
Michael Breish-Public Utility Commission of Oregon
Don Sturtevant–Simplot
Lynn Young–AARP
John Chatburn–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Kent Hanway-CSHQA

Not Present:

Tom Eckman–Northwest Power & Conservation Council
Catherine Chertudi–City of Boise, Public Works Dept

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Chellie Jensen–Idaho Power
Shelley Martin–Idaho Power
Sheree Willhite–Idaho Power
Gary Grayson–Idaho Power
Darlene Nemnich–Idaho Power
Cheryl Paoli–Idaho Power
Billie McWinn*-Idaho Power
Mindi Shodeen-Idaho Power
Nick Bengston*-CLEAResult
Jeff Brooks-Tetra Tech
Todd Greenwell-Idaho Power
Bill Shawver*-Idaho Power
Cory Read–Idaho Power
Theresa Drake–Idaho Power
Diana Echeverria*–Idaho Power
Ken Miller–Snake River Alliance
Zeke VanHooser–Idaho Power
Patti Best–Idaho Power
Becky Arte-Howell–Idaho Power
Chris Pollow-Idaho Power
Roberta Rene*-Idaho Power
Peter Richardson-Richardson Adams, PLLC
Kevin Lauckner-Franklin Energy
Jay Jeffries-Resource Action Programs
Denise Humphreys-Idaho Power

Meeting Facilitator:

Rosemary Curtin (RBCI)

Recording Secretary:

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

Meeting Convened at 9:30am

Rosemary and Quentin started the meeting with introductions of guests and members. The February EEAG meeting notes had been provided to members in advance of the meeting for their review. There were no comments or concerns regarding the February meeting notes.

9:36am-Regulatory Update—Tami White

Tami reviewed the current regulatory filings that have a DSM touch-point. There were no questions or comments from members.

9:42-2015 Financials/2014 DSM Annual Report—Pete Pengilly

Pete presented Appendix 1: Idaho Rider, Oregon Rider, and NEEA payment amounts (Jan-Mar 2015), 2015 DSM Actual Expenses by Program (Jan-Mar 2015), and highlights from other areas of the 2014 DSM Annual Report

Key points presented:

- Noted that overall on a portfolio level, energy savings are up approximately 21% through April of 2015.
- Brought attention to other items highlighted in the DSM Annual Report such as: Energy Efficiency Guides, Student Energy Efficiency Kits, Integrated Design Lab, and the Local Energy Efficiency Funds.
- Pointed out that for the first time the DSM cost-effectiveness ratios were also added into the introduction of the main report.
- Highlighted that the majority of Idaho Power's buildings have been upgraded to be more energy efficient. The corporate headquarters building also participates in the Flex Peak Program (without the incentive component).

There were questions and discussion about:

- What is the projected Idaho rider balance at the end of 2015? The forecast for the Idaho rider is about $16 million dollars balance by the end of 2015.
- What are the company's plans for moving the Oregon rider balance back to a collected status? In Oregon, Idaho Power knows that the rider percentage needs adjusting, but there aren't any definitive plans on when a filing will be made to request an adjustment to the rate of collection.
- There was much discussion about the projected Idaho Rider balance and what the approach should be to reduce the amount projected to be in the account at year-end 2015. There were suggestions for looking at a long term projection to determine what the appropriate percentage should be, not reducing the percentage but figuring out ways to spend it, and looking into what other utilities are doing to manage their rider balances. Overall, the general consensus was that frequent rider percentage changes can have negative impacts on customers.
- EEAG members would like to see Idaho Power bring more attention to its corporate responsibility by talking about what is being done in the energy efficiency arena. The Just Drive campaign is a good example of that.
- Is there a way to gauge customer feedback on the distribution of the Energy Efficiency guides and through what channels were they distributed? Both the Energy Efficiency guide and 30 Simple Things are available for customers to request online. When a new customer signs up for service, this guide could be sent to them. This guide could be provided to the stores that sell energy efficient lights. The company has checked with the box store retailers about leaving the Energy Efficiency guides at the stores. There are

some challenges with that concept. Some stores don't allow the leaving of materials and some will, but won't keep track of fulfillment.

- Tami stated that she would follow up on whether there is a new customer packet provided to customers when they first request service from Idaho Power and, if so, what is in the packet.

- Simplot encourages their employees to practice energy efficiency in the home as well as at work. They are interested in obtaining the Energy Efficiency kits for their employees. Pete stated that the company might be able to put them in touch with the supplier of those kits or Simplot's employees could individually contact Idaho Power to obtain them.

10:36-Commercial/Industrial/Irrigation Update—Quentin Nesbitt

Quentin presented information highlighting the commercial and irrigation programs.

Key points presented:

- Building Efficiency program will far exceed its goals this year because of one very large project that was completed.

- Easy Upgrades program is tracking closely to last year. The company is developing a customer follow up survey in order to improve customer satisfaction. The company is also looking at potential measure additions and changes.

- Custom Efficiency program projects are up, but savings are down. The company is not overly concerned about this because there are many projects in the pipeline. The Water Supply Cohort workshop will be started. Industrial trainings are now being done internally at a lower cost than what NEEA was able to provide.

- Irrigation Efficiency projects and savings are down slightly. This could be due to farm commodity prices being lower.

- Irrigation Peak Rewards enrollment is 102% compared to last year.

- Idaho Power filed to administer the Flex Peak program internally. This has been approved in Oregon and we are waiting for an order from Idaho. The company will not officially enroll participants until approval has been received from the IPUC.

11:00-Break

11:10-Residential Program Update—Billie McWinn

Billie presented a brief overview of the residential programs performance through the first trimester of 2015 compared to the first trimester of 2014. She highlighted the Shade Tree program and Energy Efficient Lighting (Simple Steps-Lighting and Showerheads). She solicited feedback and suggestions from the group regarding Weatherization Solutions (WX Sol), See ya later, refrigerator® (SYLR) and Home Products-Simple Steps.

Key points presented:

- The challenge with WX Sol is finding income eligible customers in two of the four regions; Capital and Eastern.

- Qualifying income levels for this program are 175-200% of the federal poverty level. The number of people living in the home influences the calculation of the income levels to qualify for the program.

- The program manager works closely with outside agencies and contractors to make this program available to eligible customers.

- The challenge with the SYLR® is the removal of the financial incentive and low participation. Idaho Power is researching low or no cost outreach ideas.

- Simple Steps appliances is a BPA promotion based program that includes clothes washers, refrigerators, and freezers. It will be aligned with major buying timeframes and the incentive structure will vary. Some of the models may or may not be cost-effective.

There were questions and discussion about:

Weatherization Solutions

- South Central Community Action Partnership (SCCAP) has a pipeline of applications that takes them into late summer, early fall. They will be doing marketing mid to late summer. Maybe Idaho Power's Education Reps could provide flyers at the schools that students could take home to their parents?

- Senior citizens tend to worry about taking advantage of programs that might prevent someone else from being able to participate. They may rather see someone else get help then take it themselves. If there is a cost to participate, it will be a barrier for them. If they understand that saving energy helps everyone they may be more likely to participate so that could be a way to market this program more effectively to them.

- The faith based community might be an area to market to, as a point of contact for seniors. Seniors might go to a pastor for help. If a pastor in a church makes the statement that WX Sol is a good program, it might make an impact to those who are listening. The pastor could be a very powerful spokesman in the communities.

- Parrish nurses could be another trusted source that seniors would listen to. Having a multifaceted approach to reaching seniors is good. This segment of our population is very cautious about being scammed.

- In regards to an incentive. The company could enter everyone who participates into a drawing to win a gift card. This could be a low cost way to encourage people to participate. This is another program where marketing is challenging due to cost-effectiveness concerns. Over arching energy efficiency is good. Maybe shift some of the marketing costs from the program level to the portfolio level.

See Ya Later, Refrigerator®

- Work with the BLM offices. When they do their television and radio spots they could mention that Idaho Power will come pickup their units for free.

Simple Steps

- Joint messaging with the water companies could be beneficial for the Simple Steps program.

- Since it is up to the retailer to determine how the incentive rolls out once the contract is signed, will Idaho Power know what that will be? Yes, the company will know what it will be.

- The general consensus of the group is that it sounds like a good program and the company should move forward. Might be worthwhile to look at this as a pilot program for one year to determine how much this moved the market and drove sales.

12:20 Lunch

Due to a full agenda and time constraints, the Program Planning presentation was given during lunch. Billie updated the group on Heating & Cooling Efficiency (H&CE), drying racks, Energy Efficiency Kits for High Schools, and LED's as promotional giveaways. Two new residential ideas that are being explored are Smart thermostats and residential demand education.

Key points presented:

- The New Ideas name was changed to Program Planning. The initial task was to come up with "ideas" but the intent of this group is to gather new ideas and turn them into program offerings.

- The measures for the H&CE program are on track to launch June 30th. The filing for Oregon is being finalized and should be filed in the next few weeks.

- Highlighted the offering structure, eligible systems, qualifying products, installation and incentive of the Smart Thermostat pilot. Would like feedback from EEAG.

- Discussed that if Idaho Power were to propose modified rate design to introduce demand charges for residential and small general service customers, that could relate to DSM activities in terms of helping customers to manage/reduce their demand. Idaho Power would like input from the EEAG about how best to educate residential customers regarding their demand and ways to help them manage their demand.

There were questions and discussion about:

Smart Thermostats

- Are these thermostats being looked at for demand response or just energy efficiency? Billie answered that even though they have the capability for demand response, the area of focus is energy efficiency.

- Since they have the capability of demand response, the company might want to consider designing the program up front so it has that ability for demand response growth down the road.

- Will this be a stand-alone program or a measure? Billie answered that hasn't been decided yet. It could be its own program, or could be a pilot offering with the H&CE program.

- There was discussion about the qualifying installation options; direct install and the DIY install. Idaho Power spoke with many other utilities and those utilities recommend having contractors install these thermostats.

- The general consensus of the group is to start this out as a pilot. A few members would like to see the DIY option down the road. A few members like the idea of packaging this with other programs. There

were a couple of suggestions regarding incenting the contractor to install and have them market these thermostats to customers. The contractor who does the install could give a free tune up as part of the package.

Residential Demand Education

- The subject of demand is huge and it is a large part of what drives costs. Educating residential customers will have to be made from a very broad perspective, the big picture. Maybe focus on what customers can do at home to reduce their demand.

- The company could do a focus group with customers who participate in A/C Cool Credit. They might already have an understanding of demand.

- Irrigation customers pay demand charges, so they understand demand, but the average residential customer probably won't. The company will have to start small and keep it simple in order for customers to understand this concept. Put a line item on the bill called Demand with no number so people will start asking questions. You have to think about the people who pay their bill online and never see a paper copy, how will the company communicate this to them?

- When designing rates, there needs to be workshops.

- Customers require context when talking about numbers in order to understand the impact.

- The whole context of future rate design was initiated by concerns about the Fixed Cost Adjustment (FCA). The Company should start small and have analogies that resonate with customers.

1:30 -2014 Impact Evaluation Results for A/C Cool Credit & Peak Rewards—Nick Bengston- CLEAResult

Nick gave an overview of CLEAResult and his role in the company.

Key Points presented:

- Highlighted the Irrigation Peak Rewards program, reviewed the methodology in determining counterfactual realization rate (what would have happened if an event was called), and the goals and findings of this evaluation.

- The counterfactual realization rate is some of the best information from this evaluation.

- Highlighted the A/C Cool Credit program, the evaluation goals, and using these results to update the predictive calculator that was built in 2012.

2:30 -Marketing Presentation—Bill Shawver, Diana Echeverria, Roberta Rene, and Anne Alenskis

Bill thanked members for calling out the Just Drive Campaign and for recognizing how challenging it is to inform and educate customers. He gave an overview of marketing and provided his email address to everyone. If anyone hears, see's, or has any ideas about ways to market Idaho Power's programs, please feel free to contact him. Bill also gave the members a homework assignment to be thinking about any marketing tactics that they hear or see that they think are particularly effective (or in-effective) and he would like to go around the room at the next meeting to get input and ideas.

Key points presented:

- Idaho Power and NEEA meet via conference call once a month to share what campaigns they are working on.
- Highlighted the current marketing tactics; Boise airport signage in concourse B and the baggage carousel, Boise city bus signage, and Energy Efficiency radio spots.
- Highlighted social media's role in marketing efforts.
- A new television commercial along with an E-News video was shown to the group.
- Idaho Power and KTVB have put together news segments that highlight energy efficiency.

3:30 -C&I Program Combination Discussion—Quentin Nesbitt

Quentin reviewed the current commercial and industrial program processes. He described each program and how they are administered and their respective applications.

Key points presented:

- The pros and cons of having a combined program for all three commercial/industrial programs.
- The three different options proposed for combining these programs:
    1. Have one program for retrofits & new construction with one application, three supplemental applications
    2. Two programs: one for retrofit with prescriptive measures and custom options and one for new construction with prescriptive and custom options
    3. Keep three programs but have the application and processes the same for all three.

There was feedback from EEAG members about:

- From our past discussions about this a potential issue was customer confusion, not knowing which program they are applying for.
- Has the company conducted surveys to see what customers would like? Not formally, it is more anecdotal information. Customers commenting about how much paperwork there is or why do they have to submit this. Idaho Power has to be able to verify that the work was done.
- Maybe applications could be designed for different customer segments; large and small businesses.
- Marketing should be segmented but the program would be just one. The customer shouldn't have to be aware of the mechanics piece.

Rosemary asked the group for parting comments:

- It is clear that the company is trying to change program delivery and the way these meetings are run. It has been a good discussion today.
- Appreciate the company's attention to detail.
- Appreciate the company asking for specific feedback on the options presented. It allows members to give more useful and helpful ideas.
- This group is spending more time in honest discussion on programs and how they work.

4:00 Meeting Adjourned

Energy Efficiency Advisory Group (EEAG)
Notes dated August 26th, 2015

Present:

Catherine Chertudi–City of Boise, Public Works Dept.
Ken Robinette–South Central Comm. Action Partnership
Stacey Donohue–Idaho Public Utilities Commission
Diego Rivas–Northwest Energy Coalition
Quentin Nesbitt–Idaho Power
Tina Jayaweera–Northwest Power & Conservation Council
Ben Otto-Idaho Conservation League
Don Strickler–Simplot
Lynn Young–AARP
John Chatburn–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Kent Hanway-CHSQA
Tami White–Idaho Power
Michael Breish-Public Utility Commission of Oregon (via phone)

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Bill Shawver*–Idaho Power
Shelley Martin–Idaho Power
Mary Hacking–Idaho Power
Darlene Nemnich–Idaho Power
Gary Grayson–Idaho Power
Amanda Richards–Honeywell
Mike Youngblood-Idaho Power
Shirley Lindstrom- Northwest Power & Conservation Council
Kevin Winslow*-Idaho Power
Mark Rogers-Idaho Public Utilities Commission
Becky Arte-Howell-Idaho Power
Denise Humphreys-Idaho Power
Chellie Jensen-Idaho Power
Dennis Merrick-Idaho Power
Patti Best-Idaho Power
Don Reading-ICIP
Anne Alenskis-Idaho Power
Cory Read–Idaho Power
Theresa Drake–Idaho Power
Andrea Simmonsen–Idaho Power
Todd Greenwell–Idaho Power
Jenny Fraser–Evergreen Economics
Ken Miller–Snake River Alliance
Donn English–Idaho Public Utilities Commission
Rick Haener-Idaho Power
Billie McWinn*-Idaho Power
Krista West-Idaho Power
Roberta Rene*-Idaho Power
Robert Everett-Idaho Power
Cheryl Paoli-Idaho Power
Randy Thorn-Idaho Power
Sheree Willhite-Idaho Power
Mindi Shodeen-Idaho Power
Brenda Tominaga-Idaho Pumpers Association
Jennifer Pope-Office of Energy Resources
Mark Stokes*-Idaho Power

Meeting Facilitator:

Rosemary Curtin-RSCI

Recording Secretary:

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

Meeting Convened at 9:30am

Rosemary and Quentin started the meeting with introductions of guests and members. Two new members have joined the group. Tina Jayaweera from the NW Power & Conservation Council will be replacing Tom Eckman and Don Strickler of J.R. Simplot will be replacing Don Sturtevant. Rosemary asked members to review the Summary of EEAG Member Interviews. Several of the recommendations from the interviews will be implemented at the November EEAG meeting. Rosemary stated that she is discussing additional recommendations with Idaho Power. The May EEAG meeting notes had been provided to members in advance of the meeting for review. There were no comments or concerns regarding the notes.

9:40 -2015 Financials—Pete Pengilly

Pete presented Appendix 1: The overall status of the Idaho Rider, Oregon Rider, and NEEA payment amounts (January-July 2015) and 2015 DSM Actual Expenses and Preliminary Energy Savings by Program (Jan-July).

There were questions and discussions about:

- In regards to the NEEA payments, do they provide a report regarding their activities? Pete answered that Idaho Power receives an annual report from NEEA. Idaho Power has a representative on the NEEA Board of Directors. Additionally many people in the Customer Relations and Energy Efficiency department are part of NEEA advisory committees and are actively involved with them.

- Is there a snapshot of what the Rider funding is now vs. a year ago at this time? Pete answered that he didn't have an exact number but that he thinks expenses seem to be on track, and he can find out.

9:51- DSM Preliminary Energy Savings by Program—Billie McWinn & Quentin Nesbitt

Billie reviewed the 2015 Year-to-Date Preliminary Savings Residential spreadsheet and Quentin reviewed the 2015 Year-to-Date Preliminary Savings Commercial/Industrial/Irrigation spreadsheet. Billie explained that she would only be discussing the programs that fell below 90% of year-to-date savings of the same time last year.

Key points presented for the residential portion:

- The Heating & Cooling Efficiency (H&CE) numbers won't match the financial information by program that Pete had presented earlier because Ductless Heat Pump has been combined with H&CE.

- EE Lighting is at 89% when compared to savings at the same time last year, but that is due to timing issues around invoice reconciliation.

- Home Improvement savings were only at 34% of last year at our May meeting. Since that time Idaho Power has increased marketing efforts; both online and direct mail, the Program Specialist visited with trade allies in the regions and met with Customer Reps on ways to help market the program.

- In order to keep the See ya later, refrigerator® (SYLR) program cost effective, the incentive was removed. Participation has gone down, but later Billie discussed what is being done to address that.

- The savings numbers for the Student EE Kits can vary due to timing because of the way school year semesters work. Teachers have a choice of which semester to participate in. Typically fall semester participation is higher so the 2015 savings numbers aren't reflected in this spreadsheet.

- Billie is looking at a better way to show savings numbers for the Home Products program in the future. 2014 savings included refrigerators & freezers, but those have since been removed. 2015 savings include

residual savings from those two items, but now also include showerheads. It isn't an apple to apples comparison right now, but moving forward it should be more comparable.

There were questions and discussion about:

- On EE Lighting, does Idaho Power know the breakdown comparison between the CFL vs. LED incentives? Billie answered that final sales numbers are not available yet, but Idaho Power can provide those to the group at a later time.

- Last year we heard that there were problems in locating eligible homes for the low income program, but the savings numbers show that isn't the case now. Billie explained that it is a timing issue and how the contractors have allocated their work so the savings is still low.

- In regards to the Home Improvement program, has the company seen that the extra marketing has been effective compared to prior years? Billie stated that the final numbers are still being evaluated.

- There are quite a few programs that are doing really well; the company shouldn't only focus on the negative. Billie stated that she wanted to make sure the company addressed any concerns that the group might have.

- Are the 2015 IRP Energy Efficiency goals similar to2014? Pete answered that they are pretty close.

Key points presented for commercial/industrial/irrigation portion:

- Building Efficiency looks very good on a per project basis. The energy savings reflect how just one large project can affect those numbers.

- Easy Upgrades savings are on track. The company is looking to add new measures to the current prescriptive list. Streamlining the customer process for the commercial and industrial programs is still in development. The company is also continually looking for ways to engage the small businesses.

- The Custom Efficiency program savings are lower than last year right now, but with this program it is a timing issue. There are some large projects that are expected to come in by the end of the year.

- Irrigation Efficiency is on track. There is some lag with the Custom projects but there aren't any issues with the program. BPA is doing a large research study and looking at irrigation scheduling. Idaho Power hasn't seen details or costs but is very engaged and ready to participate.

- A workshop for the Municipal Water Supply Cohort will be held late September. It will give prospective participants detailed information about the program. There will be 4-5 workshops for participants after that. Quentin explained that one of the biggest ways for this type of customer to save energy is through pressure zones. Through this cohort each municipal water system will be analyzed with software developed by our consultant to identify energy saving potential.

10:13-Break

10:23 -2015 Demand Response Update—Quentin Nesbitt

Quentin updated the group on the three Demand Response (DR) programs.

Key points presented for Irrigation Peak Rewards:

- Participants are split into 4 groups so as not to create large divots in the system load.

- The company is moving away from the cell phone devices and going to the AMI system.

- Reductions are lower later in the year as grain comes off irrigation and lower reductions are expected.

There were questions and discussion about:

- Regarding the 62MW of manual irrigation demand response, is that customer preferred and is there any way to encourage them to move to dispatchable? Quentin explained that manual is allowed if that service point has 1000 hp of connected load. Those customers will nominate an amount that they will shut off. There is no encouragement from Idaho Power to move towards dispatchable. Customers are resistant to have that type of device on those pumps. These pump stations cannot be turned all the way off.

- Does Idaho Power have data on the average total of manual MW that is participating? Quentin answered that interval data is available on each customer and they are paid according to their actual reduction. They receive a monthly payment.

- What was the overall realization rate? Quentin stated that it is still being calculated, but it is looking to be around 70%.

Key Points presented for Flex Peak:

- Preliminary results show a 25 MW reduction for 2 events and 15 MW reduction for the 3rd event.

- Most of the same Flex Peak customers from 2014 enrolled in the program for 2015. Idaho Power would like feedback and suggestions from EEAG on ideas to increase participation in Flex Peak; especially for the smaller commercial customers.

There were questions and discussion about:

- There was quite a bit of discussion and questions around the type of messaging that is currently being used to market Flex Peak. There were suggestions on changing the messaging so that it is more specific for the smaller customer vs. the larger customer.

- What type of smaller customer is Idaho Power targeting for this program? Would customers with large refrigeration be a potential candidate? Quentin answered that the tariff states that the customer would need to provide 20 kW so it has to be realistic for the customer. Customers who have large refrigeration systems typically won't participate on the hottest day due to the nature of their business.

- It was suggested that having a "town hall" type meeting or workshop for the small business customer might help with enrollment. Is it possible for the smaller customers to group together to nominate the 20kw? Quentin answered that it is possible for a single customer to combine service locations to do that.

- It was emphasized that someone from Idaho Power should have a peer to peer visit with the state agencies to explain how Flex Peak has worked for Idaho Power here at the Corporate Building. Explain to the agencies that it has not been an imposition on employees. He explained that a plaque will be presented to the Parks and Recreation on their recent energy efficiency work at Bruneau State Park. He offered to help Idaho Power identify the contacts at these state agencies and help with any messaging that might be needed.

- It was suggested that adding testimonials within the marketing mailers could help promote enrollment. Having a dollar amount savings associated with the amount of kW nominated could also help.

Key points presented for A/C Cool Credit:

- Participation is down since 2013. As directed by the Demand Response Settlement Agreement, Idaho Power markets to participants who move and customers who have moved into a home that has a switch already installed.

- Idaho Power would like suggestions and feedback from EEAG about marketing to additional groups. Per the Demand Response Settlement Agreement, the company stated that it would meet with EEAG to talk about participation and marketing of this program.

There were questions and discussion about:

- Are customers who have dropped out of the program being asked why they leave? Quentin answered yes along with trying to convince them to remain enrolled in the program. Customers usually answer that they are too hot.

- How many customers have dropped out because they have purchased a higher efficiency a/c unit? The Program Specialist answered that there aren't very many customers that cite that as a reason.

- Looks like it might be time to increase marketing to maintain previous participation levels.

- Marketing to new customers or first time homebuyers could be a good opportunity.

11:30 Program Planning—Billie McWinn

Billie explained the updates to existing programs and the new offerings. The topics listed in red on the slides are where she would like specific feedback from EEAG.

Key points presented:

- There are three new measures that have been incorporated into the Heating & Cooling Efficiency (H&CE) program. There is a participating contractor list and there are currently four contractors signed up. A bill insert will be mailed out in September. At the next EEAG meeting more information on participation should be available.

- The company is now using LED's as a giveaway when picking up refrigerators for the SYLR program. This started in June and since then a bill insert along with a television ad have run. There isn't any measurable data yet, but by the next EEAG meeting there should be something to report.

- At a previous meeting EEAG members provided feedback on whether or not Idaho Power should participate in the promotion based activity, Simple Steps. One of the target dates was July 4th, but Sears opted out due to internal changes. Sears will participate in the Labor Day promotion and they are the only participant for that date. Best Buy is no longer participating in the Black Friday event and Lowe's is hesitant. They want to see how it works before they commit. Idaho Power is providing point of purchase material and CLEAResult is doing the majority of the marketing.

- The new offerings and new opportunities; Energy Savings Kits, Smart Thermostats, Home Improvement, and Home Energy Audit were discussed and EEAG members were asked for feedback.

There were questions and discussion about:

- **Energy Savings Kits**

  - Is cost effectiveness of each measure or the whole kit being looked at? Billie answered that both are being evaluated.

  - Will there be a way to follow up with customers after the kit is delivered to see if the contents were actually installed? Billie stated that it she is looking into that but nothing is in place yet.

  - When will these kits be ready for customers? Billie stated that the company is looking at the end of quarter one, 2016.

- **Smart Thermostats**

  - How much would the installation for this measure be? The installation could range between $100-$300 for product and labor.

  - When a smart thermostat is purchased, customers can buy them with or without a contract for ongoing data sharing service. Customer would provide their data to the provider and the provider would then provide prompts. Idaho Power would like feedback from EEAG on the concept of the service provider data sharing.

  - Would Idaho Power require this of customers who participate? Billie answered that right now, the inclination of the company is to not require this.

  - Someone suggested that the company could offer a higher incentive for the customers who choose to sign up with the service provider vs. those who don't.

  - Since this is a pilot, it might be good to have the two groups to evaluate what the savings differences are.

  - Could Idaho Power be the third party provider for customers? Pete answered that it would be hard to obtain the data since it is proprietary to the manufacturer. The Program Specialist added that the function the third party performs would require a separate business unit.

  - Under a pilot designation, the company would have more flexibility in a two tiered approach.

  - The option of choice is important for customers.

  - Would the pilot have participation limits? Billie answered that it will be available throughout the company's service territory with no limitations on the number of customers.

  - Does the company have a goal for participation or amounts? Billie stated that those haven't been determined.

12:05 Lunch

12:52-Meeting Reconvened. Program planning presentation continued.

- **Home Improvement Program**

- Billie asked the group for feedback on whether or not Idaho Power should actively market to multifamily especially with the uncertainty around the Regional Technical Forum (RTF) savings numbers in the future.

- What is the definition of a multifamily building? The Program Specialist answered that it is four stories or higher.

- Most of the tenants in a multifamily building are renters so the building owner would need to be targeted, not the tenant. It was emphasized to not put this out as a marketing piece but rather just go directly to building owners.

- One member stated that she didn't think the RTF multifamily savings applies to high rises but that it's for the garden style buildings. Another member stated that this should be followed up with RTF to confirm the right application.

- **Home Energy Audit**

  - Billie asked for feedback if Idaho Power should offer this to gas-heated customers and not just the all-electric customer.

  - Even though it might not be cost-effective, it can increase awareness and participation in all programs. This is one of the best ways to reach customers. Has reached out to the local gas company to see if they want to partner in this? Billie stated that the company hasn't yet reached out.

  - This would be an excellent service to provide. This could be a great opportunity to get people to change their behavior and I commend Idaho Power for considering this.

  - Idaho Power will need to educate the auditors about which customers can and cannot participate in incentive programs.

  - This is a great idea. There is electric savings in gas homes that hasn't been obtained and this could be a great way to get it.

Tami gave a brief update on the residential demand education. Since the last EEAG meeting, this has continued to be evaluated. There hasn't been any decisions made on this, but Idaho Power plans on gauging customer reaction and acceptance to a three part rate design. This will include stakeholder discussion and customer focus groups. This would happen before any decision by Idaho Power is made. One member asked if the demand charge would replace the Fixed Cost Adjustment (FCA). Tami answered that as more of the collection of fixed costs is moved out of the energy charge and into the demand charge the FCA would reduced accordingly.

1:18-C&I Custom Efficiency Evaluation—Jenny Fraser/Evergreen Economics

Evergreen Economics performed a process and impact evaluation on the Custom Efficiency program. Today's presentation will focus on the impact evaluation.

Key points presented:

- The evaluation was for the 2013 program year and the incentive values are from 2013 as well.

- 73 total projects were looked at. No lighting projects were selected for site visits because Idaho Power already had documented inspections on a large portion of projects

- The process evaluation focused on the streamlined offering, the wastewater cohort, and the refrigerator operator cohort. The high level conclusion is that participants have a high level of satisfaction. The networking aspect for participants of the cohorts was a side benefit that wasn't initially expected but they are happy with those results.

There were questions and discussion about:

- Were the original savings estimates based on preliminary or final applications? Jenny answered that the energy savings is based on final applications.

- Did Idaho Power already include the HVAC interactions in their calculations? Jenny stated that the calculator Idaho Power was using did not include those.

- During the site visits, how was baseline data collected? Jenny answered that there was some baseline information in the documentation but most of it was confirmed with the facility through discussions with site personnel in order to verify savings.

- How does this evaluation for Idaho Power compare to other utilities' evaluations? Jenny stated that you want to see as close to 100% realization rate as possible. With Idaho power there was great documentation and overall in relation to other utilities the results are very good.

1:55-Program Marketing—Bill Shawver

Bill highlighted what would be covered during his presentation. He emphasized to the group again about emailing him with ideas on marketing throughout the year and not just during the EEAG meetings.

Key points presented:

- Idaho Power is in the early stages of revamping its website.

- Looking into sub-branding the energy efficiency portfolio. Idaho Power doesn't want the sub brand to become the brand but rather enhance it. Would like feedback from EEAG on the concept of sub branding.

- Social media and marketing efforts were presented along with some radio and television ads.

There were questions and discussion about:

- The idea of a sub brand is a good idea, but caution was given in choosing its name. The name is one of the most important aspects of drawing people to the brand and takes a lot of planning and research.

- With the Curb It sub brand, the City of Boise has learned that the program is the same in its' gut whether or not you are at home, work, school, or play. What you can do at home for recycling you can do anywhere. That brand brings everyone to the program and it can be touched in different ways.

- Has research been done on what types of wording and images people respond to for the marketing pieces and if so, where does that information come from? The Marketing Specialist answered that people respond to the words; "saving money" and "comfort." That information has come from E Source, JD Power, Burke, using the empowered community, and in talking with other utilities.

- A suggestion was made that people respond better to a dollar sign than a percentage sign. Telling people that they would save 2-3% on their energy bill might not resonate strongly with customers since the cost of energy is inexpensive here in Idaho. Finding a different way to get that message across might have more impact.

3:07 -IRP Discussion—Mark Stokes

Mark thanked those that participated in the Integrated Resource Plan (IRP) process and appreciates everyone sticking around for this presentation.

Key points presented:

- The IRP is a regulatory requirement and it is updated every 2 years.

- The purpose of the IRP is so that utilities can plan how they expect to provide service to customers for the next 20 years.

There were questions and discussion about:

- There has been a lot of talk about demand response at today's meeting. The discussions we have in these meetings play out in the IRP process. The current portfolio counts on the company getting a certain level of energy efficiency and demand response.

3:42-Wrap up—Rosemary Curtin

Rosemary asked EEAG members for parting comments.

- It was a good meeting, but it was pretty full so please provide more time in the agenda for discussion. Appreciated the red highlighted questions in the presentations. Really enjoyed the IRP discussion.

- Liked the tie to the IRP discussion

- Maybe mic the presenter so the person on the phone could hear the presentation.

- It was a great meeting. I learned a lot.

- Appreciated Quentin's presentation. It's nice to see the longer picture and broader trends. It was nice to see affirmation that realization rates for the Custom Efficiency program were so good.

- Would like to see follow-up on the MOU and where it is in the timeline. Maybe at the next meeting we can get an update.

- Appreciate that 44% of advertising is focused on energy efficiency.

- Excited to see the new programs/offerings roll out.

- This meeting was improved from the last one I attended remotely, I could hear well. Quentin's presentation was good, but we only had 10 minutes to discuss program participation. Felt like we should have had more time on that for productive discussion.

Rosemary thanked everyone for their comments and stated that the next EEAG Meeting would be held on November 5th.

3:47 Meeting Adjourned

Energy Efficiency Advisory Group (EEAG)
Notes dated November 5th, 2015

Present:

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

Not Present:

Lynn Young–AARP

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Lisa Nordstrom–Idaho Power
Shelley Martin–Idaho Power
Phil Devol–Idaho Power
Bill Shawver*–Idaho Power
Shirley Lindstrom–Northwest Power & Conservation Council
Don Reading–ICIP
Peter Richardson-ICIP
Susan Klein-Idaho Power
Mary Hacking-Idaho Power
Tracey Burtch-Idaho Power
Cheryl Paoli-Idaho Power
Connie Aschenbrenner-Idaho Power
Matt Larkin-Idaho Power
Barb Ryan*-Applied Energy Group Inc (via phone)
Cory Read–Idaho Power
Theresa Drake–Idaho Power
Roberta Rene*–Idaho Power
Lynn Tominaga-Idaho Irrigation Pumpers Association
Brenda Tominaga–Idaho Irrigation Pumpers Assoc.
Aaron Jarr–Franklin Energy
Denise Humphreys-Idaho Power
Donn English–Idaho Public Utilities Commission
Darlene Nemnich-Idaho Power
Anne Alenskis-Idaho Power
Zeke VanHooser-Idaho Power
Billie McWinn*-Idaho Power
Robert Everett-Idaho Power
Mindi Shodeen-Idaho Power
Craig Williamson*-Applied Energy Group Inc
Chad Worth-Energy Solutions

Meeting Facilitator:

Rosemary Curtin (RBCI)

Recording Secretary:

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

Meeting Convened at 9:32am

Rosemary and Quentin started the meeting with introductions of guests and members. There were no comments or questions on the notes from the August meeting. Rosemary passed out a comment sheet to members. If there was something that didn't get addressed during the meeting, she asked that they add it to the comment sheet and it would get picked up after the meeting.

Tami addressed the group regarding a follow up item from the August meeting. There had been a question about what was included in a new customer information packet. She passed out a copy of the letter that Idaho Power sends to new and existing customers that move to a new address. A copy of this letter was sent to Tina Jayaweera because she participated in the meeting by phone. Tami also followed up the topic of rate design. Idaho Power is continuing to evaluate, looking at system capabilities and engaging with stakeholders. No final decisions have been made on this. The last follow up item is regarding the status of the Memorandum of Understanding (MOU). Idaho Power met with staff at the Idaho Public Utilities Commission (IPUC), Avista, and Rocky Mountain Power in July. It was concluded that rather than update the current MOU, the IPUC staff would prepare a memo to the utilities on how prudency would be evaluated and determined. Stacey added that this memo is circulating at the commission.

Theresa updated the group regarding reply comments that Idaho Power filed on the Integrated Resource Plan. The comments did not include a citation which led to stakeholder confusion on Idaho Power's commitment to pursuing all cost effective energy efficiency. Theresa wanted to clarify and reaffirm that the company's commitment to pursue all cost effective energy efficiency has not changed. Ben indicated that what concerned him was the statement that there was no potential beyond the achievable. He felt that was incorrect and stated that Idaho Power has gotten above achievable and remained cost effective. Theresa thanked him for calling attention to what was missing in the comments. Ben encouraged the group to look at the ACEEE document that was cited.

9:44 a.m.-2015 Financials—Pete Pengilly

Pete presented Appendix 1: The overall status of the Idaho Rider, Oregon Rider, and NEEA payment amounts (Jan-Sept 2015), Appendix 2: 2015 DSM Actual Expenses and Preliminary Energy Savings by program (Jan-Sept), and DSM Expenses by Program.

There were questions and discussions about:

- In regards to Appendix 2, what part of Flex Peak is in base rates? Pete answered that it is the Idaho incentives. In Oregon the incentives come out of the rider. In Idaho demand response program incentives are included in base rates and tracked through the annual Power Cost Adjustment (PCA).

- In regards to the DSM Expenses by Program slide, the group would like to see the energy savings included on this sheet but realizes there's a lot on the sheet.

9:58 a.m.-Commercial Program Performance YTD—Quentin Nesbitt

Quentin updated the group on the commercial, industrial and irrigation programs.

Key points presented for the commercial and industrial portion:

- The commercial and industrial programs are at 155% YTD savings compared to last year. There aren't as many big projects in the pipeline so November and December will not be as big as last year.

- The current lighting tool will be updated once Easy Upgrades, Building Efficiency & Custom Efficiency are combined into one program.

- Quentin asked the group for input and feedback in coming up with a new name for the Commercial/Industrial Program Combination. Idaho Power has not decided on a name yet. He showed slide 11 which had some word concepts that the company has brainstormed.

There were questions and discussions about:

- If there is variability in these programs and they are hard predict, does it make sense to do a 2 year trend line so you capture some of that variability? It might help with planning and rollout. Quentin answered that in the last few years it has been consistent in the Custom Efficiency program whereas Building Efficiency has had more variability. There is a lot of overlap so maybe looking at each program individually isn't the best. It is one of the reasons the company is looking at combining these programs.

- In regards to the Easy Upgrades program and the new measures being looked at for the combined program, are the deemed savings based on Idaho Power doing its own calculations and then making the decision? Quentin answered yes and in addition to that, the company reviews the Technical Resource Manual that a third party developed for Idaho Power and asks for measures to be evaluated and added but does not necessarily always wait on the addition in order to make a decision.

- There was discussion about extra effort required by contractors in the current lighting tool when LED options are chosen. Quentin stated that proposed program modifications will fix this issue. LED project savings will be easier to calculate and review once these changes take place. In the past, there have not been all the options for LED's that we are seeing now.

- It was suggested, on the Custom Efficiency slide (9), that it would be more helpful to show a percentage of the year instead of a year to date comparison.

- In regards to coming up with a new program name, one member suggested Energy Strategies @work. The name might imply more than just incentives and include an educational component. Another member stated that for commercial/industrial customers, "energy efficiency" is a big term. He also liked the term "@work" because it was all encompassing. He didn't like the term "Institutional." Quentin stated that if any of the members had other ideas or suggestions to email him.

Key points presented for the irrigation portion:

- Irrigation Efficiency is at 81% of YTD 2014 savings. Commodity prices could be a factor. There are a number of crops that irrigators grow that aren't worth what they were in the past. Idaho Power still conducts workshops, marketing, and customer knowledge seems to be high. There will be more workshops and the company will continue to do newsletters.

- Quentin asked for input and feedback from the group on a potential tariff change for Irrigation Peak Rewards program to move customers to a one-way option. The one way option is more cost efficient as the annual fees for cell devices exceeds new AMI device cost. The manual option would be allowed when communication is not available.

There were questions and discussion about:

- Commodity prices could have something to do with the lack of participation in Irrigation Efficiency, but some of the non-participants are waiting to see if the program actually works before they sign up.

- Do you think that focusing on the success stories would help those that don't participate to see that it does work? Quentin stated that the company uses that strategy, especially in the workshops.

- In regards to the different options in Irrigation Peak, one member said the two way option should be eliminated. These pumps can be accessed remotely and irrigators can drive out and access them directly. He is also in favor of moving to the AMI devices.

- With the one-way option, would Idaho Power get information on the pumps that it turns off? Quentin answered that the AMI data shows that the pump is shut down. With the cell phone system, it logs that the pump was shut off. The company has to request a query from the third party and then sift through that data.

- It would seem that the two-way option offers benefits to the irrigator. Maybe they should pay some incremental costs if they want to keep the cell phone system.

- Does Idaho Power know what the cost savings is? Quentin stated that it would depend on how many devices would need to stay on cell service. The contract has a base amount so there is not a flat per device savings.

11:02 a.m-Residential Planning Update/Discussion—Billie McWinn

Billie provided information on year-to-date savings and participation for all residential programs and a detailed look at the Home Improvement program, A/C Cool Credit, and See ya later, refrigerator® (SYLR).

Key points presented:

- Billie reported that the residential programs are doing well this year; overall year-to-date savings at 107% of 2014.

- SYLR has experienced a decline in participation despite an increased effort in marketing and a concentrated digital campaign. The Regional Technical Forum (RTF) updated savings numbers that have lowered even further. Idaho Power has reached out to another recycling company for competitive pricing information.

- At the end of 2014 the federal tax credit expired which could be one of the reasons why the Home Improvement program has experienced a decrease in participation in 2015. The marketing for this program has increased substantially in 2015 and will continue. Members of EEAG provided feedback at the last meeting to include multifamily in the marketing materials.

- Current participation in the A/C Cool Credit program is down to less than 30,000 customers. At the August EEAG meeting, the company solicited members for feedback on marketing and program participation. Although the settlement agreement precludes us from actively marketing to new customers, there is a group of customers that dropped out of the program between suspension and settlement that we are now marketing to. Billie passed around examples of a postcard campaign.

There were questions and discussion about:

- Make sure that the multifamily buildings that are being marketed to in Home Improvement haven't already been weatherized in either WAQC or Weatherization Solutions. Billie stated that while there could be potential for overlap, the Program Specialists for Home Improvement and Weatherization are working together to ensure there is no duplication.

- Is there a way for Idaho Power to include in the new customer letter, a pamphlet about the A/C Cool Credit program? Could those customers be isolated according to the guidelines and restrictions of the

settlement? Billie answered that Idaho Power knows which customers fall within the settlement restrictions and they have been sent marketing information. Revisiting the settlement boundaries and marketing to new customers is encouraged, at least from the Oregon side. Quentin stated that in regards to the 390 MW of DR included in the Integrated Resource Plan (IRP), it is really causing surpluses for multiple years in the future. The primary purpose of the settlement was to include a minimum amount of DR even when there isn't a need identified in the IRP.

11:30 a.m.-Program Planning Update/Discussion—Billie McWinn

Billie presented an update on the new offerings for the Heating & Cooling Efficiency program (H&CE) and the drying racks. The areas in blue on the slides are where she would like discussion and feedback from the group.

Key points presented:

- The new offerings for H&CE were incorporated in June of this year. The contractor network list for Single Family Home Duct Sealing has six contractors enrolled. Once the contractor network is more fully developed the marketing push will start.

- The implementation of smart thermostats will be first quarter of 2016. There will be a qualifying products list and will require contractor installation.

- The drying racks have arrived, fifteen pallets in Boise and ten pallets in Pocatello. Interested customers have signed up to be notified when the racks will be available. Idaho Power will send out a notification of the time and place and it will be on a first-come-first-served basis. Billie asked for feedback on whether the company should follow up with customers in six months or one year. She explained the pros and cons of both.

- The company is looking into an "opt-out" option for the Energy Savings Kits (ESK) for a small number of customers. A postcard would be sent to them and if it was returned then they wouldn't get the kit. Billie is asking for feedback from the group.

- Billie explained the Multi-family offering that is being considered and asked the group for feedback on contractor install vs. facilities install.

There were questions and discussion about:

- Because the company is asking people to change behavior by using a drying rack, sending out frequent prompts would be helpful. It might be better to wait longer on the survey in order to collect better data.

- Waiting six months to do a survey should be adequate. Having prompts would be a good idea.

- The key with the ESK's is getting customers to install the items that that they receive, so focus on the best way to make that happen.

- The opt-out option programmatically has higher savings while the opt-in provides better per unit savings. One member stated that they favored the "opt- out" approach.

- Avista had something similar a few years ago where customers could opt-out. It was pretty successful with a lot of savings associated with it.

- Just sending it to customers hoping they install isn't a good idea. The company should do either opt-in or opt-out to help insure installation.

- Including a postcard that has messaging about potential money savings if installed might be helpful. Even something on the outside of the box to grab their attention.

- The opt-out option gets these items into the hands of customers who might not try this on their own.

- There have been other utilities that have these types of programs that are successful. It might be a good idea to look at those to make informed decisions.

- There was discussion concerning the multi-family direct install and whether the measures should be installed by building facility personnel or a contractor. Tenants might be more willing to participate in the facility install approach as they trust the building owners and landlords who already have a key to the unit.

- There might be a better success rate if the property manager is involved instead of a facility manager. They typically have more than one facility to manage, so coordination could be an issue.

- Both options could be available. If the property doesn't have someone on-site to do the installs, a contractor could be used instead.

- QA could be done by a third party to ensure that the items have been installed.

12:00- Lunch

1:00 Meeting Reconvened

1:00 p.m.-Residential Program Evaluations—Craig Williamson and Barb Ryan (via phone), Applied Energy Group (AEG)

Craig presented the results of the Residential Programs Evaluation. The programs that were evaluated were the Ductless Heat Pump (DHP) Pilot, Home Improvement Program (HIP), and See Ya Later, Refrigerator® (SYLR). This is a historical look at what the savings were and how the programs operated in 2014.

Key Points Presented for DHP:

- Both an Impact and Process evaluations were performed on all three programs.

- Results for both evaluations of the DHP Pilot were favorable. A few adjustments were needed on the Non-Electric Benefits (NEBs). The cost of money calculations were done differently than specified by the RTF. Also, savings depends on different climate zones. Because some zip codes have more than one climate zone, a few customers were assigned to an incorrect climate zone which resulted in a reduction of savings.

- Customers were not surveyed for these evaluations.

- Idaho Power is already doing the majority of the standard best practices and has implemented some of the recommendations since the evaluation was completed.

There were questions and discussion about:

- What are examples of NEBs? Craig answered that NEBs are what the RTF says they are. They are usually things not related directly to energy savings but rather health and comfort.

- Does AEG get any more granular to find out if certain low income customers are not pursuing incentives? Craig stated that they didn't go to that level of detail. That would require intensive surveying and it wasn't part of the scope of this evaluation.

- How common are DHP's in new construction? Craig stated that they are not a huge part of the energy efficiency portfolio across the country. They are more common in the Northwest due to the RTF. Barb added that a utility in Maine and Connecticut offer DHPs for new construction.

- DHP's could be extremely beneficial in multi-family development. Most of these housing types use baseboard heat because it is the cheapest to install.

Key points presented for HIP:

- This program more than doubled its savings goal. Most utilities have a goal; they meet this goal and then stop which translates to missed opportunities. Idaho Power didn't do this, they doubled their goal.

- In the past, the RTF did not quantify NEB's but Idaho Power will use them if available.

Key points presented for SYLR:

- This program surpassed its goals and achieved a 100% realization rate. It is a very well run program and complies with most of the best practices in the industry.

- It is easy to come up with recommendations for a poorly run program, but can be a challenge for exceptionally well run programs such as this. One recommendation is to decrease the time it takes to pick up a unit. This could be done by looking at different promotional ideas.

There were questions and discussion about:

- Are NEBs included in the cost analysis? Yes, if available. The information used for this evaluation was from 2014 which didn't have NEBs included in some RTF workbook.

- Marketing material could demonstrate how a customer could save money by not dumping their refrigerator at the landfill.

- A neighborhood blitz could be organized. Customers could be informed that Jaco will be in their neighborhood on a certain date to pick up old units. Barb stated that could be worth considering, but there are specific requirements on having someone home when Jaco comes to pick up.

2:04 –Program Marketing—Bill Shawver

Bill introduced the new Marketing Specialist, Tracey Burtch. Bill thanked one of the EEAG members for his ongoing communications with him and referenced a comment made by another EEAG member earlier about the increase in dollars spent for the residential programs. This was due to an increase in marketing activities.

Key points presented:

- In early 2016 the company will take a deeper dive into behavioral motivators and campaign messaging.

- Utilities are moving away from “apps” and moving toward adaptive and responsive web presence so the web can adapt to the device a customer is using.

- An exchange of ideas and information is encouraged so please contact Corporate Communications if you have something to share.

- The marketing for energy efficiency awareness campaigns, online panel findings and 2016 planning were reviewed. The EEAG members were asked for campaign ideas.

There were questions and discussion about:

- Has Idaho Power done movie theater ads? Roberta answered that the company did some about two years ago for HIP.

- In the past there has been advertising in stores, such as a cling, directing people to look at the more energy efficient products. Roberta stated that is something the company is looking at. It can be a challenge to work with the big box stores to allow outside marketing.

- There could be a positive spillover by utilizing the smaller stores even if you aren’t able to get into the larger box stores.

- Look at church or community groups.

- The key to behavioral motivators isn’t what customers say, but what is actually motivating them to action. Usually the revealed preference is completely different that what really motivated them to act. Bill stated that the company would be looking at the best practices and what is happening on a national level.

- In response to slide 11 (Consistent Look and Feel), for residential customers, the company should find a core message and value that it wants them to focus on instead of targeting each program.

- For example, for recycling we say, “We want you to know that you can do the same thing at home, work, and play.”

2:45-Break.

3:00-Future EE Measure Savings, IRP Avoided Costs & Cost Effectiveness—Kathy Yi

Kathy presented program and measure cost effectiveness assumptions, cost effectiveness tests, changes to the savings assumptions for measures in the current programs, and anticipated savings changes impacting 2017. This presentation is to get these issues on the radar.

Key points presented:

- For the current 2015 program year, 2013 IRP DSM Alternative costs are being used.

- A Technical Reference Manual (TRM) was developed by a third party for use by the commercial programs on items that the RTF doesn’t look at.

- Version 1.7 of the TRM will have different savings for new construction and major renovation projects that fall under the 2009 International Energy Conservation Code (IECC) and 2012 IECC.

- Idaho Power freezes savings and cost assumptions during budgets. The 2016 budgets were set in August. The RTF has met twice since August and has approved changes on a few measures which will impact planning for 2017

There were questions and discussion about:

- I found this presentation very useful to look out in the future as to what to expect for programs.

- This was very helpful in allowing stakeholders to see what utilities have to deal with when planning programs.

3:25-Open Discussion—Quentin Nesbitt

- At the last EEAG meeting, the company asked for input and ideas from members on how to increase participation in the Flex Peak program. Could Idaho Power offer coaching opportunities to the facilities that participate? Quentin stated that Idaho Power does provide some coaching to facilities after an event.

- One EEAG member shared that the coaching that EnerNOC provided was not well received within certain facilities. Receiving multiple emails and calls wasn't working and facility staff stated that if they kept getting that type of "coaching" they would no longer participate in the program. Prior to the demand response season, the different facilities receive an email discussing the Flex Peak program and a review of the prior season.

- Having other companies that currently participate in Flex Peak, share their lessons learned could be a valuable coaching opportunity.

- It would be interesting to learn about Idaho Power's budget setting process. Quentin gave a high level summary of how the Customer Relations & Energy Efficiency department plans its budget.

Rosemary asked for parting comments:

- I like the open discussion portion of the meeting. I like that we stayed with the agenda and like that the lunch was brought in. Kudos to the marketing department on Weatherization Solutions. One suggestion for the marketing material, if there is a way to make it clearer that this program is for electrically heated homes that would save on some unnecessary phone calls.

- Appreciate having the open discussion, enjoyed Kathy's presentation on what is happening in savings going forward. I liked the clarification on a few items. Programs look good and exceeding goals, company is doing a good job.

- Congratulations to Quentin and Zeke in successfully implementing and managing the Flex Peak program.

- It was a great meeting. The topics that Billie and Quentin cover should have more time and flexibility built in for more discussion.

- Liked the number of topics. It was a full agenda but not over filled. The company does a good job at soliciting feedback from members, but there needs to be a more concise way to hear what is done with that feedback.

- Like the meeting format change and will continue to stress the multi family issue. Earlier in the year the company did a good job presenting on new ideas and next steps. Would like to continue seeing that.

- I liked all the comments and open discussion. Maybe focus less on trying to fit everything in on the agenda.
- I enjoyed the program evaluations. It's a reality check of how the programs are doing and if they are running as they are supposed to.
- Would like to hear more about the evaluation plan in the future.

Rosemary stated that dates for the 2016 EEAG Meetings will be sent out in the next few weeks.

4:02 Meeting Adjourned

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NEEA MARKET EFFECTS EVALUATIONS

Table 1. 2015 NEEA Market Effects Evaluations

Report Title	Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
2013–2014 Northwest Residential Lighting Long-Term Tracking Study	Residential	DNV GL-Energy	NEEA	Assessment
2014 Energy Savings for the Commercial Real Estate Strategic Energy Management Cohorts	Commercial	Cadmus	NEEA	Impact
2014–2015 Northwest Residential Lighting Long-Term Market Tracking Study	Residential	DNV GL-Energy	NEEA	Market Assessment
Agricultural Irrigation Initiative: Data Exchange Standards	Irrigation	Next Chapter Marketing	NEEA	Assessment
Agricultural Irrigation Initiative: Grower Experience	Irrigation	Next Chapter Marketing	NEEA	Assessment
Agricultural Irrigation Initiative: Instrumentation and Hardware Best Practices in Precision Agriculture	Irrigation	Western AgTech Solutions	NEEA	Assessment
Agricultural Irrigation Initiative: Overview	Irrigation	Next Chapter Marketing	NEEA	Assessment
Agricultural Irrigation Initiative: Overview of Center Pivot Irrigation Systems	Irrigation	New Chapter Marketing	NEEA	Overview
Agricultural Irrigation Initiative: Pivot Evaluation Best Practices	Irrigation	Western AgTech Solutions	NEEA	Assessment
Agricultural Irrigation Initiative: Precision Water Application Test	Irrigation	Oregon State University	NEEA	Assessment
Agricultural Irrigation Initiative: Soil Science and the Basics of Irrigation Management	Irrigation	Western AgTech Solutions	NEEA	Assessment
Agricultural Irrigation Initiative: The Future of Agricultural Irrigation	Irrigation	Irrigation for the Future	NEEA	Assessment
Agricultural Irrigation Initiative: Using Soil Electrical Conductivity Mapping for Precision Irrigation in the Columbia Basin	Irrigation	Oregon State University	NEEA	Assessment
BOC—Expansion Initiative Market Progress Evaluation Report #2	Commercial	Research Into Action	NEEA	Market Assessment
BOC—Expansion Initiative Market Progress Evaluation Report #3	Commercial	Research Into Action	NEEA	Market Assessment
Business Case, Economic Modeling, and Market Channel Improvements	Irrigation	Next Chapter Marketing	NEEA	Assessment
Commercial Real Estate (CRE) Market Test Assessment: Understanding Delivery, Partnership Strategies and Program Channels	Commercial	New Buildings Institute	NEEA	Market Assessment
Commercial Real Estate Participant Cohorts Market Progress Report	Commercial	Cadmus Group	NEEA	Market Assessment
Consumer Messaging for Ductless Heat Pumps and Heat Pump Water Heaters	Residential	ILLUME Advising, LLC	NEEA	Assessment
CRES Initiative Market Test Assessment Final Report	Commercial	Research Into Action	NEEA	Impact
Establishing the Market Baseline for Super-Efficient Dryers	Residential	Cadmus Group	NEEA	Market Baseline
Evaluation of Key Alliance Cost Effectiveness Model Assumptions for Commissioning	Commercial	Cadmus Group	NEEA	Model Assessment
Evaluation of Key Alliance Cost Effectiveness Model Assumptions for Motor Rewinds	Industrial	Cadmus Group	NEEA	Model Assessment
Existing Building Renewal Montana and Idaho Savings Validation 2014 Results	Commercial	Navigant	NEEA	Impact
Heat Pump Water Heater Model Validation Study	Residential	Ecotope, Inc.	NEEA	Assessment
Hospitals and Healthcare Initiative Market Progress Evaluation Report #7	Commercial	Evergreen Economics	NEEA	Market Assessment

Influence Assessment: Establishing Data Exchange Standards Among Irrigation Manufacturers	Irrigation	Cadmus Group	NEEA	Influence Assessment
Laboratory Assessment of GE GEH50DFEJSRA Heat Pump Water Heater	Residential	Ecotope, Inc.	NEEA	Lab Assessment
Next Step Home Builder Focus Groups	Residential	Curtis Research Associates	NEEA	Assessment
Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #4	Residential	ILLUME Advising, LLC	NEEA	Market Assessment
Northwest Food Processors Association Energy Savings Model Review	Commercial	Energy 350	NEEA	Impact
Northwest Heat Pump Water Heater Initiative Market Progress Evaluation Report #1	Residential	Evergreen Economics	NEEA	Market Assessment
Reduced Watt Lamp Replacement Market Characterization and Baseline	Commercial	Cadeo Group	NEEA	Baseline Assessment
Reduced Wattage Lamp Replacement Market Test Assessment Report	Commercial	Opinion Dynamics	NEEA	Market Assessment
Television Initiative MPER #4	Residential	Research Into Action	NEEA	Market Assessment

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

INTEGRATED DESIGN LAB

Table 2. 2015 Integrated Design Lab

Report Title	Sector	Analysis Performed by	Study Manager	Type
2015 Task 1: Foundational Services Summary of Projects	Commercial	Integrated Design Lab	Idaho Power	Summary
2015 Task 1.8: Heat Pump Calculator Summary of Progress	Residential/Commercial	Integrated Design Lab	Idaho Power	Summary
2015 Task 2: Lunch and Learn Summary of Effort and Outcomes	Commercial/Industrial	Integrated Design Lab	Idaho Power	Summary
2015 Task 3: Commercial Real Estate Support Summary of Efforts and Outcomes	Commercial	Integrated Design Lab	Idaho Power	Summary
2015 Task 4: BSUG Summary of Effort and Outcomes	Commercial	Integrated Design Lab	Idaho Power	Summary
2015 Task 5: Building Efficiency Verifications Summary of Projects	Commercial/Industrial	Integrated Design Lab	Idaho Power	Summary
2015 Task 6: Tool Loan Library Summary of Effort and Outcomes	Commercial	Integrated Design Lab	Idaho Power	Summary
2015 Task 7: Building Metrics Labeling Summary of Effort and Outcomes	Commercial	Integrated Design Lab	Idaho Power	Summary
2015 Task 9: Technical Assistance Whole House Fan	Residential	Integrated Design Lab	Idaho Power	Analysis
2015 Task 10: IBOA/IFMA Support Summary of Effort and Outcomes	Commercial/Industrial	Integrated Design Lab	Idaho Power	Summary

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2015 TASK 1: FOUNDATIONAL SERVICES

SUMMARY OF PROJECTS

IDAHO POWER COMPANY EXTERNAL YEAR-END REPORT

December 31, 2015

Prepared for:
Idaho Power Company

Author:
Elizabeth Cooper

Report Number: 1501_001-01

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Contract Number:
5277

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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 2015 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. In 2015, the budget limits of the phases was changed such that Phase I includes projects with budgets less than $2,000, Phase II is limited to projects from $2,000 to $4,000, and Phase III is any project with a budget greater than $4,000.

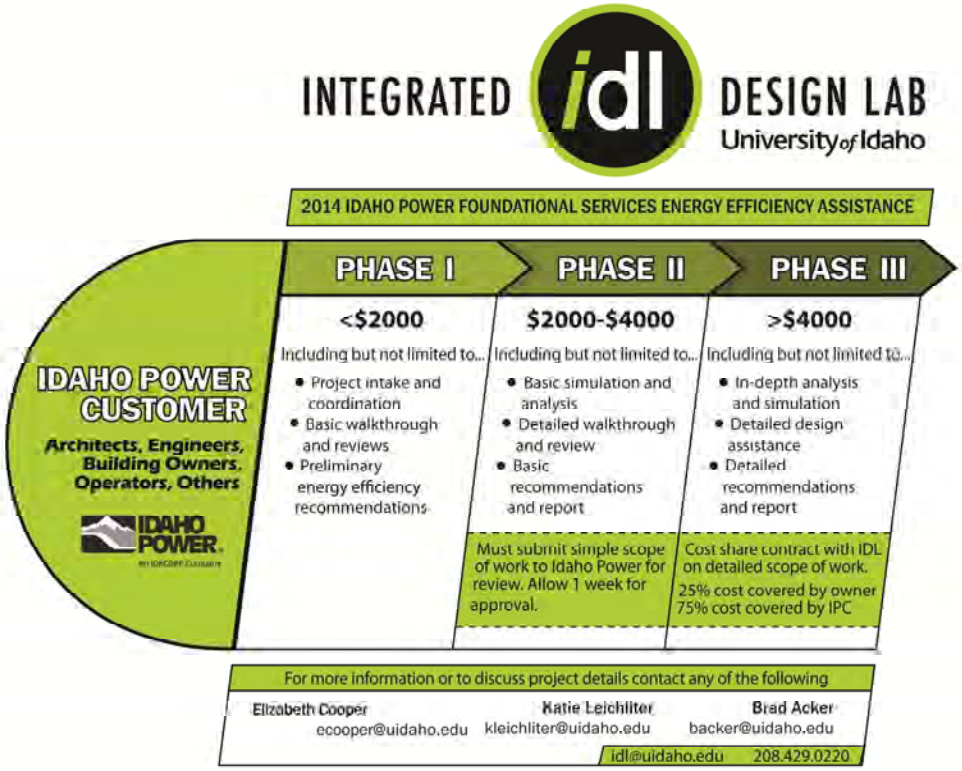

Figure 1: Foundational Services Flyer Outlining Phases

The Foundational Services program was marketed at numerous events and to multiple organizations in 2015, which included all IDL Lunch and Learn series presentations, local architect and engineering firms, ASHRAE, AIA, BOMA, and local government.

2. Project Summary

Fifty-five projects received technical assistance through the Foundational Services program in 2015. Projects 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. In total, there were forty-seven Phase I projects, two Phase II projects and one Phase III project. The full list of projects is shown in the appendix below. Details on Phase 2 and Phase 3 projects are included in the individual project reports submitted to IPC. Five projects are in early stages and the full scope of work has yet to be determined. Seventeen of the projects were for work to be completed in existing buildings, and twenty were for new construction projects. The remaining projects are not building specific, or the scope has yet to be defined.

Table 1: 2015 Foundational Services Project Summary

	Project	Approximate Area (ft2) (if applicable and known)	New or Existing	Location
	Phase 1			
1	School building scoping study		Existing	Boise
2	EEM communications	--	--	--
3	Multi-family central plant cost analysis	--	--	--
4	Analysis of commonly available modeling tools	--	--	--

5	Facility lighting design assistance	>100,000	Existing	Boise
6	Energy modeling of chiller system	--	New	Boise
7	Daylighting design assistance	±5,000	New	Boise
8	Daylighting design assistance	±5,000	New	Boise
9	Office energy efficiency upgrades inquiry	19,000	Existing	Boise
10	Energy modeling technical assistance		Existing	Boise
11	State of technology in LED	--	--	--
12	Non energy benefit review for hotels	--	--	--
13	Specialty facility energy analysis	±20,000	Existing	Boise
14	Church energy efficiency measures inquiry		Existing	Boise
15	Prospective net-zero government building support	±45,000	New	Ketchum
16	Net zero facility design support		New	Boise
17	Energy efficiency goals and communications	--	--	Boise
18	Energy conference planning meetings/support	--	--	--
19	District scale energy benchmarking analysis	--	--	Boise
20	Municipal building energy efficiency design support	--	Existing	Boise
21	Green building code stakeholders meetings	--	--	--
22	Prospective net zero facility inquiry	16,000	New	Boise
23	Daylighting inquiry			
24	Lighting upgrades inquiry		Existing	Boise
25	Guest presentation by EE expert	--	--	--
26	Specialty facility energy analysis	±10,000	New	Garden City
27	School building energy performance	6 schools	Existing	Boise
28	LED lighting analysis		--	--
29	Office facility lighting analysis			
30	School building energy efficiency support		Existing	Boise
31	Mixed use energy efficiency design support		New	Boise
32	Office facility lighting analysis			Boise
33	Lighting incentives inquiry	5,000	New	Twin Falls
34	Energy modeling technical support		Existing	Boise
35	Office TI daylighting analysis		Existing	Boise
36	Hotel energy efficiency design assistance inquiry		New	Mt. Home
37	Hotel energy efficiency design assistance inquiry		New	
38	Facility daylighting analysis			Ketchum
39	Specialty facility technical assistance			Hailey
40	Hotel energy efficiency design assistance inquiry		New	Garden City
41	Specialty facility energy analysis			Boise
42	Specialty facility assistance inquiry		New	Twin Falls
43	Office facility technical assistance inquiry		New	Boise
44	Campus benchmarking and technical assistance		--	
45	Retail design assistance inquiry		Existing	Boise
46	Recreation facility daylight inquiry			
47	Mixed-use technical assistance inquiry		Existing	Boise
	Phase 2			

48	Religious building facility daylighting study	6,000	Existing	Boise
49	Specialty facility technical and planning support		Existing	Boise
	Phase 3			
50	Office building energy management and lighting design assistance	268,000	New	Boise
	Phase to be determined			
51	Education facility		New	Boise
52	Healthcare/Education facility		New	Boise
53	School buildings	46,000	New	Meridian
54	Healthcare facility		New	Boise
55	Healthcare facility	>500,000	New/Ex	Boise
	TOTAL:	**>1,045,000**		

3. Appendices

Appendix A: Project Identification

	Project	Contact	Approx. Area (ft2) (if known)	New or Existing	Location
	Phase 1				
1	Boise Schools	Chris Wendrowski		Existing	Boise
2	Dashboard Template	Haley Falconer	--	--	--
3	LCA on Central Plant for multi-family	Mike Brown	--	--	--
4	Revit energy tools review	IDL	--	--	--
5	Boise Main Library	Steve Trout & Denise McNealy	>100,000	Existing	Boise
6	Chiller curve EnergyPlus	Josh Norhbryn	--	New	Boise
7	Fire Station #4	Stan Cole & Rob Bousfield	±5,000	New	Boise
8	Fire Station #8	Stan Cole & Rob Bousfield	±5,000	New	Boise
9	Happy Family Brands		19,000	Existing	Boise
10	Idaho Water Center	Stephanie Fox & Coby Barlow		Existing	Boise
11	LED vs. Fluorescent Comparison	IDL/IPC	--	--	--
12	Non Energy Benefit Lit Review	Haley Falconer	--	--	--
13	Payette Brewing	Mike Francis	±20,000	Existing	Boise
14	Red Rock Christian Church	Everald Penzel		Existing	Boise
15	Ketchum City Hall	Mike Simmonds & Lance Fish	±45,000	New	Ketchum
16	Boise TMFS			New	Boise
17	City of Boise (General)	Steve Burgos	--	--	Boise
18	Energy Conference Planning	Leon Duce	--	--	Boise
19	LIV District	City/USGBC	--	--	Boise
20	Boise City Hall bEQ	Beth Baird	--	Existing	Boise
21	Boise Green Building Code	IPC	--	--	--
22	Bown Library Branch	Ian Gelbrich & Rob Bousfield	16,000	New	Boise
23	Greenhouse solar				

24	IHFA			Existing	Boise
25	Molly McCabe Visit	--	--	--	--
26	Powder Haus Brewing	Lisa Schmidt	±10,000	New	Garden City
27	School Building Performance	Pete Pearson	6 schools	Existing	Boise
28	Simply LED				
29	SOVRN	Joe Rice			
30	St. Mary's			Existing	Boise
31	The Roost Mixed Use			New	Boise
32	TigerProp	Max Coursey			Boise
33	Twin Fall Chamber of Commerce		5,000	New	Twin Falls
34	Wells Fargo Musgrove Support			Existing	Boise
35	Erstad office TI	Andy Erstad		Existing	Boise
36	Capitol and Broad Hotel	Jared Smith		New	Boise
37	Inn at 500 Capitol	Obie Development (Brian Obie)		New	Boise
38	Mountain Home AFB	Joseph Armstrong			Mt Home
39	Lost Grove Brewing				
40	Limelight Hotel	Jeff Hanle		New	Ketchum
41	Sawtooth Brewing	Paul			Hailey
42	Telaya Winery	Earl Sullivan		New	Garden City
43	Ada County Dispatch	Selena O'Neal		New	Boise
44	CSI master planning	CTA		--	Twin Falls
45	George's Cycles			Existing	Boise
46	Tennis courts			-	
47	Water Cooler	David Ruby and Local Construct		Existing	Boise
	Phase 2				
48	Islamic Center of Boise	Matt Rhees	6,000	Existing	Boise
49	YMCA				
	Phase 3				
50	Simplot HQ	The Dons, Tiffany Curtis	268,000	New	Boise
	Phase to be determined				

51	BSU (Multiple)	Tony Roark (BSU) Scott Henson (LCA)		New	Boise
52	Project Pocatello	Gunnar Gladics		New	Boise
53	Holy Apostles School	Pete Rockwell	46,000	New	Meridian
54	St. Luke's orthopedic clinic	Gunnar Gladics/Brandon Taylor		New	Boise
55	St. Luke's Addition and Renovation	Gunnar Gladics	>500,000	New/Ex	Boise

2015 Task 1.8: Heat Pump Calculator

Summary of Progress

Idaho Power Company External Year-End Report

December 31, 2015

Prepared for:

Idaho Power Company

Authors:

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Report Number: 1501_010-08

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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

GSHP	Ground-Source Heat Pump
HP	Heat Pump
IDL	Integrated Design Lab
IPC	Idaho Power Company
UI	University of Idaho
VRF	Variable Refrigerant Flow
WSHP	Water-Source Heat Pump

1. Introduction

The 2015 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) that was begun in 2013 and continued through 2014. A Heat Pump Energy Savings Calculator (HePESC) spreadsheet was developed in 2013, which was capable of hourly load calculations, energy consumption estimates using regression curves from simulation, and simple cost calculations. Details on 2013 effort, progress, and methods can be found in the IDL technical report number 1301_010-01, "*2013 Heat Pump Calculator – Development and Methodology*." The scope in 2014 focused on improving the tool by means of verification and user feedback. The 2015 work included further revisions, outreach, the completion of adding a residential space-type, and the incorporation of several climate design tools. Details of this and the tool improvements are outlined in this report.

2. Beta Version Revisions and Support

The IDL team did some reformatting of the tool for the sake of simplicity and ease of use. During this process, many of the comments and instructions throughout the tool were edited for grammar and clarity. Different types of information are represented by different formats in the tool. These classifications are described in the color legend of the introduction sheet. This legend initially included eight formats for eight different types of information. During beta testing, this was found to be somewhat confusing, and so the color legend was reduced from eight types to four. The four remaining classifications of cells are: user input

(gold background), default value (blue background), hyperlinks (orange text), and instructional (flagged).

The IDL also offered user support and outreach through a presentation open to both Idaho Power and the public. Katie Leichliter delivered the lecture on July 22nd to the Building Simulators User Group (BSUG). The presentation, which was also available as a webcast focused on use of the tool and how it compared to other detailed simulation tools. The audience included IPC representatives, several architects and engineers in Boise as well as 17 viewers online. The audience found the tool's ability to explain load calculations line by line to be very helpful, as was the comparison offered between eQuest and EnergyPlus.

3. Residential Use

One of the major additions from 2014-2015, was the inclusion of a residential space-type in the tool. Initially, the tool was set up to analyze large commercial buildings of nine different usage types including offices, warehouses, and retail. Now, appearing in the "Building Use" dropdown menu is a tenth type: "Residence." One of the difficulties of adding a residential usage is that residences have very different, and smaller, types of equipment than large commercial buildings. They also have schedules and lighting loads that are quite unlike those typically associated with commercial buildings. In order to add residential equipment into the tool, the IDL added new schedules, equipment curves, pricing, and plug load information to the tool.

Once the residential space-type is selected in the tool, a new entry appears under the general building info section: number of bedrooms. The number of bedrooms is used to

approximate plug loads, lighting, and occupancy. The residential loads were selected based on the NREL 2014 Building America House Simulation Protocols, which was developed from residential survey data (Wilson). In addition to using the standard plug loads associated with residences, the user has the option to add large, uncommon loads, such as an extra refrigerator or gas fireplace.

In order to include residential HVAC equipment, new performance curves had to be developed. During 2014, the IDL ran over 1,500 simulations in BEopt for residential HVAC systems including DX units, gas and electric furnaces, and heat pumps all of various efficiencies. The staff at IDL compiled this data and added the resulting performance curves into the tool just as the commercial systems had been. A complete list of the residential systems and regression curves added to the tool can be found in Appendix A. The staff also compiled cost data for each of these systems by requesting quotes from different manufacturers. This data has been incorporated into the latest version of the HP Calculator tool, nearly doubling the system selection that had been available when the tool was used only for commercial buildings

4. Climate Design Tools

The IDL has developed several different climate design tools that existed as separate spreadsheets in the past. These tools included passive cooling with thermal mass and natural ventilation, cross ventilation, stack ventilation, and night flush strategies. These tools are now compiled within the HP Calculator tool under the “Advanced Design” tab. One of the climate design tools, the balance point calculator, was not added, because this already exists within the normal “Loads Results” tab of the HP Calculator within the more detailed energy signature

analysis. These tools are now much faster to use than when they had existed as standalone spreadsheets, because many of the inputs needed for these separate calculations are already entered into the first sheet of the HP calculator. These features are shown in Appendix B: Climate Design Tools.

5. Feedback and Next Steps

Since the tool has become much more than a simple estimator of heat pump savings, a new name for the tool is under consideration: HVAC Analysis and Loads Tool (or "HAL" if an acronym is required). The earth tube and passive solar climate design tools still need to be incorporated into the Advanced Design portion of the HP Calculator. Further development of the tool could be to include other building types, such as multifamily. Given the pace of innovation, there are many new products on the market now that were not available during the creation of the tool. In order to include these additional HVAC systems, the IDL would need to increase the data simulation set. It would also be beneficial to the integrity of the tool to include more iterations of current and baseline conditions to allow for better interpolation between efficiencies for the performance curves in the tool. The IDL could also hold a training program either specific to IPC or open to the public on the use of this tool as well as the climate design tools that are included in the calculator.

6. References

ASHRAE. (2013). Chapter 18: Nonresidential cooling and heating load calculations. In Ashrae handbook: Fundamentals. Atlanta, GA: ASHRAE.

Back-of-the-Envelope Calculator Version 2.0 (n.d.). Retrieved February 21, 2014 from Energy Center of Wisconsin website: http://www.ecw.org/project.php?workid=1&resultid=286.

Masy, G. (2008). *Definition and Validation of a Simplified Multizone Dynamic Building Model Connected to a Heating System and HVAC Unit* (Doctoral Thesis). Retrieved from website: http://bictel.ulg.ac.be/ETD-db/collection/available/ULgetd-11052008-145605/ (ULgetd-11052008-145605).

Mendon, V., & Taylor, T. (2014). Development of Residential Prototype Building Models and Analysis System for Large-Scale Energy Efficiency Studies Using EnergyPlus. *Building Simulation Conference* (pp. 457-464). Atlanta: ASHRAE/IBPSA-USA

Wilson, E., Metzger, D., Hrowitz, S., and Hendron, R. (2014). 2014 Building America House Simulation Protocols. National Renewable Energy Laboratory, Technical Reprot NREL/TP-5500-60988

2015 Task 2: Lunch and Learn

Summary of Effort and Outcomes

Idaho Power Company Internal Year-End Report

December 31, 2015

Prepared for:

Idaho Power Company

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Acronyms and Abbreviations

AIA	American Institute of Architects
Arch	Architect(ure)
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
BCGCC	Boise Green Building Code
BESF	Building Energy Simulation Forum (Energy Trust of Oregon)

Bldg.	Building
BOMA	Building Owners and Managers Association
CSI	Construction Specifications Institute
Cx	Customer Experience
Elec.	Electrical
EUI	Energy Use Intensity
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
IECC	International Energy Conservation Code
IPC	Idaho Power Company
LEED	Leadership in Energy & Environmental Design
LED	Light Emitting Diode
M&V	Measurement and Verification
Mech.	Mechanical
Mgmt.	Management
NCARB	National Council of Architectural Registration Boards
TBD	To Be Determined
UI	University of Idaho
USGBC	U.S. Green Building Council
WBS	WELL Building Standard

1. 2015 Summary and Cumulative Analysis

Table 1: 2015 Lunch and Learn Summary

	Date	Title	Presenter	Group / Location	Attendees
1	3/12	Deep Retrofits on Historic Projects	Energy Trust of Oregon	Commercial Real Estate Firm- Boise	7
2	3/19	Daylight in Buildings - Getting the Details Right	Kevin Van Den Wymelenberg	Architecture Organization 1 - Pocatello	5
3	6/4	Adding to Zero: Chemeketa Community College's Path to Net Zero	Energy Trust of Oregon	Commercial Real Estate Firm- Boise	13
4	7/20	IECC 2012 for Industrial Building	Ken Baker / Kevin Van Den Wymelenberg	Industry Organization 2 - Boise	17
5	7/22	Daylight in Buildings - Schematic Design	Kevin Van Den Wymelenberg	Architecture Firm 2 - Boise	6
6	8/6	Occupant Cx	Energy Trust of Oregon (Julia Day)	Commercial Real Estate Firm- Boise	11
7	8/17	Daylight in Buildings - Getting the Details Right	Kevin Van Den Wymelenberg	Engineering Firm 2 - Boise	17
8	8/18	Daylight Sensing Electric Light Controls	Kevin Van Den Wymelenberg	Architectural Organization 2 – Ketchum	12
9	8/18	Architectural HVAC Integration Strategies	Kevin Van Den Wymelenberg	Architectural Organization 2 – Ketchum	7
10	8/19	Architectural HVAC Integration Strategies	Kevin Van Den Wymelenberg	Engineering Firm 1 - Boise	11
11	8/26	Daylight in Buildings - Getting the Details Right	Kevin Van Den Wymelenberg	Architecture Firm 2 - Boise	4
12	8/27	Daylight Sensing Electric Light Controls	Kevin Van Den Wymelenberg	Engineering Firm 1 - Boise	5
13	9/8	Operations and Maintenance Strategies	Brad Acker	Engineering Firm 2 - Boise	12
14	9/15	Radiant Design Considerations	Damon Woods	Architecture Firm 1 - Boise	9
15	9/17	Benchmarking and Energy Goal Setting	Elizabeth Cooper	Architecture Organization 1 – Idaho Falls	5
16	9/29	Boise Green Building Code & Idaho Power Efficiency Programs	Jason Blais, Katie Leichliter, Sheree Willhite	Industry Organization 3 - Boise	55
17	10/13	Integrated Design Case Principles	Katie Leichliter	Architecture Organization 3 - Boise	-
18	10/13	Benchmarking and Energy Goal Setting	Elizabeth Cooper	Architecture Firm 1 - Boise	20
19	11/11	Integrated Design Case Principles	Elizabeth Cooper	Architecture Firm 3 – Boise	4
20	12/08	The Importance of Building Performance Modeling for Architects	Elizabeth Cooper	Architecture Firm 3 - Boise	3

Table 1 above summarizes all Lunch and Learn presentations given in 2015. 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. Twenty sessions were held in 2015. The statistics in this section are cumulative for the first 20 presentations. At each presentation participants were asked to sign in and fill out an evaluation form. Presentations were judged on a scale of 1 to 5, please see table 2, however, participants were given the opportunity to provide hand written responses.

Table 2: Evaluation Form Scale

Evaluation	1	2	3	4	5
In general, today's presentation was:	Not Useful		Somewhat Useful		Very Useful
The content of the presentation was:	Too Basic		About Right		Too Advanced
Please rate the following parts of the presentation: Organization, Clarity, Opportunity for Questions, Instructor's Knowledge of Subject Matter, and Delivery of Presentation	Needs Improvement		Good		Excellent

Table 3: Overall Attendance Breakdown

Architect:	176	Electrician:	
Engineer:	9	Contractor:	
Mech. Engineer:	16	Other:	80
Elec. Engineer:	5	None Specified:	35
Total (In-Person):	**321**		

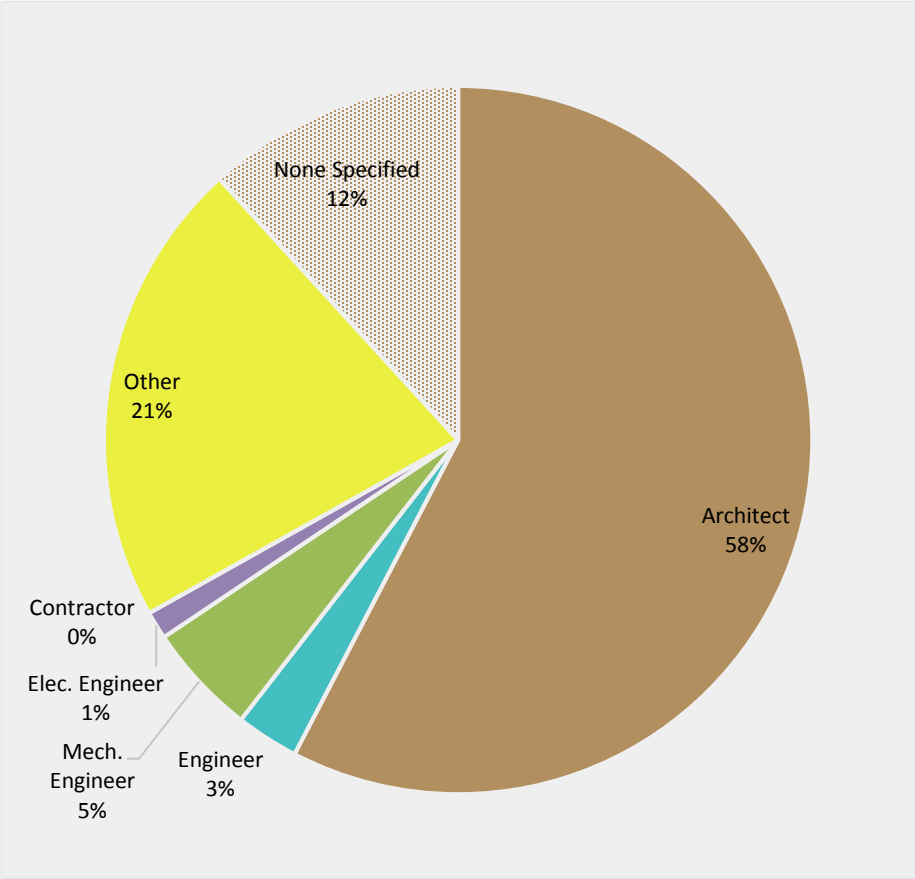

Figure 1: Attendee Profession

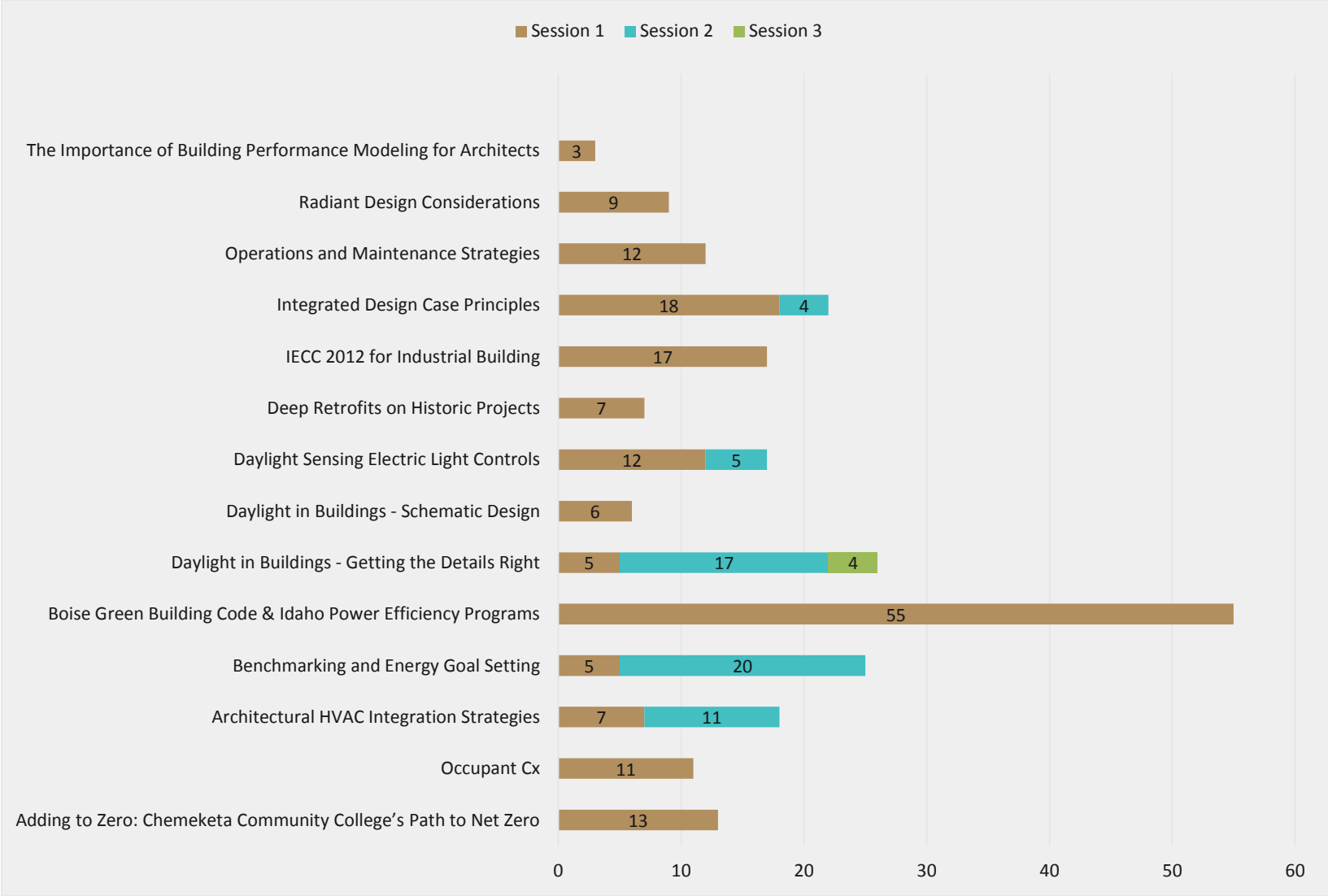

Figure 2: Attendee Count by Title and Session

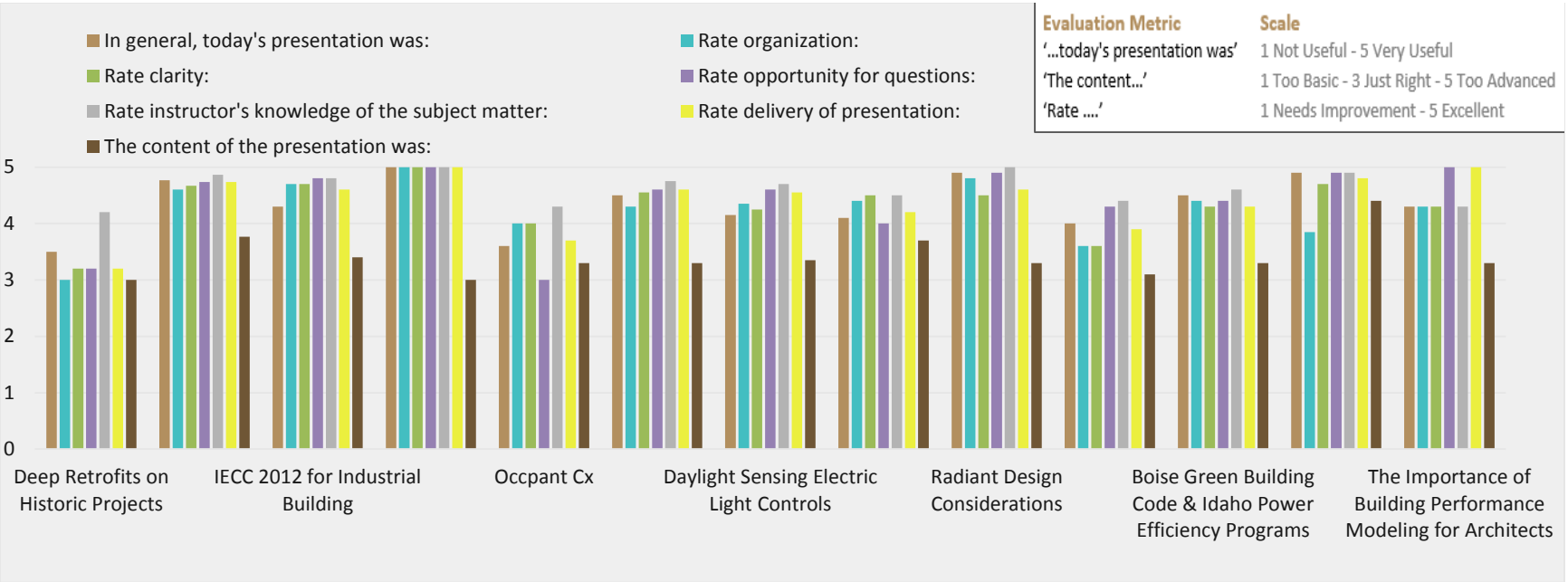

Figure 3: Average Evaluations by Session Title

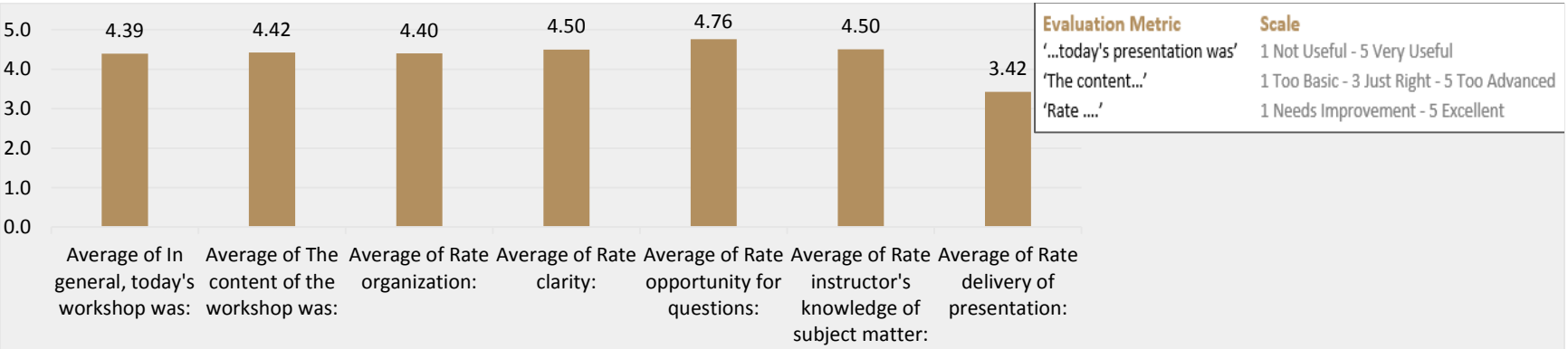

Figure 4: Overall Averages of Evaluations for all Sessions

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. The feedback received from participants is generally constructive criticism used to keep sessions updated but also to propose other potential topics and questions to the Integrated Design Lab.

2.1 Session 1: Deep Retrofits on Historic Projects (3/12/15)

Title: Deep Retrofits on Historic Projects

Description: Deep retrofits go well beyond a system-by-system approach to existing building equipment upgrades. They require a holistic building redesign that incorporates infrastructure, mechanical and electrical systems, building skin, renewable energy, and energy analysis and management. Unlike new construction projects, deep retrofits have the added complexity of working through constraints inherent in the existing structure that designers and contractors must resolve.

This course will present how the owner, developer, design teams, and general contractor approached the conversion and deep retrofit of the former Meier & Frank warehouse into a high-performance office building that serves as the North American headquarters for Vestas. The project is LEED® Platinum certified and has achieved an Energy Star score of 99 through post occupancy energy analysis verification.

Presentation Info:

Date:	3/12/2015
Location:	Commercial Real Estate Firm- Boise
Presenter:	Energy Trust of Oregon – Multiple

Attendance:

Architect:	4	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	1	Other:	2
Elec. Engineer:		None Specified:	
Total (In-Person):	**7**		

2.2 Session 2: Daylight in Buildings – Getting the Details Right (3/19/15)

Title: Daylight in Buildings: Getting the Details Rights

Description: 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 reflectances, 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:	3/19/2015
Location:	Architectural Organization 1 - Pocatello
Presenter:	Kevin Van Den Wymelenberg

Attendance:

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

2.3 Session 3: Adding to Zero: Chemeketa Community College's Path to Net Zero (6/4/15)

Title: Adding to Zero: Chemeketa Community College's Path to Net Zero

Description: The Chemeketa Community College Health Science Complex (HSC) in Salem, Oregon was one of thirteen projects that participated in Energy Trust of Oregon's Path to Net Zero (PTNZ) pilot. This pilot allowed the project team to analyze and utilize energy-reducing features including natural ventilation, dedicated heat recovery with demand control ventilation, hydronic heating, passive cooling, photovoltaics, and a control system for integrated mechanical and electrical system operation. The HSC also has an exceptionally integrated lighting design. The Owner was committed to designing a passive building that would operate within a limited extended range of comfort, and providing detailed room-level metering.

Through this training, we will explore the project's design concept, development and construction. The building has been operating for nearly three years, and the project team will be able to share room-level data that is available to demonstrate building performance. In addition, Energy Trust's team will introduce to the new PTNZ program, which is available starting 2015.

Presentation Info:

Date:	6/4/2015
Location:	Industry Organization 1 – Webinar
Presenter:	Energy Trust of Oregon – Multiple People

Attendance:

Architect:	5	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other*:	
Elec. Engineer:		None Specified:	8
Total (In-Person):	**13**		

2.4 Session 4: IECC 2012 for Industrial Building (7/20/15)

Title: IECC 2012 for Industrial Building

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:	7/20/2015
Location:	Industry Organization 2 - Boise
Presenter:	Keven Van Den Wymelenberg & Ken Baker

Attendance:

Architect:		Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other*:	15
Elec. Engineer:		None Specified:	
Total (In-Person):	**15**		
*Other included:	Broker, Property Mgmt, and Real estate		

2.5 Session 5: Daylight in Buildings – Schematic Design Methods (7/22/15)

Title: Daylight in Buildings – Schematic Design Methods

Description: 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. The concept of providing useable work plane illumination is delivered while the importance of creating visually comfortable and balanced daylit spaces is stressed. This presentation highlights the architectural form generators as well concepts of interior surface brightness to produce high quality and comfortable daylit spaces.

Presentation Info:

Date:	7/22/2015
Location:	Architecture Firm 2 - Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	4	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other*:	
Elec. Engineer:		None Specified:	2
Total (In-Person):	**6**		

2.6 Session 6: Occupant Cx: Learning from Occupants to Improve Building Design (8/06/15)

Title: Occupant Cx: Learning from Occupants to Improve Building Design

Description: Both passive design and high performance building strategies offer a wealth of potential benefits to both occupants and owners, such as increased satisfaction, employee productivity, and building energy and cost savings. However, negative occupation patterns often compromise these benefits, especially if end users do not have the knowledge to properly manage and take advantage of these efficient building systems. Understanding how occupants interact with high-performance buildings can help inform designers to implement better strategies that foster positive energy outcomes as well as an improved occupant experience. Research from case studies showing insights gained from existing high performance and net-zero buildings will be presented. This course will also offer common design and construction issues to avoid with their lessons learned and suggestions for better educating occupants to take advantage of energy-savings design strategies such as daylighting and natural ventilation.

Presentation Info:

Date:	8/06/2015
Location:	Commercial Real Estate Firm- Boise
Presenter:	Julia Day

Attendance:

Architect:	4	Electrician:	
Engineer:		Contractor:	

Mech. Engineer:		Other:	4
Elec. Engineer:		None Specified:	
Total (In-Person):	**8**		

2.7 Session 7: Daylight in Buildings Getting the Details Right (8/17/15)

Title: Daylight in Buildings Getting the Details Right

Description: 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 reflectances, 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:	8/17/2015
Location:	Engineering Firm 2 - Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:	6	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other:	
Elec. Engineer:		None Specified:	5
Total (In-Person):	**11**		

2.8 Session 8: Daylight Sensing Electric Light Controls (8/18/15)

Title: Daylight Sensing Electric Light 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:	8/18/2015

Location:	Architectural Organization 2 – Ketchum
Presenter:	Elizabeth Cooper

Attendance:

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

2.9 Session 9: Architectural HVAC Integration Strategies (8/18/15)

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:	8/18/2015
Location:	Architectural Organization 2 - Ketchum
Presenter:	Kevin Van Den Wymelenberg

Attendance:

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

2.10 Session 10: Architectural HVAC Integration Strategies (8/19/15)

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:	8/9/2015
Location:	Engineering Firm 1 - Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

Architect:		Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	3	Other:	8
Elec. Engineer:		None Specified:	
Total (In-Person):	**11**		

2.11 Session 11: Daylight in Buildings Getting the Details Right (8/26/15)

Title: Daylight in Buildings Getting the Details Right

Description: 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 reflectances, 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:	8/26/2015
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**		

2.12 Session 12: Daylight Sensing Electric Light Controls (8/27/15)

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:	8/27/2015
Location:	Engineering Firm 1 – Boise
Presenter:	Kevin Van Den Wymelenberg

Attendance:

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

2.13 Session 13: Operations and Maintenance Strategies (9/5/15)

Title: Operations and Maintenance Strategies

Description: 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 learn 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.

Presentation Info:

Date:	9/5/2015
Location:	Engineering Firm 2 – Boise

Presenter:	Brad Acker

Attendance:

Architect:		Electrician:	
Engineer:	2	Contractor:	
Mech. Engineer:	1	Other:	9
Elec. Engineer:		None Specified:	1
Total (In-Person):	**13**		

2.14 Session 14: Radiant Design Considerations (9/15/15)

Title: Radiant 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:	9/15/2015
Location:	Architecture Firm 1 – Boise
Presenter:	Damon Woods

Attendance:

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

2.15 Sessions 15 : Benchmarking and Energy Goal Setting (9/17/15)

Title: Benchmarking and Energy Goal Setting

Description: Learning the language and tools of the energy engineering field is critical to reaching real energy reductions in buildings. This presentation discusses several methods for establishing energy goals and targets in the pre-design phase and what the implications are for generating ideas to approach serious reductions in usage. Local examples will be highlighted. Measuring the performance of existing and new projects is critical to long term success because, you can't improve what you don't measure.

Presentation Info:

Date:	9/17/2015
Location:	Architecture Organization 3 – Ketchum
Presenter:	Elizabeth Cooper

Attendance:

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

2.16 Session 16: Boise Green Building Code & Idaho Power Efficiency Programs (9/29/15)

Title: Boise Green Building Code & Idaho Power Efficiency Programs

Description:
Jason Blais, City of Boise, Building Division - highlights about the City of Boise's new voluntary Green Building Code. This code serves as another option for sustainable building design that focuses on site development and land us, material resource conservation, water conservation, energy conservation, indoor environmental quality, and building commissioning. Sheree Willhite, Building Efficiency Program - will review cash incentives for energy efficient design on new construction projects and major remodels. Katie Leichliter of the UI - Integrated Design Lab will be available to discuss technical assistance and other resources the IDL can provide to advance your projects.

Presentation Info:

Date:	9/29/2015
Location:	Industry Organization 3 – Boise
Presenter:	Katie Leichliter, Jason Blais, Sheree Willhite

Attendance:

Architect:	22	Electrician:	
Engineer:	3	Contractor:	
Mech. Engineer:	5	Other*:	14
Elec. Engineer:	1	None Specified:	8
Total (In-Person):	**53**		
*Other included:	IPC Customer Rep., Elec Designer, Mechanical, Interior Designer, Engr, Project Manager,		

2.17 Session 17: Benchmarking and Energy Goal Setting (10/13/15)

Title: Benchmarking and Energy Goal Setting

Description: Learning the language and tools of the energy engineering field is critical to reaching real energy reductions in buildings. This presentation discusses several methods for establishing energy goals and targets in the pre-design phase and what the implications are for generating ideas to approach serious reductions in usage. Local examples will be highlighted. Measuring the performance of existing and new projects is critical to long term success because, you can't improve what you don't measure.

Presentation Info:

Date:	10/13/2015
Location:	Architecture Organization 3 - Boise
Presenter:	Katie Leichliter

Attendance:

Architect:	14	Electrician:	
Engineer:	1	Contractor:	
Mech. Engineer:		Other*:	
Elec. Engineer:		None Specified:	5
Total (In-Person):	**20**		

2.18 Session 18: Integrated Design Principles (10/13/15)

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:	10/13/2015
Location:	Architecture Firm 1 – Boise
Presenter:	Elizabeth Cooper

Attendance:

Architect:	4	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:		Other*:	
Elec. Engineer:		None Specified:	

Total (In-Person):	**4**

2.19 Session 19: Integrated Design Principles (11/11/15)

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:	11/11/2015
Location:	Industry Organization 4 – Boise
Presenter:	Elizabeth Cooper

Attendance:

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

2.20 Session 20: The Importance of Building Performance Modeling for Architects (12/08/15)

Title: The Importance of Building Performance Modeling for Architects

Description: 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 are the step and strategies 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.

Presentation Info:

Date:	12/08/2015
Location:	Architecture Firm 3 – Boise
Presenter:	Elizabeth Cooper

Attendance:

Architect:	1	Electrician:

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

3. Future Work

Feedback was gathered from the 224 Lunch and Learn evaluations received throughout 2015. The comments from these were valuable in defining possible future Lunch and Learn topics and informed the list of suggestions below.

<u>Potential Future Topics:</u>

- Building management (integrated)
  - Benchmarking
  - Training on M&V tools
  - Real-time performance measurements
- Mechanical systems
  - Building HVAC System
  - HVAC controls and programming
  - Passive heating/cooling/ventilation
- Codes
  - Advances in insulation systems
  - Energy Efficient Envelopes (Think this fits here)
- Modeling/Simulation
  - Details about models programs use (heat transfer models)
  - EnergyPlus, OpenStudio, Revit
- Lighting/Daylighting
  - Daylight calculations process and refresher course
  - Revit Daylighting and export
  - Energy consumption
  - Human Comfort

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 such as, consultants or owners they work with.

2015 Task 3: Commercial Real Estate Support

Summary of Effort and Outcomes

Idaho Power Company External Year-End Report

December 31, 2015

Prepared for:

Idaho Power Company

Author:

Elizabeth Cooper

Report Number: 1501_03-01

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Prepared by:
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IDL Director:
Elizabeth Cooper

Author:
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Prepared for:
Idaho Power Company

Contract Number:
5277

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DISCLAIMER

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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 Commercial Real Estate task was new within the University of Idaho Integrated Design Lab (UI-IDL) scope of work in 2015. Idaho Power Company requested that the UI-IDL support and collaborate with GreenSteps to implement energy efficiency measures in select commercial properties in the Idaho Power Company territory. The support and planning 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 UI-IDL's role included: building audits, providing audit reports, providing technical support at follow up meetings, working with building staff to properly specify energy efficiency projects to vendors, and ENERGY STAR certification to eligible buildings. The scope of work aimed to continue the support of the GreenSteps team or other tasks as directed by Idaho Power in the area of commercial real estate. The GreenSteps team remained the direct contact with the building owners and managers; UI-IDL assisted GreenSteps as requested.

2. Task Summary

The IDL worked with GreenSteps on several projects in 2015 providing a variety of technical assistance in the support of commercial energy efficiency projects. The following is a summary of activities associated with this task:

- Meetings were held on a quarterly basis with GreenSteps and building owners or representatives to discuss energy efficiency opportunities and strategies

- GreenSteps asked the IDL to provide technical assistance for six buildings
- UI-IDL staff performed multiple site visits and building audits as requested by GreenSteps
- Two buildings attained, or are in the process of attaining, first time ENERGY STAR® certification
- One building achieved ENERGY STAR renewal
- A natural ventilation plan for one building was provided to the building owner for distribution to the building tenants and occupants
- UI-IDL has scheduled to place CO_2 loggers and measure air flow in one building in 2016
- One owners plans a major mechanical system upgrade as a result of technical design assistance from UI-IDL
- One owner plans to pursue exterior lighting efficiency upgrades in 2016
- Multiple contacts were made with building owners and operators who indicated an interest in pursuing ENERGY STAR certification or energy efficiency upgrades

2015 TASK 4: BSUG

SUMMARY OF EFFORT AND OUTCOMES

IDAHO POWER COMPANY EXTERNAL YEAR-END REPORT

December 31, 2015

Prepared for:

Idaho Power Company

Author:

Katie Leichliter

Dylan Agnes

Report Number: 1501_004-01

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Contract Number:
5277

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Acronyms and Abbreviations

AIA	American Institute of Architects
App	Application
ARUP	London based multi-discipline firm
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
BCVTP	Building Controls Virtual Test-Bed
BEMP	Building Energy Modeling Professional
BESF	Building Energy Simulation Forum (Energy Trust of Oregon)

BIM	Building Information Modeling
BOMA	Building Owners and Managers Association
BSME	Bachelor of Science in Mechanical Engineering
BSUG	Building Simulation Users' Group
CBECS	Commercial Building Energy Consumption Survey
Comm	Commercial
CTA	CTA Architects Engineers
EDR	Eskew+Dumez+Ripple
Elec.	Electrical
eQUEST	Quick Energy Simulation Tool
GBXML	Green Building Extensible Markup Language
HePESC	Heat Pump Energy Savings Calculator
HVAC	Heating, Ventilation, and Air Conditioning
IBPSA	International Building Performance Simulation Association
IDL	Integrated Design Lab
IPC	Idaho Power Company
LBNL	Lawrence Berkeley National Laboratory
LEED	Leadership in Energy & Environmental Design
M. Arch	Masters of Architecture
ME	Mechanical Engineer(ing)
Mech.	Mechanical
MEP	Mechanical, Electrical, and Plumbing
MS Arch	Masters of Science Architecture
NCARB	National Council of Architectural Registration Boards
RDA	Revit Daylighting Analysis
TMY	Typical Meteorological Year
THERM	
UDC	Urban Design Center
UI	University of Idaho
USGBC	U.S. Green Building Council

1. Introduction

The 2015 Idaho Power scope of work for the Building Simulation Users' Group (BSUG) task included planning, organization hosting six monthly meetings, recording attendance and evaluations, archiving video of the presentations, and maintaining the BSUG 2.0 website.

2. 2015 Summary and Cumulative Analysis

In 2015, six 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
1/28	Performance – Based Wall Design using THERM	Gunnar Gladics	Hummel	24	131	27	66
2/25	Annual Energy and Daylight Impacts of Blind Control Patterns through Simulation	Amir Nezamdoost & Alen Mahic	IDL	11	60	11	35
7/22	Simulation Engine Loads Comparison and Heat Pump Calculator Preview	Katie Leichliter	IDL	9	33	7	17
9/3	Using Post Occupancy evaluation to Develop Data Driven Design Process	Corey Squire	Lake Flato Architects	12	27	12	14
10/7	Integrating Building Performance Simulation at a Design Firm	Jacob Dunn	EDR + APO	31	100	17	61
10/28	High Density, Low Cost: The Development of Accessible Building Monitoring	Roderick Bates	Kieran Timberlake	12	43	5	22
11/18	Using Energy Models for Commission Controls	Damon Woods	IDL	7	50	9	28
			Total:	**106**	**444**	**86**	**230**
				550		**316**	

2.1 2015 Attendance

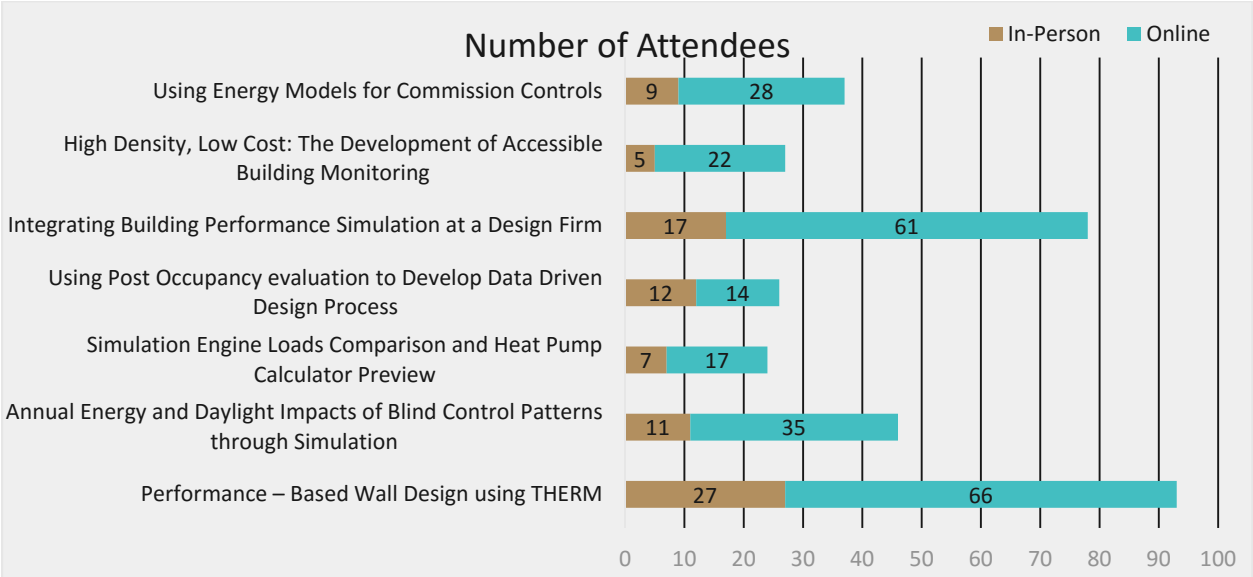

Figure 1: Attendee Count by Session and Type

Table 2: Overall Attendance Breakdown

Architect:	37	Electrician:	
Engineer:	13	Contractor:	2
Mech. Engineer:	19	Other:	23
Elec. Engineer:	3	None Specified:	219
Total (In-Person):	**86**		
Total (Online):	**230**		
Total (Combined):	**316**		

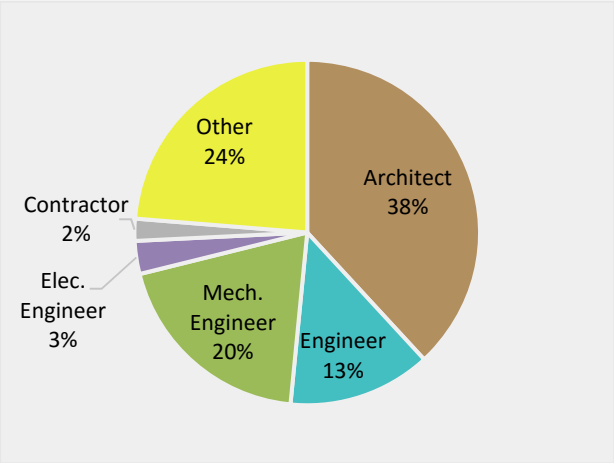

Figure 2: Attendee Profession Breakdown

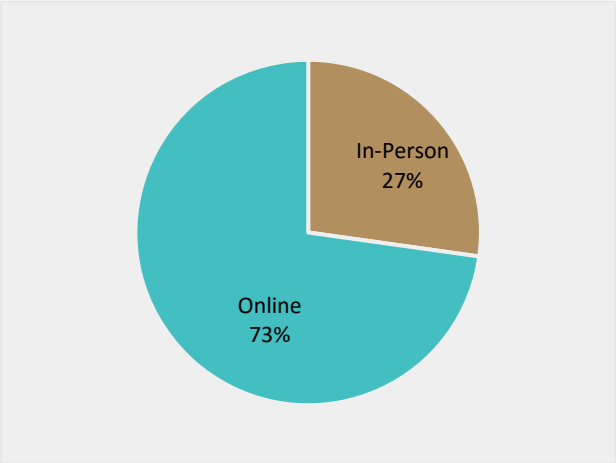

Figure 3: Attendee Type Breakdown

2.2 2015 Evaluations

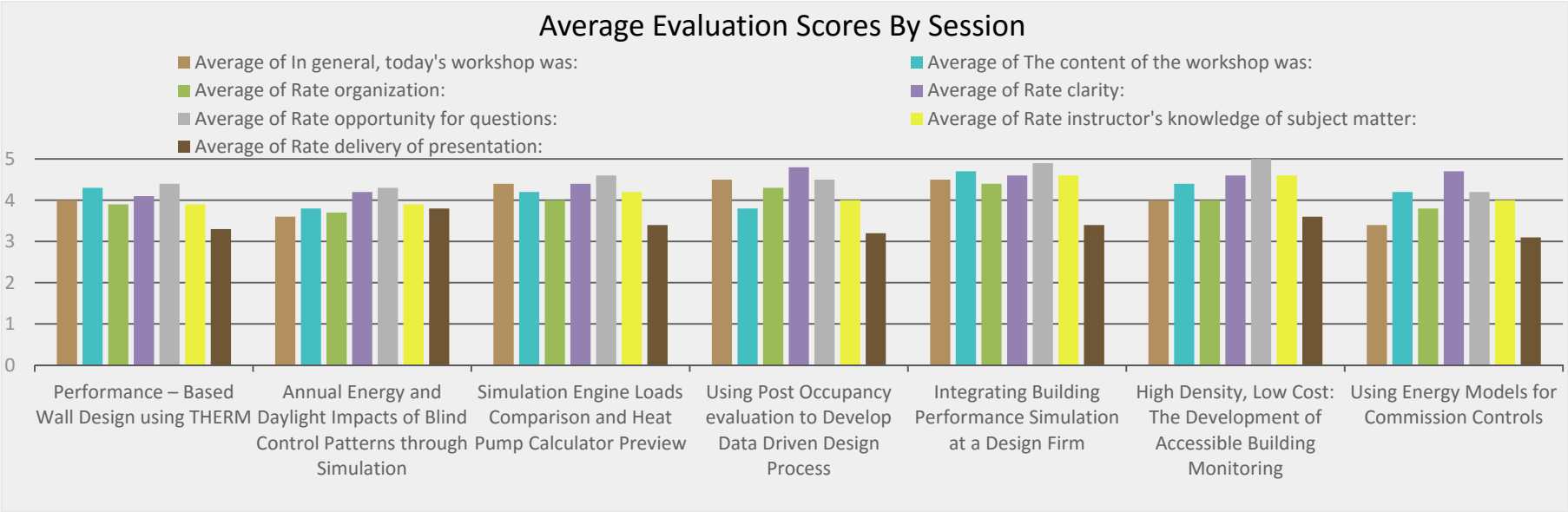

Figure 4: Average Evaluations by Session

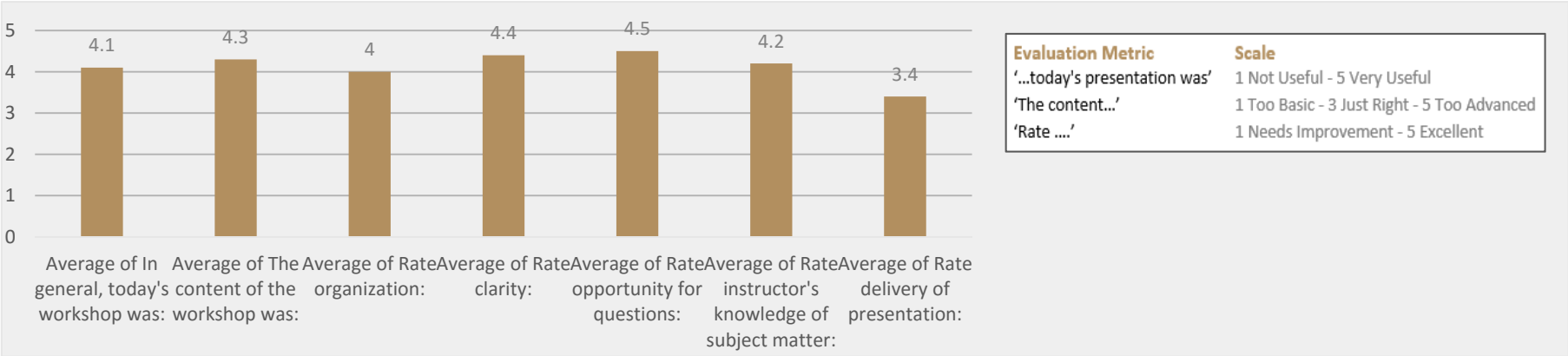

Figure 5: Average Evaluation Scores for All Sessions

3. Session Summaries

3.1 Session 1: Performance – Based Wall Design using THERM

Title: Performance – Based Wall Design using THERM

Date: 1/28/15

Description: Gunnar Gladics will be sharing the process of using THERM for performance-based wall design. Specifically, he will discuss how the program can be used to determine thermal bridging within a wall, how it might affect energy use and comfort, and strategies to minimize it. He will also discuss the program's capabilities assisting with moisture mitigation and code compliance.

From the THERM website: "THERM is a state-of-the-art, Microsoft Windows™-based computer program developed at Lawrence Berkeley National Laboratory (LBNL) for use by building component manufacturers, engineers, educators, students, architects, and others interested in heat transfer. Using THERM, you can model two-dimensional heat-transfer effects in building components such as windows, walls, foundations, roofs, and doors; appliances; and other products where thermal bridges are of concern. THERM's heat-transfer analysis allows you to evaluate a product's energy efficiency and local temperature patterns, which may relate directly to problems with condensation, moisture damage, and structural integrity."

Presenter: Gunnar Gladics has recently joined the Hummel team to bring additional experience in building performance and sustainable design. He has a strong background in building science, working at the University of Idaho's Integrated Design Lab as an architectural research scientist for five years prior to joining Hummel. Gunnar has consulted on energy and sustainability issues on hundreds of projects in the Northwest and across the country.

Attendance:

Architect:	13	Electrician:	0
Engineer:	1	Contractor:	1
Mech. Engineer:	4	Other*:	6
Elec. Engineer:	2	None Specified:	66
Total (In-Person):	**27**		
Total (Online):	**66**		
*If 'Other' was noted:	Designer, IPC Programs, Consultant, IPC Customer Rep.		

Evaluation Highlights (What attendees found most valuable):

- Already understood benefit of thermal de-coupling but concerned about water vapor.
- Good overview. Not too basic or advanced.
- Difference between design R value & actual achieved R-value.
- Directed to resources applicable to everyday work.

3.2 Session 2: Annual Energy & Daylight Impacts of Blind Control Patterns through Simulation

Title: Annual Energy and Daylight Impacts of Blind Control Patterns through Simulation

Date: 2/25/15

Description: Manual blind controls are typically not included in energy modelling and often are not considered in daylight modelling. This is in part because there is no consensus in the research or practice community about the way users operate manual blinds. However, researchers have recently proposed multiple algorithms for this purpose. Blind control patterns affect the energy consumption (interior lighting loads and space heating and cooling loads) of buildings but a deeper understanding of the range of effects is needed before widespread adoption of manual blind control algorithms in daylighting and energy simulation will occur or consensus about appropriate algorithms reached. Preliminary results show annual lighting end-use variances up to more than 6% and other end-uses up to more than 20% depending on the blind control algorithm. This presentation will briefly discuss and compare the proposed algorithms, and describe the process for inclusion of blind control within the simulation programs EnergyPlus and Radiance.

Presenters: Alen Mahic joined the University of Idaho Integrated Design Lab in Boise three years ago and has been heavily focused on daylighting technical assistance and education. With a strong understanding of the Radiance daylighting tool, he has helped the Lab expand on its digital simulation capabilities through scripted automation of advanced simulation techniques. Alen is an M.Arch graduate from the University of Idaho.

Amir Nezamdoost is currently a research assistant at the IDL and is pursuing his M.S.Arch through the U of I, focusing on performance of manual blind control patterns in daylighting and energy simulation. He received his B.Arch with concentration on energy efficient buildings from Azad University (Mashhad, Iran) in 2010 and worked in professional architecture studios there for two years. To continue his professional experience in the U.S., Amir joined the IDL in 2013. His work at the IDL has included daylighting design and simulation on multiple projects as well as developing building simulations in EnergyPlus, OpenStudio, and Radiance.

Attendance:

Architect:	3	Contractor:	1
Mech. Engineer:	3	Other*:	3
Elec. Engineer:	1	None Specified:	35
Total (In-Person):	**11**		
Total (Online):	**35**		
*If 'Other' was noted:	IPC Programs (3)		

Evaluation Highlights (What attendees found most valuable):

- That cooling load was not greatly affected by blind use. The combination of programs used to do simulation.
- Learning about how the workflow was handled between the EnergyPlus and Radiance.
- Discussion of influencing factors on blinds

3.3 Session 3: Simulation Engine Loads Comparison and Heat Pump Calculator Preview

Title: Simulation Engine Loads Comparison and Heat Pump Calculator Preview

Date: 7/22/15

Description: A macro-free, single zone Heat Pump Energy Savings Calculator (HePESC) workbook is currently under development by the Integrated Design Lab in Boise, Idaho. As part of the calculator vetting process, an in-depth loads analysis was done comparing the heat gain results with those from EnergyPlus and eQuest. Comparisons were made for lighting, plug loads, infiltration, glazing solar heat gain, zone temperature, and overall building loads. Through these comparisons, it is obvious the simulations use differing calculation methods which result in varying final outputs. This presentation will give a brief overview of the heat pump calculator project and progress, then further discuss the loads results from the simulation studies and possible next steps.

Presenter: Katie Leichliter is a Research Scientist at the University of Idaho – Integrated Design Lab in Boise. She conducts energy efficiency field work, measurement and verification, and operational and investment grade audits. Katie also conducts simulation research for energy efficiency in existing building renewal projects, and has developed stand-alone energy analysis tools. She has given multiple presentations on building efficiency opportunities to building design and operation professionals. Katie graduated with a Bachelors and Masters of Science in Mechanical Engineering from the University of Idaho and spent three years in a private mechanical design practice specializing in BIM, building simulation, and HVAC design. Katie serves on the board of governors of the Idaho ASHRAE Chapter.

Attendance:

Architect:	2	Electrician:	
Engineer:	5	Contractor:	
Mech. Engineer:	5	Other*:	1
Elec. Engineer:		None Specified:	10
Total (In-Person):	**7**		
Total (Online):	**16**		
*If 'Other' was noted:	Post IPE		

Evaluation Highlights (What attendees found most valuable):

- Interesting to see this tool…looking forward to trying it out myself
- Cool tool, will be helpful
- About the simulation energy tools

- The comparison with eQuest & e+ and the central ventilation
- Explaining the load calcs, line by line

3.4 Session 4: Using Post-Occupancy evaluation to Develop Data Driven Design Process (9/3/15)

Title: Using Post Occupancy evaluation to Develop Data Driven Design Process

Date: 9/3/15

Description: Established in 1984, Lake|Flato believes in architecture that is rooted to its place, responds to the natural environment and merges with the landscape. With a palette of regional materials, we create buildings that are tactile and modern, environmentally responsible and well-crafted. The firm has been honored with over 200 design awards, including the American Institute of Architects Firm of the Year Award in 2004, eight Committee on the Environment Top Ten Project Awards, and the Global Award for Sustainable Architecture in 2015.

While we have been setting sustainability goals and simulating energy performance for years, we recently revamped our process and began implementing a more thorough, methodical approach to tracking and analyzing the actual energy performance of our residential projects. By installing energy monitoring devices to collect real time, circuit by circuit energy data, we have been able to drill down and find out precisely where every kilowatt-hour is being spent. The results have surprised us and caused us to rethink the way we simulate performance and the way we design.

Presenter: Corey Squire, LEED AP O+M is the Sustainability Coordinator at Lake|Flato. Corey works with all Lake|Flato teams to establish sustainability goals, analyze designs with simulation software, and collect post-occupancy performance data. He received a Bachelor of Arts in Environmental Studies from Oberlin College and a Master of Architecture from Tulane University. In 2012, Corey was awarded the Eskew+Dumez+Ripple Research Fellowship to study building post-occupancy energy performance and sustainable design processes. Corey's research on post occupancy evaluation in custom residential projects has been an instrumental contribution to Lake|Flato's innovative approach toward analyzing energy performance.

Attendance:

Architect:	6	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	3	Other*:	3
Elec. Engineer:		None Specified:	27
Total (In-Person):	**12**		
Total (Online):	**27**		
*If 'Other' was noted:	IPC Programs		

Evaluation Highlights (What attendees found most valuable):

- Case studies were interesting

- “Pool” load types
- The comparison and monitoring equipment
- Comparisons and experiments, as well as the honesty.

3.5 Session 5: Integrating Building Performance Simulation at a Design Firm – Trials and Tribulations

Title: Integrating Building Performance Simulation at a Design Firm – Trials and Tribulations

Date: 10/7/15

Description: In-house architecture simulation services. Is this an achievable and worthwhile prospect? Does building performance simulation add value to an architecture practice? Is it worth the time and trouble? These are examples of the questions that Jacob Dunn has been grappling with since leaving the University of Idaho Integrated Design Lab over a year ago to bring architectural simulation to Eskew+Dumez+Ripple (EDR), a New Orleans-based, design-first practice and AIA Firm of the Year recipient in 2015. Over the past year, Jacob has worked with their director of Building Performance and Sustainability, Z Smith, to integrate performance-driven design throughout their studio. This presentation will cover the trials and tribulations of this task, while proposing frameworks and initiatives firms can use that encourage performance based design and building simulation in practice. Jacob will discuss the need for the redefinition of the way firms think about design, how they structure project teams, and how they implement new technologies and tools at every stage of the design process, Finally, Jacob will present EDR implementation case studies and initiatives piloted by the firm to provide insight into the difficulty and value that simulation can provide to design and sustainability.

Presenter: Jacob Dunn grew up in the Boise, Idaho in the Pacific Northwest (ASHRAE Climate Zone 5B) before recently moving to his new home in New Orleans (ASHRAE Climate Zone 2A). He holds a Master's Degree in Architecture from the University of Idaho and his professional background has pivoted between research, sustainability consulting, education, and architecture. After working for about a year in London for ARUP's Foresight Innovation and Incubation group, Jacob finished his degree and started working at the University of Idaho's Integrated Design Lab (IDL). At the IDL, he specialized in consulting through architectural simulation, conducted research on energy efficiency, and taught various graduate-level architecture courses. Jacob used simulation on a daily basis for both architectural and engineering analysis, and across a broad spectrum of building types in both new and existing structures. After four years of being a Research Scientist, he was recruited out of Idaho to Eskew+Dumez+Ripple (EDR) and tasked with enabling evidenced-based design and simulation analysis to their award-winning design firm. At EDR, Jacob currently works with design teams to explore the link between aesthetics and performance through simulation and a scientific approach to sustainability.

Attendance:

Architect:	8	Electrician:	
Engineer:		Contractor:	
Mech. Engineer:	1	Other*:	8
Elec. Engineer:		None Specified:	60
Total (In-Person):	**17**		
Total (Online):	**60**		
*If 'Other' was noted:	EIT, Prof, Eng, ID		

Evaluation Highlights (What attendees found most valuable):

- Evaluation of design software + use/abilities of software
- Good synopsis of Revit tools, consulting experiences
- Points along the process where it makes most sense to incorporate which tools/analysis + tips on Revit extensions
- Organization was excellent – really great to see multiple project phases and in relation to energy analysis
- Use in Practice/Real world issues

3.6 Session 6: Using Energy Models to Commission Controls

Title: Using Energy Models to Commission Controls

Date: 11/18/15

Description: Accurate, effective and thorough commissioning of building controls is often neglected or incomplete due to several factors; fear of occupant complaints, equipment damage, cost and time all contribute to a lack of proper commissioning. Building Controls Virtual Test-Bed (BCVTB), a free software available from Lawrence Berkeley National Lab, enables a user to connect their energy simulation to elements in the real world. It can be used to incorporate real-time weather, sensor outputs, or even pieces of control hardware. The research team at IDL implemented this process for a large campus building currently in operation, by physically connecting one of its controllers to an energy model developed in OpenStudio. This approach enabled identification and correction of operating parameters, including economizer control settings. By tuning just a few operational settings, this project had a potential to save up to 12% of the building's energy per year. This lecture will cover how the IDL successfully connected OpenStudio/EnergyPlus models to physical controllers.

Presenters: Damon Woods is a PhD student at the University of Idaho and has been with the Integrated Design Lab since 2012. His research focus is on increasing the energy efficiency of buildings by using modeling and predictive control of radiant systems. Damon received a BS in Mechanical Engineering from Montana State University and an MS in Mechanical Engineering from Boise State University in 2013.

Attendance:

Architect:	3	Electrician:	
Engineer:	7	Contractor:	
Mech. Engineer:	2	Other*:	3
Elec. Engineer:		None Specified:	20
Total (In-Person):	**9**		
Total (Online):	**26**		
*If 'Other' was noted:	Professor, Energy Manager, Utility Rep		

Evaluation Highlights (What attendees found most valuable):

- Inspiration on the potential of modeling
- Concept
- Details on the graphic that showed integration of EnergyPlus and the fact that commissioning should never stop.
- Economizer example

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 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 from the BSUG 2.0 website.

Between January 1, 2015 and November 25, 2015, total page views summed to 166 with unique page views at 147 for 313 total sessions at the site. Of the 313 sessions, 114 (36%) 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.

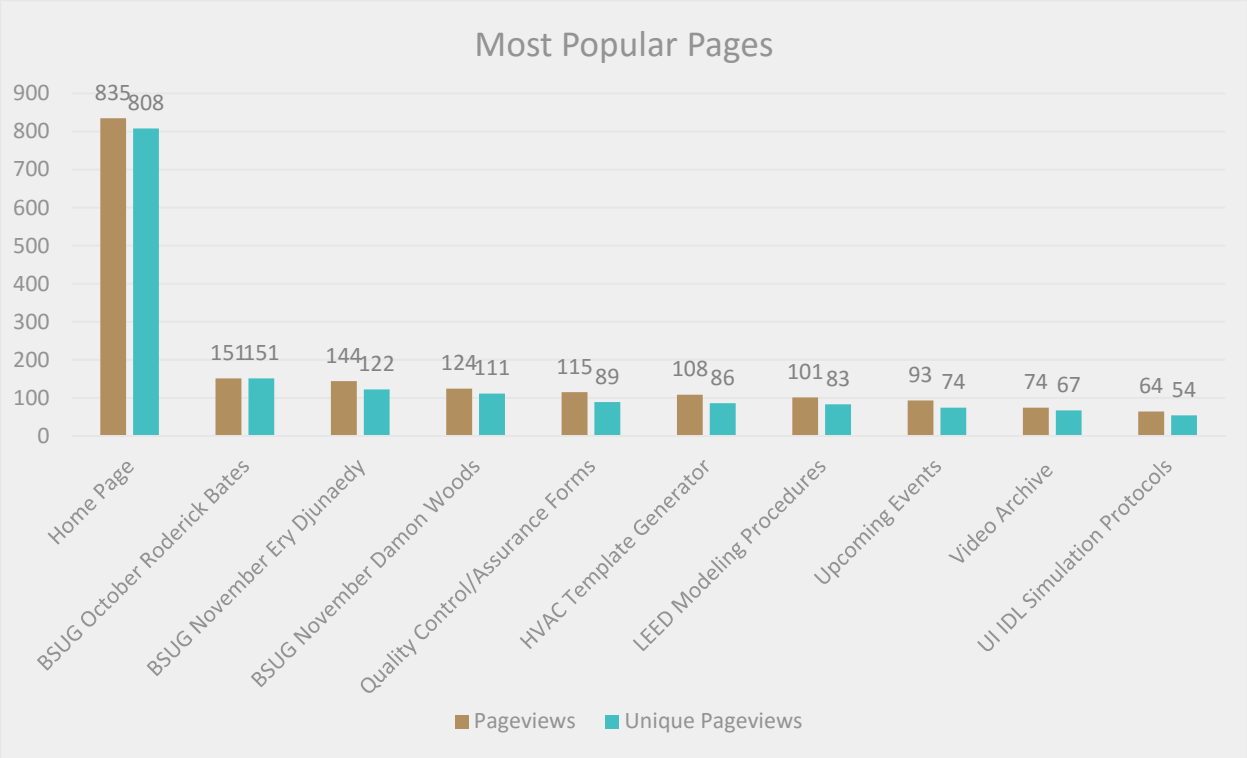

Figure 6: Number of Page Views for the Ten Most Popular Pages in 2015

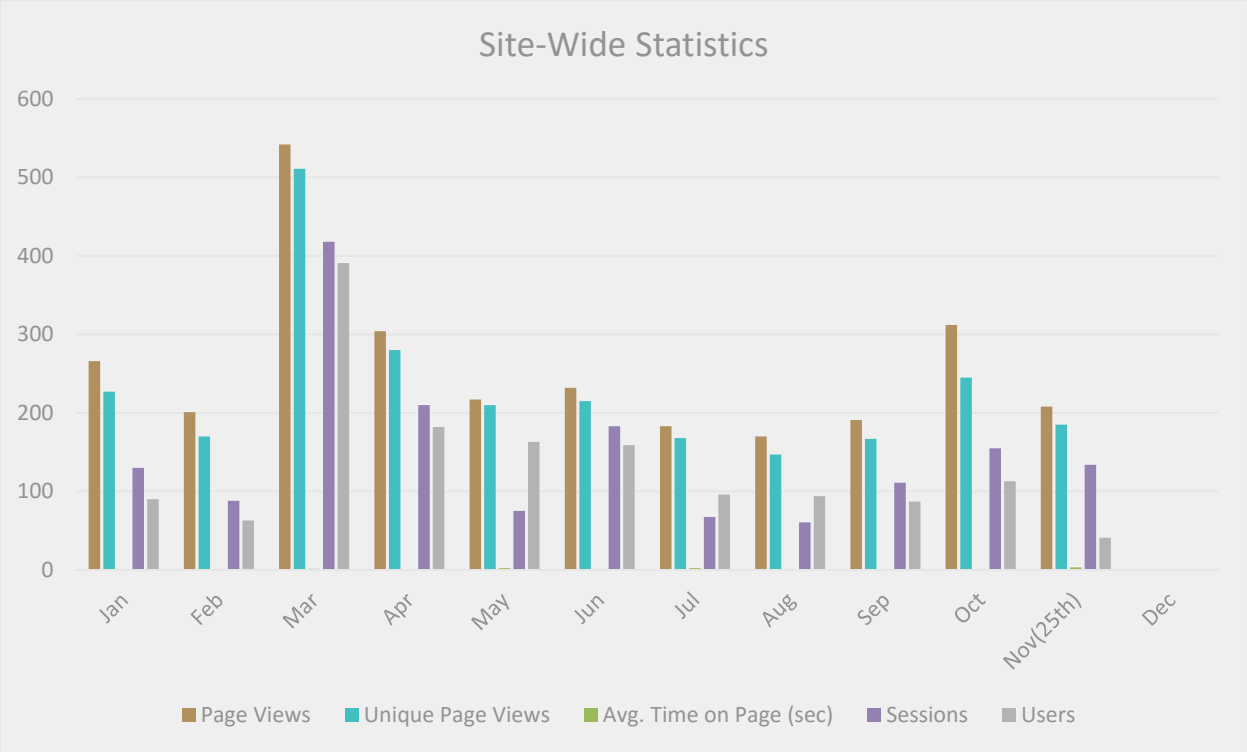

Figure 7: Monthly Site-Wide Statistics

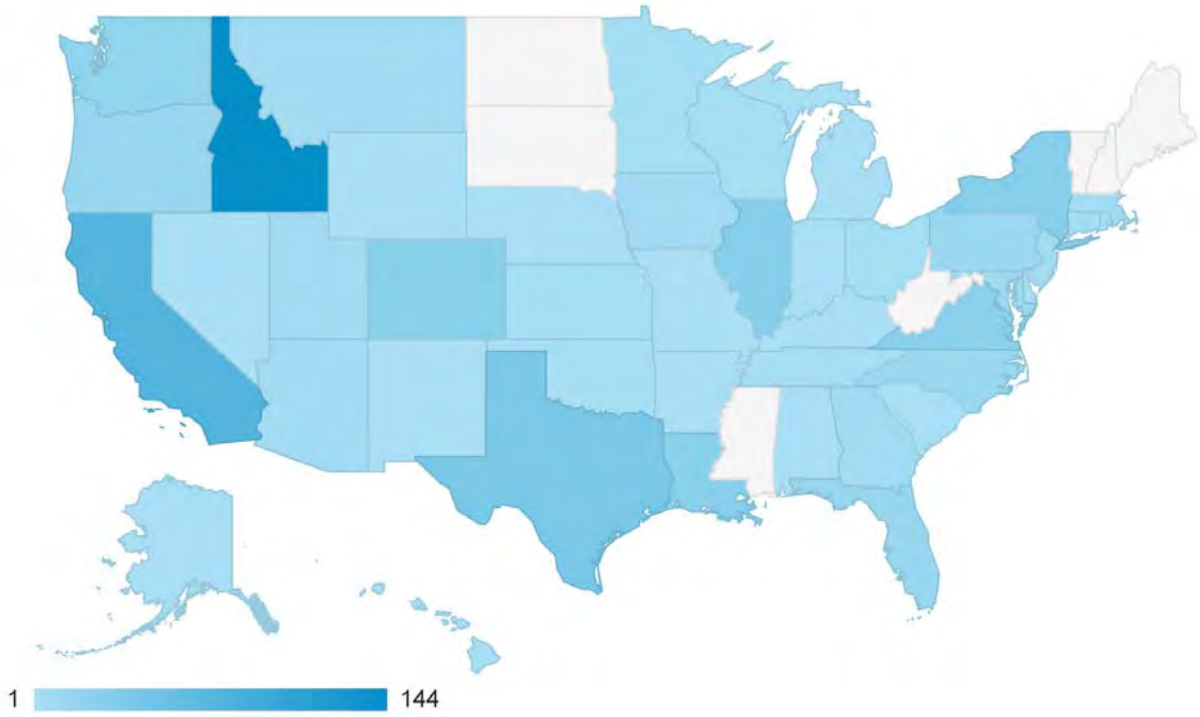

Figure 8: Heat Map of All U.S. Sessions in 2015

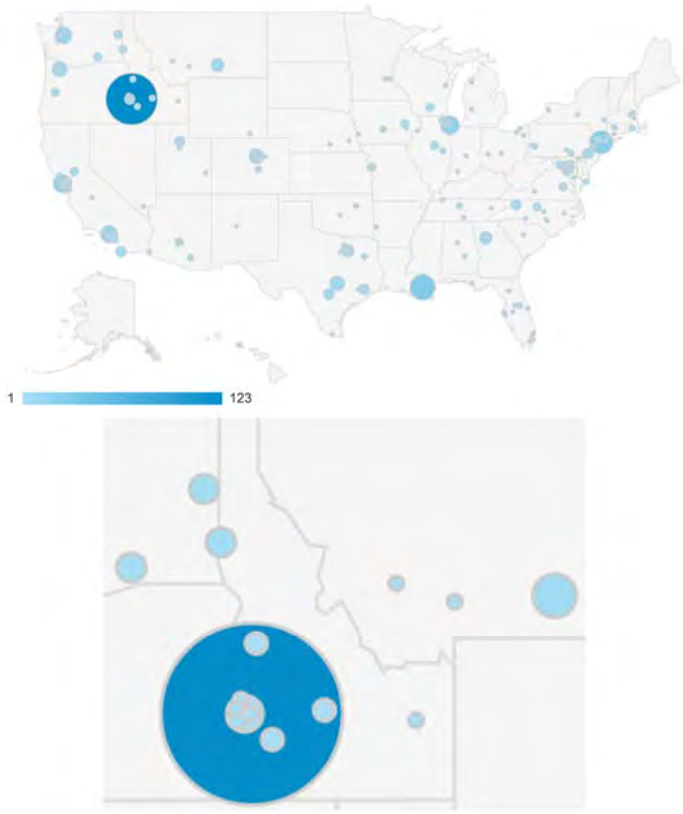

Figure 9: Bubble Maps of All Sessions and Idaho in 2015

5. Other Activities and Suggestions for Future Improvements

2015 was a successful year for the BSUG task with 6 sessions completed and 331 total attendees – 86 in-person and 230 online. Feedback was provided by attendees via the evaluation forms, 89 of which were collected. These offered a starting point for determining future improvements to the program.

A brainstorming session was held at the end of the last BSUG – Session 6. At the last session, discussion centered on potential topics for 2016 as well as general improvements and

ways to increase attendance. Below is a short summary of main takeaways from the last session as well as the feedback from the evaluations.

Potential Topics:

- Google Flux
- Business Case for Modeling
- Modeling at different levels of accuracy/time
- CBECS LBL Calibrated Models
- Meteorologist

Potential Speakers:

- TBD

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

2015 Task 5: Building Efficiency Verifications

Summary of Projects

Idaho Power Company External Year-End Report

December 31, 2015

Prepared for:

Idaho Power Company

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Report Number: 1501_005-01

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2. 2015 Building Efficiency Verification Projects 1

3. 2015 Photo Controls Review Projects 4

Acronyms and Abbreviations

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

1. Introduction

The University of Idaho Integrated Design Lab (UI-IDL) had two roles for the Building Efficiency Verification (BEV) task in 2015. 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. 2015 Building Efficiency Verification Projects

The UI-IDL completed nine Building Efficiency Verification projects in 2015. A detailed report for each project was submitted to IPC, including claimed and actual installation for each specific incentive the project applied for. With the exception of one, all of the projects reviewed in 2015 were completed under the new Building Efficiency's 2014 Program which supersedes the Building Efficiency's 2011 Program. The specific incentives for these programs are outlined in Table 1 and Table 2. Notable changes included the addition of the 'Appliances with Electric Water Heating' and 'Refrigeration' sections in the 2014 program.

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

Table 2: 2014 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	A1	Efficient Air-Cooled AC & Heat Pump Units
	A2	Efficient VRF Units
	A3	Efficient Chillers
	A4	Air Side Economizers
	A5	Direct Evaporative Coolers
Building Shell	B1	Reflective Roof Treatment
Controls	C1	Energy Management Control System
	C2	Guest Room Energy Management System
	C3	HVAC Variable Speed Drives
Appliances with Electric Water Heating	W1	Efficient Laundry Machines
	D1	EnergyStar Undercounter Dishwashers
	D2	EnergyStar Commercial Dishwasher
Refrigeration	R1	Head Pressure Controls
	R2	Floating Suction Controls
	R3	Efficient Condensers

To streamline writing project reports, a detailed template in spreadsheet form was created. This template is quick and easy to use allowing the user to focus on reviewing project specifics and less time on formatting and organizing. It contains all necessary incentive

information neatly organized in one file. Figure 1 shows how the each incentive is separated into tabs, which are color coded for working efficiently. Figure 2 is representative of the look and feel of each tab, containing information about the project and requirements for the incentive.

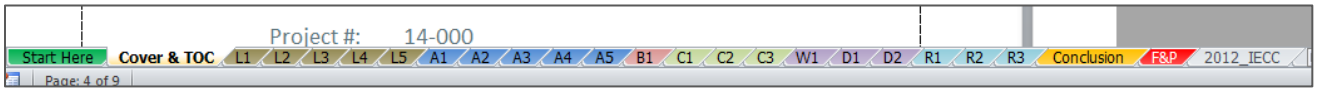
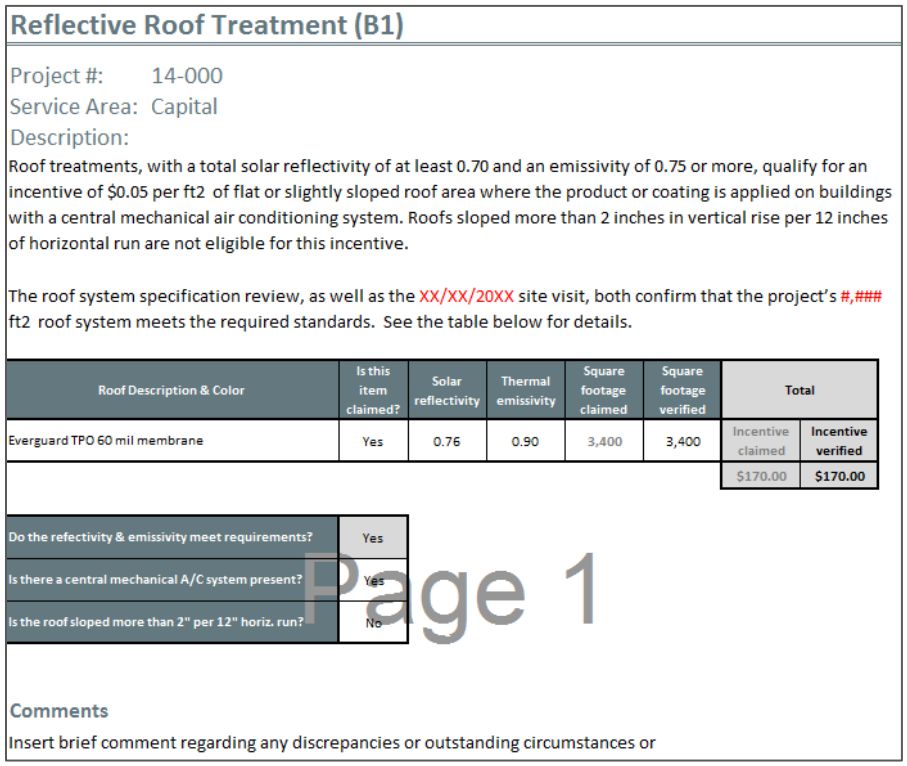


Figure 1: Workflow from left to right with tabs for each incentive.



Reflective Roof Treatment (B1)

Project #: 14-000
Service Area: Capital
Description:

Roof treatments, with a total solar reflectivity of at least 0.70 and an emissivity of 0.75 or more, qualify for an incentive of $0.05 per ft2 of flat or slightly sloped roof area where the product or coating is applied on buildings with a central mechanical air conditioning system. Roofs sloped more than 2 inches in vertical rise per 12 inches of horizontal run are not eligible for this incentive.

The roof system specification review, as well as the XX/XX/20XX site visit, both confirm that the project's #,### ft2 roof system meets the required standards. See the table below for details.

Roof Description & Color	Is this item claimed?	Solar reflectivity	Thermal emissivity	Square footage claimed	Square footage verified	Total	
Everguard TPO 60 mil membrane	Yes	0.76	0.90	3,400	3,400	Incentive claimed	Incentive verified
						$170.00	$170.00

Do the refectivity & emissivity meet requirements?	Yes
Is there a central mechanical A/C system present?	Yes
Is the roof sloped more than 2" per 12" horiz. run?	No

Page 1

Comments

Insert brief comment regarding any discrepancies or outstanding circumstances or

Figure 2: Example of the general layout of each tab with project and incentive information.

Table 3 below summarizes the nine projects and respective qualified incentive measures which were verified by UI-IDL. The new template was used to write the reports for these projects.

Table 3: BEV Project Summary

IPC Project #	Facility Description	Location	Incentive Measures	UI-IDL Site-Visit Date
11-348	Industrial - Large	Pocatello, ID	C3	10/29/15
14-006	Retail (non-food)	Twin Falls, ID	A1, C1	10/28/15
14-033	Warehouse	American Falls, ID	L1	10/28/15
14-071	Paramedic Station	Boise, ID	L1, L2, L4, L5, A1, A5, B1, W1, D1	12/08/15
14-101	Hospital	Boise, ID	L1, L4, R3	06/19/15
14-105	Retail (non-food)	Nampa, ID	A1	06/12/15
14-140	Industrial - Large	Jerome, ID	L2	10/28/15
14-143	College/University	Nampa, ID	L1, L3, L4, L5, A1, A4, B1, C1,	12/09/15
14-149	Retail (non-food)	Twin Falls, ID	L1, L4, A1,	10/28/15

3. 2015 Photo Controls Review Projects

In 2015, the UI-IDL received at least seven 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 for four of these projects including a warehouse, a government facility, an office, and a manufacturing facility. Reviews were not completed for two government facilities and a university library since the requested necessary documentation was not received by the UI-IDL. Follow-up may be necessary on these projects.

2015 TASK 6: TOOL LOAN LIBRARY

SUMMARY OF EFFORT AND OUTCOMES

IDAHO POWER COMPANY EXTERNAL YEAR-END REPORT

December 31, 2015

Prepared for:

Idaho Power Company

Authors:

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Brad Acker

Report Number: 1501_006-05

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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
TPS	Third Party Service
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 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). In the past years interest in these type of libraries have grown. Recently the Smart Building Center which is a project of the Northwest Energy Efficiency Council has started a lending library and they list other lending libraries spanning a large range of tools, not just energy efficiency focused tools.

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 includes basic background information, 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.

2. Marketing

Marketing for the TLL was done at various UI-IDL and IPC activities throughout 2015, as well as on the UI-IDL website. Five hundred tool loan flyers were printed in March of 2015 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 and lectures to professional organizations such as American Institute of Architects (AIA), International Building Operators Association (IBOA), City of Boise, Building Owners and Operators Association (BOMA), and the Idaho Green Energy and Building Conference.

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 2015, the TLL home page had 3,160 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	

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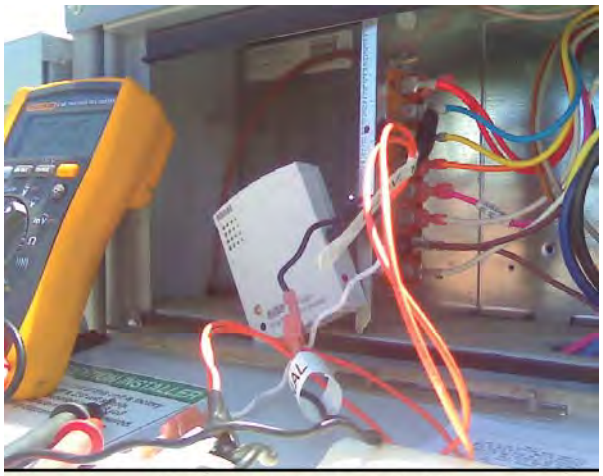

TOOL LOAN PROCESS

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.

Figure 1: TLL Flyer Front

Figure 2: TLL Flyer Back

3. Tool Calibration Plan

Equipment items included in the tool loan program are typically distributed with a manufacturer guaranteed calibration period between 1 and 3 years. The vast majority of items are beyond this guaranteed period of calibration. While many items may stay within calibration for years after the guaranteed calibration period ends, re-verifying the item is within calibration and re-calibrating if necessary is highly recommended. Calibration services are available on most tools either from the manufacturer or various certified calibration services nationwide. While IDL suggests that every tool should be kept 100% up-to-date on calibration, several inquiries and other research suggests doing so is not without substantial cost.

Appendix C is a summary of calibration status of the tool loan inventory and includes the current best estimate for implementation of an annual calibration program. Calibration is a time intensive endeavor, generally requiring expensive test equipment. Ideally recalibration would be performed by the original manufacturer factory and would typically be outsourced to a third party service (TPS) when factory recalibration services are unavailable.

In lieu of certified calibration, there are occasionally measures that IDL can take to ensure items are within calibration tolerances. There are a few equipment types, for instance, that can be cross-checked against other equipment for accuracy. Some sensors, like carbon dioxide or volatile organic compound sensors, test procedures may be followed to ensure accuracy of readings.

4. 2015 Summary Of Loans

In 2015, loan requests totaled 56 with 42 loans completed. The second and third quarters equally had the highest volume of loans at 14 total. Loans were made to 24 different locations and 31 unique users. A wide range of tools was borrowed, as listed in Figure 7. 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 2015.

Table 1: Project and Loan Summary

	Request Date	Location		Project	Type of Loan	# of Tools Loaned
1	1/7/2015	Boise	ID	OB1	Audit	7
2	1/14/2015	Twin Falls	ID	OB2	Audit	12
3	1/20/2015	Garden City	ID	OB3	Audit	3
4	2/2/2015	Boise	ID	MB1	Audit	12
5	2/3/2015	Shoshone	ID	Dairy1	Verification of EEMs	15
6	2/12/2015	Nampa	ID	Home1	Audit	1
7	2/13/2015	Boise	ID	WWTP1	Verification of EEMs	1
8	2/17/2015	Burley	ID	Plant1	Verification of EEMs	1
9	2/17/2015	Twin Falls	ID	OB4	Verification of EEMs	7
10	2/18/2015	Boise	ID	School	Audit	1
11	3/11/2015	Boise	ID	Plant2	Audit	7
12	3/30/2015	Boise	ID	Plant3	Audit	1
13	4/6/2015	Weiser	ID	WWTP2	Verification of EEMs	1
14	4/10/2015	Nampa	ID	OB5	Audit	11
15	4/16/2015	Boise	ID	WWTP3	Audit	15
16	4/17/2015	Boise	ID	Plant4	Audit	1

17	4/27/2015	Shoshone	ID	Dairy2	Verification of EEMs	37
18	5/5/2015	Boise	ID	Theater	Verification of EEMs	4
19	5/5/2015	Meridian	ID	OB6	Audit	7
20	5/6/2015	Caldwell	ID	Plant5	Verification of EEMs	1
21	5/6/2015	Burley	ID	Plant6	Verification of EEMs	9
22	5/8/2015	Sun Valley	ID	Lodge1	Verification of EEMs	1
23	5/11/2015	Boise	ID	OB7	Audit	2
24	5/21/2015	Boise	ID	Bank1	Verification of EEMs	5
25	5/29/2015	Boise	ID	Home2	Audit	1
26	6/30/2015	Boise	ID	Lab1	Audit	23
27	7/6/2015	Ontario	OR	Medical1	Verification of EEMs	4
28	7/15/2015	Boise	ID	OB8	Verification of EEMs	5
29	7/21/2015	Boise	ID	Dairy3	Audit	1
30	7/23/2015	Burley	ID	Plant7	Verification of EEMs	16
31	7/24/2015	Spokane	WA	Audit1	Audit	7
32	7/30/2015	Boise	ID	Freezers	Audit	1
33	7/31/2015	Nampa	ID	OB9	Audit	21
34	8/4/2015	Twin Falls	ID	OB10	Audit	5
35	8/5/2015	Nampa	ID	OB11	Audit	7
36	8/6/2015	Boise	ID	OB12	Audit	3
37	8/19/2015	Boise	ID	Plant9	Audit	38
38	9/4/2015	Twin Falls	ID	OB12	Verification of EEMs	9
39	9/19/2015	Boise	ID	Library1	Verification of EEMs	1
40	9/23/2015	Meridian	ID	OB13	Audit	2
41	10/1/2015	Boise	ID	Home3	Audit	6
42	10/2/2015	Boise	ID	OB14	Verification of EEMs	2
43	10/12/2015	Boise	ID	OB15	Verification of EEMs	1
44	10/14/2015	Nampa	ID	OB16	Audit	1
45	11/6/2015	Boise	ID	OB17	Verification of EEMs	1
46	11/16/2015	Boise	ID	WWTP4	Audit	8
47	11/18/2015	Pocatello	ID	OB18	Audit	7

48	11/18/2015	Boise	ID	OB19	Audit	1
49	11/20/2015	Burley	ID	Plant10	Audit	3
50	11/25/2015	Boise	ID	Plant11	Audit	1
51	12/7/2015	Kuna	ID	OB20	Audit	1
52	12/15/2015	Durkee	OR	Plant12	Verification of EEMs	1
53	12/17/2015	Meridian	ID	Plant13	Audit	1
54	12/18/2015	Twin Falls	ID	Plant14	Verification of EEMs	1
55	12/22/2015	Boise	ID	OB21	Verification of EEMs	1
56	12/29/2015	Boise	ID	Home4	Verification of EEMs	1

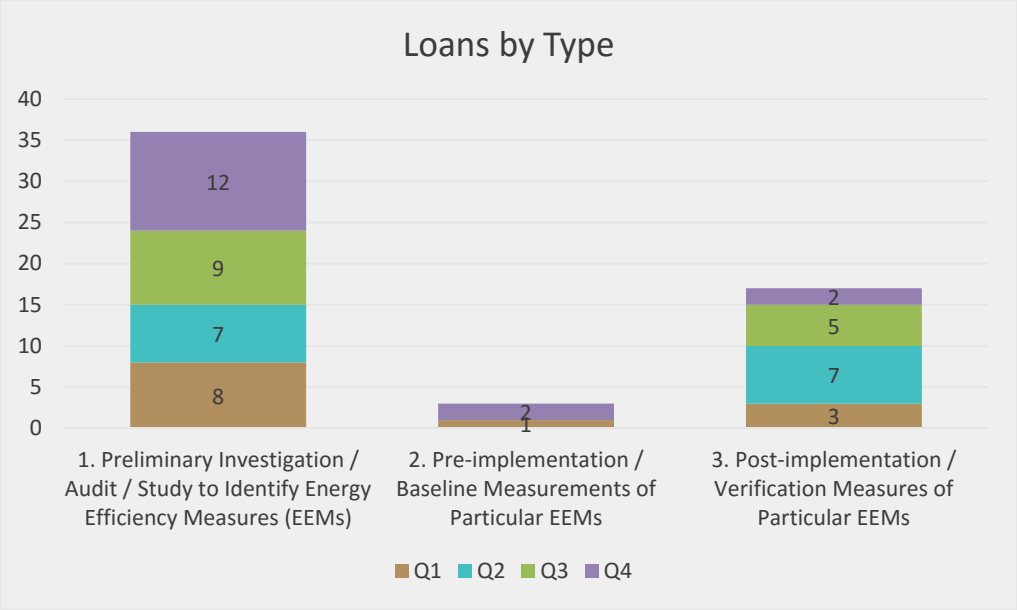

Figure 3: Loans by Type

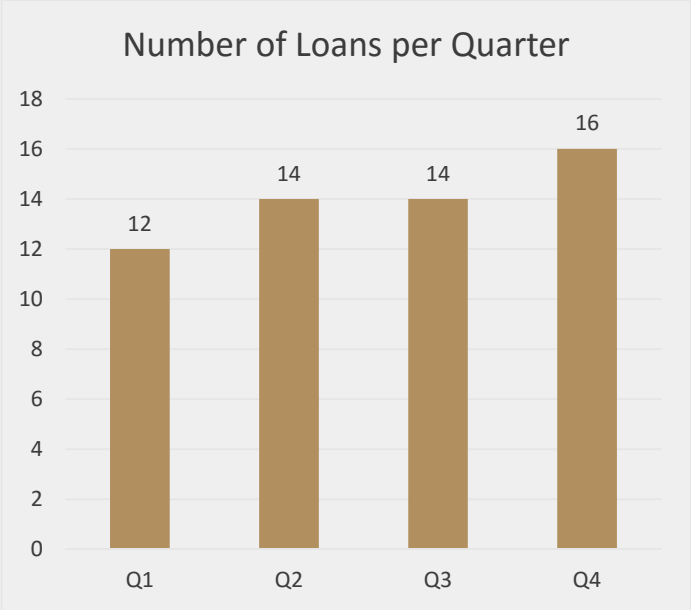

Figure 4: Number of Loans per Quarter

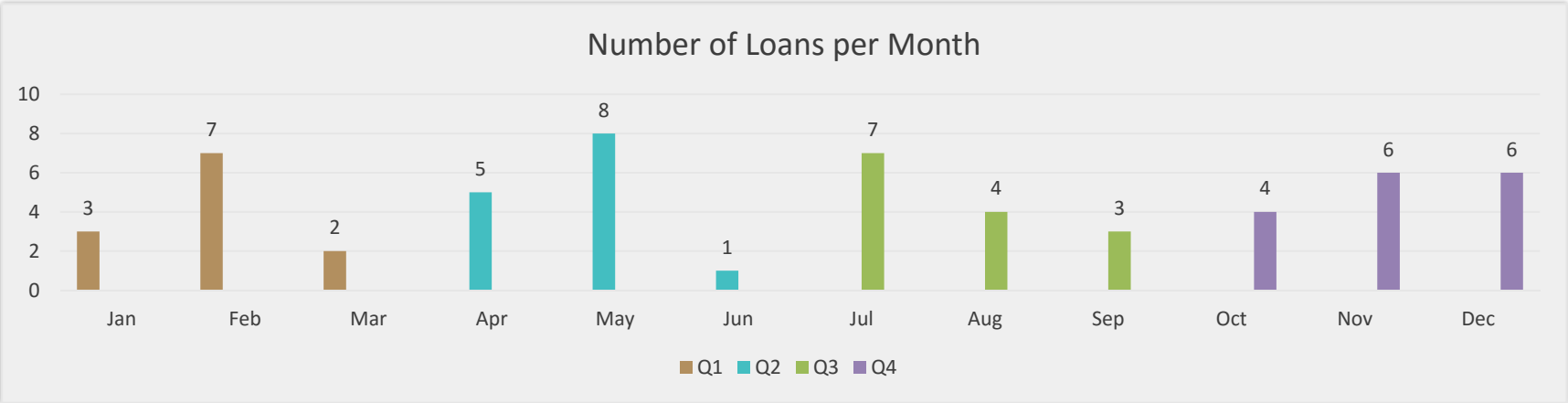

Figure 5: Number of Loans per Month

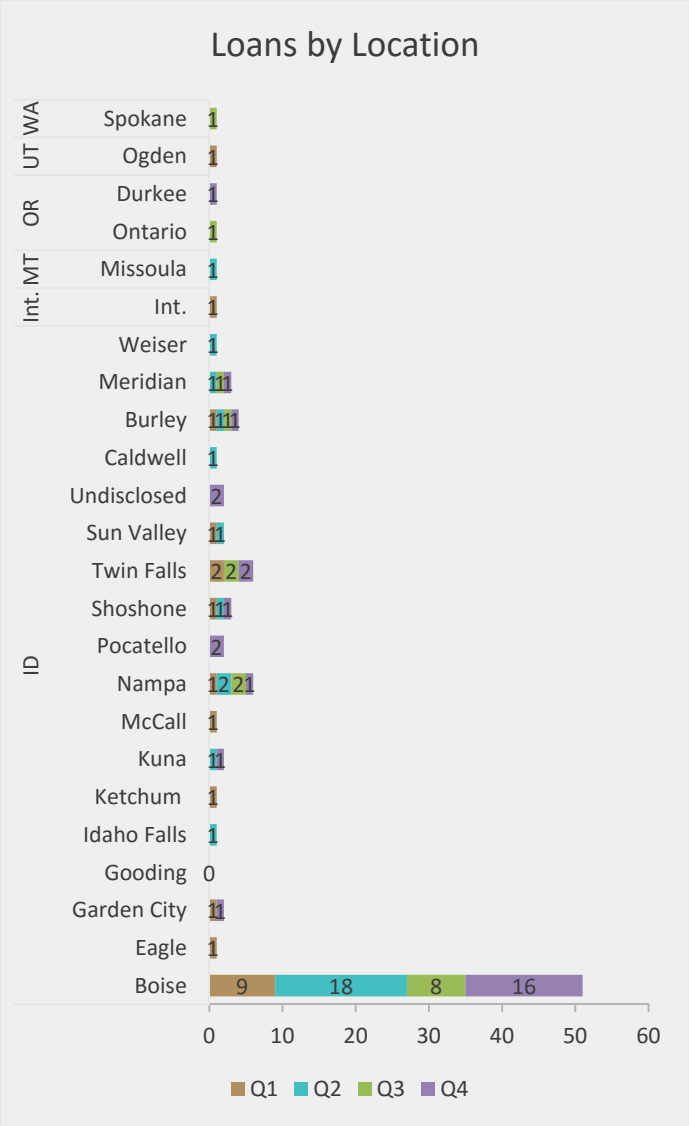

Figure 6: Number of Loans by Location

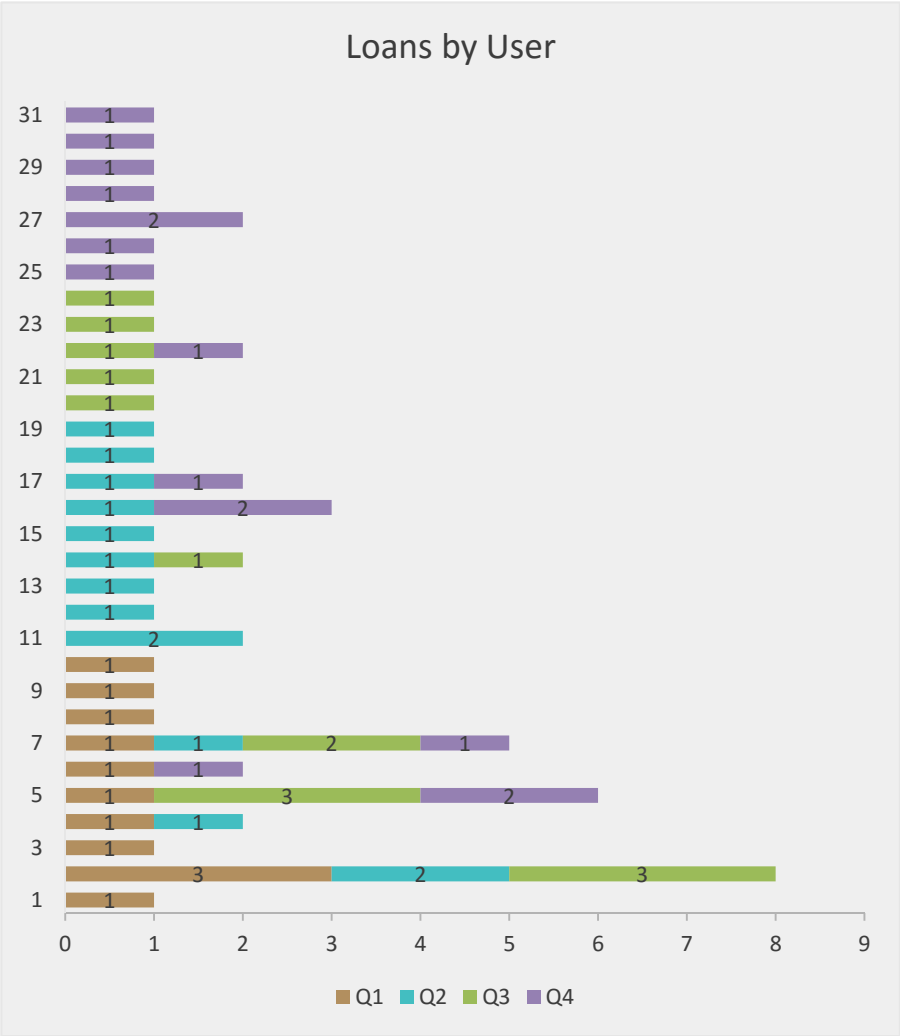

Figure 7: Number of Loans by User

TOTAL TOOLS LOANED: **317**	Q1=**66**	Q2=**111**	Q3=**113**	Q4= **27**

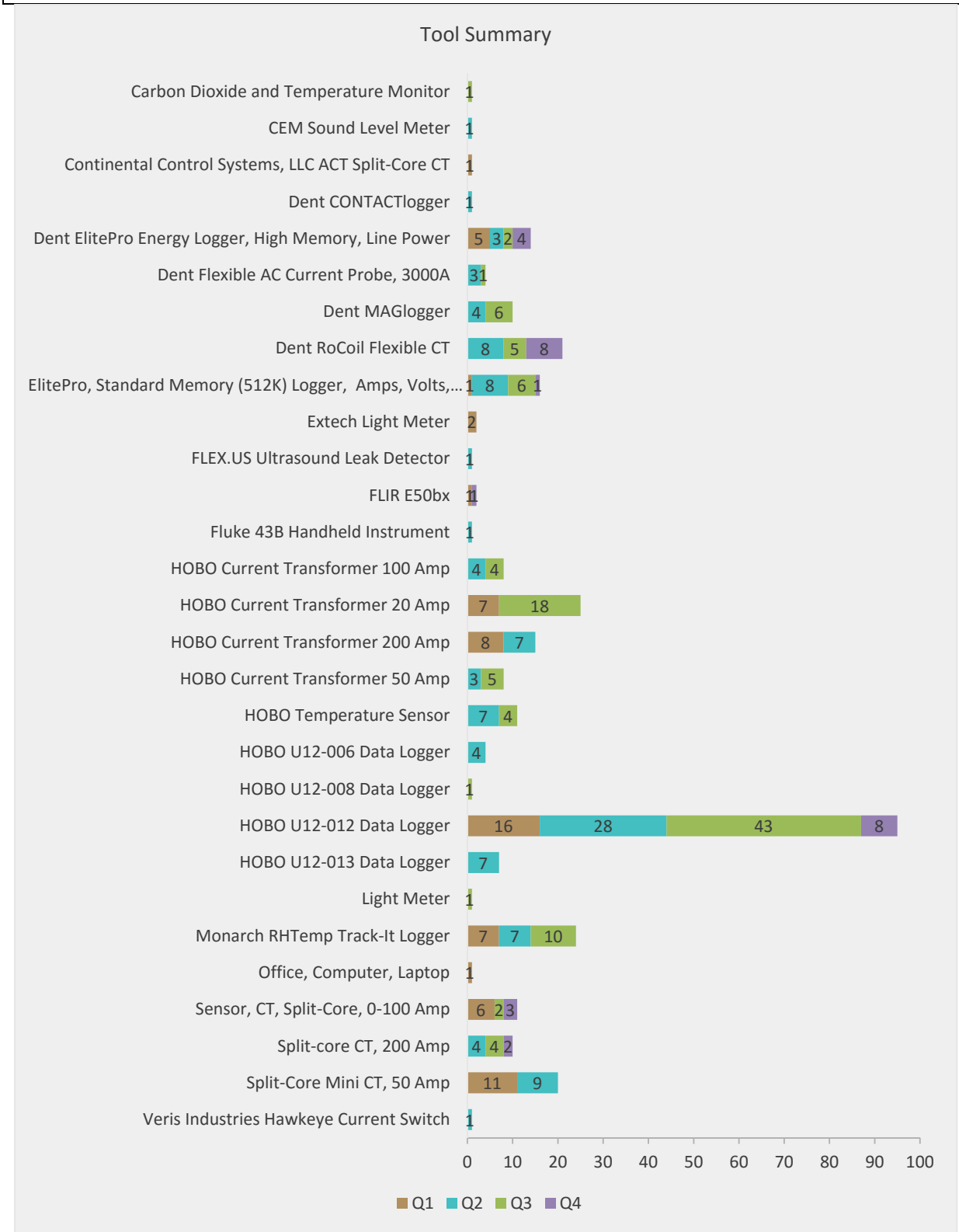

Figure 7: Summary of Tools Loaned

2015 Task 7: Building Metrics Labeling

Summary of Effort and Outcomes

Idaho Power Company Year-End Report

December 31, 2015

Prepared for:

Idaho Power Company

Author:

Elizabeth Cooper

Report Number: 1501_007-01

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2.2 Marketing 1

3. Next Steps 4

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. In 2014 the work focused on providing user support, general promotion of the tool, and tool debugging with minor functionality improvements. The task in 2015 was a continuation of the support, promotion and improvement of the tool that was started in 2014.

2. Summary of Progress

2.1 Website Progress

The majority of the progress made in 2015 was maintenance and support. No additional content was added.

2.2 Marketing

The UI-IDL created a two-sided flyer that was used as the main method for marketing in 2014, this flyer was distributed widely in 2015 and a second printing was made. The flyer can be seen in the figures on the following pages.

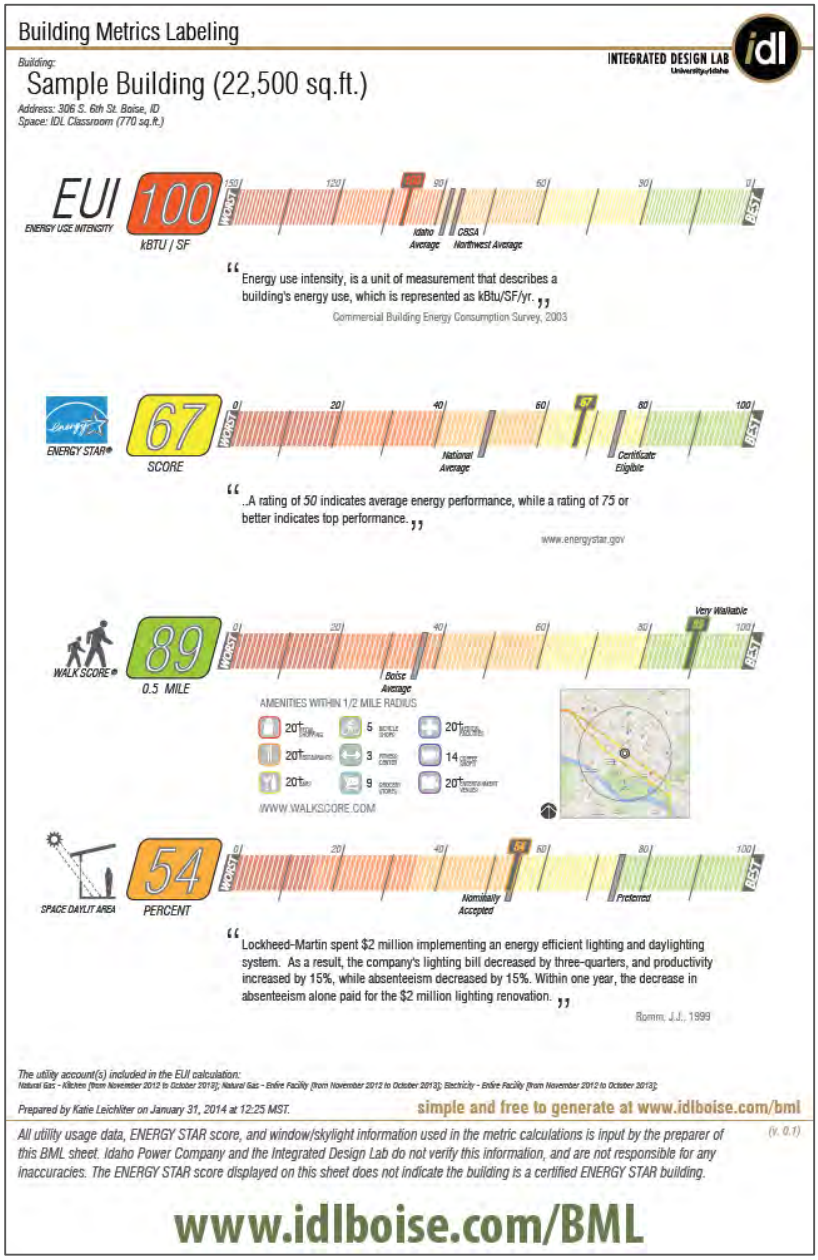

Figure 1: BML Flyer Front

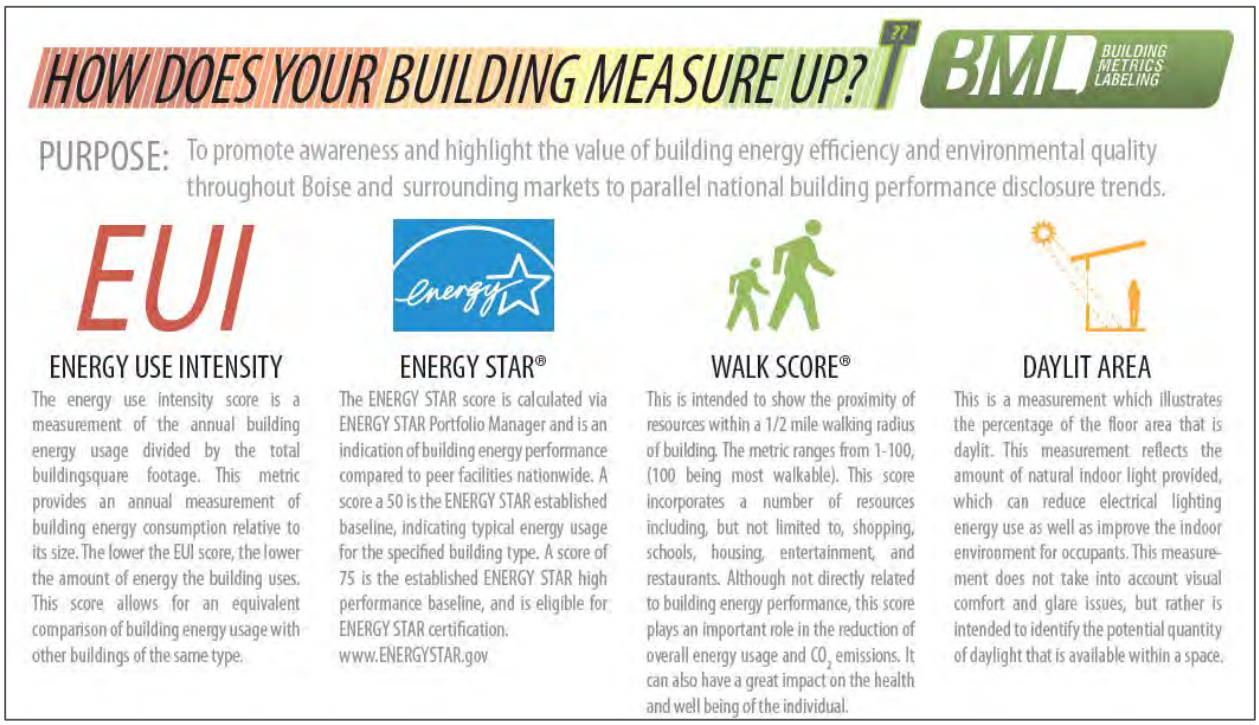

Figure 2: BML Flyer Back

During 2015, the tool was discussed and/or the flyer was distributed at multiple events, listed below.

- 20 Lunch and Learn presentations to architecture or engineering firms and organizations (flyers and a slide before the main presentation)
- Multiple Central Addition planning meetings hosted by USGBC
- Six BSUG events
- A presentation to the Mayor and Planning and Development Services staff at the City of Boise (4/30/2015)
- A presentation to a, including brokers and managers
- A presentation to a commercial real estate management company, and building owners, followed up with a link emailed to property managers
- Multiple emails to commercial real estate management companies, including a link, marketing materials and follow up

One-on-one marketing and support was also available when requested. In 2015, three requests for information were made; two by local development firms, one by an architectural firm.

3. Next Steps

In preparation for additional marketing and community engagement in 2016, the UI-IDL will create a list of potential users and stakeholders. The list will be comprised of approximately 12 individuals, organizations, and businesses to contact in 2016.

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
- Add automation from ENERGYSTAR® if capabilities become available
- Develop a new database of comparable building utility usages
- Solicit targeted users for feedback
- Coordinate with IPC and IMG to pursue increased automation of data flow directly to building owners and real estate agents

INTEGRATED DESIGN LAB
University of Idaho

2015 Task #9: Technical Assistance

Whole House Fan

Report

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Idaho Power Company

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Acronyms and Abbreviations

A/C	Air Conditioning
CFM	Cubic Feet per Minute
CLG	Cooling
COP	Coefficient of Performance
DX	Direct Expansion
ECM	Energy Conservation Measure
EER	Energy-Efficiency Ratio
IAT	Outdoor Air Temperature
IDL	Integrated Design Lab
IPC	Idaho Power Company
M&V	Measurement and Verification
OAT	Outdoor Air Temperature
SHR	Sensible Heat Ratio
TMY	Typical Meteorological Year
UI	University of Idaho
WHF	Whole House Fan

1. INTRODUCTION

The following work has been conducted to analyze the energy impact of installing a whole house fan (WHF) for cooling. EnergyPlus simulation software was utilized to perform this analysis. A WHF is one which draws air from the home's living space and exhausts it typically to an attic space. These fans are best installed in a central location in the home so as to provide air exchange from all locations of the home. Exterior windows need to be open by the residents to draw in cool air to provide the home with cooling. These fans are typically not automated to turn on or off on their own due to the fact that windows need to be manually opened. Running a WHF with windows closed can have the potential to cause safety concerns with back drafting combustion appliances. Due to the behavioral control aspect of this technology a wide range of energy models were developed to inform program designers. The energy model is based on a DOE prototype model house (US DOE, 2013). Two baseline single-family home models were developed, one single story and one two-story home comprised of typical 2006 residential construction (Mendon & Taylor, 2014) with a single zone and net conditioned area of 1,200 ft^2 and 2,400 ft^2 respectively. Further details on equipment sizing and model characteristics are provided below. Using typical meteorological year (TMY) weather for Boise Idaho for an annual simulation, all models were simulated without a WHF and with a WHF having two fan design flow rates. This report summarizes the major differences in cooling energy between the different conditions.

2. METHODS

In this study, energy use was determined for a baseline model compared to the same home with a WHF. In this study home size and WHF flow rate parameters were variable so a range of energy use characters could be explored. This resulted in a total of six EnergyPlus models: two baseline models and two WHF models for each baseline. Three of the models were 1200 ft^2, one story homes, which will be referred to as One Story, and three of the models were 2400 ft^2, two story homes, which will be referred to as Two Story. Each model contains one conditioned zone (main living area), an attic, and a basement as well as similar physical construction and geometry, a typical DX split fan coil cooling system, and no heating system. Two flow rates of the WHF were investigated for each home size, 1 CFM/ ft^2 and 2 CFM/ ft^2. The home cooling set point was set to 78°F. If the outdoor air was at 78°F or below, the WHF was allowed to cool the space. If the outdoor air was above 78°F the DX cooling cooled the space. Space sub-cooling effects or impacts of thermal storage were not investigated. Table 1 gives an overview of the simulations discussed in the following sections.

Table 1 Summary of six models showing house type, size, and WHF model flow rates

Model	House Type	House Size	WHF Flow Rate
Baseline	One Story	1200 ft^2	N/A
Baseline	Two Story	2400 ft^2	N/A
WHF	One Story	1200 ft^2	1 CFM/ ft^2
WHF	One Story	1200 ft^2	2 CFM/ ft^2
WHF	Two Story	2400 ft^2	1 CFM/ ft^2
WHF	Two Story	2400 ft^2	2 CFM/ ft^2

Baseline Models

The EnergyPlus models developed are based on the DOE prototype model homes (US DOE, 2013). Two baseline models were developed, one single story and one two story. Figure 1 shows the SketchUp physical model illustrating the features of each house, mainly the shape and levels. Table 2 describes the model's physical characteristics as well as the cooling equipment input parameters.

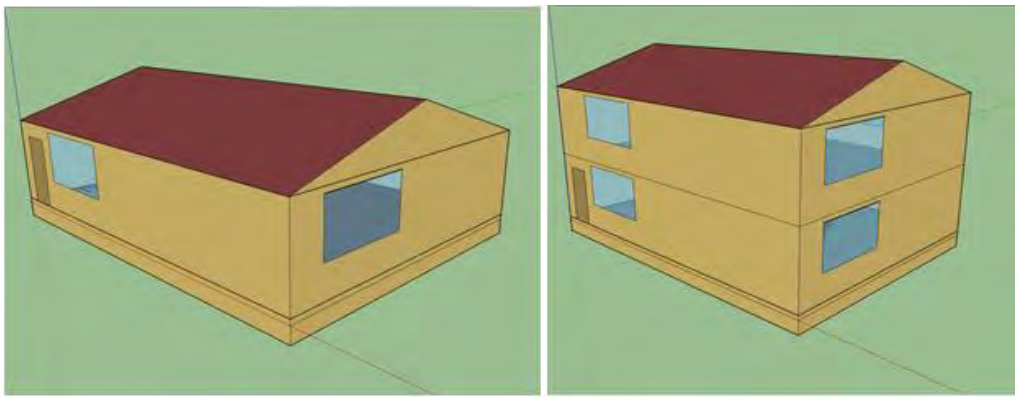

Figure 1 (left) One Story: 1200 ft^2 with 2.5 tons of cooling (right) Two Story: 2400 ft^2 with 3.5 tons of cooling

Table 2 Summary of input parameters

	One Story	Two Story
Net Conditioned Area	1200 ft^2	2400 ft^2
Levels	1	2
Gross Rated Total Cooling Capacity Tons [kW]	2.5 [8.792]	3.5 [12.309]
Gross Rated SHR (Sensible Heat Ratio)	0.72	0.71
COP	3.37	3.37
Rated Air Flow CFM [m^3/s]	1,000 [0.472]	1,375 [0.649]
Model CLG Coil Electric kW Usage	1.814	3.081
Model Blower Electric kW Usage	0.348	0.581

The house cooling set point was established at 78°F. For the cooling system, equipment characteristics typical air conditioner specifications were estimated from Rheem's Classic Series

of Air Conditioners (A/Cs) using an A/C system with 2.5 nominal tons and 3.5 nominal tons of cooling capacity for One Story and Two Story, respectively. Inputs needed by EnergyPlus are 'Gross Rated Total Cooling Capacity' in wattage, 'Gross Rated Sensible Heat Ratio' (SHR), 'COP', and 'Rated Air Flow Rate' (Table 2).

Similarly rated products were referenced in order to guide model cooling equipment inputs, which are recorded in Table 3. Based on referenced system performance parameters, equivalent EnergyPlus cooling equipment values were estimated. Model inputs for the total cooling capacity were idealized, directly converting nominal tonnages to wattages. This resulted in an EnergyPlus input wattage increase of 4.7% for One Story and 1.2% for Two Story from product specifications due to products being slightly smaller than nominal sizes. The gross rated SHR was calculated from product specifications as follows:

$$SHR = \frac{Sensible\ Cooling\ Capacity}{Total\ Cooling\ Capacity}$$

The COP was calculated using the Energy-Efficiency Ratio (EER) and conversion factor:

$$COP = \frac{EER}{3.41214}$$

Indoor rated air flow rate was simply converted from CFM to m^3/s, because EnergyPlus requires metric units for its calculations.

Table 3 Rheem Classic Series A/C specifications

	2.5 Ton (One Story)	3.5 Ton (Two Story)
Total Capacity Btuh [kW]	28,600 [8.4]	41,500 [12.2]
Net Sensible Btuh [kW]	20,500 [6.0]	29,300 [8.6]
EER	11.5	11.5
Indoor CFM	1000	1375

WHF Models

The EnergyPlus run model schedule was modified to use a WHF for ventilated cooling in lieu of typical DX cooling. Fan control conditions were established based on inside and outside temperature conditions. Table 4 shows the thermostat set point and WHF control structure. The WHF operates when the IAT is between the minimum and maximum points and when the outdoor air temperature (OAT) is between its minimum and maximum points. This allows for a control to use outdoor air when it is cool and use DX when it is warm outdoors. If the IAT and OAT are outside of their operational ranges and the zone temperature is above the thermostat set point, then the WHF shuts OFF, and cooling is performed by the DX coil and blower fan.

A heating system is not active. During early energy model testing the heating system interfered with WHF operation, ultimately increasing cooling energy use. Before deactivation, the house heating set point was established at 72°F. During heating mode, the WHF introduced 50°F outside air into the zone. This caused the heating system to constantly and unnecessarily counteract the WHF, and vice versa. In a realistic situation, however, household operators would not run the WHF while requiring heat. Thus, for modeling simplicity, it was removed.

Table 4 Cooling system control structure

Cooling Setpoints	
Thermostat Set Point (DX)	Cooling: 78°F
	No Heating
WHF IAT	Max: 122°F
	Min: 78°F
WHF OAT (Supply)	Max: 78°F
	Min: 32°F

For each house size, design air flow rates of 1 CFM/ ft^2 and 2 CFM/ ft^2 were used, resulting in a 1200 CFM fan at 279 W, 2400 CFM fan at 400 W, and 4800CFM fan at 600 W. The WHF power usages were approximated from available commercial products. The less efficient belt-driven fans allowed for the desired CFM/ ft^2. Although direct drive fans are able to move more air with less electrical power input, the selection was strictly limited to belt-driven fans for fair model comparison. Other fan details are shown in Table 5.

Table 5 WHF types and characteristics

Design Flow Rate	**1200 CFM (0.566 m^3/s)**	**2400 CFM (1.133 m^3/s)**	**4800 CFM (2.265 m^3/s)**
Power	279 W	400 W	600 W
Pressure Rise	320 Pa (1.28" H_2O)	230 Pa (0.92" H_2O)	172 Pa (0.69" H_2O)
Total Efficiency	65%	65%	65%

Table 6 shows the power usages for each model and their cooling components. Values for component power are EnergyPlus outputs. Based on model input parameters and equipment characteristics, calculations were made by EnergyPlus resulting in shown power usages. The compressor power and blower fan power were dependent on cooling equipment properties (Table 2) and house load (return temperature from the house). With regards to the WHF, WHF power consumptions were calculated based on simple fan characteristic relationships shown in Table 5. Note that the compressor power (DX CLG kW) is slightly different in the baseline and the WHF models. This difference is due to the difference in the return air temperatures. Cooler return temperatures are experienced for a time around switching from WHF to DX cooling, resulting in lower DX circuit power use.

Table 6 Summary of model power usages

	One Story		Two Story	
	BASELINE MODELS			
DX CLG kW	1.814		3.081	
Blower Fan kW	0.348		0.581	
	WHF MODELS			
WHF CFM	**1200**	**2400**	**2400**	**4800**
DX CLG kW	1.933	1.793	3.137	3.133
Blower Fan kW	0.432	0.401	0.689	0.689
WHF kW	0.279	0.400	0.400	0.600

3. RESULTS

Model parameters were broken down into each cooling system component: the WHF; the blower/central supply fan; and the DX cooling coil, which includes the compressor and outside condenser fan. Typical annual hours of operation and total annual energy consumption of both the individual cooling components and the whole cooling system energy characteristics were tabulated for performance comparison and model behavior. The impact a WHF has on the usage, operational runtime and energy, of the A/C system is also summarized. Overall results in the tables are highlighted in yellow.

To gain an understanding of any potential offset a WHF could ideally provide the runtime and energy usage below 78°F OAT was quantified. Based on the control sequence, the WHF would operate when outside conditions were met, OAT below 78°F, and the house called for cooling, IAT above 78°F. Capturing this window of time, and equivalent energy use, in the baseline models provided insight to the achievable offsets in the WHF models (Table 7). The A/C system usage (runtime and energy) offset is about 30% for One Story and Two Story.

Table 7 Potential A/C system offsets from baseline models based on control conditions

	One Story	Two Story
Total Hours of Cooling	1126	1125
Cooling Hours Below 78°F OAT	343	342
% of Cooling Hours Below 78°F OAT	30.4%	30.4%
Total Cooling Energy [kWh]	1156	1956
Potential Cooling kWh Savings Below 78°F OAT	346	584
Potential % Energy Offset	29.9%	29.9%

After implementing the WHF into the baseline model and analyzing the hours of operation (Table 8), operating runtime for the A/C system (DX CLG Coil + Blower Fan) decreased by an average of 39% over all cases from the baselines to the WHF models (Table 9). This is about 9% higher than the percentage of cooling hours below 78°F OAT as realized in the baseline potential. Because WHF operation is also dependent on the IAT, it is reasonable to conclude that the WHF actually shifted the A/C system cooling load. The amount of time the system called for cooling increased during times of the day where the OAT was below 78°F, decreasing DX cooling runtime by about 9% more than the maximum potential and utilizing the WHF. Comparing the WHF types, 1 CFM/ft^2 and 2CFM/ ft^2, the 2 CFM/ft^2 fan operated an average of 150 hours less than the 1 CFM/ft^2 case. To more clearly visualize the differences, Figure 2 shows a histogram comparing annual average hours of WHF use for the 1 CFM/ft^2 and 2CFM/ ft^2 cases for each outside air temperature bin.

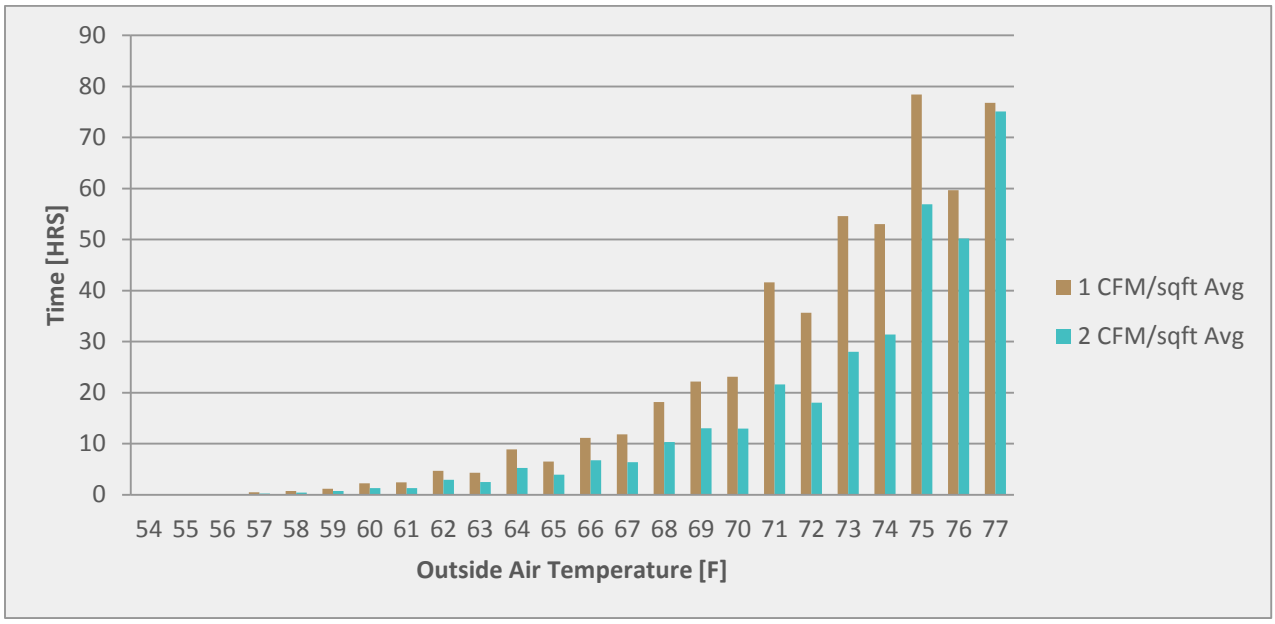

Figure 2 WHF average usages for each fan type

Considering the performance of the WHF types based on overall energy consumption (referring to Table 8 and Table 9) shows that 150 hours correlates to a 4 kWh difference, or a total WHF energy consumption difference that is slightly greater than 1%. A 39% average reduction of A/C runtime and WHF implementation resulted in an overall average of 21% energy decrease across all cases. This percent energy difference from baseline can be graphically seen in Figure 3. The data below the 78°F mark of the distribution highlights the energy offset the WHF achieves. Also note for the WHF models that there is a slight decrease in total cooling energy use above 81°F, which illustrates the 9% A/C system cooling load reduction previously discussed.

Table 8 Model outputs for each house

	House Size	1200 sqft		2400 sqft	
BASELINE	DX CLG Coil Use [hrs]	528		528	
	Blower Use [hrs]	598		597	
	TOT CLG HRS (DX+Blower)	1126		1125	
	DX CLG Coil [kWh]	950		1611	
	Blower [kWh]	206		344	
	TOT CLG Energy (DX+Blower) [kWh]	1156		1956	
	TOT CLG EUI [kWh/sqft]	0.97		0.82	
	WHF Type	**1200 CFM**	**2400 CFM**	**2400 CFM**	**4800 CFM**
WHF	DX CLG Coil Use [hrs]	339	362	355	353
	Blower Use [hrs]	319	341	335	332
	WHF Use [hrs]	543	368	493	330
	DX + Blower HRS	658	703	690	685
	TOT CLG HRS (DX+Blower+WHF)	1201	1071	1183	1015
	DX CLG Coil [kWh]	647	641	1101	1093
	Blower [kWh]	136	135	228	226
	WHF [kWh]	152	147	197	198
	DX + Blower Energy [kWh]	783	776	1329	1319
	TOT CLG Energy (DX + Blower + WHF) [kWh]	934	924	1526	1517
	TOT CLG EUI [kWh/sqft]	0.79	0.78	0.64	0.64

Table 9 Cooling energy savings and differences from baseline due to WHF

	1200 sqft		2400 sqft	
WHF Type	**1200 CFM**	**2400 CFM**	**2400 CFM**	**4800 CFM**
DX CLG Coil Savings [kWh]	303	309	510	518
Blower Savings [kWh]	70	71	116	118
DX CLG Coil + Blower Savings [kWh]	373	380	627	637
TOT CLG Energy (DX + Blower + WHF) Savings [kWh]	222	232	430	439
DX (Compressor) Energy Diff. (%)	32%	33%	32%	32%
Blower Energy Diff. (%)	34%	34%	34%	34%
DX CLG Coil + Blower Energy Diff. (%)	32%	33%	32%	33%
% Energy Diff. from Baseline	19%	20%	22%	22%
A/C System Usage Decrease (%)	42%	38%	39%	39%

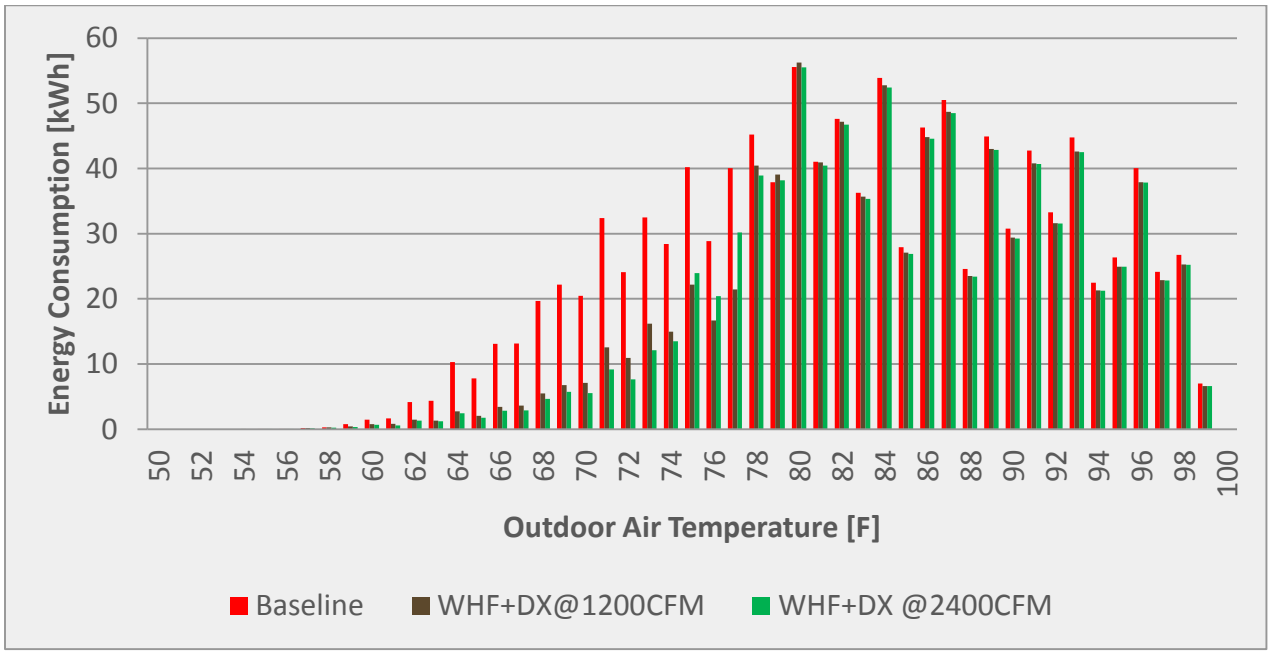

Figure 3 Total cooling energy comparisons for the One Story

4. DISCUSSION

The applications of WHF can result in significant energy savings. Existing DX system size and the type / size of WHF installed will all play into the ultimate savings achieved. Simulation results highlight the importance of monitoring and reducing WHF hours of operation along with the importance of installing the most efficient fan possible, which is typically a direct drive ECM model. In addition the simulations show sensitivity of saving as it relates to CFM/ft^2 of home size, again relating back to the power use of the fan. These findings would best be informed by field studies or data. Such data was not reviewed as part of this study.

1. WORKS CITED

Mendon, V., & Taylor, T. (2014). Development of Residential Prototype Building Models and Analysis System for Large-Scale Energy Efficiency Studies Using EnergyPlus. *Building Simulation Conference* (pp. 457-464). Atlanta: ASHRAE/IBPSA-USA.

US DOE. (2013, July 11). *Residential Prototype Building Models.* Retrieved from Building Energy Codes Program: https://www.energycodes.gov/development/residential/iecc_models

2015 TASK 10: IBOA/IFMA SUPPORT

SUMMARY OF EFFORT AND OUTCOMES

IDAHO POWER COMPANY EXTERNAL YEAR-END REPORT

December 31, 2015

Prepared for:

Idaho Power Company

Author:

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Report Number: 1501_001-10

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Acronyms and Abbreviations

ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
bEQ	(ASHRAE) Building Energy Quotient
BOC	Building Operator Certification
BOMA	Building Owners and Operators Association
EUI	Energy Use Intensity
IBOA	Intermountain Building Operators Association
IDL	Integrated Design Lab
IFMA	International Facility Management Association
IMG	Intermountain Gas
IPC	Idaho Power Company
UI	University of Idaho
USGBC	United States Green Building Council

1. Introduction

The objective of this task was to help the local IBOA organization succeed and meet their goals and to address the barriers as identified by NEEA and stakeholders. These barriers included; Lack of time to attend, Lack of funds/willingness to pay, Lack of awareness, Lack of a compelling business case, Lack of product performance (ANSI certification)

Additionally, UI-IDL worked with the leadership of IBOA to determine their needs. The barriers and needs on which the UI-IDL can have an impact are; the lack of product awareness and the development of a compelling business case for employee certification and involvement in IBOA. This was accomplished by conducting research, providing technical support and education, attending coordination meetings, and helping with marketing efforts.

2. Summary of Work

The two major deliverables for this task were to 1) provide technical support and education, and 2) Support IBOA initiatives. The following is a summary of the activities associated with these deliverable:

Provide technical support and education:

- Develop “Tech Talks” via lunch and learn format for BOC certification continuing education
    - One “Tech Talk” was developed and delivered to IBOA in January. Another talk was scheduled for IFMA on Economic Analyses of Efficiency Projects, but was canceled due to low enrollment.

Support IBOA initiatives:

- Attended quarterly conference calls:
    - January 21st- updates on BOC 1003, 1004, 212
    - May 21st- (Topic unknown)
    - November 5th- IEQ, Water Efficiency and O&M for Sustainable Buildings
- Attended coordination meetings on specific knowledge sectors:
    - May 7 – HVAC Systems – standard and high performance
    - June 4 – Lighting Equipment & Controls
    - Sept 3 – Building Controls and Preventive Maintenance
    - Oct 1 – Electrical Systems, Diagnostics and Motors
    - Nov 5 – IEQ, Water Efficiency and O&M for Sustainable Buildings
    - Dec 3 – Building Scoping and Building Commissioning
- Attended IFMA Northern Rockies Annual conference
- Marketed the BOC certification at trainings/classes in Salt Lake City, Boise, Missoula, and Idaho Falls.

Research/Surveys

RESEARCH/SURVEYS

Table 3. 2015 Research/Surveys

Report Title	Program or Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
2015 Idaho Power Easy Upgrades Program Customer Survey	Commercial/Industrial	Idaho Power	Idaho Power	Survey
Easy Savings Program Survey Response Summary 2014–2015	Residential	Idaho Power	Idaho Power	Survey
Energy Efficiency Campaign Awareness Survey	Residential	Idaho Power	Idaho Power	Survey
Flex Peak 2015 Survey Results	Commercial/Industrial	Idaho Power	Idaho Power	Survey
Holiday Lighting	Residential	Idaho Power	Idaho Power	Survey
Home Energy Audit Program Survey	Residential	Idaho Power	Idaho Power	Survey
Idaho Power–CAPAI Survey Report 2016	Residential	Idaho Power	Idaho Power	Survey
Idaho Power Energy Wise® Program Summary Report	Residential	Research Action Programs	Idaho Power	Program Summary
Idaho Power Shade Tree Survey	Residential	Idaho Power	Idaho Power	Survey
Idaho Power Weatherization Assistance Program	Residential	Idaho Power	Idaho Power	Survey
Idaho Power Weatherization Programs	Residential	Idaho Power	Idaho Power	Survey
Residential Laundry Habits Survey	Residential	Idaho Power	Idaho Power	Survey
Technical Reference Manual 1.7	Commercial/Industrial	ADM	Idaho Power	Research

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2015 Idaho Power Easy Upgrades Program Customer Survey

Monday, February 01, 2016

92

Total Responses

Complete Responses: 88

Q1: How did you first learn about the Easy Upgrades program?

Answered: 92 Skipped: 0

Answer Choices	Responses	
Contractor, supplier or vendor	45.65%	42
Idaho Power employee	17.39%	16
Business associate	11.96%	11
Mailing from Idaho Power	7.61%	7
Participation in other Idaho Power energy efficiency program	11.96%	11
Easy Upgrades program web site	3.26%	3
Other (please specify)	2.17%	2
Total		**92**

Q2: Overall how satisfied are you with the Easy Upgrades program?

Answered: 92 Skipped: 0

Answer Choices	Responses	
Very satisfied	88.04%	81
Somewhat satisfied	9.78%	9
Somewhat dissatisfied	0.00%	0
Very dissatisfied	2.17%	2
Total		92

Q4: For each of the following statements indicate the level to which you agree or disagree.

Answered: 90 Skipped: 2

	Strongly Disagree 1	2	3	4	Strongly Agree 5	N/A	Total
Idaho Power staff was helpful.	**1.11%** 1	**0.00%** 0	**3.33%** 3	**12.22%** 11	**70.00%** 63	**13.33%** 12	90
Idaho Power incentive application forms were easy to follow.	**1.11%** 1	**0.00%** 0	**11.11%** 10	**24.44%** 22	**52.22%** 47	**11.11%** 10	90
Your application was processed within the time frame you expected.	**1.14%** 1	**2.27%** 2	**3.41%** 3	**26.14%** 23	**61.36%** 54	**5.68%** 5	88

Q5: Please rate the contractor you used for your Easy Upgrades project in the following areas:

Answered: 89 Skipped: 3

	Poor 1	2	3	4	Excellent 5	N/A	Total
Quality of work	1.14% 1	1.14% 1	3.41% 3	17.05% 15	71.59% 63	5.68% 5	88
Professionalism	3.41% 3	0.00% 0	2.27% 2	19.32% 17	69.32% 61	5.68% 5	88
Knowledge of energy efficiency aspects of new equipment	1.15% 1	0.00% 0	5.75% 5	17.24% 15	68.97% 60	6.90% 6	87
Knowledge of Easy Upgrades program	1.15% 1	0.00% 0	5.75% 5	19.54% 17	65.52% 57	8.05% 7	87

Q6: How likely would you be to recommend this contractor to a business associate?

Answered: 87 Skipped: 5

Answer Choices	Responses	
Definitely would	82.76%	72
Probably would	13.79%	12
Probably would not	1.15%	1
Definitely would not	2.30%	2
Total		**87**

Q8: Please indicate which of the following types of equipment you received an Easy Upgrades incentive for. (Check all that apply)

Answered: 88 Skipped: 4

Answer Choices	Responses	
Lighting/Controls	94.32%	83
HVAC/Controls	7.95%	7
Building Shell	1.14%	1
Food Services Equipment	0.00%	0
Variable Frequency Drive (VFD)	2.27%	2
Other	4.55%	4
Total Respondents: 88		

Q10: How would you like to receive energy efficiency information from Idaho Power in the future?(Check all that apply)

Answered: 84 Skipped: 8

Answer Choices	Responses	
Mailing from Idaho Power	38.10%	32
Idaho Power employee	10.71%	9
Email from Idaho Power	59.52%	50
Idaho Power website	15.48%	13
Other (please specify)	2.38%	2
Total Respondents: 84		

Q11: Would you like an Idaho Power program representative to follow up with you on any questions you have regarding the program?

Answered: 88 Skipped: 4

Answer Choices	Responses	
Yes	6.82%	6
No	93.18%	82
Total		88

EASY SAVINGS PROGRAM

Survey Response Summary 9/30/15

Question	% Answered	Qty Answered	Total Answered
1. How much would you like to save?			120
$30 - Install just the LED light bulb, High-efficiency showerhead, Kitchen faucet aerator, and the Limelight nightlight	18%	21	
$85 - Install the above items and unplug an unused refrigerator or freezer	9%	11	
$240 - Complete the Easy Savings® Quick Start Guide Steps	73%	88	
	100%	120	
2. Have you (or will you) lower your heat during the day?			124
Yes, I lowered it	77%	96	
Yes, I plan to lower it	17%	21	
No	6%	7	
	100%	124	
3. Have you (or will you) lower your heat at night?			122
Yes, I lowered it	77%	94	
Yes, I plan to lower it	18%	22	
No	5%	6	
	100%	122	
4. Did you place the Thermostat Temperature Sticker near your thermostat?			122
Yes, I placed it	61%	75	
Yes, I plan to place it	20%	25	
No	18%	22	
	100%	122	

5. Did you (or will you) install the 11.5-watt Light Emitting Diode (LED)? 123

Yes, I installed it	78%	96
Yes, I plan to install it	20%	24
No	2%	3
	100%	123

6. Did you (or will you) install the Limelight Night Light? 124

Yes, I installed it	81%	101
Yes, I plan to install it	15%	19
No	3%	4
	100%	124

7. Did you (or will you) install the Draft Stoppers? 124

Yes, I installed them	52%	64
Yes, I plan to install them	39%	48
No	10%	12
	100%	124

8. Did you place the Turn Off Light Sticker near a light switch that was often left on? 123

Yes, I placed it	55%	68
Yes, I plan to place it	19%	23
No	26%	32
	100%	123

9. Do you turn off lights in empty rooms more often now? 124

Yes	95%	118
No	5%	6
	100%	124

10. Did you install the High-Efficiency Showerhead? 118

Yes, I installed it	70%	83
No, it does not fit pipes	19%	22
No	11%	13
	100%	118

11. Did you install the Kitchen Faucet Aerator? 121

Yes, I installed it	69%	84
No, it does not fit pipes	18%	22
No	12%	15
	100%	121

12. Do you use cold water when you do your laundry? 123

Yes, always	60%	74
Yes, sometimes	34%	42
Never	6%	7
	100%	123

13. Did you place the Wash in Cold Water Magnet on your washing machine? 120

Yes, I placed it	51%	61
Yes, I plan to place it	13%	16
Don't have a washing machine	19%	23
No	17%	20
		120

14. Did you use the Digital Thermometer to check the temperature of your water? 117

Yes	68%	79
No	32%	38
	100%	117

15. Did you (or will you) change the temperature setting of your water heater? 120

Yes, I raised it (warmer)	14%	17
Yes, I lowered (cooler)	39%	47
No	47%	56
	100%	120

16. Did you check the temperature of your refrigerator(s) and freezer(s)? 119

Yes	87%	103
No	13%	16
	100%	119

17. Did you (or will you) adjust the temperature of your refrigerator(s) and freezer(s)? 118

Yes, turned up (warmer)	34%	40
Yes, turned down (colder)	28%	33
No	38%	45
	100%	118

18. Did you unplug your old or unused refrigerator(s) and freezer(s)? 123

Yes, I unplugged 1 unit	8%	10
Yes, I plan to unplug 1 unit	1%	1
Yes, I unplugged 2 units	3%	4
Yes, I plan to unplug 2 units	0%	0
Not applicable	82%	101
No	6%	7
	100%	123

19. Did you recycle your old or unused refrigerator(s) and freezer(s)? 124

Yes, I recycled 1 unit	9%	11
Yes, I plan to recycle 1 unit	2%	3
Yes, I recycled 2 units	3%	4
Yes, I plan to recycle 2 units	1%	1
Not applicable	80%	99
No	5%	6
	101%	124

20. Did you place the Turn Your Computer Off Sticker on your computer? 122

Yes	38%	40
I don't have a computer	62%	65
No	14%	17
		122

21. How many items from your Easy Savings® Kit did you install? 120

All	46%	55
4	18%	22
3	23%	28
2	8%	10
1	3%	3
None	2%	2
	100%	120

22. How effective was the Easy Savings® Quick Start Guide in helping you become more energy efficient? 121

Very effective	69%	84
Somewhat effective	26%	31
Not effective at all	2%	2
Didn't use	3%	4
	100%	121

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? 123

I learned a lot	78%	96
I learned a little	20%	24
Nothing	2%	3
	100%	123

empowered community

Energy Efficiency Campaign Awareness Survey Results

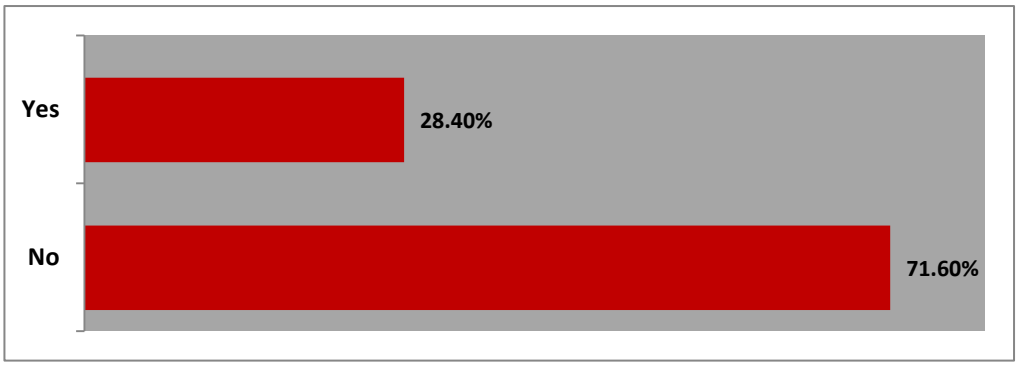
June 2015

Do you remember seeing or hearing one or more of these ads?

QUESTION TOTAL: 588

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Yes	167	28.40%
O2	No	421	71.60%

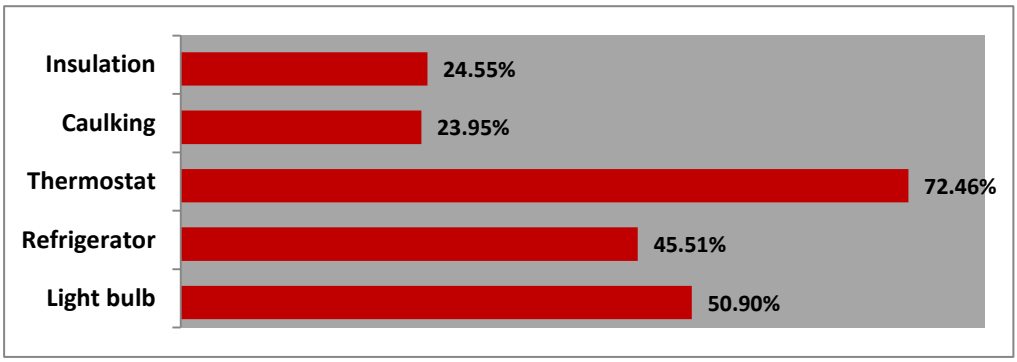


Which of the following ad themes do you recall seeing or hearing before taking this survey?

(asked only of respondents who said they recalled seeing the ads before taking the survey)

QUESTION TOTAL: 167
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Insulation	41	24.55%
O2	Caulking	40	23.95%
O3	Thermostat	121	72.46%
O4	Refrigerator	76	45.51%
O5	Light bulb	85	50.90%

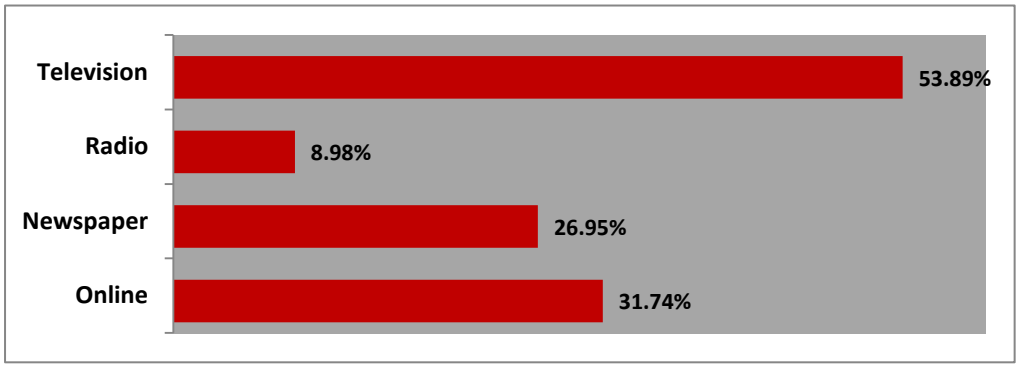


Where did you see, or hear, the ad(s) before taking this survey?

(asked only of respondents who said they recalled seeing the ads before taking the survey)

QUESTION TOTAL: 167
NO RESPONSE: 0

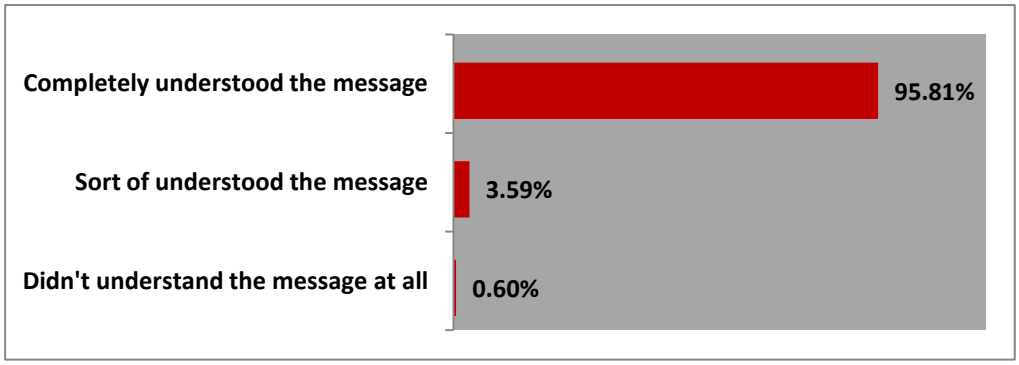
	OPTIONS	TOTAL	PERCENT
O1	Television	90	53.89%
O2	Radio	15	8.98%
O3	Newspaper	45	26.95%
O4	Online	53	31.74%



How well would you say you understood the message in the ad(s)?
(asked only of respondents who said they recalled seeing the ads before taking the survey)

QUESTION TOTAL: 167
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Completely understood the message	160	95.81%
O2	Sort of understood the message	6	3.59%
O3	Didn't understand the message at all	1	0.60%

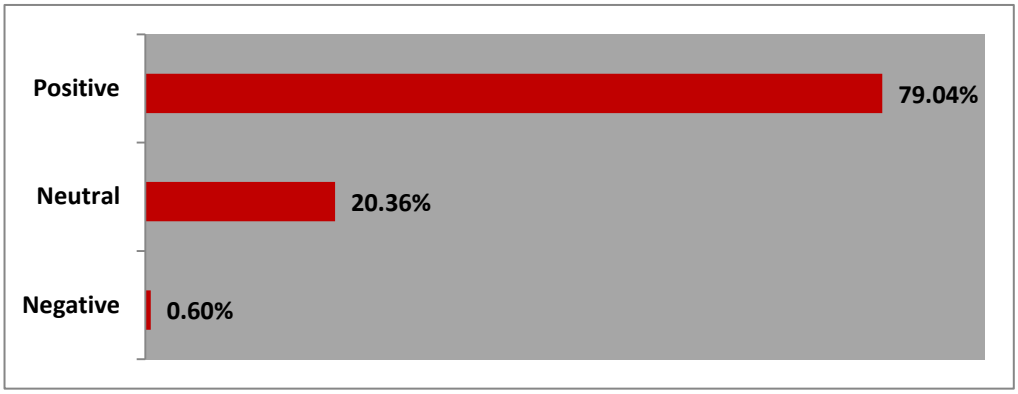


Overall, how did you feel about the ad(s) you saw or heard?

(asked only of respondents who said they recalled seeing the ads before taking the survey)

QUESTION TOTAL: 167
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Positive	132	79.04%
O2	Neutral	34	20.36%
O3	Negative	1	0.60%



What is it about the ad(s) that gave you a positive feeling?

(asked only of respondents who said they had a positive feeling about the ad(s) they recalled)

QUESTION TOTAL:	132
NO RESPONSE:	0

Verbatim Responses	Total
Simple and to the point	2
$$ Savings per degree warmer thermostat	1
a company that was showing us how to save energy in a laid back easy format	1
A demonstration on saving energy that is easy to do.	1
A good plan for most people.	1
Always want to save on energy bills.	1
An understanding of what you could save by cleaning the coils on your fridge	1
Because the message resonates with me.	1
clear consise to the point colorful eye catching	1
Common sense reminder	1
Conservation is necessary and helps keep the cost of power down	1
Conservation of energy and saving money.	1
contemporary use of illustration style, simplr/direct message	1
cut my bills, conserver	1
Cute drawings	1
cutting power usage	1
Direct to the point. Self explanatory.	1
don't know	1
Easy concept to get & easy to do!	1
Easy fix.	1
Easy to read and the graphics correlated with the written message.	1
easy to understand and direct and to the point	1
Encouraged me to follow some if not all of the suggestions.	1
encouragement of saving energy and money	1
Encouragement to save energy, and help cut costs.	1
Encourages all to try to save.	1
Engaging art work and provides a quick, easy, and free way to act.	1
felt it was a good reminder on ways to reduce energy costs.	1
felt like I understood the message and appreciated it too.	1

For the most part, all the messages are showing that anyone can save money, and help the environment.	1
Fun graphics, simple concise message heading even if I didn't read the entire text.	1
glad you are informing the public so energy can be saved for the good of the environment	1
good advise	1
Good color	1
Good for saving energy and good for environment.	1
good information	1
Good information. Easy to understand. Like the nostalgic look of the photos.	1
good message	1
good program	1
got the point across easily. liked the color	1
got your attention	1
Great reminders to pay attention.	1
Happy to see public education about energy conservation.	1
I enjoyed the color and whimsical design.	1
I feel the best way to answer this is by saying I am conscience of saving power , but to so many they just don't care.	1
I felt like I really wanted to participate in being better about conserving energy in my home. I was inspired to buy light bulbs.	1
I felt reassured that I am doing what I can to save energy	1
I keep my thermostat at that already so it reenforced behavior	1
I like any ads that promote environmental conservation.	1
I like our area doing more to stay green & make less pollution.	1
I never really thought of a second appliance in the house. It made me stop and think, do I really need that appliance.	1
I understood the old refrigerator in the garage ad, but I don't think many people received that message.	1
I was glad that Idaho Power is trying to help their customers conserve energy and save money.	1
I was wondering what would be the best temp for my ac and this is how i found out.	1
Idaho Power is working to help consumers be smarter with power use and savings	1
in that they reflect my knowledge and belief.	1
IPC is interested in me	1
It was a positive message that was implemented a wonderful way.	1
It came from Idaho Power	1
It helped me to remember to adjust my thermostat, not only in cool weather, but also in hot weather	1
It is every ones job to save energy.	1

It is something I do already it made me feel like I was making a difference.	1
It made sense.	1
It reminded me to check for leaks around windows and doors.	1
It reminds folks that wasting energy carries a price	1
It suggests a practical step to save energy and money.	1
It was a great reminder on where to set the thermostat, I like to get reminders like that	1
It was to improve my home...	1
it will help people understand how to save power	1
It's nice that Idaho Power wants to help it's customers use electricity more efficiently	1
Letting people know that something so simple can make a difference.	1
Light bulbs fascinate me. So I paid more attention to it.	1
Like the colors, thought it was funny when somebody said goodbye to their old refrigerator like it was an old friend.	1
Made me realize how I can save energy.	1
made you think and question if you have done any of those	1
maybe lowering power bill with temp contol	1
NIce to built on what I already know and to affirm that it actually does make a difference. LIghtbulbs are expensive.	1
picture	1
Positive message, easy to accomplish energy savings, message	1
POssible and easy to save energy and save money.	1
Promotion of conservation and mindfulness. Information to educate self and others	1
Recycling message, money for old fridge	1
Reminder that LED bulbs are out there	1
Saving energy is always a good idea!	1
Saving energy is always good!	1
Saving energy is important.	1
saving money	1
savings	1
Seeing the number on the thermostat gave me the idea to do better and set mine at 76....	1
short, to the point, upbeat, easy to understand the message	1
Showed a simple idea to save energy. Simple to do and relatively pain free.	1
Showed the ease of how to achieve the best for your home.	1
Showed ways to conserve energy	1
Simple	1
simple and easy to understand not too preachy	1
Simple and straight forward. Nice art work.	1
Simple easy to understand message	1

Simple graphics with a simple message, but one that we all need to be reminded of every once in a while!	1
Simple message with eye-catching simple graphics	1
Simple positive message.	1
Simple to understand and clear.	1
simple, less "noise", direct	1
That following the ads would help to keep my electric bill down.	1
that saving energy doesn't have to be expensive or complicated. that anyone can do their part	1
The ad gave specific information on how to conserve energy	1
The ads confirmed for us that we're doing our best to save energy.	1
The ads were very specific and easy to follow. I got the point. Not	1
The amount you can save by adjusting your thermostat.	1
the graphics were nice and casual, and I felt like we are not the only home with insulation issues, everyone can do well to look at	1
The message to conserve energy.	1
The rhyme in the refrigerator ad is catchy and memorable; the lightbulb ad just makes sense, changing to energy efficient bulbs.	1
the theme	1
The theme and the message.	1
There is something to be done that will save energy and have little effect on me	1
There were small things that I could do.	1
They all let me know what I can do to help.	1
They are all simple things that can be done to save energy!	1
They are clear, concise and get the point across! Plus the ideas they are conveying are easy to achieve.	1
They are simple ways to save energy	1
They make sense and are easy to understand.	1
they tell it like it is == good thinking	1
They were easy to understand with a clear message.	1
They were helpful and clear.	1
They were written in language that was understandable to most people.	1
Turning down your thermostat saves energy.	1
Very much needed with our energy situation.	1
We all can save energy	1
We are comfortable at 78-80 degrees. We're saving money!!	1
We need to conserve energy, it is good to get a reminder.	1
Would reduce expenses	1
You would have to know me to completely understand, but I could almost write a book in answer to this question. But simply put, in	1

What is it about the ad(s) that gave you a negative feeling?

(asked only of respondents who said they had a negative feeling about the ad(s) they recalled)

QUESTION TOTAL:	1
NO RESPONSE:	0

Verbatim Responses	Total
I can't stand to be too warm, especially when I'm pregnant. So the idea of turning up the thermostat to save money will not work for	1

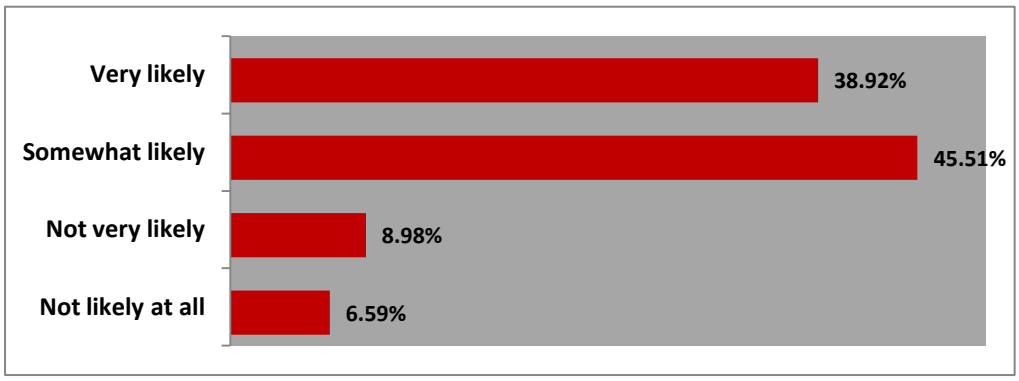
How likely are you to make any energy saving changes in your home after seeing or hearing these ads?

(asked only of respondents who said they recalled seeing the ads before taking the survey)

QUESTION TOTAL: 167

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Very likely	65	38.92%
O2	Somewhat likely	76	45.51%
O3	Not very likely	15	8.98%
O4	Not likely at all	11	6.59%



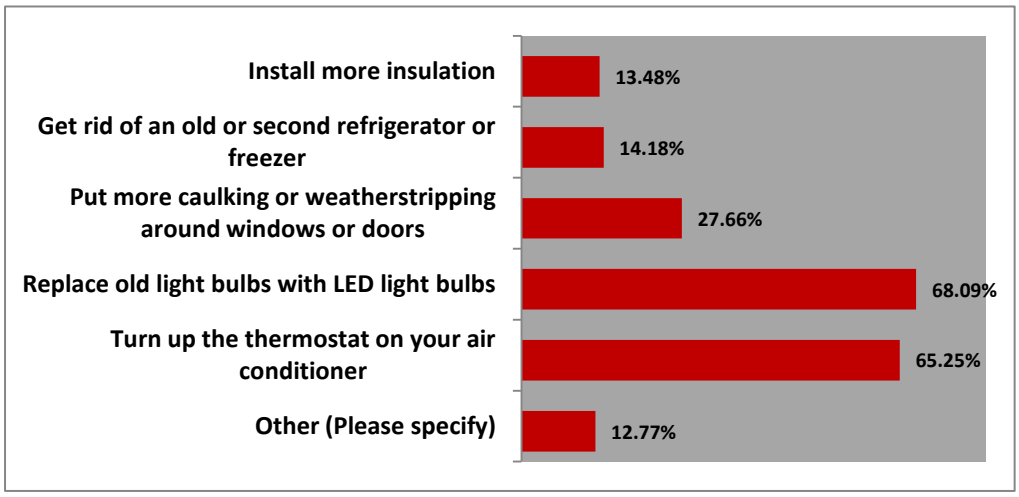
What energy saving changes are you most likely to make after seeing or hearing these ads?

(asked only of respondents who said they recalled seeing the ads before taking the survey)

QUESTION TOTAL: 141

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Install more insulation	19	13.48%
O2	Get rid of an old or second refrigerator or freezer	20	14.18%
O3	Put more caulking or weatherstripping around	39	27.66%
O4	Replace old light bulbs with LED light bulbs	96	68.09%
O5	Turn up the thermostat on your air conditioner	92	65.25%
O6	Other (Please specify)	18	12.77%

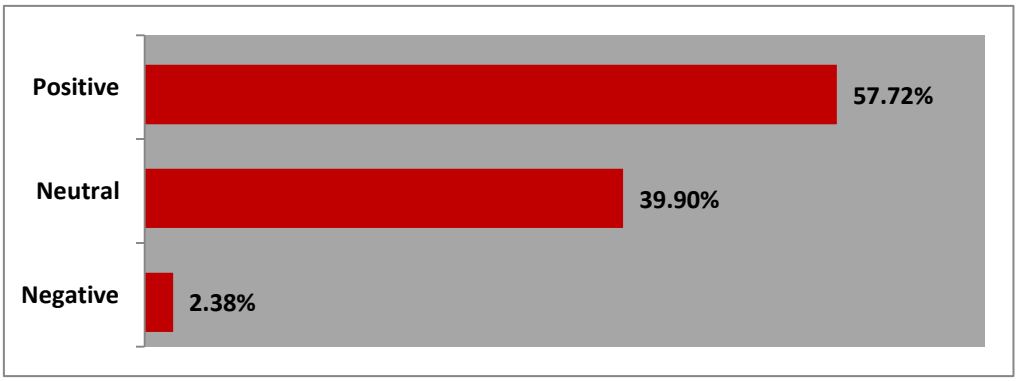


Now that you have seen them, overall, how did you feel about these ad(s) ?

(asked only of respondents who said they did not recall seeing the ads before taking the survey)

QUESTION TOTAL: 421
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Positive	243	57.72%
O2	Neutral	168	39.90%
O3	Negative	10	2.38%



What is it about the ad(s) that gave you a positive feeling?

(asked only of respondents who said they did not recall seeing the ads before taking the survey but had a positive feeling towards the ads after seeing them)

QUESTION TOTAL:	243
NO RESPONSE:	0

Verbatim Responses	Total
Colorful	2
saving money	2
A good way to remind people of saving money and resources if they can follow suggestions	1
Any attempt to spread the word about conservation is good. :)	1
artistic, easy to read, and positive messages about energy savings	1
attractive, put positive spin on RE	1
Bright and colorful, short concise captions	1
bright colors and simple graphics. concise message.	1
Bright colors, fun, contemporary graphic elements	1
Bright colors, simple illustrations of the point, positive, not pushing guilt.	1
Bright colors, simple message	1
Bright, sounded friendly, focused on both conservation and helping people lower power bills	1
Cartoonie light. Specific suggestions provided. Dialing it in was not clear.	1
catchy colors. hip. etc.	1
Catchy, quick to the message. Graphics tie in w the message.	1
Changing a light bulb is easy and saves energy. Giving up a fridge is probably not easy for a lot of people.	1
Changing a lightbulb and dial it in r the only good memorable ones	1
Clean, informative and attractive.	1
Clever sayings. Suggested actions are all easy to implement.	1
Color choice. Short statment. Picture makes it easy to understand.	1
color, graphics and catchy phrases	1
colorful and good ideas	1
Colorful!!	1
colorful, noticeable, short, to the point, common sense-able, easy to incorporate	1
Colorful, simple	1
Colors and graphics made me want to read the entire ad.	1
colors and they are friendly	1

common sense	1
common sense reminders	1
Concrete actions to take. That's always good. Any time a problem is brought up or mentioned, it is great to have attached to it, what YOU can do about it. Thanks.	1
Concrete ideas for saving energy and thus saving money (and helping the global warming environment by having less of a carbon footprint.)	1
Conservation and efficiency	1
conserving energy	1
Conveys a simple message, clearly.	1
Cute, colorful, good ideas	1
Cutting energy use	1
different ways to save electricity	1
Doing something good about your energy usage	1
easy on eyes, colorful, simple thinks to safe.	1
Easy steps to make a difference	1
Easy tips and information about programs that could be useful.	1
Easy tips, fun hip design	1
Easy to read and good graphics - also it makes this tips seem simple and positive to do.	1
Easy to read and understand the message.	1
Easy to read, not cluttered. Not preachy. They don't make me feel guilty.	1
Easy to relate to offering simple fixes that anyone can do.	1
easy to understand	1
Easy to understand and apply to dait life and they also conveyed the impact these changes would make.	1
easy to understand what to do and nice graphics	1
Easy to understand, familiar catch-phrases	1
Easy ways to conserve energy. Little things we can all do. I have heard "see you later, refrigerator " but not in this particular ad campaign.	1
Educational in nature.	1
Encouraging households to use less energy!	1
Energy conservation ideas is always helpful.	1
Energy saving	1
Energy saving tips	1
Eye catching and informative	1
eye catching designs with simple, easy to understand messages about saving energy and money	1
Friendly graphics, simple message	1
Fun, simple, bright.	1
Gave examples of how to be energy efficient in the summer.	1
Gentle reminders of simple things we can do to save energy.	1
Good advice with easy and fast information	1

Good advice.	1
Good ideas to think about on saving energy and money.	1
Good information	1
Good message to conserve energy & money	1
good pictures, simple messages, good color schemes.	1
good reminders	1
Good reminders, easy to read and understand	1
Good suggestions and colorful	1
Good, simple, messages.	1
graphics	1
Graphics and messages were catchy and didn't feel "preachy".	1
graphics are friendly, and the text emphasizes easy things to do	1
Happy graphics.	1
helpful information	1
I can be part of the change to save energy into home	1
I enjoy the conservative illustrations, catchy slogans, and to the point messages...	1
I like saving money. The ads reminded me to check into options I'd saving energy which equals saving money.	1
I like that customers and Idaho Power are learning about energy efficiency.	1
I like the colors and the font.	1
I like the content and the reminder of ways to conserve energy.	1
I like the design. Ads are straightforward and easy to understand.	1
I like the emphasis on saving energy.	1
I like the idea of people not only saving $, but of being environmentally conscious.	1
I like the message that saving energy is easy and can make one's life more comfortable.	1
I like the one about keep warm air in cold air out or vise versa. Refers to need of insulation	1
I like the ones with specific details...like 3% saved on the bill for each degree on thermostat!	1
I like the suggestions on ways to help save energy	1
I liked the fact that they were cartoons, something original and different from the norm.	1
I really like the designs.	1
Idaho power is doing something to help the environment and the community	1
Ideas for saving money are always a good thing.	1
Ideas on how to be more energy efficient. Idaho Power is a willing partner to help homeowners increase their efficiency	1
Ideas to save money	1
It is easy to make small changes.	1

It was easy to get the message of the ads because of the simplicity of the colors and drawings. The message was short and straight forward.	1
It's an educational step. :)	1
Just easy ways to save energy.	1
Just the idea of thinking about simple things we can do to save energy and $$$$.	1
Like how clear the energy savings were displayed	1
Looks of adds draw attention to energy savings which saves money.	1
message and artistic delivery was non confrontational	1
Most had some sort of assistance offered for all electric homes which I have.	1
N/A	1
New look, graphic makes the point of the ad.	1
Nice graphics, bright and colorful, positive.	1
not complicated. The average person should understand them all.	1
Options to save energy	1
Positive & good information	1
positive approach to keep control of my power bill	1
positive message about saving energy	1
Practical ideas but why not promote solar hot water heating and solar electric to reduce reliance on fossil fuels	1
Proactive efforts bring positive results.	1
Promoting conservation	1
quick message	1
Quick short things that can be done to save energy which equates to saving money, which helps the environment.	1
relative to the current situation, especially with this upcoming heat wave. Always nice to have specific ideas on how to save energy and stay comfortable.	1
reminding me to check lights, filters, windows and doors for leaks	1
Retro graphics are great.	1
Saving energy always give me a positive feeling	1
Saving energy by sealing out the hot air	1
Saving energy is a no brainer, but I feel most people don't care or just don't know how. This seems to make it easy to do.	1
Saving energy IS easy	1
Saving energy is good for everyone.	1
Saving energy is important. The illustrations were very cute.	1
Saving energy is VERY IMPORTANT	1
saving energy, education, cute images, nice vivid colors	1
Saving energy, money and addressing climate change were doable with some simple steps.	1

Saving energy=saving money Nice cartoonish ads	1
saving engergy	1
saving money and energy	1
Saving money and/or energy and it seems easy to do	1
saving money.	1
Short and informative. Good graphics-modern and illustrative of message.	1
Short, quick messaging	1
simple actions to take to save energy	1
simple and common sense	1
Simple and cute.	1
Simple and true	1
Simple attractive graphics. Conservation message	1
Simple bright colors, fun	1
Simple ideas	1
simple message, colorful graphics	1
Simple message, message fits graphic, message is action oriented.	1
Simple message. Simple drawings.	1
simple statements that hit home	1
Simple things anyone can do to conserve energy.	1
Simple, actionable steps I can take to reduce energy consumption.	1
Simple. Colorful. Easy to understand.	1
Simplicity	1
simplicity and power savings awareness	1
Simplicity of message on ways to save.	1
Some are not practical (or likely to happen) for the average homeowner... insulation/caulking, but a few are easily doable for the average homeowner. These are the ones that caught my eye. We've already replaced most of our bulbs with LED's (spendy though) and raised the thermostat setting. Also, for many, ditching the garage refer. is not an option. I know we always use ours. Just hope there's not a long term power outage.	1
Specific and friendly messages that promote conservation.	1
Specific problem to solve. Ad nice and clean.	1
Specific ways to save energy and money.	1
Straightforward language and simple actions that anyone can do.	1
Suggestions that saving energy and money is doable.	1
Supportive message. Cute pictures. Fun colors.	1
Sustainability	1
That Idaho Power is making efforts to educate folks about energy saving.	1

That there are ways to save electricity and many aren't too difficult.	1
That we could save energy	1
That we should do our best to save energy and money and that Idaho Power cares about that.	1
The are obviously designed by someone who wants to catch attention. The portray a message quickly.	1
The artwork used and the information presented.	1
The bright colors caught my eye. The message to save money is motivational.	1
The bright, fun colors and fun graphics with easy to read messages.	1
The cartoons make it easier and more fun to read.	1
The catchy phrase and fun picture we good to pull me and and the information on the bottom was simple, easy to understand, and they all seemed like doable ideas.	1
the colorful pictures	1
The coloring of the ads and the sayings tend to click more. It had a nice simple feeling to it making me feel that I can do simple things to save me some money on my utility bills.	1
The colors were bright and eye catching and the captions were encouraging about ways to save power and money.	1
the colors.	1
The indicate things you can do to cut energy use.	1
the layout.	1
The look (cartoonish)	1
The look and colors. Also the short message	1
The message	1
The phrases captured my interest and then I was able to read the details.	1
The priority of energy conservation	1
The simple design, the clear messages, the HOW TO do something to help with costs.	1
The style makes it look like it is simple to make the change	1
The suggestion that someone might not of thought of. They are bright and catch your eye	1
Their simple, and show that saving energy can be pretty simple too.	1
There are number of ways to save energy	1
These are very mild. They could have a larger impact.	1
They all encourage saving energy, reducing dependence of existing generating and delivery infrastructure and saving money.	1
They appear happy.	1
they are "upbeat" rather thn threatening or warning.	1
They are attractive and send a message	1
They are colorful, easy to read.	1
they are cute with the rhyming	1

They are encouraging people to be responsible about conserving energy.	1
they are just a reminder and we all need reminded once in a while	1
They are things that we are already doing.	1
they are upbeat, generally light and great content	1
They are visually appealing and easy to read.	1
They are visually please and have a simple, straight-forward message.	1
they are well presented and give me a lot of "food for thought"	1
They gave an action that I can choose to do and why its go to do it.	1
They gAve examples of steps to take.	1
They gave great tips on saving energy	1
They give information about specific things people can do to save energy, which is a good thing.	1
They give solutions and options to problems.	1
They give you something you can do.	1
They had a good message. I feel the "cartoon" design made them more fun and worth looking at.	1
They identify positive steps that are easy to understand.	1
They look good and gave good advise	1
They make simple suggestions and explanations on saving electrical energy.	1
They might remind some people, who weren't already thinking about it, of some simple ways to conserve energy.	1
They present easy, and practical ways to reduce energy use and costs.	1
They seem friendly and provide clear suggestions to save energy.	1
They urge people to be more proactive when it comes to energy use.	1
They were all helpful, non-intrusive tips that could be relevant to various customers.	1
They were cheerful and colorful	1
They were short and simple and applied one positive thing about electrical use.	1
They were simple, easy & quick to read, and gave great tips that would benefit me.	1
They were simple, easy to get the message	1
They were very clear about some easy options I could consider to save energy and money.	1
They're all about conserving energy costs.	1
They're bright, catchy phrases and good information	1
They're colorful	1
They're cute and easy to read and understand.	1
They're eye catching and have a good and simple message	1
To help the environment	1

Upbeat	1
Very educational and helpful ways to lower your electric bill.	1
Very straightforward and simple ways to save energy	1
Very young and kid-dish in presentation, cartoon-like = fun.	1
visual	1
Ways to save electricity as well as money.	1
ways to save energy and stay cooler	1
We all like saving money on the electric bill.	1
We all want to save energy	1
We always need reminders even if we are familiar with the messages the ads give. These ads were simple, easy to read, straight to the point, and if followed can save money.	1
we are reducing our dependence on burning fossil fuels	1
well done, helpful hints and reminders	1
You care about us customers saving energy	1

What is it about the ad(s) that gave you a negative feeling?

(asked only of respondents who said they did not recall seeing the ads before taking the survey but had a negative feeling towards the ads after seeing them)

QUESTION TOTAL:	10
NO RESPONSE:	0

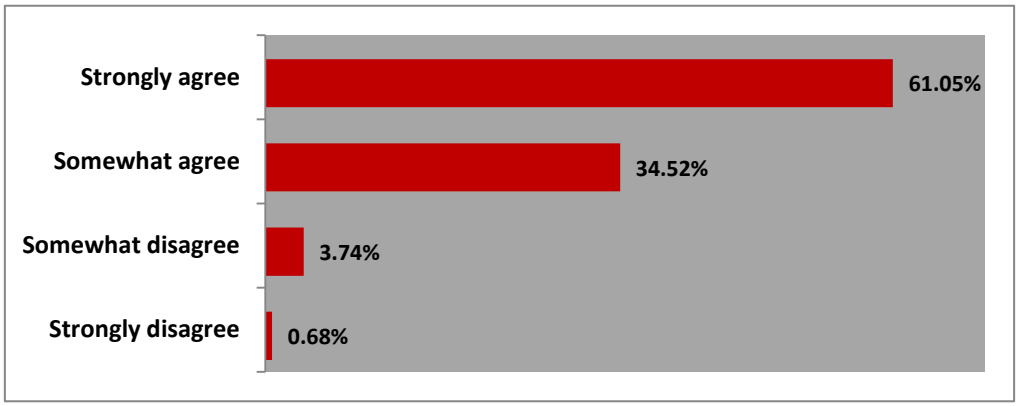
Verbatim Responses	Total
Absolute waste of money. If someone wants to save energy, they can look on a web site somewhere or do research. I'd rather the money spent on said ads be given back to customers, thus...saving us actual money!	1
Cartoons are not interesting. I see enough with my kids.	1
I don't like that they are cartoons.	1
Idaho power should be investing more resources in renewable generation rather than investing money in advertising conservation	1
The cost .	1
The font of the text is ugly. The graphics are simplistic as is the message. The ads are not specific and don't provide enough information.	1
They strike me as childish and aimed at someone who wouldn't get the point.	1
They're ugly. Hate the font.	1
To childish.	1
You are spending profit I have to pay for. Where else can I buy power, you put a boat load of PSA in with every bill. Maybe you could lower my monthly annual power adjustment cost if you weren't spending thousands or millions of bucks on ada.	1

How much would you agree, or disagree, that Idaho Power encourages energy efficiency and saving energy with its customers?

QUESTION TOTAL: 588

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Strongly agree	359	61.05%
O2	Somewhat agree	203	34.52%
O3	Somewhat disagree	22	3.74%
O4	Strongly disagree	4	0.68%



What could Idaho Power do differently to encourage customers to be more energy efficient or to save energy?

(asked only of respondents who said theysomewhat or strongly disagreed that Idaho power encourages energy efficiency)

QUESTION TOTAL: 26
NO RESPONSE: 0

Verbatim Responses	Total
Coupons, free inspections done by Idaho Power, other types of incentives.	1
Don't have any good ideas. The apathy of the consuming public is the reason for many of the world's problems.	1
Encourage renewables, stop coal generated purchases, encourage solar at both a personal and commercial level.	1
Encourage the use of renewables. Encourage the construction of renewable sources by retaining the 20 year contract provision.	1
Evolve from fossil fuels or become part of the problem	1
Fully embrace the AC Cool Credit and repeal the rollback. Incentives/penalties for utilizing power at peak times. Reward instead of discouraging roof top solar and other distributed generation.	1
Get more wind and solar energy moving in Idaho and use sustainable and renewable sources NOW!	1
Have a time of day program, help with low cost loans for windows, doors and insulation and not just for needy families but for houses that use alot of energy.	1
Help customers convert from electric heating to gas heating. Help customers install solar panels or other green power.	1
I don't see active programs anymore for doing energy audits and home retrofitting. Idaho Power also appears to be fighting alternate energy methods that it does not benefit from.	1
I saw no ads. Most effective advertising now is on the internet, and they certainly weren't there.	1
I think that you have to go out and actively recruit customers. Also the incentives/help need to not be pathetic.	1
I would focus more on the actual approximate monetary savings. 3% doesn't sound worth the trouble.	1
Improve targeting and marketing to customers	1
Incorporate the extent to which Idaho Power believes that more energy efficiency reduces the need for dirty generation. People want e-e, no question, but getting rid of fossil fuels is a motivator.	1
it's all about money, show examples of savings	1
Monetary incentives	1
More of the energy saving education. With statistics, it's compelling	1

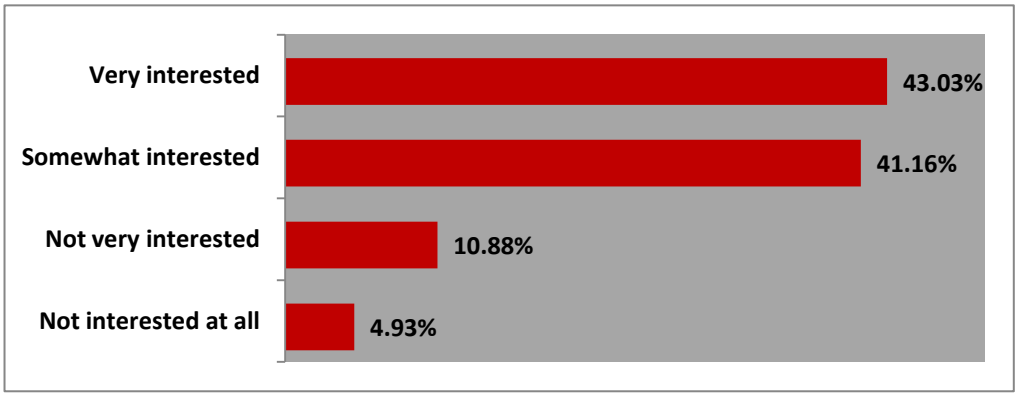
More promos with a dedicated separate websites for upgrading appliances, insulation and simple upgrades like LED bulbs and smart power strips.	1
Most energy use at this point is realistically fixed. You're not going to cook less, or lower the heat below what's comfortable, or bother to run climate control at all unless it makes you ...comfortable.	1
Offer incentives and rebates. I recently looked to see if there were any rebates for replacing old air conditioning units or furnaces and there was only a rebate for a heat pump. Our old city used to offer a lot of rebates to get people to upgrade units to more energy efficient models	1
Offer larger financial incentives for efficiency. Also, actively developing renewable sources of energy rather than putting money into coal and gas plants.	1
Promote promote promote	1
reduce rates for reduced consumption	1
reward energy efficiency with cash rewards; like washing dishes at 11 pm instead of 6 pm, recommending best times to run appliances, what to do with hot water heaters when going out of town	1
The best way to encourage efficiency is to increase the price of electricity. The second best way would be to show people their real time energy use with a monitor most likely placed in their kitchen.	1

How interested would you be in getting more information from Idaho Power about energy saving programs for your home?

QUESTION TOTAL: 588

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Very interested	253	43.03%
O2	Somewhat interested	242	41.16%
O3	Not very interested	64	10.88%
O4	Not interested at all	29	4.93%



Flex Peak Program Summary

How much do you agree, or disagree, with the following statements about the application process and operation of the program:		
	Mean Response	4.4
How clear were the notification messages for the Flex Peak Program events?		
	Mean Response	4.9
For each of the events Idaho Power called this summer, please indicate how prepared were you for the event?		
	Mean Response	*4.2*
Following each event, Idaho Power provided post event performance data for each participating facility. How useful was this information in helping you refine future nominations for the program?		
	Mean Response	4.9
If you contacted Idaho Power, how helpful was Idaho Power with any questions you had regarding the Flex Peak Program?		
	Mean Response	4.6
How satisfied are you with the timeliness of receiving your incentive payment?		
	Mean Response	4.7
How satisfied are you with your incentive amount?		
	Mean Response	4.2
How satisfied are you with your overall experience with the Flex Peak Program?		
	Mean Response	4.5
How likely would you be to re-enroll in the Flex Peak Program in the future?		
	Mean Response	4.9

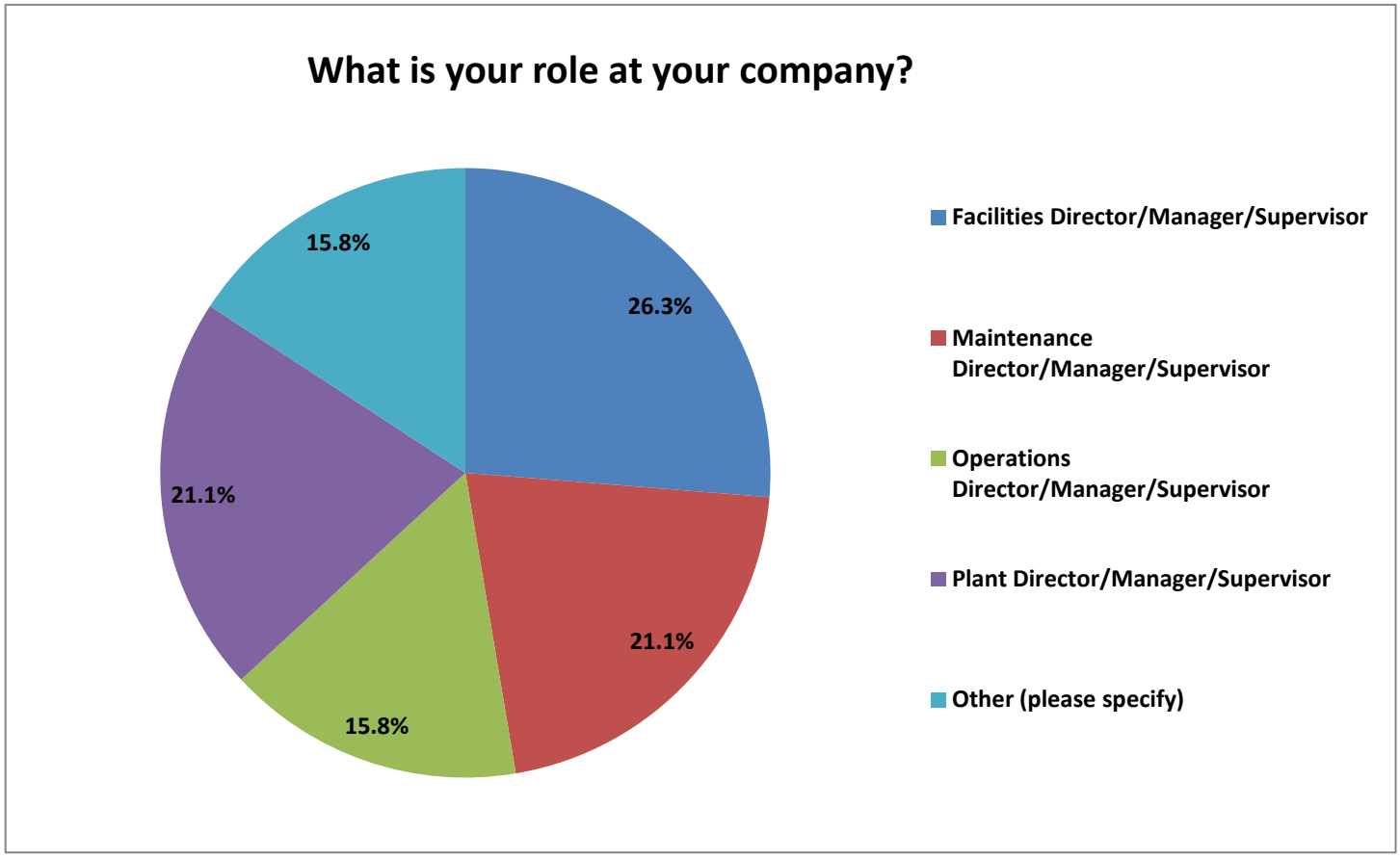
Overall Program Average 4.6

Flex Peak Program Survey

What is your role at your company?		
Answer Options	**Response Percent**	**Response Count**
Facilities Director/Manager/Supervisor	26.3%	5
Maintenance Director/Manager/Supervisor	21.1%	4
Operations Director/Manager/Supervisor	15.8%	3
Plant Director/Manager/Supervisor	21.1%	4
Other (please specify)	15.8%	3
	answered question	19
	skipped question	0

Other (please specify)

Energy Engineer
Master Electrician
Lead Water Tech.



Flex Peak Program Survey

How much do you agree, or disagree, with the following statements:

Answer Options	Strongly agree (5)	Somewhat agree (4)	Neither agree nor disagree (3)	Somewhat disagree (2)	Strongly disagree (1)	Not applicable	Response Count
The application form was easy to complete.	10	7	0	0	0	0	17
If we needed to, it was easy to change the kW amount my	6	8	2	0	0	1	17
If we needed to, it was easy to opt-out of an event.	7	6	3	0	0	1	17
Overall, the application process was easy to understand.	10	6	1	0	0	0	17
						answered question	17
						skipped question	2

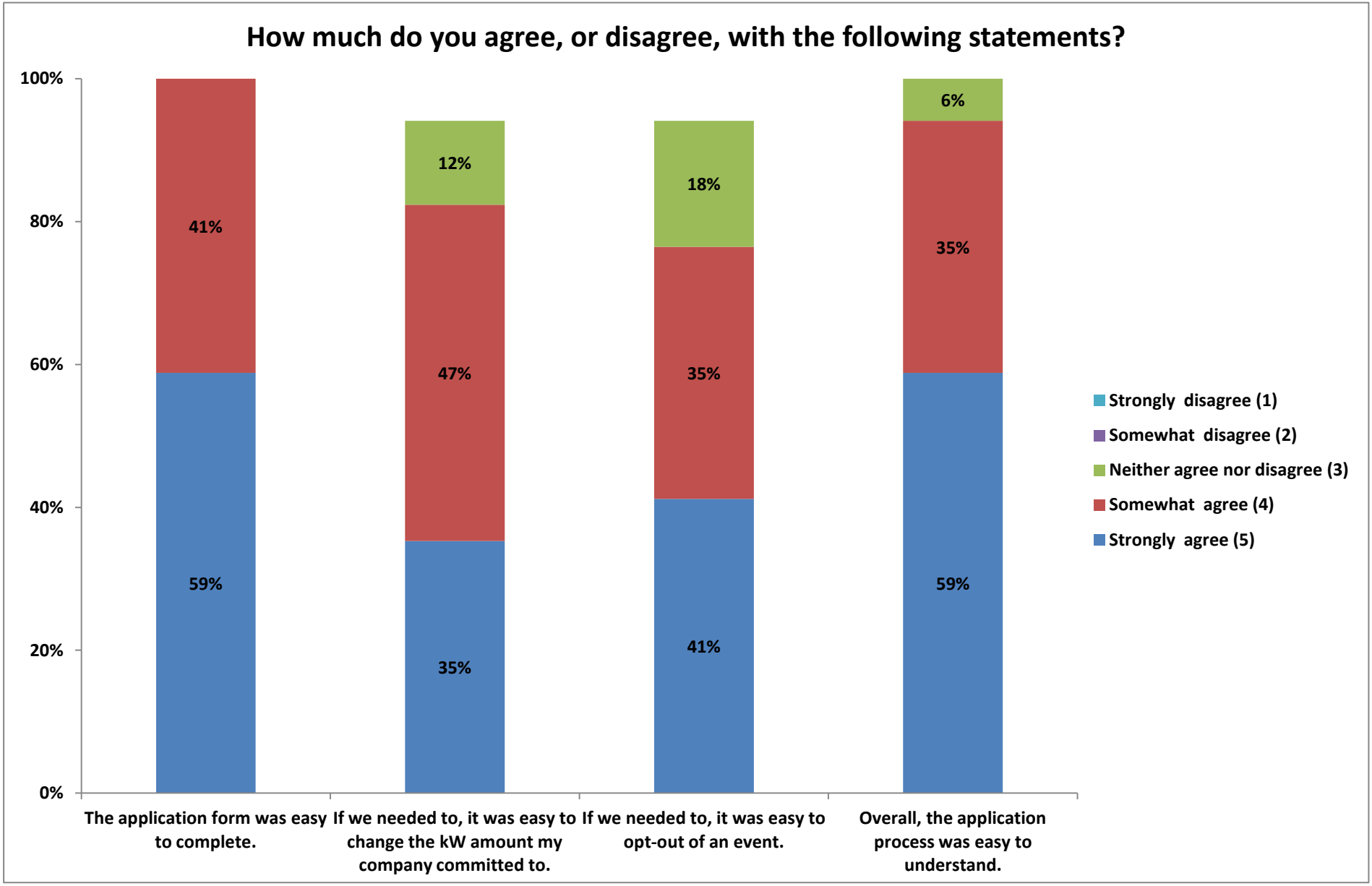
Overall Mean

How much do you agree, or disagree, with the following statements:

Answer Options	Weighted Strongly agree (5)	Weighted Somewhat agree (4)	Weighted Neither agree nor disagree (3)	Weighted Somewhat disagree (2)	Weighted Strongly disagree (1)	Response Count	Mean Response
The application form was easy to complete.	50	28	0	0	0	17	4.6
If we needed to, it was easy to change the kW amount my company committed to.	30	32	6	0	0	16	4.3
If we needed to, it was easy to opt-out of an event.	35	24	9	0	0	16	4.3
Overall, the application process was easy to understand.	50	24	3	0	0	17	4.5
						Overall Mean	4.4

How much do you agree, or disagree, with the following statements:

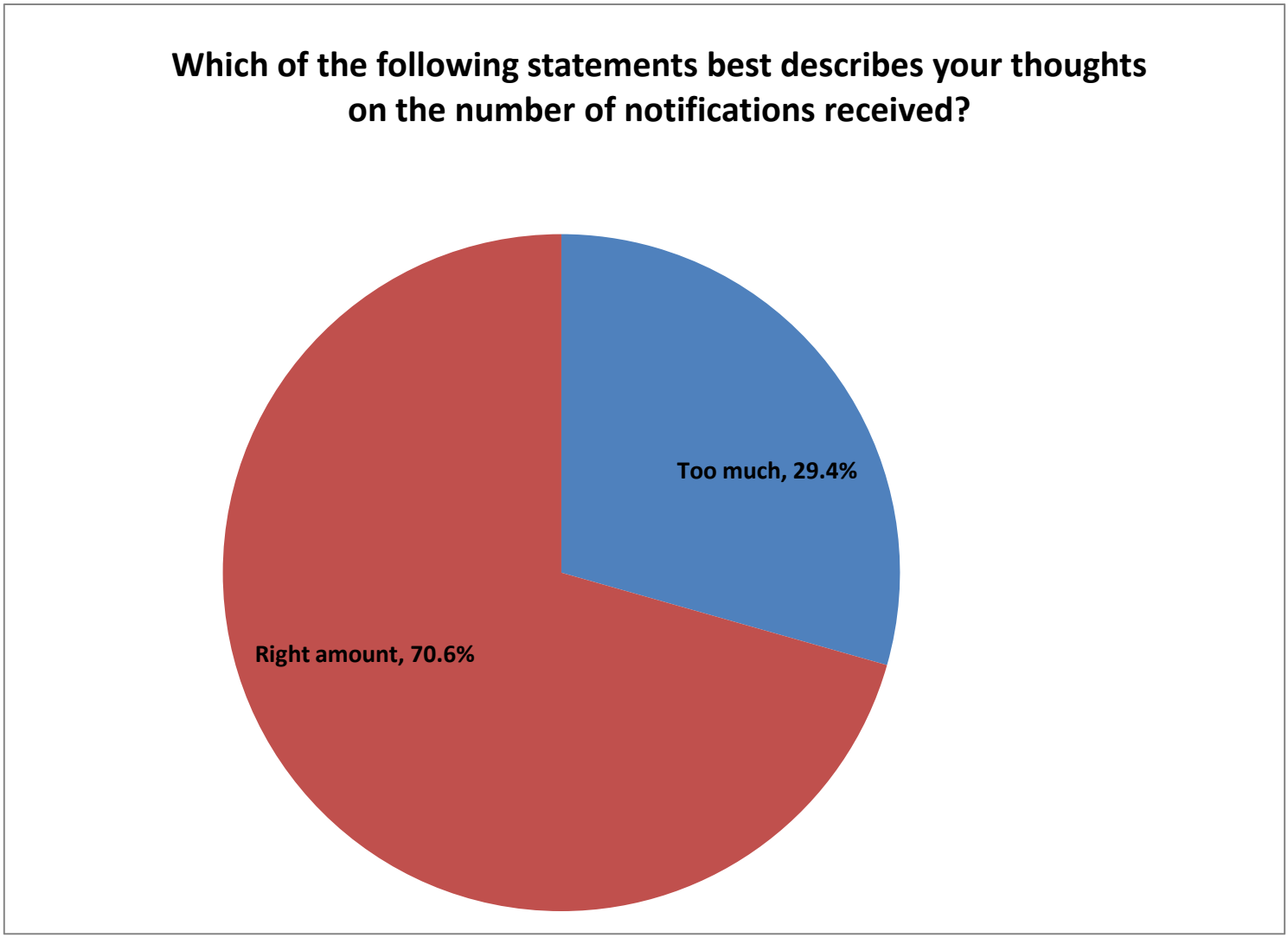
Answer Options	Strongly agree (5)	Somewhat agree (4)	Neither agree nor disagree (3)	Somewhat disagree (2)	Strongly disagree (1)	Not applicable	Response Count
The application form was easy to complete.	59%	41%	0%	0%	0%	0%	17
If we needed to, it was easy to change the kW amount my	35%	47%	12%	0%	0%	6%	17
If we needed to, it was easy to opt-out of an event.	41%	35%	18%	0%	0%	6%	17
Overall, the application process was easy to understand.	59%	35%	6%	0%	0%	0%	17
						answered question	17
						skipped question	2


How much do you agree, or disagree, with the following statements?
100%
80%
60%
40%
20%
0%
41%
59%
12%
47%
35%
18%
35%
41%
6%
35%
59%
The application form was easy to complete.
If we needed to, it was easy to change the kW amount my company committed to.
If we needed to, it was easy to opt-out of an event.
Overall, the application process was easy to understand.
Strongly disagree (1)
Somewhat disagree (2)
Neither agree nor disagree (3)
Somewhat agree (4)
Strongly agree (5)

Flex Peak Program Survey

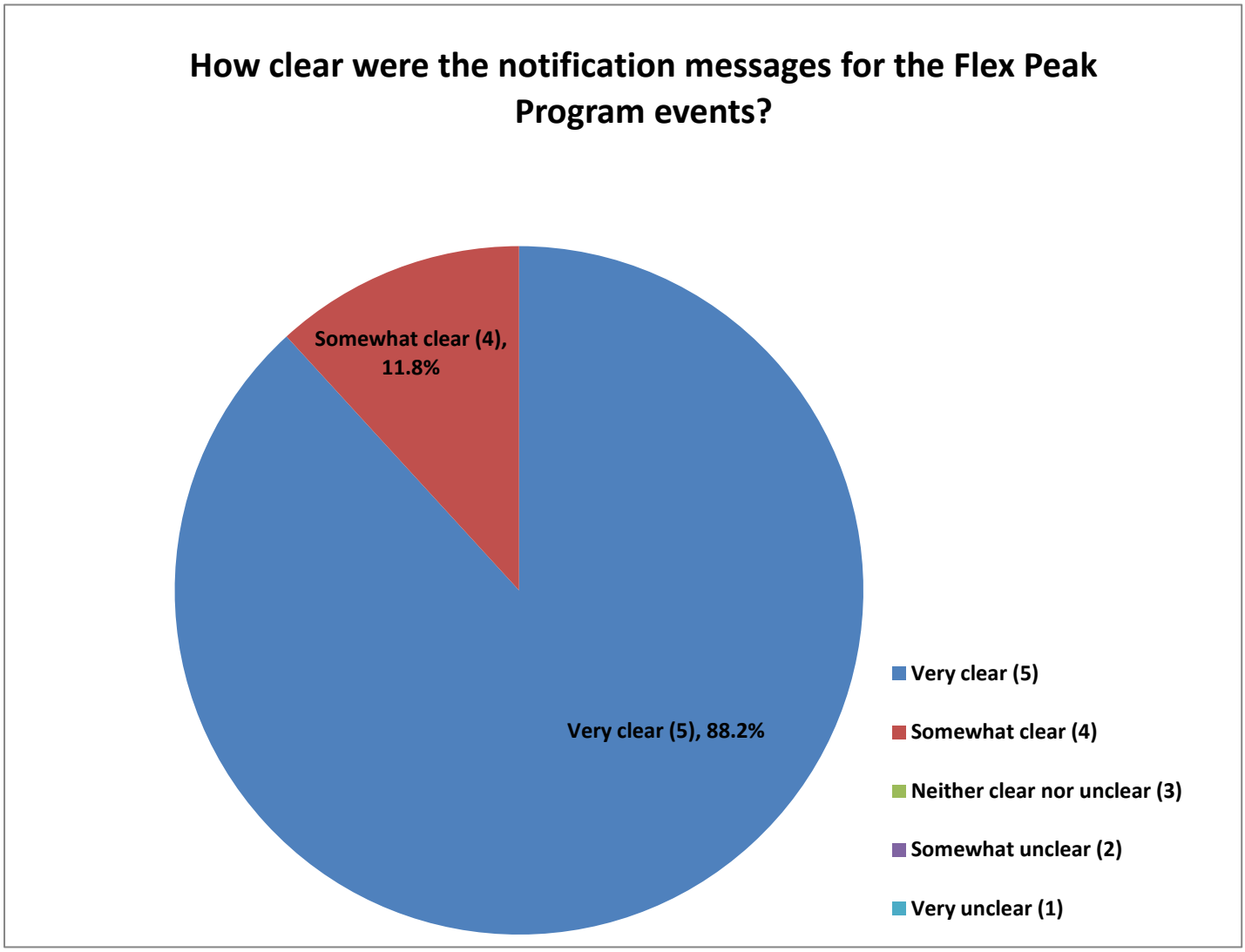
Idaho Power notified customers of an event by contacting them three times by email or by phone. Which of the following statements best describes your thoughts on the number of notifications received?		
Answer Options	**Response Percent**	**Response Count**
Too much	29.4%	5
Right amount	70.6%	12
Too little	0.0%	0
	answered question	17
	skipped question	2

Overall Mean



Flex Peak Program Survey

How clear were the notification messages for the Flex Peak Program events?			
Answer Options	Response Percent	Response Count	Weighted Response
Very clear (5)	88.2%	15	75
Somewhat clear (4)	11.8%	2	8
Neither clear nor unclear (3)	0.0%	0	0
Somewhat unclear (2)	0.0%	0	0
Very unclear (1)	0.0%	0	0
answered question		17	
skipped question		2	
		Mean Response	4.9



Flex Peak Program Survey

For each of the events Idaho Power called this summer, please indicate how prepared were you for the event?

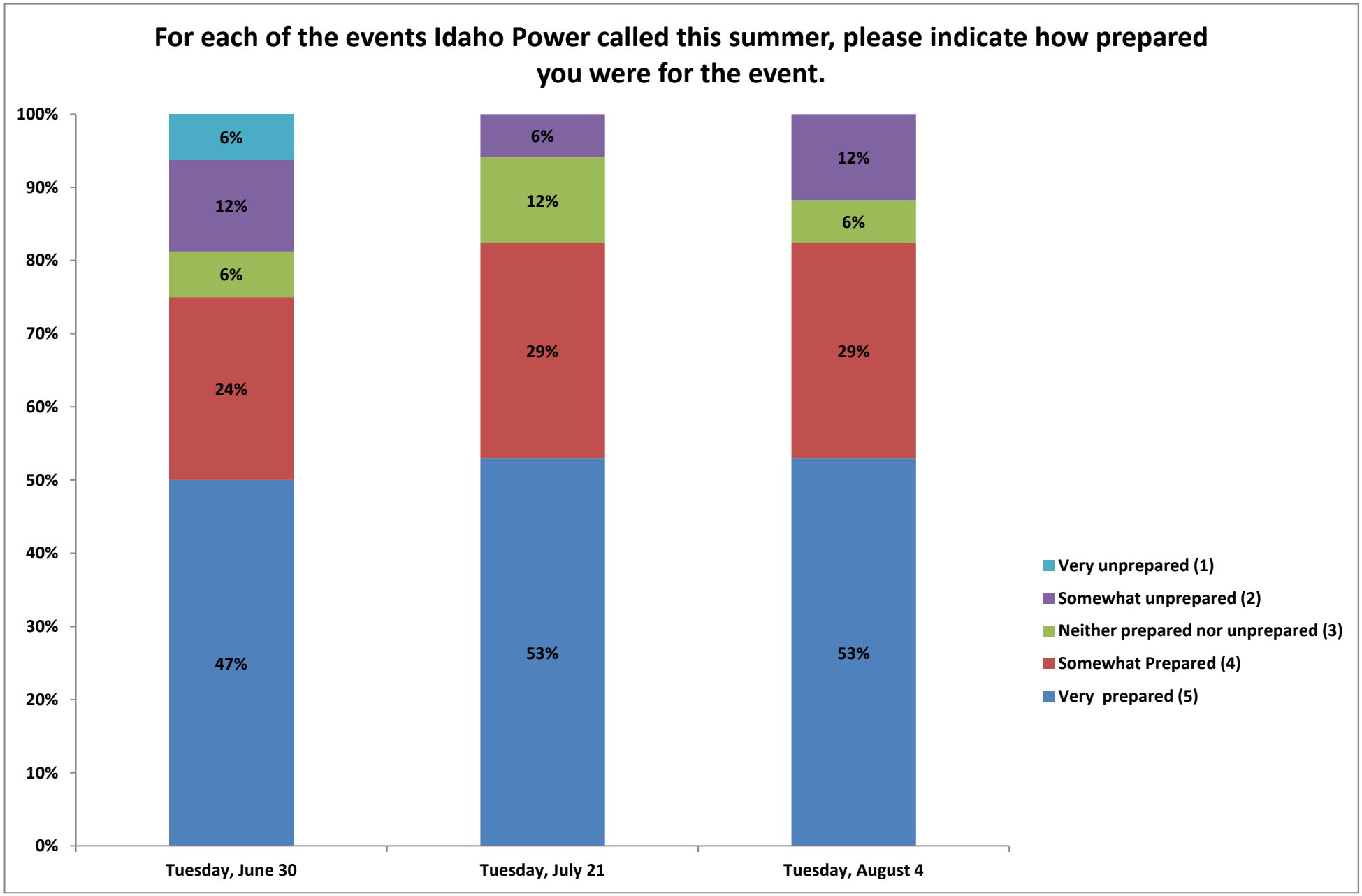
Answer Options	Very prepared (5)	Somewhat Prepared (4)	Neither prepared nor unprepared (3)	Somewhat unprepared (2)	Very unprepared (1)	Not applicable	Response Count
Tuesday, June 30	8	4	1	2	1	1	17
Tuesday, July 21	9	5	2	1	0	0	17
Tuesday, August 4	9	5	1	2	0	0	17
						answered question	17
						skipped question	2

Overall Mean

Answer Options	Weighted Very prepared (5)	Weighted Somewhat Prepared (4)	Weighted Neither prepared nor unprepared (3)	Weighted Somewhat unprepared (2)	Weighted Very unprepared (1)	Response Count	Mean Response
Tuesday, June 30	40	16	3	4	1	16	4.0
Tuesday, July 21	45	20	6	2	0	17	4.3
Tuesday, August 4	45	20	3	4	0	17	4.2
						Overall Mean	*4.2*

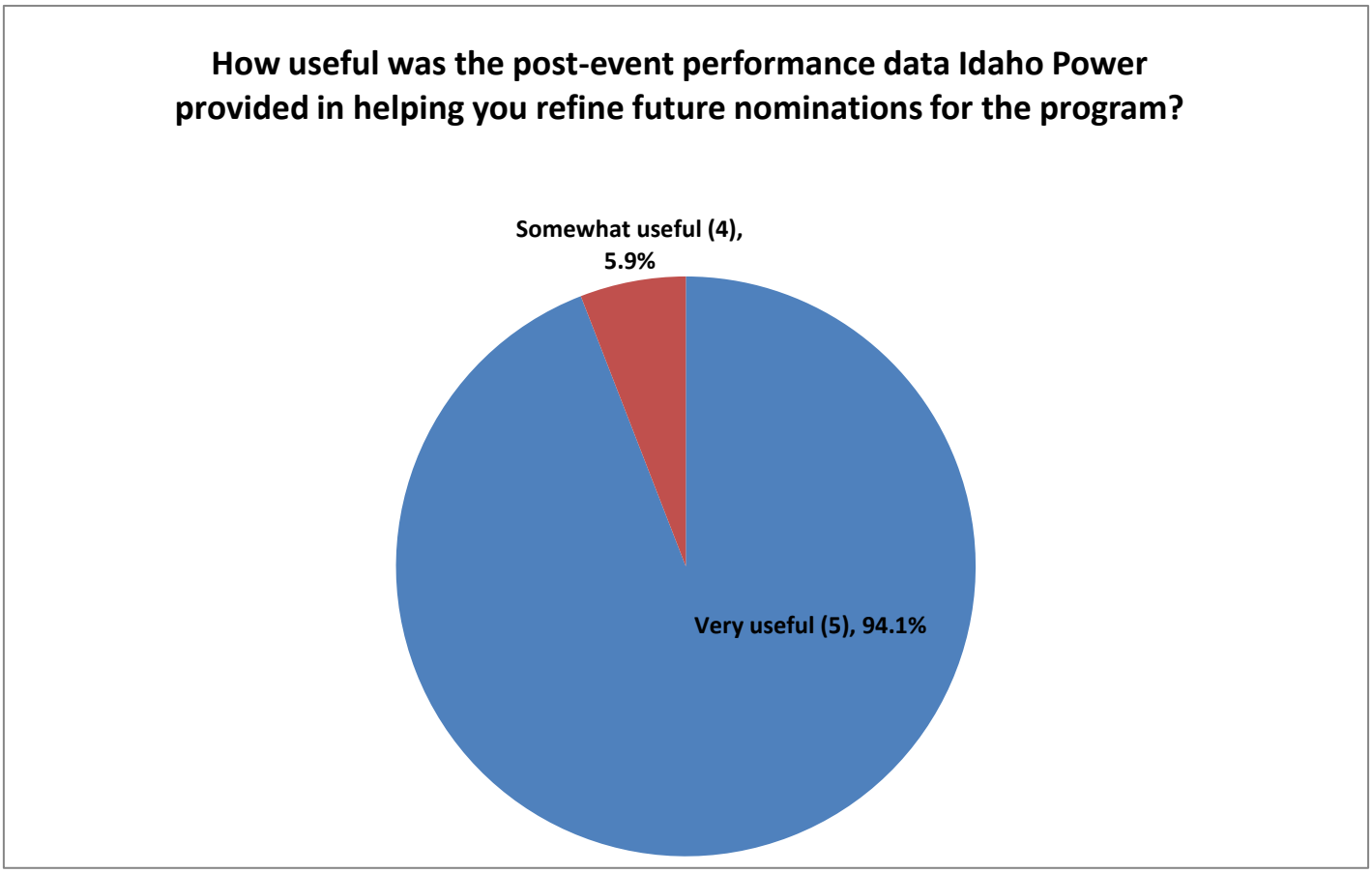
For each of the events Idaho Power called this summer, please indicate how prepared were you for the event?

Answer Options	Very prepared (5)	Somewhat Prepared (4)	Neither prepared nor unprepared (3)	Somewhat unprepared (2)	Very unprepared (1)	Not applicable	Response Count
Tuesday, June 30	47%	24%	6%	12%	6%	6%	17
Tuesday, July 21	53%	29%	12%	6%	0%	0%	17
Tuesday, August 4	53%	29%	6%	12%	0%	0%	17
						answered question	17
						skipped question	2


For each of the events Idaho Power called this summer, please indicate how prepared you were for the event.
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
6%
12%
6%
24%
47%
6%
12%
29%
53%
12%
6%
29%
53%
Tuesday, June 30
Tuesday, July 21
Tuesday, August 4
Very unprepared (1)
Somewhat unprepared (2)
Neither prepared nor unprepared (3)
Somewhat Prepared (4)
Very prepared (5)

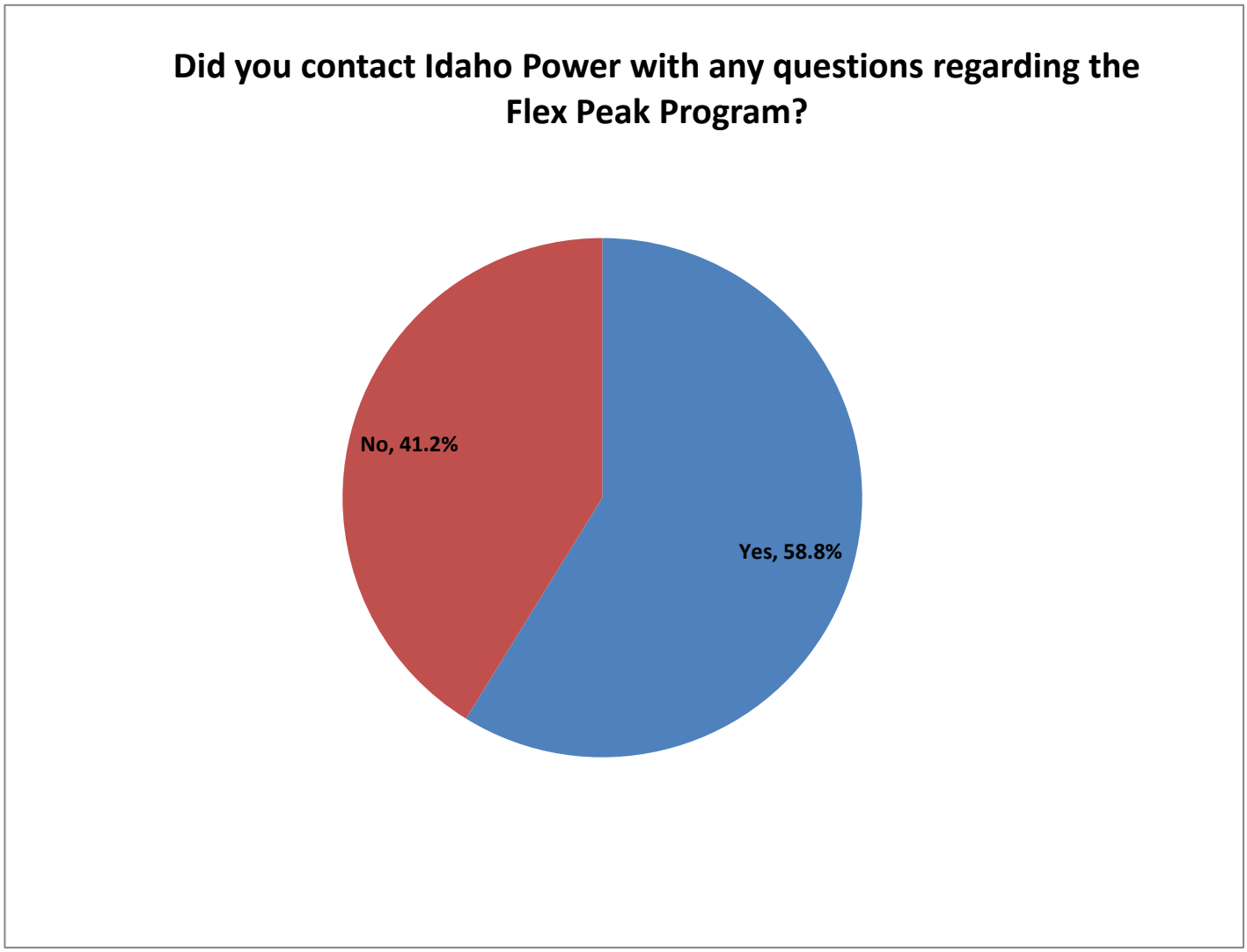
Flex Peak Program Survey

Following each event, Idaho Power provided post event performance data for each participating facility. How useful was this information in helping you refine future nominations for the program?			
Answer Options	Response Percent	Response Count	Weighted Response
Very useful (5)	94.1%	16	80
Somewhat useful (4)	5.9%	1	4
Neither useful nor useless (3)	0.0%	0	0
Somewhat useless (2)	0.0%	0	0
Very useless (1)	0.0%	0	0
	answered question	17	
	skipped question	2	
		Mean Response	4.9



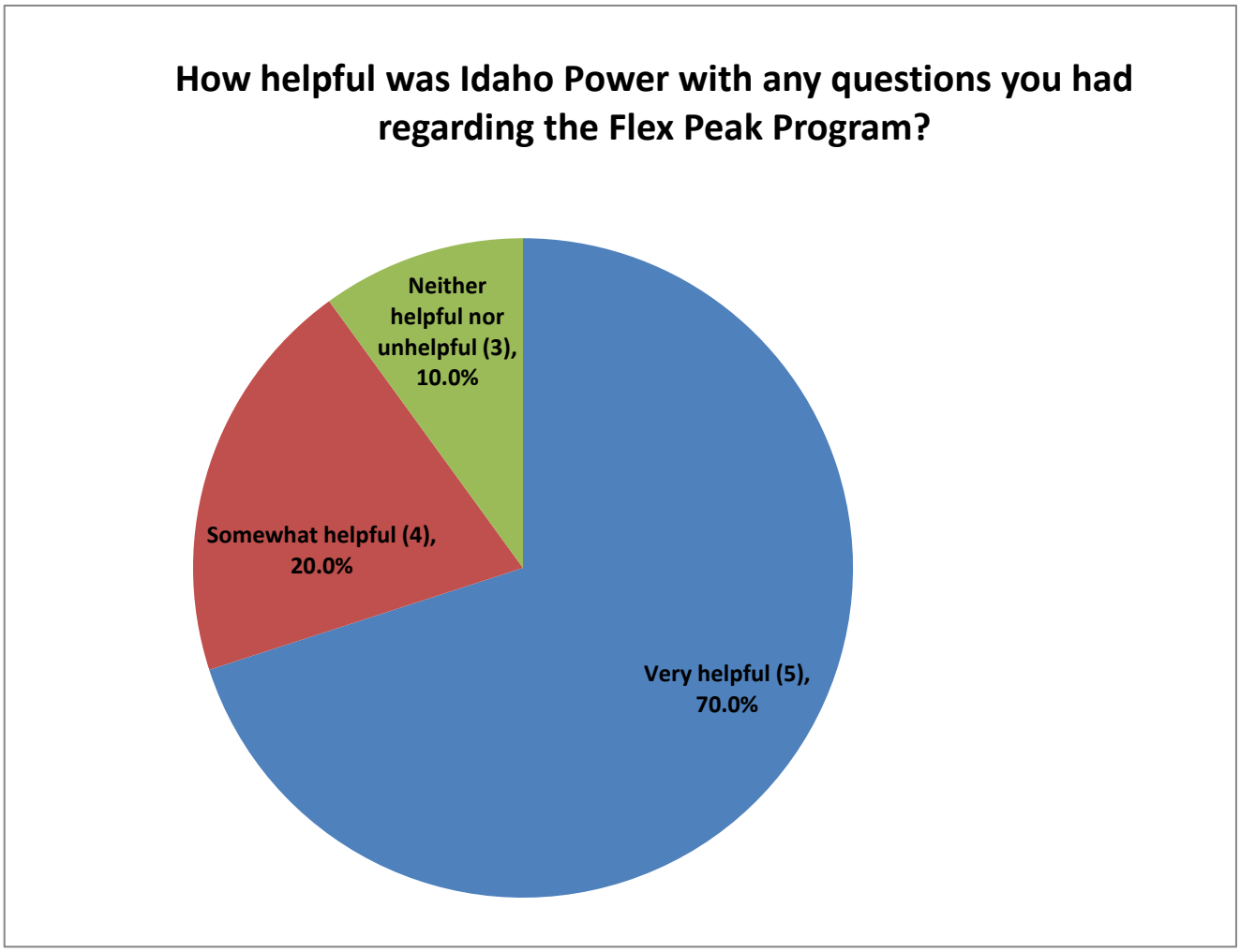
Flex Peak Program Survey

Did you contact Idaho Power with any questions regarding the Flex Peak Program?		
Answer Options	Response Percent	Response Count
Yes	58.8%	10
No	41.2%	7
answered question		17
skipped question		2



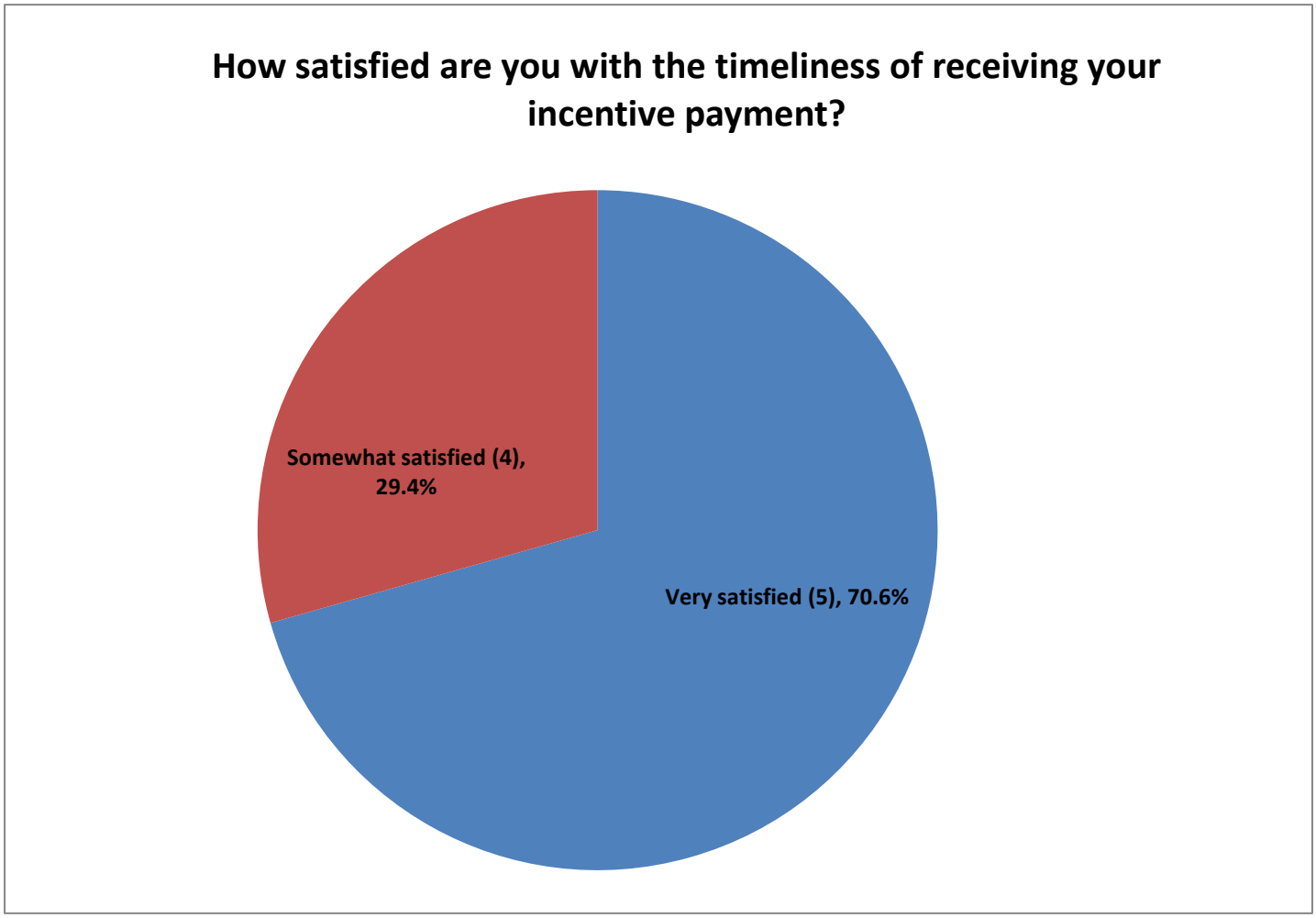
Flex Peak Program Survey

If you contacted Idaho Power, how helpful was Idaho Power with any questions you had regarding the Flex Peak Program?			
Answer Options	Response Percent	Response Count	Weighted Response
Very helpful (5)	70.0%	7	35
Somewhat helpful (4)	20.0%	2	8
Neither helpful nor unhelpful (3)	10.0%	1	3
Somewhat unhelpful (2)	0.0%	0	0
Very unhelpful (1)	0.0%	0	0
	answered question	10	
	skipped question	9	
		Mean Response	4.6



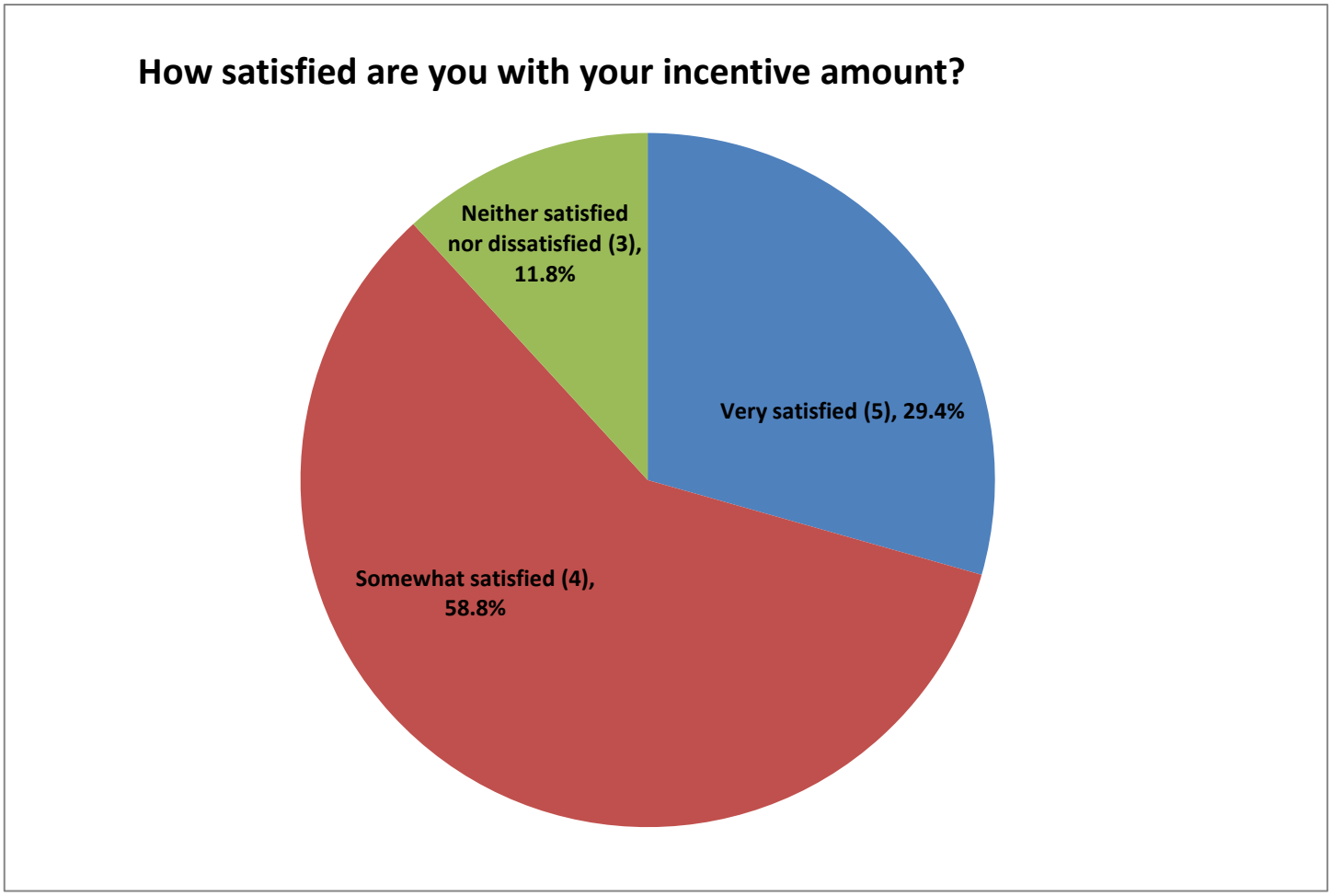
Flex Peak Program Survey

How satisfied are you with the timeliness of receiving your incentive payment?			
Answer Options	Response Percent	Response Count	Weighted Response
Very satisfied (5)	70.6%	12	60
Somewhat satisfied (4)	29.4%	5	20
Neither satisfied nor dissatisfied (3)	0.0%	0	0
Somewhat dissatisfied (2)	0.0%	0	0
Very dissatisfied (1)	0.0%	0	0
	answered question	17	
	skipped question	2	
		Mean Response	4.7



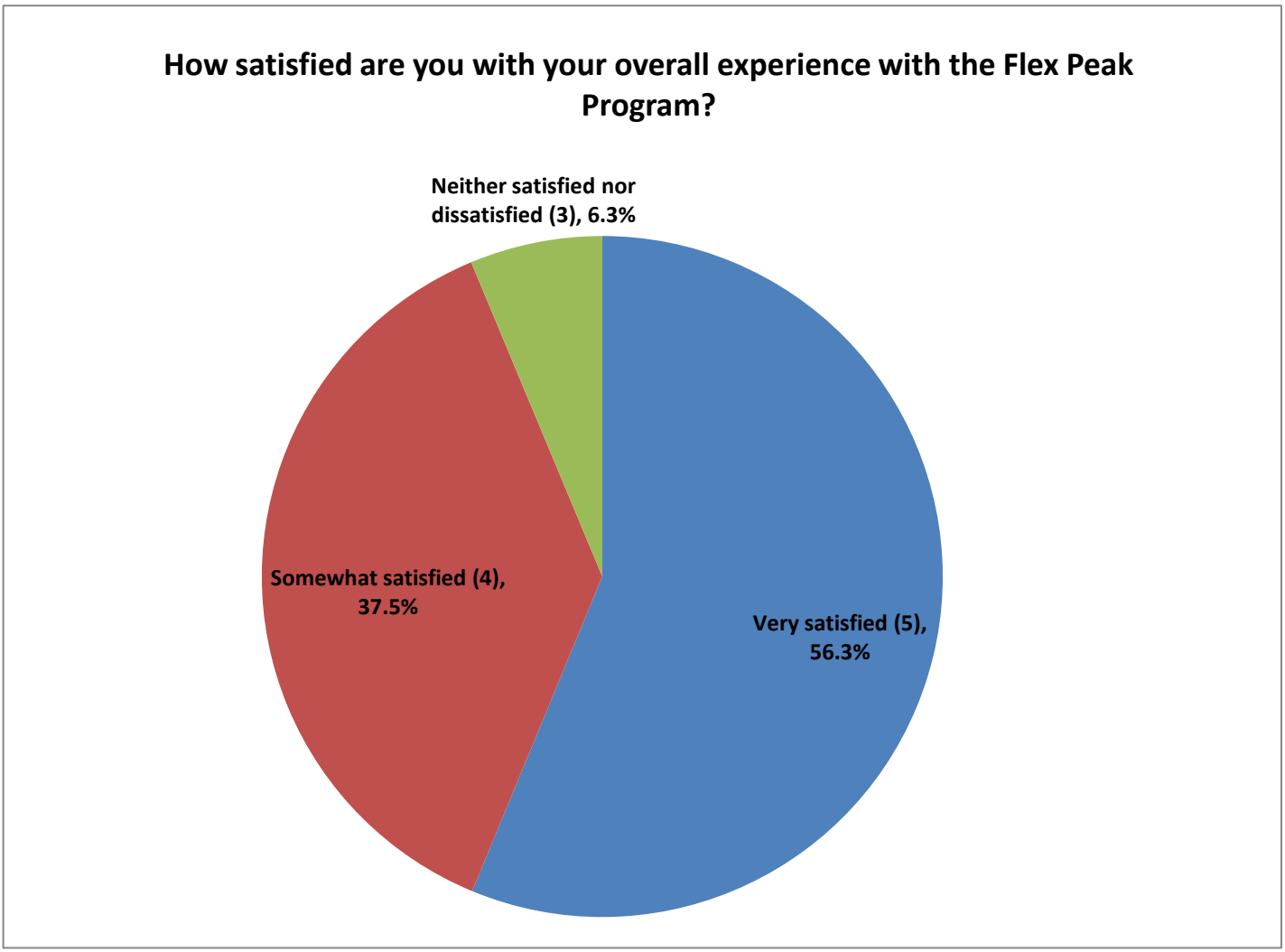
Flex Peak Program Survey

How satisfied are you with your incentive amount?			
Answer Options	Response Percent	Response Count	Weighted Response
Very satisfied (5)	29.4%	5	25
Somewhat satisfied (4)	58.8%	10	40
Neither satisfied nor dissatisfied (3)	11.8%	2	6
Somewhat dissatisfied (2)	0.0%	0	0
Very dissatisfied (1)	0.0%	0	0
	answered question	17	
	skipped question	2	
		Mean Response	4.2



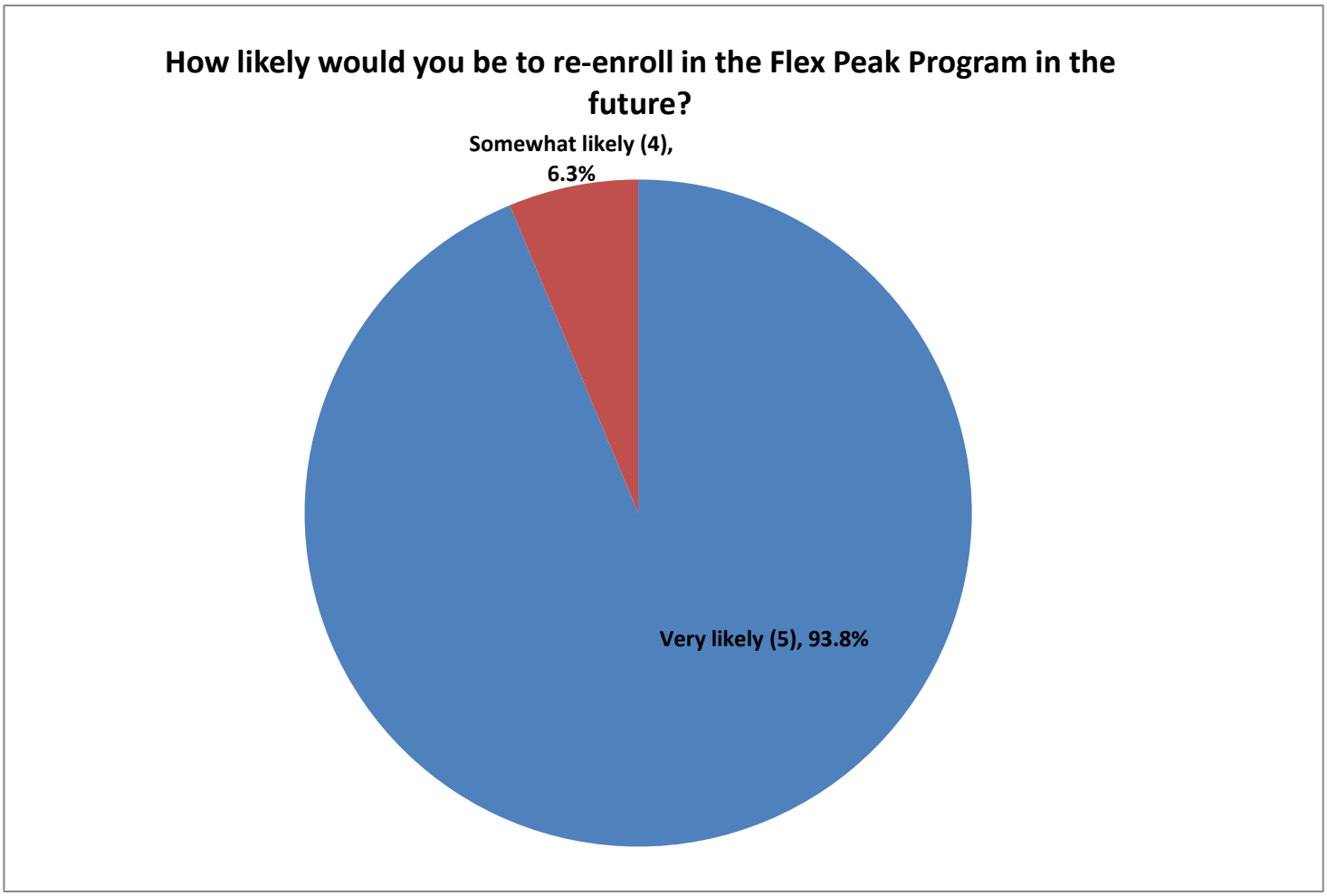
Flex Peak Program Survey

How satisfied are you with your overall experience with the Flex Peak Program?			
Answer Options	Response Percent	Response Count	Weighted Response
Very satisfied (5)	56.3%	9	45
Somewhat satisfied (4)	37.5%	6	24
Neither satisfied nor dissatisfied (3)	6.3%	1	3
Somewhat dissatisfied (2)	0.0%	0	0
Very dissatisfied (1)	0.0%	0	0
	answered question	16	
	skipped question	3	
		Mean Response	4.5



Flex Peak Program Survey

How likely would you be to re-enroll in the Flex Peak Program in the future?			
Answer Options	Response Percent	Response Count	Weighted Response
Very likely (5)	93.8%	15	75
Somewhat likely (4)	6.3%	1	4
Neither likely nor unlikely (3)	0.0%	0	0
Somewhat unlikely (2)	0.0%	0	0
Very unlikely (1)	0.0%	0	0
	answered question	16	
	skipped question	3	
		Mean Response	4.9



Flex Peak Program Survey

Please provide any additional comments about Idaho Power's Flex Peak Program.

Answer Options	Response Count
	5
answered question	5
skipped question	14

Response Text
I understand that the program does not want to give more than two hours notice, but it would be very useful to have more advance notice of an impending event. The more notice the better.
Overall Mean
Zeke was very helpful and knowledgeable.
Just need to work on notification gliche.
Idaho's peak program was easy to enroll, performance reports made available timely after each event, easy to make changes to nominations in between events. The support team was outstanding in their management and communications for the program. They provide detail information needed to review with other levels of OD management. We look forward to next season.

empowered community

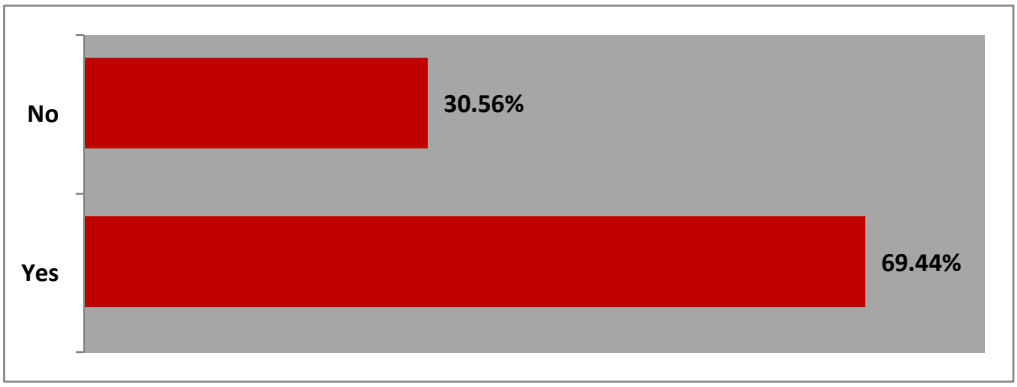
Holiday Lighting Survey Results

December 2015

Do you use holiday lighting at your home?

QUESTION TOTAL: 445
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Yes	309	69.44%
O2	No	136	30.56%



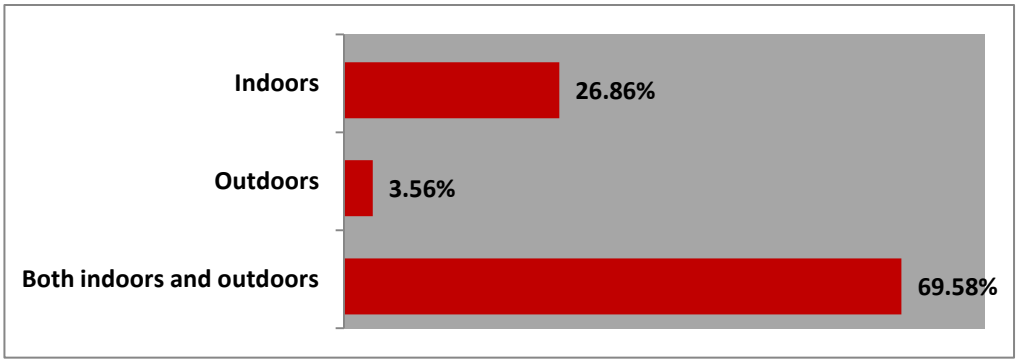
Where do you use holiday lighting?

(asked only of respondents who said they use holiday lighting)

QUESTION TOTAL: 309

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Indoors	83	26.86%
O2	Outdoors	11	3.56%
O3	Both indoors and outdoors	215	69.58%

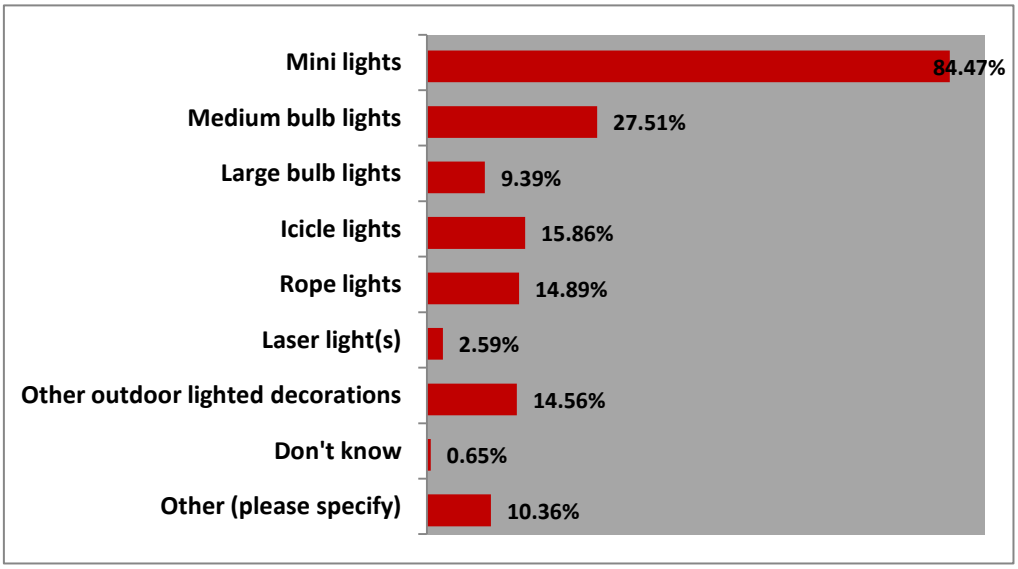


What type of holiday lights do you use?

(asked only of respondents who said they use holiday lighting)

QUESTION TOTAL: 309
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Mini lights	261	84.47%
O2	Medium bulb lights	85	27.51%
O3	Large bulb lights	29	9.39%
O4	Icicle lights	49	15.86%
O5	Rope lights	46	14.89%
O6	Laser light(s)	8	2.59%
O7	Other outdoor lighted decorations	45	14.56%
O8	Don't know	2	0.65%
O9	Other (please specify)	32	10.36%



What type of holiday lights do you use? Other (please specify).

Verbatim Responses	Total
LED	9
LEDs	2
solar lights	2
all led lights	1
All Mini or Medium LED's	1
battery candles	1
bubble lights	1
colored spots	1
Halloween lights tooo	1
led and led spotlight	1
LED candles battery	1
LED lights	1

LED mini lights	1
Led outdoors	1
Led rope	1
LED Spotlights	1
nativity scene	1
Small LED lights inside of large	1
Solar string lights	1
spot light	1
Traditional incandescent lights	1
we didn't use any this year but we	1

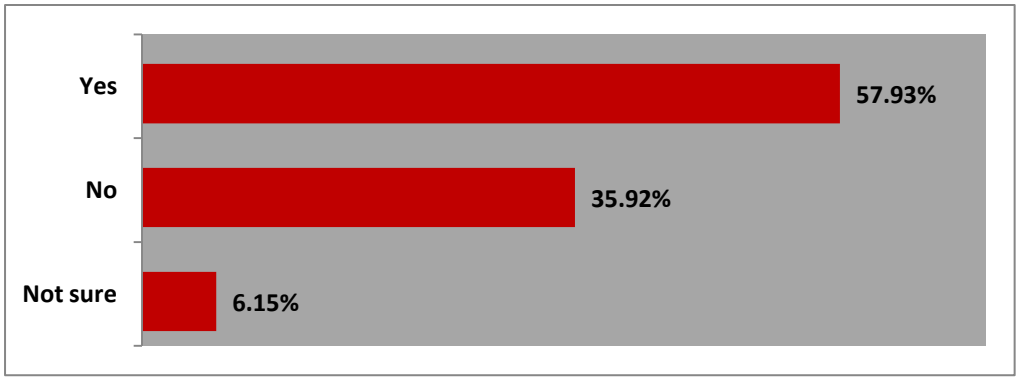
Are any of your holiday lights LED lights?

(asked only of respondents who said they use holiday lighting)

QUESTION TOTAL: 309

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Yes	179	57.93%
O2	No	111	35.92%
O3	Not sure	19	6.15%



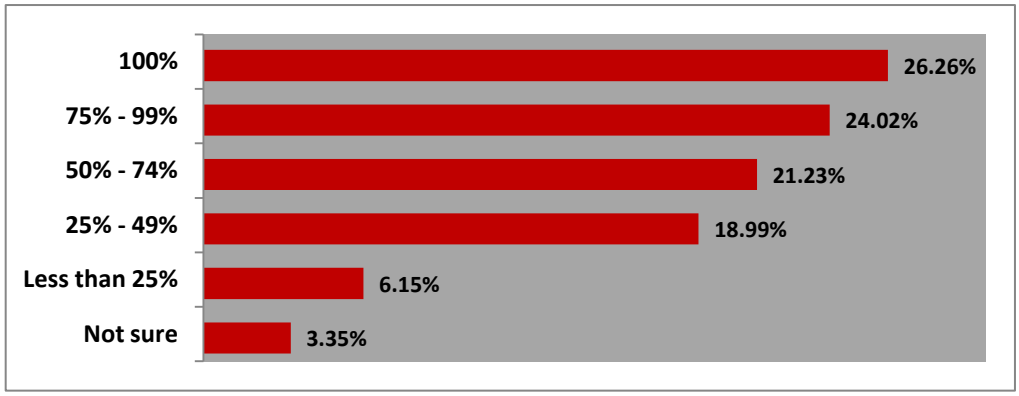
What proportion of your holiday lights are LED's?

(asked only of respondents who said they use LED lights)

QUESTION TOTAL: 179

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	100%	47	26.26%
O2	75% - 99%	43	24.02%
O3	50% - 74%	38	21.23%
O4	25% - 49%	34	18.99%
O5	Less than 25%	11	6.15%
O6	Not sure	6	3.35%



Home Energy Audit Program Survey

Monday, February 01, 2016

140

Total Responses

Complete Responses: 120

Q1: How easy was it for you to apply for the Home Energy Audit program?

Answered: 140 Skipped: 0

Answer Choices	Responses	
Very easy	77.86%	109
Somewhat easy	17.14%	24
Somewhat difficult	3.57%	5
Very difficult	1.43%	2
Total		**140**

Q3: Please identify the auditor that you used for your home audit.

Answered: 103 Skipped: 37

Answer Choices	Responses	
Brian Bennett, The Energy Auditor	18.45%	19
Chris Callor, Affordable Energy Improvements, LLC	29.13%	30
Dallen Ward, Home Energy Efficiency Technologies (H.E.E.T.)	5.83%	6
Jessie Lumbreras, Energy Zone, LLC	3.88%	4
Robert Johnson, Savings Around Power	1.94%	2
Rod Burli, Home Energy Management	6.80%	7
Tad Duby, On Point, LLC	33.98%	35
Total		**103**

Q4: Please rate your home auditor on each of the following:

Answered: 127 Skipped: 13

	Excellent	Good	Fair	Poor	Total
Courteousness	**78.57%** 99	**21.43%** 27	**0.00%** 0	**0.00%** 0	126
Professionalism	**76.19%** 96	**23.02%** 29	**0.79%** 1	**0.00%** 0	126
Explanation of work/measurements to be performed as part of the audit	**71.77%** 89	**25.81%** 32	**1.61%** 2	**0.81%** 1	124
Explanation of recommendations resulting from audit	**66.67%** 84	**25.40%** 32	**4.76%** 6	**3.17%** 4	126
Overall experience with auditor (from scheduling an appointment to follow up after the audit)	**68.25%** 86	**23.81%** 30	**6.35%** 8	**1.59%** 2	126

Q6: How did you receive your Home Energy Audit report?

Answered: 121 Skipped: 19

Answer Choices	Responses	
Accessed report online	35.54%	43
Received paper copy	43.80%	53
Both	20.66%	25
Total		121

Q7: How difficult was it for you to access the report online?

Answered: 123 Skipped: 17

Answer Choices	Responses	
Very easy	34.96%	43
Somewhat easy	20.33%	25
Somewhat difficult	2.44%	3
Very difficult	7.32%	9
N/A	34.96%	43
Total		123

Q8: How much did the audit influence you to reduce the amount of electricity you consume?

Answered: 124 Skipped: 16

Answer Choices	Responses	
Influenced me a lot	37.10%	46
Influenced me some	49.19%	61
Didn't influence me much	12.10%	15
Didn't influence me at all	1.61%	2
Total		**124**

Q9: As a result of the Home Energy Audit program, please indicate how strongly you agree or disagree with the following statements.

Answered: 125 Skipped: 15

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	N/A	Total
I am more informed about energy usage in my home	**57.26%** 71	**40.32%** 50	**0.81%** 1	**0.81%** 1	**0.81%** 1	124
Other members of my household are more informed about our household energy usage	**33.61%** 41	**36.89%** 45	**9.02%** 11	**0.82%** 1	**19.67%** 24	122
I am more informed about energy efficiency programs that are available to me through Idaho Power	**41.80%** 51	**45.90%** 56	**8.20%** 10	**3.28%** 4	**0.82%** 1	122
I know what no to low-cost actions I can take	**53.33%** 64	**33.33%** 40	**5.00%** 6	**1.67%** 2	**6.67%** 8	120
I know what next steps I should take	**59.84%** 73	**30.33%** 37	**4.92%** 6	**0.00%** 0	**4.92%** 6	122

Q10: After receiving your audit through the Home Energy Audit program, please indicate if you have taken any of the following actions:

Answered: 120 Skipped: 20

	Yes	No	Total
Visited the Idaho Power website	**40.00%** 46	**60.00%** 69	115
Unplugged appliances when not in use	**53.51%** 61	**46.49%** 53	114
Signed up for myAccount	**39.45%** 43	**60.55%** 66	109
Shared my energy audit experience with relatives and/or friends	**65.25%** 77	**34.75%** 41	118
Other	**52.17%** 24	**47.83%** 22	46

Q11: Since receiving your audit through the Home Energy Audit program, please indicate when, or if, you will complete any of the following improvements:

Answered: 121 Skipped: 19

	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	Total
Replace additional incandescent light bulbs with more efficient light bulbs (e.g., CFLs and LEDs)	59.32% 70	16.95% 20	8.47% 10	7.63% 9	3.39% 4	4.24% 5	118
Replace additional showerheads with low-flow models	36.75% 43	9.40% 11	3.42% 4	14.53% 17	15.38% 18	20.51% 24	117
Recycle an extra refrigerator or freezer	15.32% 17	3.60% 4	5.41% 6	13.51% 15	27.93% 31	34.23% 38	111
Replace an older, inefficient appliance with a new ENERGY STAR® model	14.78% 17	4.35% 5	8.70% 10	27.83% 32	13.04% 15	31.30% 36	115
Service heating equipment	34.51% 39	21.24% 24	8.85% 10	7.08% 8	10.62% 12	17.70% 20	113
Service cooling equipment	28.95% 33	18.42% 21	10.53% 12	7.02% 8	10.53% 12	24.56% 28	114
Increase attic insulation	14.66% 17	13.79% 16	7.76% 9	20.69% 24	9.48% 11	33.62% 39	116
Increase wall insulation	8.77% 10	4.39% 5	2.63% 3	9.65% 11	21.93% 25	52.63% 60	114
Increase underfloor insulation	5.31% 6	12.39% 14	6.19% 7	22.12% 25	14.16% 16	39.82% 45	113
Seal air leaks	23.48% 27	35.65% 41	9.57% 11	10.43% 12	3.48% 4	17.39% 20	115
Seal duct work	15.32% 17	25.23% 28	8.11% 9	15.32% 17	5.41% 6	30.63% 34	111
Other	42.86% 12	10.71% 3	3.57% 1	10.71% 3	0.00% 0	32.14% 9	28

Q13: What benefits did you experience from the Home Energy Audit program? (Check all that apply)

Answered: 118 Skipped: 22

Answer Choices	Responses	
Cost savings	56.78%	67
Personal satisfaction	64.41%	76
Raised awareness of energy use	76.27%	90
Benefit to the environment	25.42%	30
Home improvement	48.31%	57
Comfort	49.15%	58
Other	5.93%	7
Total Respondents: 118		

Q14: What barriers do you encounter in making energy savings changes in your home? (Check all that apply)

Answered: 118 Skipped: 22

Answer Choices	Responses	
Cost	82.20%	97
Time	25.42%	30
Convenience	27.12%	32
Lack of necessity	20.34%	24
Do not know who to contact	9.32%	11
Other (please specify)	5.93%	7
Total Respondents: 118		

Q15: The most effective method for Idaho Power to provide information about energy efficiency is to: (Check all that apply)

Answered: 117 Skipped: 23

Answer Choices	Responses	
Offer classes in convenient locations	13.68%	16
Communicate information in local newspapers	16.24%	19
Communicate information on the Idaho Power website	26.50%	31
Communicate information on social media	18.80%	22
Offer a minimal cost home audit service	57.26%	67
Send newsletters or information directly to homeowners	51.28%	60
Send email communications to homeowners	29.91%	35
Send information in monthly Idaho Power bill	76.07%	89
Other (please specify)	5.98%	7
Total Respondents: 117		

Q16: How much do you agree with the following statements:

Answered: 117 Skipped: 23

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Total
My Home Energy Audit report contained valuable information	**69.83%** 81	**25.00%** 29	**3.45%** 4	**1.72%** 2	116
I would recommend the Home Energy Audit program to a friend or relative	**69.57%** 80	**26.09%** 30	**2.61%** 3	**1.74%** 2	115
I am satisfied with my overall experience with the Home Energy Audit program	**70.09%** 82	**22.22%** 26	**5.98%** 7	**1.71%** 2	117

Q18: Please identify your age in the ranges below:

Answered: 119 Skipped: 21

Answer Choices	Responses	
Under 25	0.00%	0
26-35	0.84%	1
36-50	15.13%	18
51-65	43.70%	52
Over 65	40.34%	48
Total		119

Q19: What is the highest level of education you completed?

Answered: 117 Skipped: 23

Answer Choices	Responses	
Less than high school	0.85%	1
Some high school	0.85%	1
High school graduate or equivalent	13.68%	16
Some college	23.93%	28
Two year Associate degree orTrade/Technical school	14.53%	17
Four year college degree	24.79%	29
Some graduate courses	6.84%	8
Advanced degree	14.53%	17
Total		**117**

Q20: May we use your name and comments in Idaho Power's communication efforts?

Answered: 119 Skipped: 21

Answer Choices	Responses	
Yes	54.62%	65
No	45.38%	54
Total		119

Q21: Do you have any issues or concerns you would like us to contact you about?

Answered: 116 Skipped: 24

Answer Choices	Responses	
Yes	12.93%	15
No	87.07%	101
Total		116

15021 A0060 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.

YES NO

SAVINGS TARGET

1. How much would you like to save?
   - ○ $22 – Install the LED light bulbs, LED night light, and the Kitchen Faucet Aerator.
   - ○ $138 – Install the above items, unplug an unused refrigerator or freezer, and install the indoor clothes line.
   - ○ $320 – Complete all the Easy Savings® Quick Start Guide Steps.

HEATING

2. Have you lowered your heat during the day?
   ○ Yes, I lowered it ○ Yes, I plan to lower it ○ No
3. Have you lowered 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 $117 per year!

LIGHTING

5. Did you install the first 9-watt Light-Emitting Diode (LED)?
   ○ Yes, I installed it ○ Yes, I plan to install it ○ No
6. Did you install the second 9-watt Light-Emitting Diode (LED)?
   ○ Yes, I installed it ○ Yes, I plan to install it ○ No
7. Did you install the third 9-watt Light-Emitting Diode (LED)?
   ○ Yes, I installed it ○ Yes, I plan to install it ○ No
8. Did you install the LED Night Light?
   ○ Yes, I placed it ○ Yes, I plan to place it ○ No

FOLD - DO NOT PRINT

9. Did you install the Draft Stoppers?
   ○ Yes, I installed them ○ Yes, I plan to install them ○ No
10. Do you turn off lights in empty rooms more often now?
    ○ Yes ○ No
    Using LEDs and shutting off unused lights can SAVE up to $13 or more a year!

WATER

11. Did you install the Kitchen Faucet Aerator?
    ○ Yes, I installed it ○ Yes, I plan to install it
    ○ No, it does not fit pipes ○ No
    By installing a Kitchen Faucet Aerator, you could SAVE up to $9 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 $37 per year!
14. Did you use the Digital Thermometer to check the temperature of your water?
    ○ Yes ○ Yes, I plan to use it ○ No
15. Did 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 ○ Yes, I plan to check it ○ No
17. Did 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 install the Indoor Clothes Line?
    ○ Yes ○ Yes, I plan to install it ○ No
    Unplugging old refrigerators and freezers and using the Indoor Clothes Line can SAVE up to $116 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 $12 a year!

EASY SAVINGS® QUICK START GUIDE

21. How many items from your Easy Savings® Kit did you install?
    ○ All ○ 3 ○ 1
    ○ 4 or more ○ 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 OR VISIT WWW.GETWISE.ORG/SURVEY/IP-CAPAI AND RESPOND ONLINE FOR A CHANCE TO WIN $100!

IDAHO POWER. An IDACORP Company

IDAHO POWER-CAPAI EASY SAVINGS SURVEY
Español en el otro lado

Action

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 SAVINGS

* For $100 drawing contact information, contact CAPAI at 208-375-2382.
** All savings estimates are based on typical electrically heated Idaho households implementing all suggested changes. Your personal savings may vary.

111269

FOLD - DO NOT PRINT

2014-2015

IDAHO POWER
ENERGY WISE® PROGRAM SUMMARY REPORT

SUBMITTED BY:
RESOURCE ACTION PROGRAMS®

RESOURCEACTION
PROGRAMS

Idaho Power Energy Wise® Program Summary Report 2014-2015

Made possible by:

IDAHO POWER®

An IDACORP Company

Submitted by:

RESOURCEACTION PROGRAMS

August 2015

""My son came home very excited to test the products. He had a lot of fun and has learned a lot. The kit was very easy to use. We were done in 15 minutes to test everything out."

Jan Merrill, Parent
Ellis Elementary School

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"I liked having my son do the calculations to learn how much was being saved with new light bulbs."

Ann Waibel, Parent
Washington Elementary

Executive Summary

Resource Action Programs® (RAP) is pleased to present this Program Summary Report to Idaho Power, which summarizes the 2014-2015 Idaho Power Energy Wise® Program. The program was implemented in the Idaho Power service area in the state of Idaho by 6,699 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

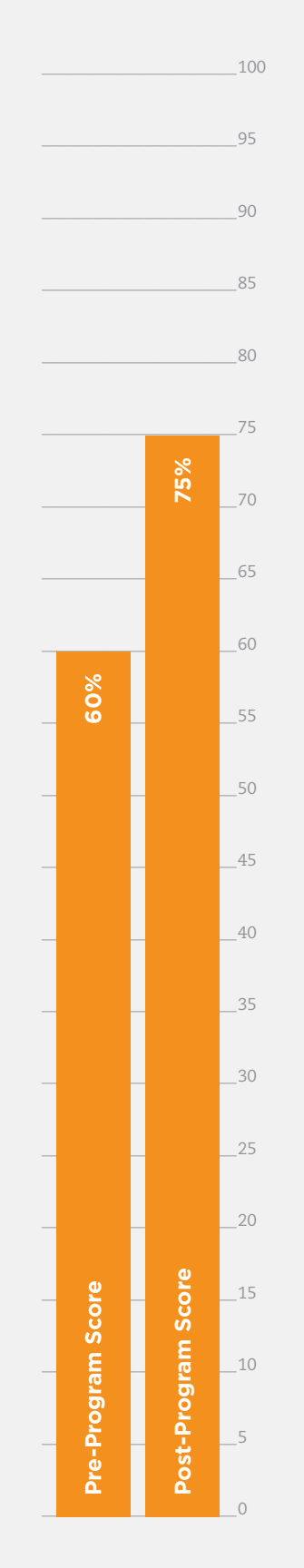
A successful program excites and engages participants. Students, parents, and teachers are asked to evaluate the program and provide personal comments. A sample of the feedback is given in the margin. ›

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.



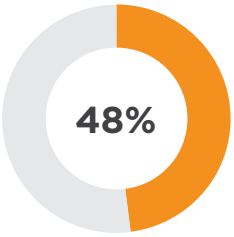
Knowledge Gained

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 **60%** to **75%**.

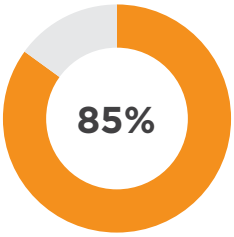
Measures Installed

Students completed take-home activities as part of the program and reported on the kit measures they installed in their homes.

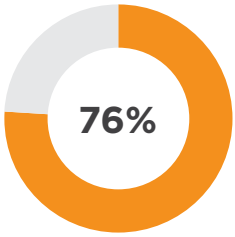
A summary of responses can be found in Appendix B.



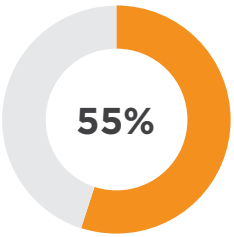
Students who reported they installed the High-Efficiency Showerhead.



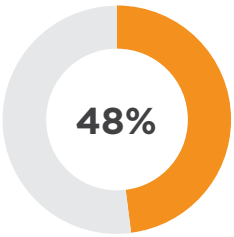
Students who indicated they installed the LED Night Light.



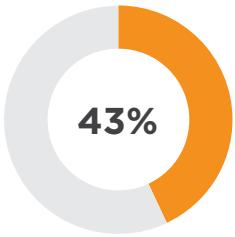
Students who reported they used the Shower Timer.



Students who reported they installed the 13-watt CFL.



Students who reported they installed the 18-watt CFL.



Students who reported they installed the 23-watt CFL.

Student Survey Response by Region

	Total	Capital	Canyon	Eastern	Southern	Western
Participants	**6,699**	1,423	2,484	1,014	982	796
Surveys Received	**4,885**	919	1,951	814	606	595
Percent Response	**73%**	65%	79%	80%	62%	75%

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	
11,448,794	gallons of water saved
1,476,013	kWh of electricity saved
46,187	therms of gas saved
11,448,794	gallons of wastewater saved

PROJECTED LIFETIME SAVINGS	
114,487,937	gallons of water saved
14,651,467	kWh of electricity saved
461,874	therms of gas saved
114,487,937	gallons of wastewater saved

PROJECTED ANNUAL SAVINGS PER HOME	
1,709	gallons of water saved
220	kWh of electricity saved
7	therms of gas saved
1,709	gallons of wastewater saved

PROJECTED LIFETIME SAVINGS PER HOME	
17,090	gallons of water saved
2,187	kWh of electricity saved
69	therms of gas saved
17,090	gallons of wastewater saved

"Our daughter taught us so much. We didn't know some of these items existed. We will buy more shower heads and timers. We appreciate learning more about saving energy and are grateful for your sponsorship. Thank you!"

Jodi Erickson, Parent
Greenacres Elementary School

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 2014-2015 program was taught in grades 3-6 throughout the Idaho Power service area.

The Idaho Power Community Education Representative 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 water and 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.

"They liked all aspects of this course. I was pleased with the level of engagement they demonstrated."

Fred Anderson, Teacher
Groveland Elementary

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/Guardian Program Introduction Letter*

Student Survey Form

Certificate of Achievement

Energy Wise Kit Containing:

- High-Efficiency Showerhead*
- Shower Timer
- LED Night Light
- 13-watt Compact Fluorescent Lamp
- 18-watt Compact Fluorescent Lamp
- 23-watt Compact Fluorescent Lamp
- FilterTone® Alarm*
- Digital Thermometer*
- Reminder Stickers and Magnet Pack
- Flow Rate Test Bag
- Natural Resource Fact Chart
- Parent/Guardian Program Evaluation
- Installation DVD

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

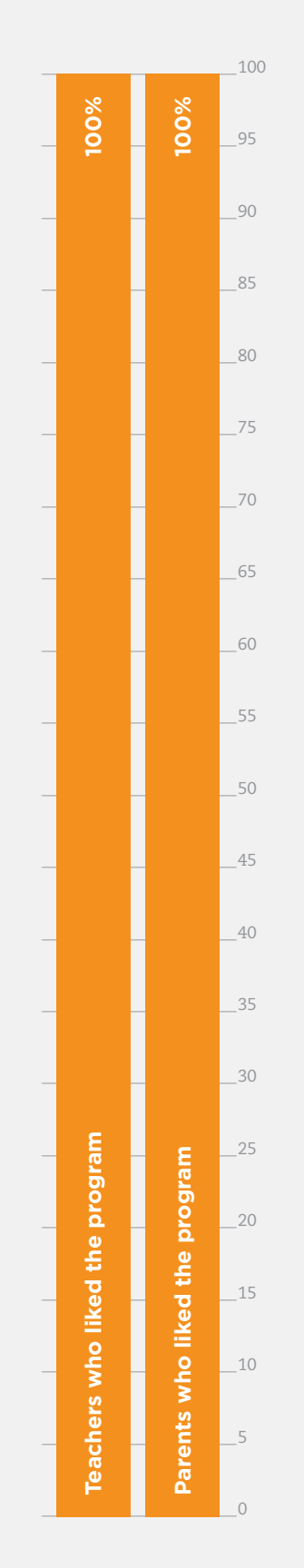
Teacher Program Evaluation

Pre/Post Student Survey Answer Keys

Electricity Poster

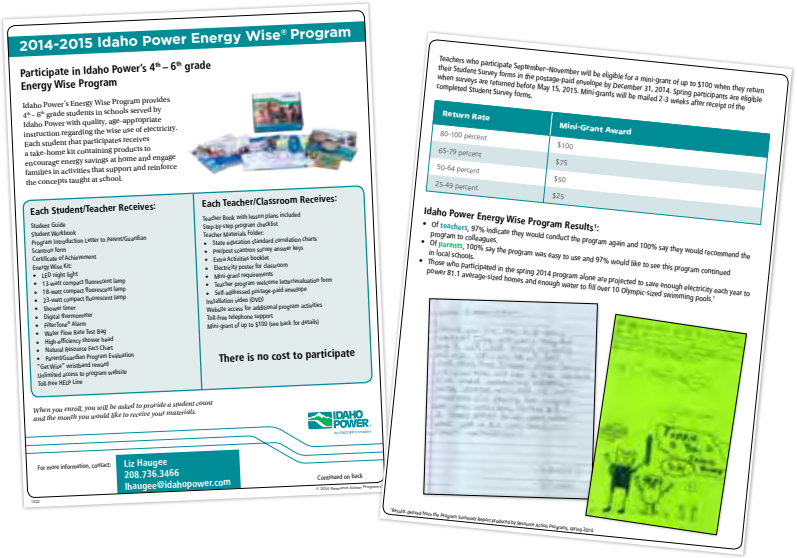
Self-Addressed Postage-Paid Envelope

** 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 the Idaho Power logo throughout each Energy Wise Kit. In addition to the kit, the Teacher Program Evaluation and Parent/Guardian Program Introduction Letter also feature Idaho Power branding. Further, a custom Teacher Solicitation Flyer was created for Community Education Representatives' program promotion and a cross-marketing Residential Energy Efficiency promotional brochure included to promote other energy-efficiency programs.



2014-2015 Idaho Power Energy Wise® Program

Participate in Idaho Power's 4th – 6th grade Energy Wise Program

Idaho Power's Energy Wise Program provides 4th - 6th grade students in schools served by Idaho Power with quality, age-appropriate instruction regarding the wise use of electricity. Each student that participates receives a take-home kit containing products to encourage energy savings at home and engage families in activities that support and reinforce the concepts taught at school.

Each Student/Teacher Receives:

Student Guide
Student Workbook
Program Introduction Letter to Parent/Guardian
Scantron form
Certificate of Achievement
Energy Wise Kit:
- LED night light
- 13-watt compact fluorescent lamp
- 18-watt compact fluorescent lamp
- 23-watt compact fluorescent lamp
- Shower timer
- Digital thermometer
- filterTone® Alarm
- Water Flow Rate Test Bag
- High-efficiency shower head
- Natural Resource Fact Chart
- Parent/Guardian Program Evaluation
- "Get Wise" wristband reward
- Unlimited access to program website
- Toll-free HELP Line

Each Teacher/Classroom Receives:

Teacher Book with lesson plans included
Step-by-step program checklist
Teacher Materials Folder:
- State education standard correlation charts
- Pre/post scantron survey answer keys
- Extra Activities booklet
- Electricity poster for classroom
- Mini-grant requirements
- Teacher program welcome letter/evaluation form
- Self-addressed postage-paid envelope

Installation video (DVD)
Website access for additional program activities
Toll-free telephone support
Mini-grant of up to $100 (see back for details)

There is no cost to participate

When you enroll, you will be asked to provide a student count and the month you would like to receive your materials.

IDAHO POWER

For more information, contact:
Liz Haugee
208.736.3466
lhaugee@idahopower.com

Continued on back

Teachers who participate September–November will be eligible for a mini-grant of up to $100 when they return their Student Survey forms in the postage-paid envelope by December 31, 2014. Spring participants are eligible when surveys are returned before May 15, 2015. Mini-grants will be mailed 2-3 weeks after receipt of the completed Student Survey forms.

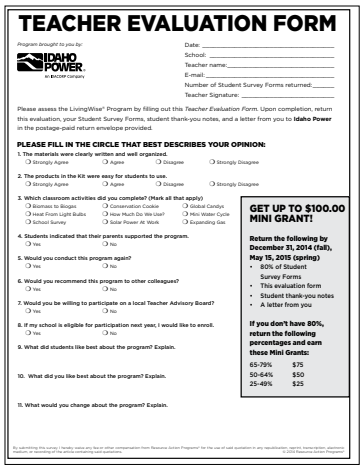
Return Rate	Mini-Grant Award
80-100 percent	$100
65-79 percent	$75
50-64 percent	$50
25-49 percent	$25

Idaho Power Energy Wise Program Results[1]:

- Of teachers, 97% indicate they would conduct the program again and 100% say they would recommend the program to colleagues.
- Of parents, 100% say the program was easy to use and 97% would like to see this program continued in local schools.
- Those who participated in the spring 2014 program alone are projected to save enough electricity each year to power 81.1 average-sized homes and enough water to fill over 10 Olympic-sized swimming pools.[1]

[1]Results defined from Fly Program Summary Report prepared by Resource Action Programs, spring 2014.

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 Candys
❍ 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 December 31, 2014 (fall), May 15, 2015 (spring)
- 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, placement, museum, or scanning of the article containing said quotations. © 2012 Resource Action Programs®

Teacher Evaluation Form

PARENTS

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/Pledge Form

STUDENTS

PLEDGE FORM

Name:	Date:
School:	Teacher:

Pledging to save energy and water is an important step in conserving our natural resources and will save your family money on utility bills. As you go through the Program, you will learn why it is important to conserve energy and water. The Program will teach you simple ways to save energy, water, and money. Taking the Pledge shows that you want to be more energy and water efficient to reduce your family's utility bills.

TAKE THE PLEDGE

We have helped you out by writing your first pledge. All you have to do to complete the first pledge is install the items from your kit. Now, write two more pledges describing how you will be more energy and water efficient at home. Remember, a pledge is a promise.

1. I pledge to do my part by installing all of the items in my kit to save energy and water as well as reduce my family's utility bills.
2. _____
3. _____

SIGN THE PLEDGE

I have written and reviewed my pledges above and by signing this form, I promise to use energy and water more efficiently at home.

Student Signature _____ *Parent Signature* _____

These Kits are made possible by: IDAHO POWER. An IDACORP Company

Developed by: RESOURCEACTION PROGRAMS

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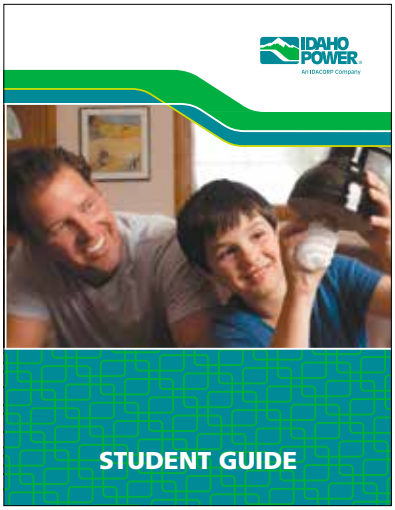
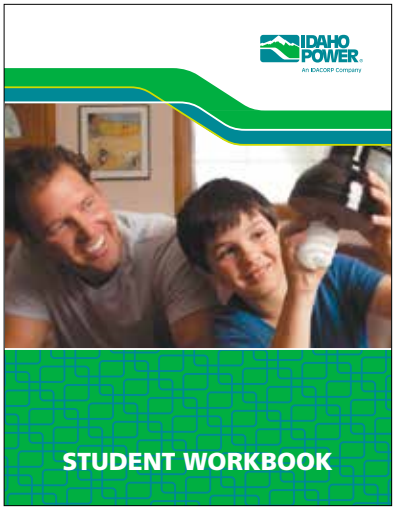
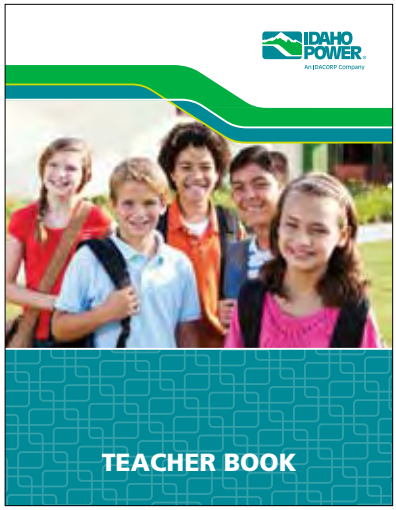
Parent Letter/Pledge Form



Student Guide



Student Workbook



Teacher Book

ENERGY WISE

CERTIFICATE OF ACHIEVEMENT
Awarded to

_____

for making a difference in your community by successfully completing the Energy Wise® program.

Diane Santos, Ed.D., Director of Education

Energy Wise® is developed by: RESOURCEACTION PROGRAMS

©2012 Resource Action Programs®

Certificate of Achievement

Kit Box

"The students liked trying all the new materials. They enjoyed installing them."

Meko Myers, Teacher
Valley View Elementary School

Program Implementation

The 2014-2015 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 outreach and program introduction by Idaho Power CERs
7. Teachers enrolled in the program individually by Idaho Power CERs
8. Implementation dates scheduled with teachers by Idaho Power CERs
9. Program material delivered to coincide with desired implementation date
10. Delivery confirmation
11. Periodic contact to ensure implementation and teacher satisfaction
12. Program completion incentive offered
13. Results collection
14. Program completion incentive delivered to qualifying teachers
15. Thank you cards sent to participating teachers
16. Data analysis
17. 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 3-6 that participated during the 2014-2015 school year.

For more than 22 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 400,000 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 water and energy literacy amongst program participants.

"They loved working through the different components of the kit with their parents. I heard how much fun it was."

Anthony Haskett, Teacher
Ronald Reagan Elementary School

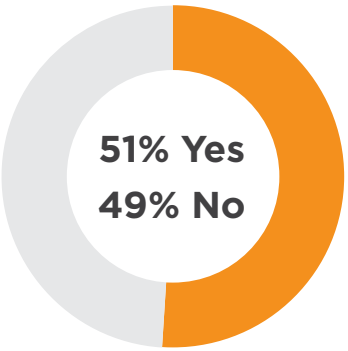
Program Impact

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:

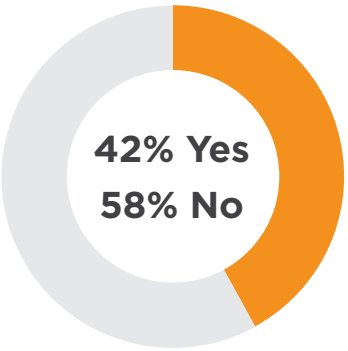
A. Home Survey for Capital Region

Participating teachers were asked to return their students' completed home check-up and home activities results. Of the 49 participating teachers in the Capital region, 40 (82%) returned survey results for the program. Students were asked to install the kit measures and complete the home activities with parent assistance. Of the 1,374 participating children in the Capital region, 919 (67%) returned completed surveys.

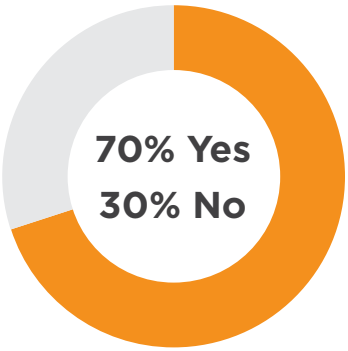
Did your family install the 13-watt Compact Fluorescent Lamp (CFL)?	**Yes - 51%**
Did your family install the new High-Efficiency Showerhead?	**Yes - 42%**
Did your family change the way they use energy?	**Yes - 70%**



Students who indicated they installed the 13-watt Compact Fluorescent Lamp.



Students who indicated they installed the High-Efficiency Showerhead.

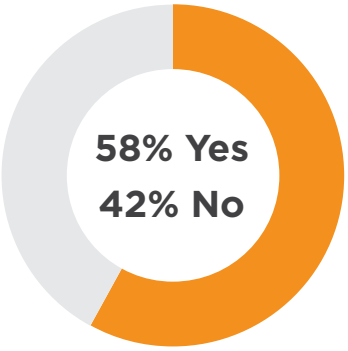


Students who indicated their family changed the way they use energy.

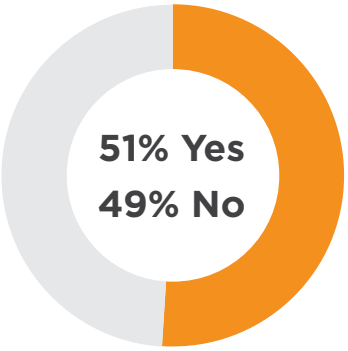
Home Survey for Canyon Region

Participating teachers were asked to return their students' completed home check-up and home activities results. Of the 83 participating teachers in the Canyon region, 75 (90%) returned survey results for the program. Students were asked to install the kit measures and complete the home activities with parent assistance. Of the 2,401 participating children in the Canyon region, 1,951 (81%) returned completed surveys.

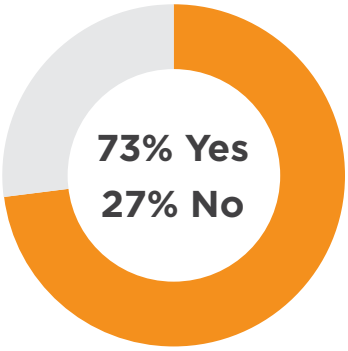
Did your family install the 13-watt Compact Fluorescent Lamp (CFL)?	**Yes - 58%**
Did your family install the new High-Efficiency Showerhead?	**Yes - 51%**
Did your family change the way they use energy?	**Yes - 73%**



Students who indicated they installed the 13-watt Compact Fluorescent Lamp.



Students who indicated they installed the High-Efficiency Showerhead.

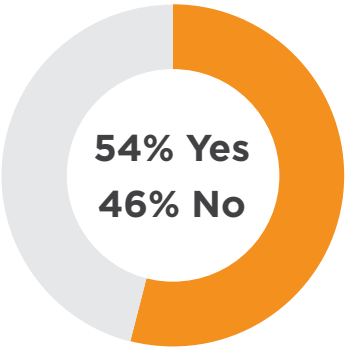


Students who indicated their family changed the way they use energy.

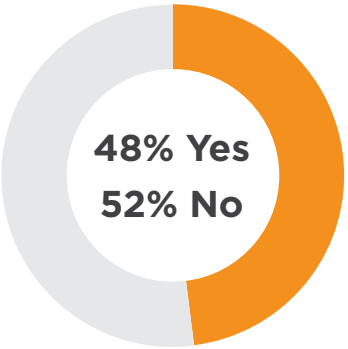
Home Survey for Eastern Region

Participating teachers were asked to return their students' completed home check-up and home activities results. Of the 39 participating teachers in the Eastern region, 35 (90%) returned survey results for the program. Students were asked to install the kit measures and complete the home activities with parent assistance. Of the 975 participating children in the Eastern region, 814 (83%) returned completed surveys.

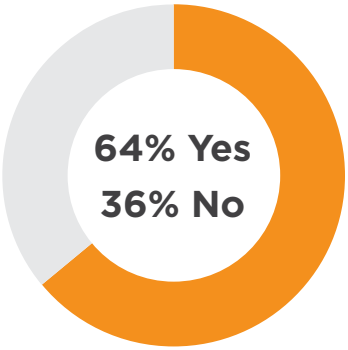
Did your family install the 13-watt Compact Fluorescent Lamp (CFL)?	**Yes - 54%**
Did your family install the new High-Efficiency Showerhead?	**Yes - 48%**
Did your family change the way they use energy?	**Yes - 64%**



Students who indicated they installed the 13-watt Compact Fluorescent Lamp.



Students who indicated they installed the High-Efficiency Showerhead.

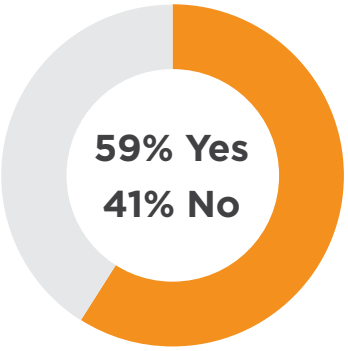


Students who indicated their family changed the way they use energy.

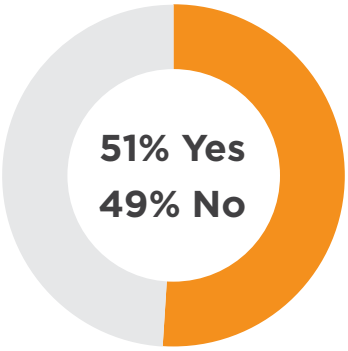
Home Survey for Southern Region

Participating teachers were asked to return their students' completed home check-up and home activities results. Of the 35 participating teachers in the Southern region, 23 (66%) returned survey results for the program. Students were asked to install the kit measures and complete the home activities with parent assistance. Of the 947 participating children in the Southern region, 606 (64%) returned completed surveys.

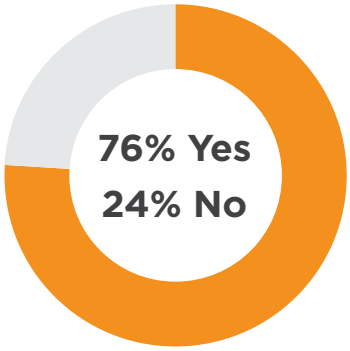
Did your family install the 13-watt Compact Fluorescent Lamp (CFL)?	**Yes - 59%**
Did your family install the new High-Efficiency Showerhead?	**Yes - 51%**
Did your family change the way they use energy?	**Yes - 76%**



Students who indicated they installed the 13-watt Compact Fluorescent Lamp.



Students who indicated they installed the High-Efficiency Showerhead.

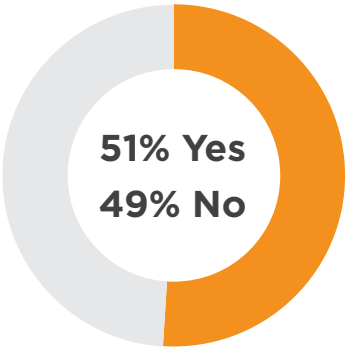


Students who indicated their family changed the way they use energy.

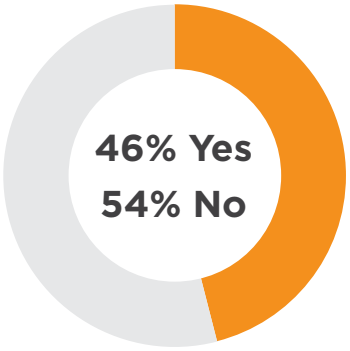
Home Survey for Western Region

Participating teachers were asked to return their students' completed home check-up and home activities results. Of the 20 participating teachers in the Western region, 17 (85%) returned survey results for the program. Students were asked to install the kit measures and complete the home activities with parent assistance. Of the 776 participating children in the Western region, 595 (77%) returned completed surveys.

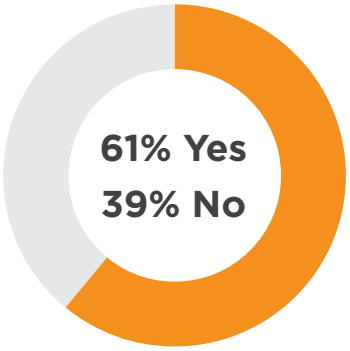
Did your family install the 13-watt Compact Fluorescent Lamp (CFL)?	**Yes - 51%**
Did your family install the new High-Efficiency Showerhead?	**Yes - 46%**
Did your family change the way they use energy?	**Yes - 61%**



Students who indicated they installed the 13-watt Compact Fluorescent Lamp.



Students who indicated they installed the High-Efficiency Showerhead.

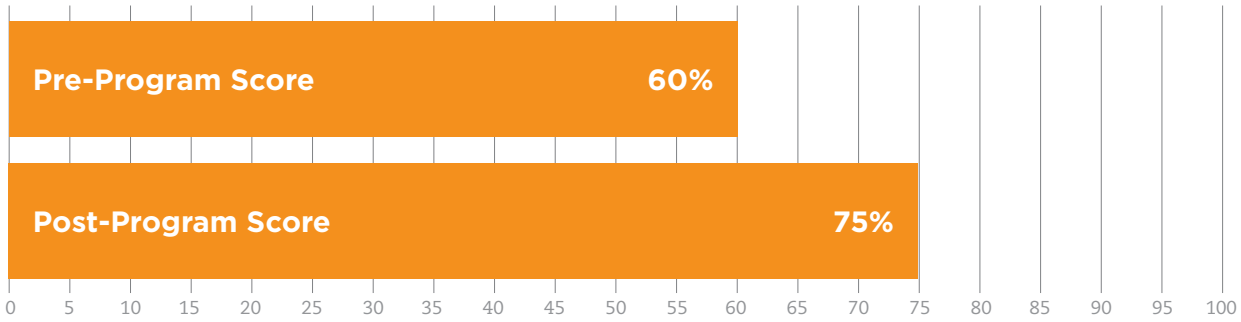


Students who indicated their family changed the way they use energy.

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 **6.0** questions correctly prior to being involved in the program and then improved to answer **7.5** questions correctly following participation. Of the 6,473 students participating, 4,885 returned survey responses.

Scores improved from 60% to 75%.



Pre-Program and Post-Program Test Questions

		Pre	Post
1	Which layer of Earth do we live on?		
	Crust	69%	87%
	Mantle	6%	3%
	Inner Core	7%	3%
	Outer Core	17%	7%
2	Non-Potable water is safe to drink.		
	True	23%	13%
	False	77%	87%
3	Which of these is not a renewable resource?		
	Wind	19%	11%
	Plants	5%	3%
	Gold	59%	77%
	Animals	16%	9%

4	Saving water saves energy.		
	True	86%	95%
	False	14%	5%
5	Which are fossil fuels?		
	Coal	21%	17%
	Oil	11%	6%
	Natural Gas	14%	8%
	All of the above	54%	69%
6	Which type of energy is created in the process of Photosynthesis?		
	Nuclear Energy	20%	15%
	Thermal Energy	25%	20%
	Chemical Energy	32%	54%
	Electric Energy	24%	11%
7	Which kit item will save the most natural resources?		
	Compact Fluorescent Lamp	19%	15%
	High-Efficiency Showerhead	35%	59%
	FilterTone® Alarm	18%	9%
	LED Night Light	28%	16%
8	Which major appliance uses the most energy?		
	Dishwasher	19%	15%
	Refrigerator	62%	67%
	Dryer	20%	18%
9	A Compact Fluorescent Lamp (CFL) uses more energy than an incandescent bulb.		
	True	41%	25%
	False	59%	75%
10	On-peak time is the best time to play video games.		
	True	28%	18%
	False	72%	82%

C. Home Activities—Summary

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, 6,699 households are expected to save the following resource totals. Savings from these actions and new behaviors will continue for many years to come. Of the 6,473 students participating, 4,885 returned survey responses.

Projected Resource Savings

A list of assumptions and formulas used for these calculations can be found in Appendix A.

Number of Participants:	**6,699**		
	Annual	**Lifetime**	
Projected reduction from Showerhead retrofit:	**11,448,794**	**114,487,937**	gallons
Product Life: **10 years**	**729,102**	**7,291,025**	kWh
	38,730	**387,305**	therms
Projected reduction from **13**-watt Compact Fluorescent Lamp (CFL):	**172,519**	**1,682,047**	kWh
Product Life: **10,000 hours**			
Projected reduction from **18**-watt Compact Fluorescent Lamp (CFL):	**140,646**	**1,371,283**	kWh
Product Life: **10,000 hours**			
Projected reduction from **23**-watt Compact Fluorescent Lamp (CFL):	**121,333**	**1,182,989**	kWh
Product Life: **10,000 hours**			
Projected reduction from LED Night Light retrofit:	**161,910**	**1,619,103**	kWh
Product Life: **10,000 hours**			
Projected reduction from FilterTone® installation:	**150,502**	**1,505,021**	kWh
Product Life: **10 years**	**7,457**	**74,569**	therms
TOTAL PROGRAM SAVINGS:	**11,448,794**	**114,487,937**	gallons
	1,476,013	**14,651,467**	kWh
	46,187	**461,874**	therms
TOTAL PROGRAM SAVINGS PER HOUSEHOLD:	**1,709**	**17,090**	gallons
	220	**2,187**	kWh
	7	**69**	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. Of the 226 participating teachers, 157 returned teacher program evaluation surveys.

Teacher Response

(A summary of responses and regional data can be found in Appendix D)

100% 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.

What did students like best about the program? Explain.

"Taking the kits home and installing the items and then sharing their experiences with the class."
Heather Tucker, Desert Springs Elementary School

"They liked all aspects of this course. I was pleased with the level of engagement they demonstrated."
Fred Anderson, Groveland Elementary

"They liked learning about different ways they could save energy to save money. They also liked that they kit allowed them to include their families in this activity."
Katie Strawser, Desert Springs Elementary School

"The students liked the energy-saving kits. They enthusiastically and conscientiously applied all the products they could."
Petra Vawter, Marsing Middle School

"The kits! We talked about them nearly every day!"
Amy Mattei, West Canyon Elementary

"The night light was a big hit. The student guide as it brought about good peer to peer discussions."
John Harlan, Central Elementary School

"They loved having their own booklets and the activities that came with the reading."
Maggie Mahler, Whittier Elementary School

What did you like best about the program? Explain.

"It created conversation about energy and what we use. It goes along well with our electricity unit."
Glen Kershaw, Mill Creek 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 are 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. Of the 6,473 participating families, 107 parents returned program evaluation surveys.

Parent Response

(A summary of responses and regional data can be found in Appendix E)

98% of participating parents indicated that the program was easy to use.

99% of participating parents indicated they would continue to use the kit items after the completion of the program.

99% 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?

"I liked having my son do the calculations to learn how much was being saved with new light bulbs."
Ann Waibel, Washington Elementary

"The children learn how much water and power is required to do normal day activities."
Ellen Makinster, Lake Ridge Elementary School

"I liked the shower head and timer the most. My kids shower way too long, so I think they will make a difference."
Steven Fisher, Indian Creek & Ross Elementary School

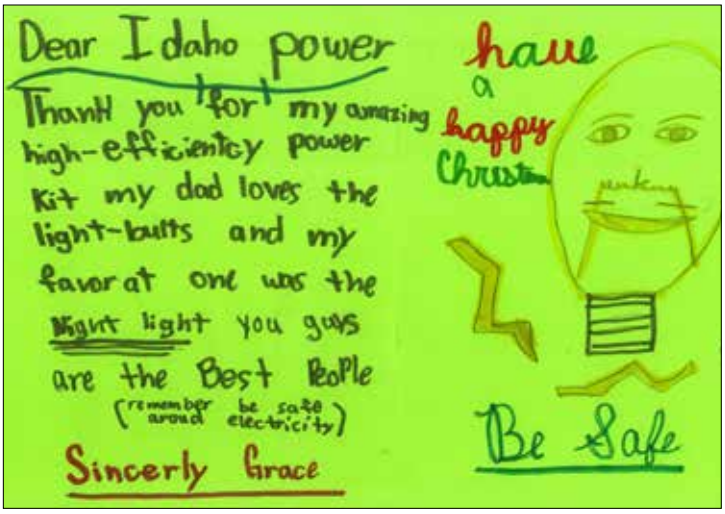
"That the kids learn the importance of using resources wisely and are taught ways to do so."
Kari Whitney, Filer Intermediate School

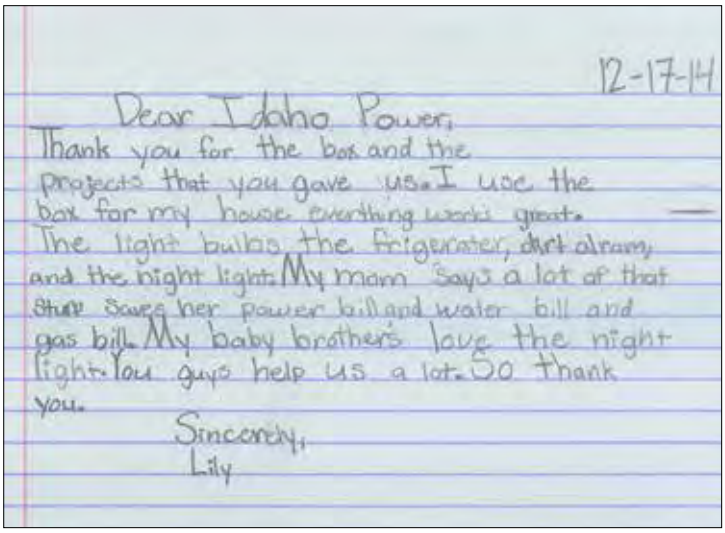
"I like that you are educating kids on the importance of saving energy."
Alexis Jimenez, Birch Elementary School

Are there any comments you would like to express to your child's program sponsor?

"This is an awesome program! I'm glad Idaho Power is taking an initiative to teach our young generations how to conserve resources. Way to go!"
Kari Whitney, Filer Intermediate School

F. Student Letters


Dear Idaho power
Thank you for my amazing high-efficiency power kit my dad loves the light-bulbs and my favorat one was the Night light you guys are the Best People (remember be safe around electricity)
Sincerly Grace
have a happy Christ
Be Safe


12-17-14
Dear Idaho Power,
Thank you for the box and the projects that you gave us. I use the box for my house. everthing works great. The light bulbs the frigerator, dirt alram, and the night light. My mom says a lot of that stuff saves her power bill and water bill and gas bill. My baby brothers love the night light. You guys help us a lot. So thank you.
Sincerely,
Lily

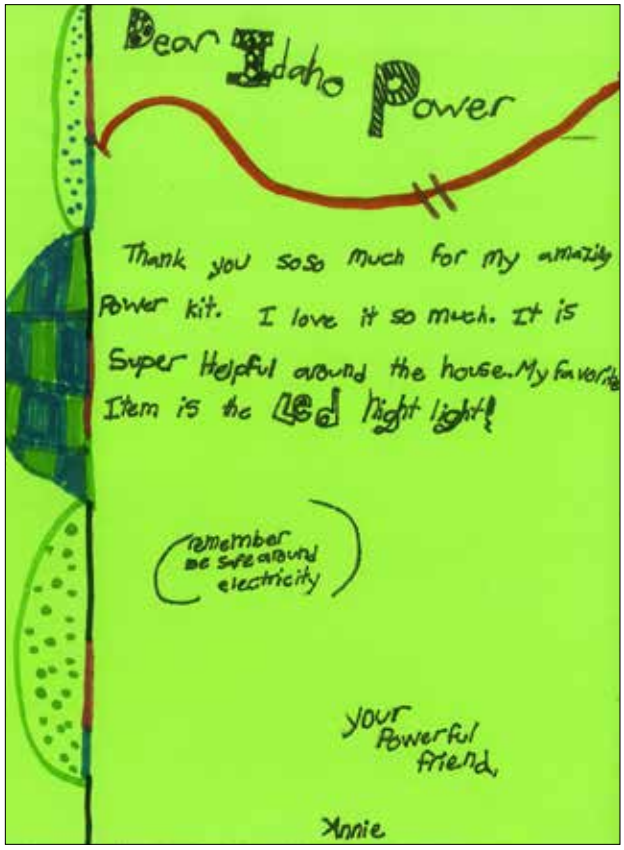
Dear Idaho Power Company

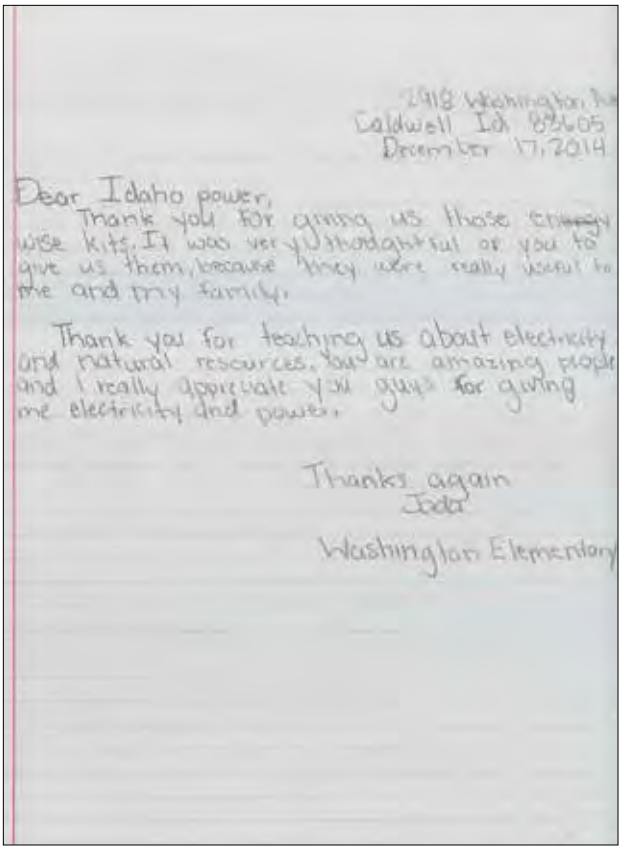
Thank you for giving us the box of supplies for our tests. It was a delight experimenting with all of the supplies. My favorite part of the test was the light bulbs. You saved my mom 5$ for lights. I had a great time playing with it.

Sincerely

Bailey

Student Letters




2918 Washington, Ave
Caldwell Id. 83605
December 17, 2014

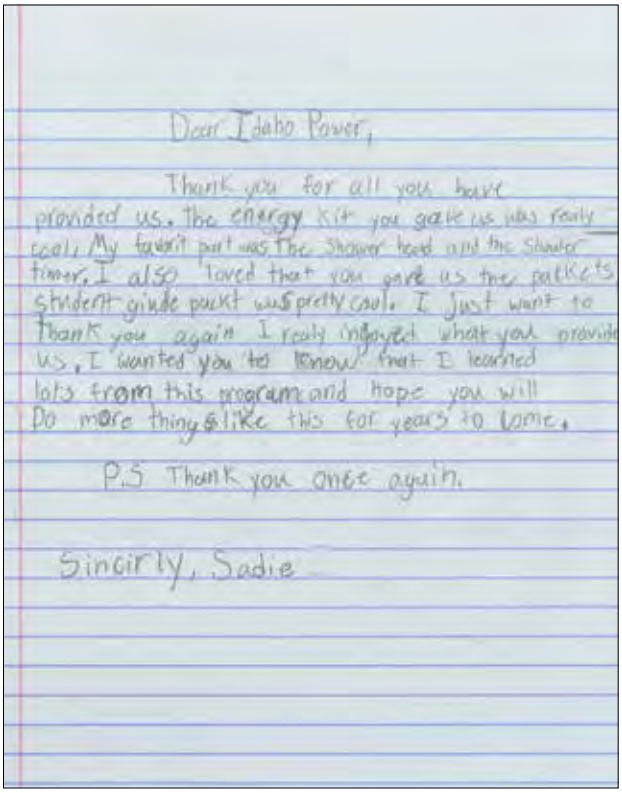
Dear Idaho power,
Thank you for giving us those energy wise kits. It was very thoughtful of you to give us them, because they were really useful to me and my family.

Thank you for teaching us about electricity and natural resources. You are amazing people and I really appreciate you guys for giving me electricity and power.

Thanks again
Jada

Washington Elementary

Student Letters

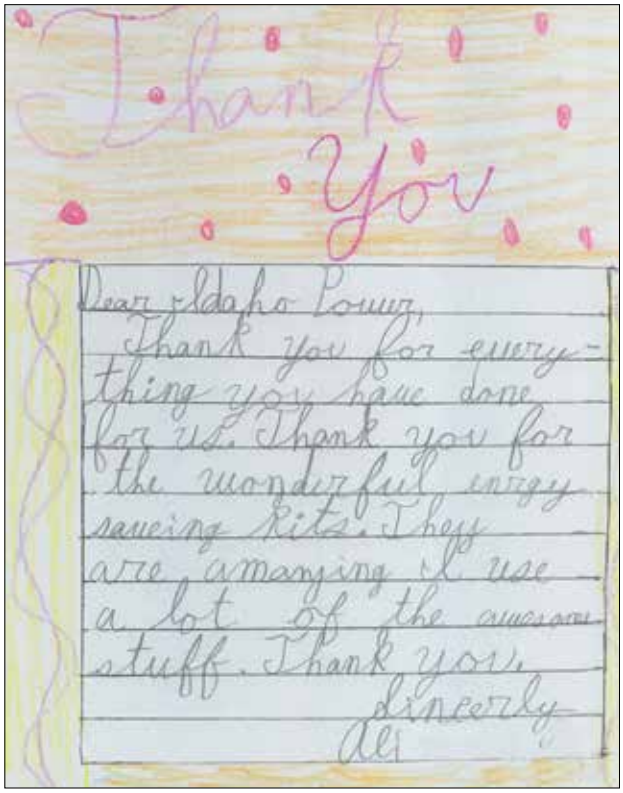


Dear Idaho Power,

Thank you for all you have provided us. The energy kit you gave us was really cool. My favorit part was the shower head and the shower timer. I also loved that you gave us the pockets student guide pocket was pretty cool. I just want to thank you again I really enjoyed what you provide us. I wanted you to know that I learned lots from this program and hope you will Do more thing like this for years to come.

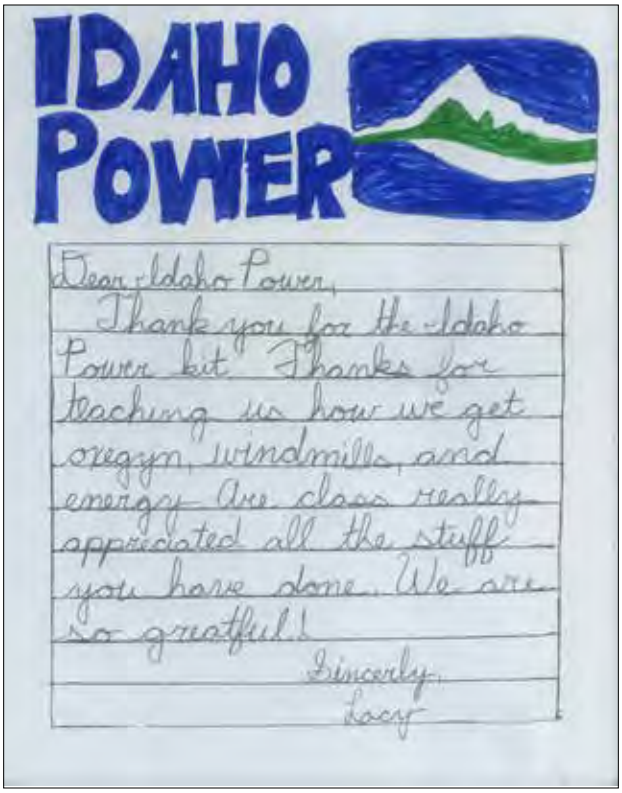
P.S Thank you once again.

Sincirly, Sadie



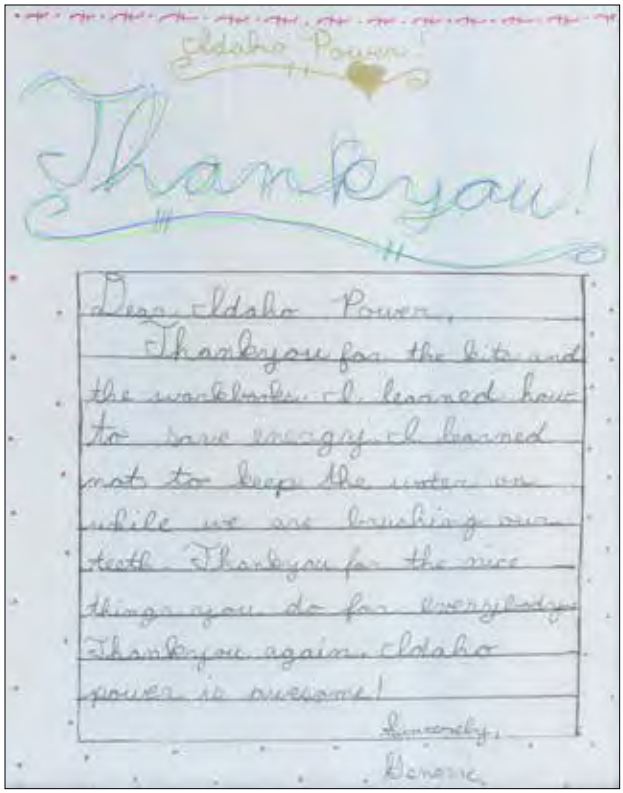
Thank You

Dear Idaho Power,
Thank you for everything you have done for us. Thank you for the wonderful energy saveing kits. They are amazing I use a lot of the awesome stuff. Thank you.
Sincerly
Ali



IDAHO POWER

Dear Idaho Power,
Thank you for the Idaho Power kit. Thanks for teaching us how we get oxygen, windmills, and energy. Our class really appreciated all the stuff you have done. We are so greatful!
Sincerly,
Lacy

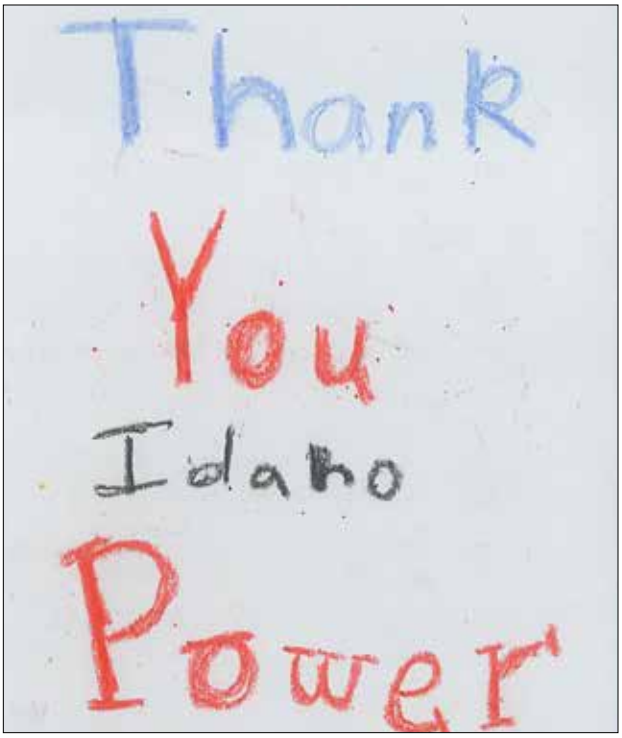


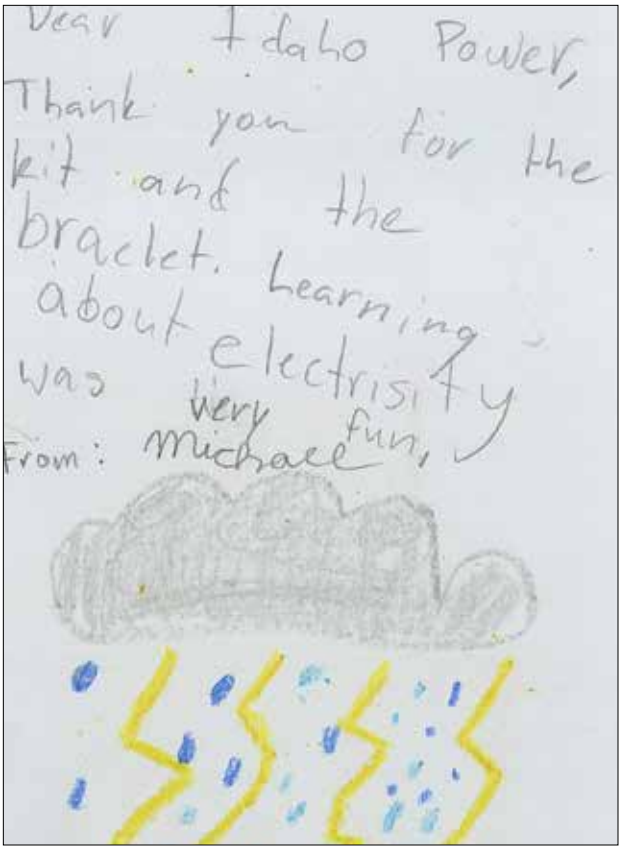
Idaho Power!

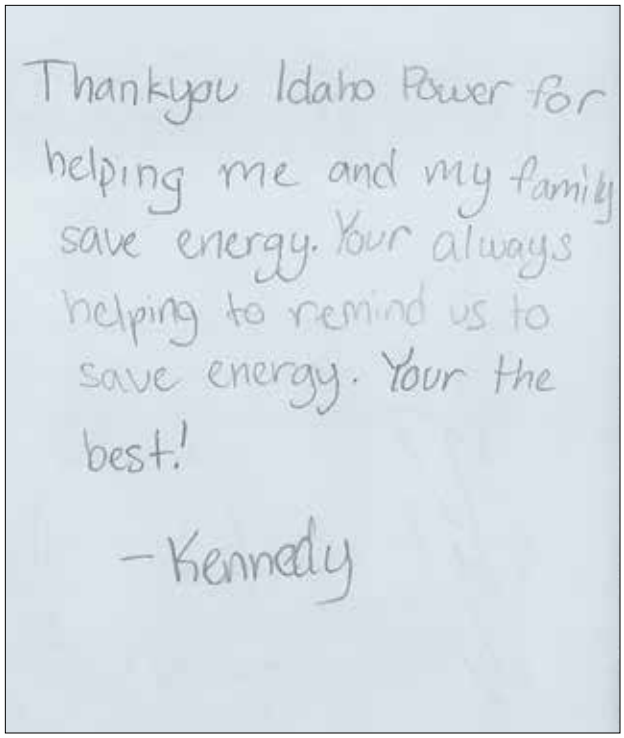
Thank you!

Dear Idaho Power,
Thankyou for the kits and the workbooks. I learned how to save energy. I learned not to keep the water on while we are brushing our teeth. Thankyou for the nice things you do for everybody. Thankyou again. Idaho power is awesome!
Sincerely,
Denaric

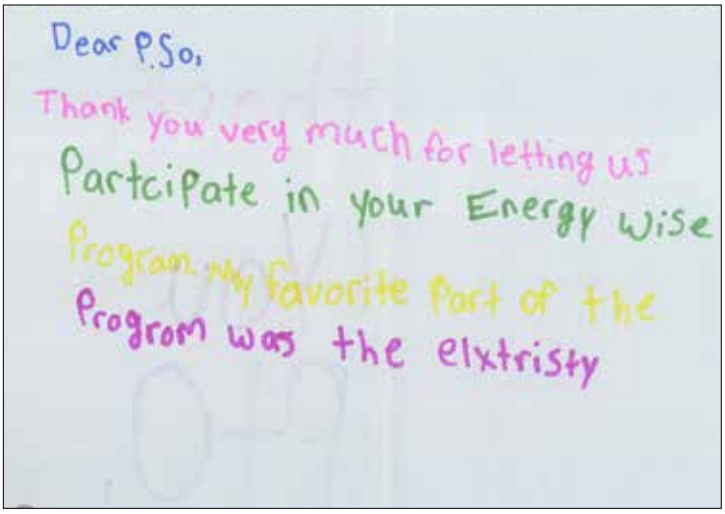
Student Letters

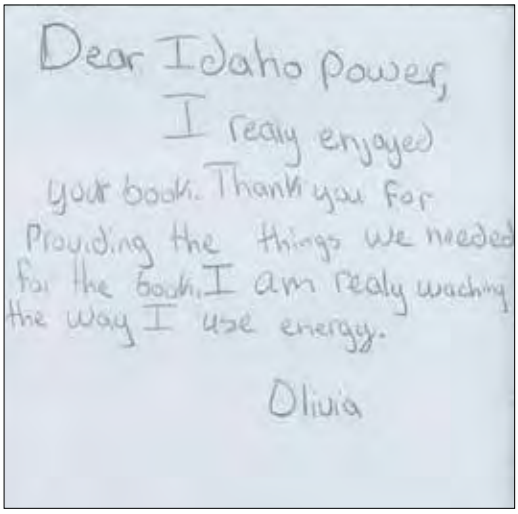




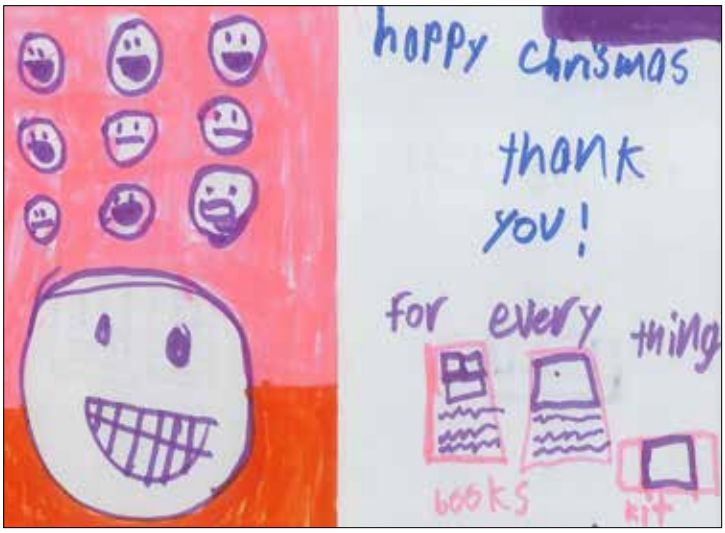


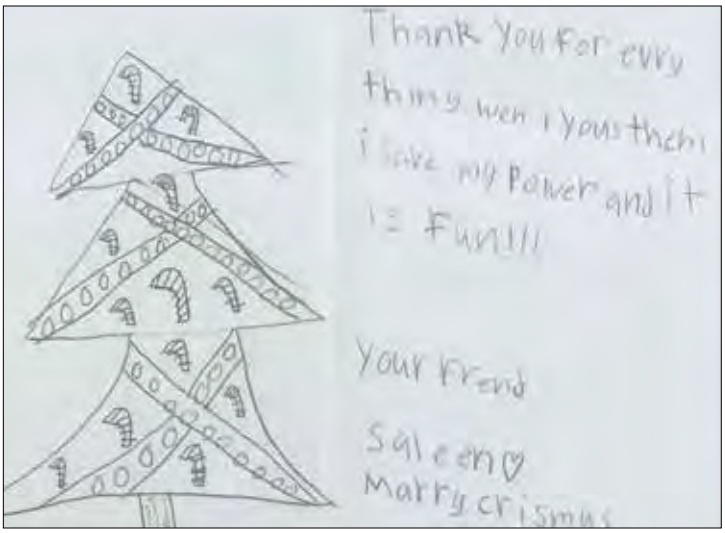
Student Letters


Dear P.So,
Thank you very much for letting us
Partcipate in your Energy Wise
Program. My favorite Part of the
Program was the elxtristy


Dear Idaho Power,
I realy enjoyed
your book. Thank you for
Providing the things we needed
for the book. I am realy watching
the way I use energy.
Olivia

thank
you
for
the
kit


happy christmas
thank
you!
for every thing
books
kit


Thank you for every
thing wen i yous them
i love my Power and it
is Fun!!!
Your frend
Saleen
Marry crismas

"They liked learning about different ways they could save energy to save money. They also liked that the kit allowed them to include their families in this activity."

Katie Strawser, Teacher
Desert Springs Elementary School

Appendices

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Projected Savings from Showerhead Retrofit

Showerhead Retrofit Inputs and Assumptions:

Average household size:	5.09	people[1]
Average number of full bathrooms per home:	2.00	full bathrooms per home[1]
% of water heated by gas:	51.49%	[1]
% of water heated by electricity:	48.47%	[1]
Installation / participation rate of:	48.48%	[1]
Average Showerhead has a flow rate of:	2.01	gallons per minute[1]
Retrofit Showerhead has a flow rate of:	1.32	gallons per minute[1]
Number of participants:	6,699	[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:	11,448,794	gallons[4]
Showerhead retrofit projects a **lifetime** reduction of:	114,487,937	gallons[5]

Projected Electricity Savings:

Showerhead retrofit projects an **annual** reduction of:	729,102	kWh[2,6]
Showerhead retrofit projects a **lifetime** reduction of:	7,291,025	kWh[2,7]

Projected Natural Gas Savings:

Showerhead retrofit projects an **annual** reduction of:	38,730	therms[2,8]
Showerhead retrofit projects a **lifetime** reduction of:	387,305	therms[2,9]

1 Data Reported by Program Participants.

2 (March 4, 2010). EPA WaterSense® Specification for Showerheads Supporting Statement. Retrieved 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:	**28.74%**	[4]
Number of participants:	**6,699**	[4]

Projected Electricity Savings:

The FilterTone installation projects an **annual** reduction of:	**150,502**	kWh[5]
The FilterTone installation projects a **lifetime** reduction of:	**1,505,021**	kWh[6]

Projected Natural Gas Savings:

The FilterTone installation projects an **annual** reduction of:	**7,457**	therms[7]
The FilterTone installation projects a **lifetime** reduction of:	**74,569**	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:	**58.37**	watts[3]
Installation / participation rate of:	**55.34%**	[3]
Number of participants:	**6,699**	[3]

Projected Electricity Savings:

The CFL retrofit projects an **annual** reduction of:	**172,519**	kWh[2,4]
The CFL retrofit projects a **lifetime** reduction of:	**1,682,047**	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:	**60.64**	watts[3]
Installation / participation rate of:	**48.01%**	[3]
Number of participants:	**6,699**	[3]

Projected Electricity Savings:

The CFL retrofit projects an **annual** reduction of:	**140,646**	kWh[2,4]
The CFL retrofit projects a **lifetime** reduction of:	**1,371,283**	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:	**64.02**	watts[3]
Installation / participation rate of:	**43.05%**	[3]
Number of participants:	**6,699**	[3]

Projected Electricity Savings:

The CFL retrofit projects an **annual** reduction of:	**121,333**	kWh[2,4]
The CFL retrofit projects a **lifetime** reduction of:	**1,182,989**	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:	**84.89%**	[3]
Number of participants:	**6,699**	[3]

Projected Electricity Savings:

The Energy Efficient Night Light retrofit projects an **annual** reduction of:	**161,910**	kWh
The Energy Efficient Night Light retrofit projects a **lifetime** reduction of:	**1,619,103**	kWh

1 Assumption (12 hours per day)

2 Product life provided by manufacturer

3 Data reported by program participants

Home Check-Up

	Total	Capital	Canyon	Eastern	Southern	Western
Participants	6,699	1,423	2,484	1,014	982	796
Surveys Received	4,885	919	1,951	814	606	595
Percent Response	73%	65%	79%	80%	62%	75%

		Total	Capital	Canyon	Eastern	Southern	Western
1	What type of home do you live in?						
	Single Family Home (Mobile)	9%	8%	9%	12%	9%	8%
	Single Family Home (Manufactured)	8%	3%	6%	11%	11%	14%
	Single Family Home (Built)	67%	77%	67%	59%	64%	67%
	Multi-Family (2-4 units)	11%	9%	11%	13%	10%	9%
	Multi-Family (5-20 units)	4%	3%	5%	4%	5%	2%
	Multi-Family (21+ units)	1%	1%	1%	1%	2%	0%
2	Was your home built before 1992?						
	Yes	40%	36%	30%	59%	46%	51%
	No	60%	64%	70%	41%	54%	49%
3	Is your home owned or rented?						
	Owned	68%	73%	66%	68%	63%	72%
	Rented	32%	27%	34%	32%	37%	28%
4	How many kids live in your home (age 0-17)?						
	1	12%	12%	11%	11%	13%	13%
	2	29%	35%	28%	28%	27%	29%
	3	28%	28%	28%	28%	29%	25%
	4	16%	13%	17%	18%	15%	19%
	5+	15%	11%	15%	14%	17%	15%

Due to rounding of numbers, percentages may not add up to 100%

Home Check-Up

(continued)

	Total	Capital	Canyon	Eastern	Southern	Western
5 How many adults live in your home (age 18+)?						
1	12%	11%	11%	14%	12%	11%
2	69%	73%	71%	65%	69%	67%
3	12%	11%	11%	14%	13%	13%
4	4%	4%	4%	4%	3%	6%
5+	2%	1%	3%	2%	3%	2%
6 Does your home have a programmable outdoor sprinkler system?						
Yes	65%	84%	73%	48%	55%	40%
No	35%	16%	27%	52%	45%	60%
7 Does your home have a programmable thermostat?						
Yes	73%	82%	79%	66%	67%	60%
No	26%	18%	21%	34%	33%	40%
8 What is the main source of heating in your home?						
Natural Gas	48%	62%	55%	42%	34%	22%
Electric Heater	38%	30%	35%	38%	48%	51%
Propane	4%	1%	2%	7%	6%	7%
Heating Oil	1%	1%	1%	1%	2%	1%
Wood	5%	2%	3%	7%	6%	14%
Other	4%	4%	4%	5%	4%	6%
9 What type of air conditioning unit do you have?						
Central Air Conditioner	70%	83%	79%	48%	55%	62%
Evaporative Cooler	6%	4%	4%	8%	8%	7%
Room Unit	14%	9%	11%	20%	18%	19%
Don't Have One	11%	4%	6%	24%	18%	12%
10 Does your home have a dishwasher?						
Yes	84%	96%	88%	74%	73%	77%
No	16%	4%	12%	26%	27%	23%

Due to rounding of numbers, percentages may not add up to 100%

Home Check-Up

(continued)

	Total	Capital	Canyon	Eastern	Southern	Western
11 How many half-bathrooms are in your home?						
0	66%	59%	61%	77%	71%	76%
1	29%	36%	34%	19%	21%	20%
2	3%	3%	3%	2%	6%	2%
3	1%	1%	1%	1%	2%	1%
4+	1%	1%	0%	1%	0%	0%
12 How many full bathrooms are in your home?						
1	23%	15%	18%	32%	31%	32%
2	58%	56%	67%	45%	53%	53%
3	16%	24%	12%	20%	13%	11%
4	3%	4%	2%	2%	2%	3%
5+	1%	1%	1%	1%	1%	1%
13 How many toilets are in your home?						
1	17%	10%	13%	26%	23%	25%
2	46%	35%	48%	46%	52%	51%
3	29%	41%	33%	21%	18%	16%
4	6%	11%	5%	6%	5%	6%
5+	2%	3%	2%	2%	1%	3%
14 How is your water heated?						
Natural Gas	51%	65%	59%	46%	38%	25%
Electricity	48%	35%	41%	54%	62%	75%

Due to rounding of numbers, percentages may not add up to 100%

Home Activities

	Total	Capital	Canyon	Eastern	Southern	Western
Participants	6,699	1,423	2,484	1,014	982	796
Surveys Received	4,885	919	1,951	814	606	595
Percent Response	73%	65%	79%	80%	62%	75%

		Total	Capital	Canyon	Eastern	Southern	Western
1	What is the flow rate of your old showerhead?						
	0 - 1.0 GPM	11%	7%	12%	12%	11%	14%
	1.1 - 1.5 GPM	18%	16%	18%	20%	20%	20%
	1.6 - 2.0 GPM	22%	22%	23%	24%	20%	21%
	2.1 - 2.5 GPM	22%	27%	20%	20%	23%	21%
	2.6 - 3.0 GPM	16%	16%	16%	15%	17%	16%
	3.1+ GPM	11%	12%	12%	9%	9%	8%
2	Did you install the new High-Efficiency Showerhead?						
	Yes	48%	42%	51%	48%	51%	46%
	No	51%	58%	49%	52%	49%	54%
3	If you answered "yes" to question 2, what is the flow rate of your new showerhead?						
	0 - 1.0 GPM	22%	19%	22%	24%	22%	22%
	1.1 - 1.5 GPM	40%	41%	39%	39%	41%	41%
	1.6 - 2.0 GPM	38%	40%	40%	37%	37%	37%
4	Did you use the Shower Timer?						
	Yes	76%	74%	79%	74%	78%	69%
	No	24%	26%	21%	26%	22%	31%
5	Did your family install the 13-watt Compact Fluorescent Lamp (CFL)?						
	Yes	55%	51%	58%	54%	59%	51%
	No	45%	49%	42%	46%	41%	49%

Due to rounding of numbers, percentages may not add up to 100%

Home Activities

(continued)

	Total	Capital	Canyon	Eastern	Southern	Western
6 If you answered "yes" to question 5, what is the wattage of the incandescent bulb you replaced?						
40-watt	20%	17%	22%	21%	22%	18%
60-watt	41%	46%	40%	39%	39%	39%
75-watt	14%	15%	12%	15%	15%	14%
100-watt	9%	9%	10%	9%	7%	9%
Other	16%	14%	16%	17%	16%	20%
7 Did your family install the 18-watt Compact Fluorescent Lamp (CFL)?						
Yes	48%	45%	50%	47%	51%	45%
No	52%	55%	50%	53%	49%	55%
8 If you answered "yes" to question 7, what is the wattage of the incandescent bulb you replaced?						
40-watt	15%	14%	14%	19%	14%	16%
60-watt	34%	39%	33%	35%	35%	30%
75-watt	22%	21%	23%	19%	24%	23%
100-watt	10%	12%	10%	8%	8%	10%
Other	18%	14%	19%	19%	19%	20%
9 Did your family install the 23-watt Compact Fluorescent Lamp (CFL)?						
Yes	43%	40%	45%	41%	47%	39%
No	57%	60%	55%	59%	53%	61%
10 If you answered "yes" to question 9, what is the wattage of the incandescent bulb you replaced?						
40-watt	14%	11%	13%	15%	16%	14%
60-watt	28%	32%	26%	31%	29%	22%
75-watt	18%	17%	17%	16%	20%	20%
100-watt	21%	25%	23%	14%	16%	22%
Other	21%	15%	21%	25%	20%	21%
11 Did your family install the FilterTone® Alarm?						
Yes	29%	27%	31%	24%	30%	28%
No	71%	73%	69%	76%	70%	72%

Due to rounding of numbers, percentages may not add up to 100%

Home Activities

(continued)

	Total	Capital	Canyon	Eastern	Southern	Western
12 How much did your family turn down the thermostat in winter for heating?						
1 - 2 Degrees	18%	20%	20%	14%	20%	13%
3 - 4 Degrees	19%	18%	21%	16%	19%	17%
5+ Degrees	14%	14%	15%	13%	12%	15%
Didn't Adjust Thermostat	49%	47%	45%	56%	49%	55%
13 How much did your family turn up the thermostat in summer for cooling?						
1 - 2 Degrees	15%	20%	16%	14%	11%	12%
3 - 4 Degrees	18%	18%	20%	14%	17%	18%
5+ Degrees	15%	15%	16%	12%	13%	18%
Didn't Adjust Thermostat	52%	47%	48%	61%	59%	52%
14 Did you install the LED Night Light?						
Yes	85%	84%	86%	83%	87%	84%
No	15%	16%	14%	17%	13%	16%
15 Did your family lower your water heater settings?						
Yes	26%	23%	30%	22%	29%	22%
No	74%	77%	70%	78%	71%	78%
16 Did your family raise the temperature on your refrigerator?						
Yes	17%	14%	21%	11%	18%	15%
No	83%	85%	79%	89%	82%	85%
17 Did you complete the optional online energy use activity?						
All of it	7%	6%	9%	5%	6%	8%
Some of it	17%	15%	20%	15%	21%	12%
None	75%	80%	71%	80%	72%	80%
18 Did you work with your family on this Program?						
Yes	71%	73%	73%	67%	74%	63%
No	29%	27%	27%	33%	26%	37%
19 Did your family change the way they use water?						
Yes	63%	64%	65%	57%	69%	57%
No	37%	36%	35%	43%	31%	43%

Due to rounding of numbers, percentages may not add up to 100%

Home Activities

(continued)

	Total	Capital	Canyon	Eastern	Southern	Western
20 Did your family change the way they use energy?						
Yes	70%	70%	73%	64%	76%	61%
No	30%	30%	27%	36%	24%	39%
21 How would you rate the Idaho Power Energy Wise® Program?						
Great	48%	51%	51%	47%	42%	45%
Pretty Good	33%	34%	33%	30%	39%	31%
Okay	15%	13%	14%	19%	15%	19%
Not So Good	3%	3%	2%	3%	4%	5%

Due to rounding of numbers, percentages may not add up to 100%

Participant List

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Canyon	Birch Elementary School	[redacted]	1	27	Yes
Canyon	Birch Elementary School	[redacted]	1	25	Yes
Canyon	Birch Elementary School	[redacted]	1	26	Yes
Canyon	Birch Elementary School	[redacted]	1	26	Yes
Canyon	Central Canyon Elementary School	[redacted]	1	28	Yes
Canyon	Central Elementary School	[redacted]	1	25	No
Canyon	Central Elementary School	[redacted]	1	23	Yes
Canyon	Central Elementary School	[redacted]	1	23	Yes
Canyon	Crimson Point Elementary	[redacted]	1	32	Yes
Canyon	Crimson Point Elementary	[redacted]	1	32	Yes
Canyon	Crimson Point Elementary	[redacted]	1	28	Yes
Canyon	Crimson Point Elementary	[redacted]	1	28	Yes
Canyon	Crimson Point Elementary	[redacted]	1	25	Yes
Canyon	Crimson Point Elementary	[redacted]	1	25	Yes
Canyon	Crimson Point Elementary	[redacted]	1	25	Yes
Canyon	Crimson Point Elementary	[redacted]	1	31	Yes
Canyon	Desert Springs Elementary School	[redacted]	1	26	Yes
Canyon	Desert Springs Elementary School	[redacted]	1	27	Yes
Canyon	Desert Springs Elementary School	[redacted]	1	27	Yes
Canyon	Desert Springs Elementary School	[redacted]	1	28	Yes
Canyon	Endeavor School	[redacted]	1	103	Yes
Canyon	Greenhurst Elementary School	[redacted]	1	29	No

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Canyon	Greenhurst Elementary School	[redacted]	1	28	Yes
Canyon	Idaho Arts Charter School	[redacted]	1	29	Yes
Canyon	Idaho Arts Charter School	[redacted]	1	30	Yes
Canyon	Idaho Arts Charter School	[redacted]	1	30	Yes
Canyon	Idaho Arts Charter School	[redacted]	1	30	Yes
Canyon	Iowa Elementary	[redacted]	1	31	Yes
Canyon	Iowa Elementary	[redacted]	1	3	Yes
Canyon	Iowa Elementary	[redacted]	0	27	Yes
Canyon	Iowa Elementary	[redacted]	1	28	Yes
Canyon	Lake Ridge Elementary	[redacted]	1	33	Yes
Canyon	Lake Ridge Elementary	[redacted]	1	33	Yes
Canyon	Lake Ridge Elementary	[redacted]	1	33	Yes
Canyon	Lakevue Elementary School	[redacted]	1	27	Yes
Canyon	Lakevue Elementary School	[redacted]	1	27	Yes
Canyon	Lakevue Elementary School	[redacted]	1	27	Yes
Canyon	Lakevue Elementary School	[redacted]	1	28	Yes
Canyon	Lewis & Clark Elementary	[redacted]	1	24	Yes
Canyon	Lewis & Clark Elementary	[redacted]	1	23	Yes
Canyon	Lewis & Clark Elementary	[redacted]	1	22	Yes
Canyon	Mill Creek Elementary School	[redacted]	1	31	Yes
Canyon	Mill Creek Elementary School	[redacted]	1	31	Yes
Canyon	Mill Creek Elementary School	[redacted]	1	31	Yes

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Canyon	Owyhee Elementary	[redacted]	1	29	Yes
Canyon	Owyhee Elementary	[redacted]	1	29	Yes
Canyon	Owyhee Elementary	[redacted]	1	29	Yes
Canyon	Reed Elementary	[redacted]	1	27	Yes
Canyon	Reed Elementary	[redacted]	1	22	No
Canyon	Reed Elementary	[redacted]	1	21	Yes
Canyon	Reed Elementary	[redacted]	1	23	Yes
Canyon	Ronald Reagan Elementary School	[redacted]	1	31	No
Canyon	Ronald Reagan Elementary School	[redacted]	1	33	Yes
Canyon	Ronald Reagan Elementary School	[redacted]	1	31	No
Canyon	Roosevelt Elementary School	[redacted]	1	37	No
Canyon	Roosevelt Elementary School	[redacted]	1	36	Yes
Canyon	Roosevelt Elementary School	[redacted]	1	37	Yes
Canyon	Ross Elementary School	[redacted]	1	27	No
Canyon	Ross Elementary School	[redacted]	1	23	No
Canyon	Sacajawea Elementary School	[redacted]	1	29	Yes
Canyon	Sacajawea Elementary School	[redacted]	1	29	Yes
Canyon	Sacajawea Elementary School	[redacted]	1	29	Yes
Canyon	Silver Trail Elementary School	[redacted]	1	28	Yes
Canyon	Silver Trail Elementary School	[redacted]	1	26	Yes
Canyon	Silver Trail Elementary School	[redacted]	0	2	Yes
Canyon	Silver Trail Elementary School	[redacted]	1	28	Yes

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Canyon	Teed Elementary	[redacted]	1	33	Yes
Canyon	Teed Elementary	[redacted]	1	33	Yes
Canyon	Teed Elementary	[redacted]	1	33	Yes
Canyon	Vallivue Middle School	[redacted]	1	15	Yes
Canyon	Washington Elementary School	[redacted]	1	27	Yes
Canyon	Washington Elementary School	[redacted]	1	27	Yes
Canyon	Washington Elementary School	[redacted]	1	27	Yes
Canyon	West Canyon Elementary	[redacted]	1	33	Yes
Canyon	West Canyon Elementary	[redacted]	1	34	Yes
Canyon	West Canyon Elementary	[redacted]	1	33	Yes
Canyon	Willow Creek Elementary	[redacted]	1	28	Yes
Canyon	Willow Creek Elementary	[redacted]	1	31	Yes
Canyon	Willow Creek Elementary	[redacted]	1	31	Yes
Canyon	Willow Creek Elementary	[redacted]	1	28	Yes
Canyon	Wilson Elementary School	[redacted]	1	18	Yes
Canyon	Wilson Elementary School	[redacted]	1	24	Yes
Canyon	Wilson Elementary School	[redacted]	1	17	Yes
Canyon	Wilson Elementary School	[redacted]	1	24	Yes
Canyon	Wilson Elementary School	[redacted]	1	24	Yes
Capital	Amity Elementary School	[redacted]	1	28	Yes
Capital	Amity Elementary School	[redacted]	1	29	Yes
Capital	Amity Elementary School	[redacted]	1	28	Yes

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Capital	Barbara Morgan STEM Academy	[redacted]	1	29	No
Capital	Barbara Morgan STEM Academy	[redacted]	1	29	Yes
Capital	Barbara Morgan STEM Academy	[redacted]	1	29	Yes
Capital	Cecil Andrus Elementary	[redacted]	1	27	Yes
Capital	Cecil Andrus Elementary	[redacted]	1	27	Yes
Capital	Cecil Andrus Elementary	[redacted]	1	32	No
Capital	Cecil Andrus Elementary	[redacted]	1	28	No
Capital	Cecil Andrus Elementary	[redacted]	1	27	Yes
Capital	Cynthia Mann Elementary School	[redacted]	1	24	Yes
Capital	Cynthia Mann Elementary School	[redacted]	1	25	Yes
Capital	Cynthia Mann Elementary School	[redacted]	1	12	Yes
Capital	Eliza Hart Spalding Elementary School	[redacted]	1	31	No
Capital	Eliza Hart Spalding Elementary School	[redacted]	1	31	Yes
Capital	Eliza Hart Spalding Elementary School	[redacted]	1	31	Yes
Capital	Eliza Hart Spalding Elementary School	[redacted]	1	31	Yes
Capital	Hunter Elementary School	[redacted]	1	29	Yes
Capital	Hunter Elementary School	[redacted]	1	29	Yes
Capital	Hunter Elementary School	[redacted]	1	29	Yes
Capital	Hunter Elementary School	[redacted]	1	29	Yes
Capital	Hunter Elementary School	[redacted]	1	29	Yes
Capital	Longfellow Elementary School	[redacted]	1	25	Yes
Capital	Longfellow Elementary School	[redacted]	1	26	Yes

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Capital	Mary McPherson Elementary School	[redacted]	1	28	Yes
Capital	Mary McPherson Elementary School	[redacted]	1	28	Yes
Capital	Mary McPherson Elementary School	[redacted]	1	28	Yes
Capital	Meridian Elementary	[redacted]	1	30	Yes
Capital	Meridian Elementary	[redacted]	1	30	Yes
Capital	Ponderosa Elementary School	[redacted]	1	30	Yes
Capital	Ponderosa Elementary School	[redacted]	1	30	No
Capital	Ponderosa Elementary School	[redacted]	1	31	Yes
Capital	Prospect Elementary	[redacted]	1	30	No
Capital	Prospect Elementary	[redacted]	1	30	Yes
Capital	Prospect Elementary	[redacted]	1	30	No
Capital	Prospect Elementary	[redacted]	1	29	Yes
Capital	St. Joseph's Catholic School	[redacted]	1	26	Yes
Capital	St. Joseph's Catholic School	[redacted]	1	27	Yes
Capital	Ustick Elementary School	[redacted]	1	24	Yes
Capital	Ustick Elementary School	[redacted]	1	23	Yes
Capital	Ustick Elementary School	[redacted]	1	22	Yes
Capital	Valley View Elementary School	[redacted]	1	32	Yes
Capital	Valley View Elementary School	[redacted]	1	32	Yes
Capital	Washington Elementary	[redacted]	1	30	No
Capital	Washington Elementary	[redacted]	1	30	Yes
Capital	Whittier Elementary School	[redacted]	1	23	No

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Capital	Whittier Elementary School	[redacted]	1	26	Yes
Capital	Whittier Elementary School	[redacted]	1	31	Yes
Eastern	American Falls Intermediate School	[redacted]	1	11	No
Eastern	Claude A. Wilcox Elementary School	[redacted]	1	22	Yes
Eastern	Claude A. Wilcox Elementary School	[redacted]	1	22	Yes
Eastern	Claude A. Wilcox Elementary School	[redacted]	1	22	Yes
Eastern	Claude A. Wilcox Elementary School	[redacted]	1	22	Yes
Eastern	Donald D. Stalker Elementary School	[redacted]	1	20	Yes
Eastern	Donald D. Stalker Elementary School	[redacted]	1	20	Yes
Eastern	Donald D. Stalker Elementary School	[redacted]	1	20	Yes
Eastern	Ellis Elementary School	[redacted]	1	30	Yes
Eastern	Ellis Elementary School	[redacted]	1	30	No
Eastern	Ellis Elementary School	[redacted]	1	30	Yes
Eastern	Grace Lutheran School	[redacted]	1	26	Yes
Eastern	Greenacres Elementary School	[redacted]	1	25	Yes
Eastern	Greenacres Elementary School	[redacted]	1	25	Yes
Eastern	Groveland Elementary	[redacted]	1	23	Yes
Eastern	Groveland Elementary	[redacted]	1	24	Yes
Eastern	Indian Hills Elementary	[redacted]	1	26	Yes
Eastern	Indian Hills Elementary	[redacted]	1	26	Yes
Eastern	Indian Hills Elementary	[redacted]	1	26	Yes
Eastern	Indian Hills Elementary	[redacted]	1	26	Yes

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Eastern	Jefferson Elementary	[redacted]	1	18	Yes
Eastern	Jefferson Elementary	[redacted]	1	18	Yes
Eastern	Jefferson Elementary	[redacted]	1	18	Yes
Eastern	Lewis and Clark Elementary	[redacted]	1	27	Yes
Eastern	Lewis and Clark Elementary	[redacted]	1	26	Yes
Eastern	Lewis and Clark Elementary	[redacted]	1	27	Yes
Eastern	Ridge Crest Elementary School	[redacted]	1	30	Yes
Eastern	Ridge Crest Elementary School	[redacted]	1	29	Yes
Eastern	Ridge Crest Elementary School	[redacted]	1	28	Yes
Eastern	Rockland Elementary School	[redacted]	1	18	No
Eastern	Rockland Elementary School	[redacted]	1	11	No
Eastern	Salmon Middle/High School	[redacted]	1	36	Yes
Eastern	Salmon Middle/High School	[redacted]	1	36	Yes
Eastern	Snake River Middle School	[redacted]	1	80	Yes
Eastern	Stoddard Elementary School	[redacted]	1	20	Yes
Eastern	Stoddard Elementary School	[redacted]	1	20	Yes
Eastern	Stoddard Elementary School	[redacted]	1	20	Yes
Eastern	Washington Elementary School	[redacted]	1	19	Yes
Eastern	Washington Elementary School	[redacted]	1	18	Yes
Southern	Alturas Elementary (Woodside)	[redacted]	1	17	Yes
Southern	Alturas Elementary (Woodside)	[redacted]	1	15	Yes
Southern	Alturas Elementary (Woodside)	[redacted]	1	16	Yes

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Southern	Alturas Elementary (Woodside)	[redacted]	1	15	No
Southern	Canyonside Christian School	[redacted]	1	12	Yes
Southern	Filer Intermediate	[redacted]	1	29	No
Southern	Filer Intermediate	[redacted]	1	29	No
Southern	Filer Intermediate	[redacted]	1	29	No
Southern	Filer Intermediate	[redacted]	1	30	Yes
Southern	Heritage Academy	[redacted]	1	20	No
Southern	I.B. Perrine Elementary	[redacted]	1	26	No
Southern	I.B. Perrine Elementary	[redacted]	1	33	Yes
Southern	I.B. Perrine Elementary School	[redacted]	1	33	Yes
Southern	I.B. Perrine Elementary School	[redacted]	1	33	Yes
Southern	I.B. Perrine Elementary School	[redacted]	1	33	No
Southern	Kimberly Elementary	[redacted]	1	28	Yes
Southern	Kimberly Elementary	[redacted]	1	28	Yes
Southern	Kimberly Elementary	[redacted]	1	28	No
Southern	Kimberly Elementary	[redacted]	1	28	No
Southern	Lighthouse Christian School	[redacted]	1	11	Yes
Southern	Lighthouse Christian School	[redacted]	1	14	No
Southern	Summit Elementary	[redacted]	1	29	Yes
Southern	Summit Elementary	[redacted]	1	27	No
Southern	Summit Elementary	[redacted]	1	29	Yes
Southern	Summit Elementary	[redacted]	1	27	Yes

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Southern	Summit Elementary	[redacted]	1	28	No
Southern	Summit Elementary	[redacted]	1	28	Yes
Southern	Summit Elementary	[redacted]	1	28	Yes
Southern	Summit Elementary	[redacted]	1	27	Yes
Southern	Summit Elementary	[redacted]	1	27	Yes
Southern	Summit Elementary	[redacted]	1	27	Yes
Southern	Summit Elementary	[redacted]	1	27	Yes
Southern	Valley Elementary	[redacted]	0	1	Yes
Southern	Valley Elementary	[redacted]	1	24	Yes
Southern	Valley Elementary	[redacted]	1	26	Yes
Southern	Wendell Middle School	[redacted]	1	85	Yes
Western	Donnelly Elementary	[redacted]	1	21	Yes
Western	Emmett Middle School	[redacted]	1	65	Yes
Western	Emmett Middle School	[redacted]	1	60	Yes
Western	Emmett Middle School	[redacted]	1	68	Yes
Western	Fruitland Elementary School	[redacted]	1	26	No
Western	Fruitland Elementary School	[redacted]	1	26	No
Western	Fruitland Elementary School	[redacted]	1	26	Yes
Western	Fruitland Elementary School	[redacted]	1	26	Yes
Western	Fruitland Elementary School	[redacted]	1	30	Yes
Western	Homedale Elementary	[redacted]	1	22	Yes
Western	Homedale Elementary	[redacted]	1	95	Yes

Note: "T" represents number of teachers and "S" represents number of students

Participant List

(continued)

REGION	SCHOOL	TEACHER	T	S	SURVEYS RETURNED
Western	Marsing Elementary School	[redacted]	1	18	Yes
Western	Marsing Middle School	[redacted]	1	75	Yes
Western	Park Intermediate	[redacted]	1	22	Yes
Western	Park Intermediate	[redacted]	1	23	Yes
Western	Park Intermediate	[redacted]	1	24	Yes
Western	Park Intermediate	[redacted]	1	26	Yes
Western	Park Intermediate	[redacted]	1	25	Yes
Western	Parma Middle School	[redacted]	1	90	Yes
Western	Pleasant Valley School	[redacted]	1	8	No
		TOTALS	226	6,473	
		TOTAL PARTICIPANTS	6,699		

Note: "T" represents number of teachers and "S" represents number of students

Teacher Program Evaluation Data

	Total	Capital	Canyon	Eastern	Southern	Western
Participants	226	49	83	39	35	20
Surveys Received	157	26	67	33	17	14
Percent Response	69%	53%	81%	85%	49%	70%

		Percent	Number
1	The materials were clearly written and well organized.		
	Strongly Agree	62%	96
	Agree	37%	58
	Disagree	1%	1
	Strongly Disagree	0%	0
2	The products in the kit were easy for students to use.		
	Strongly Agree	43%	66
	Agree	56%	87
	Disagree	1%	2
	Strongly Disagree	0%	0
3	Students indicated that their parents supported the program.		
	Yes	96%	149
	No	4%	7
4	Would you conduct this program again?		
	Yes	97%	151
	No	3%	4
5	Would you recommend this program to other colleagues?		
	Yes	99%	153
	No	1%	2
6	If my school is eligible for participation next year, I would like to enroll.		
	Yes	95%	147
	No	5%	8

Due to rounding of numbers, percentages may not add up to 100%

Parent/Guardian Program Evaluation Data

	Total	Capital	Canyon	Eastern	Southern	Western
Participants	6473	1374	2401	975	947	776
Surveys Received	107	14	38	18	33	4
Percent Response	2%	1%	2%	2%	3%	1%

		Percent	Number
1	Was the program easy for you and your child to use?		
	Yes	98%	105
	No	2%	2
2	Will you continue to use the kit items after the completion of the program?		
	Yes	99%	105
	No	1%	1
3	Would you like to see this program continued in local schools?		
	Yes	99%	105
	No	1%	1

Due to rounding of numbers, percentages may not add up to 100%

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Idaho Power Shade Tree Survey

Monday, February 01, 2016

859

Total Responses

Complete Responses: 821

Q1: How did you hear about Idaho Power's Shade Tree Project? (Check all that apply)

Answered: 859 Skipped: 0

Answer Choices	Responses	
Letter from Idaho Power	56.11%	482
Friend or relative	25.03%	215
Neighbor	4.54%	39
Idaho Power employee	4.89%	42
Other (please specify)	14.55%	125
Total Respondents: 859		

Q2: What was the primary reason you participated in the program? (Mark one)

Answered: 859 Skipped: 0

Answer Choices	Responses	
Tree was free	18.98%	163
Home too warm in the summer	18.74%	161
Reduce energy bill	21.65%	186
Improve landscape/property value	12.57%	108
Wanted a tree	17.69%	152
Help the environment	6.29%	54
Other (please specify)	4.07%	35
Total		**859**

Q3: What kept you from planting a tree prior to the Shade Tree Project? (Mark one)

Answered: 855 Skipped: 4

Answer Choices	Responses	
Lack of knowledge	14.50%	124
Cost	55.56%	475
Time	10.53%	90
Other (please specify)	19.42%	166
Total		**855**

Q4: Where would you typically purchase a new tree? (Mark one)

Answered: 847 Skipped: 12

Answer Choices	Responses	
Garden section of a do-it-yourself/home improvement store	31.52%	267
Nursery/garden store	65.29%	553
Other (please specify)	3.19%	27
Total		847

Q5: How long did you spend on the online enrollment tool? (Mark one)

Answered: 852 Skipped: 7

Answer Choices	Responses	
10 minutes or less	**56.34%**	480
11-20 minutes	**30.63%**	261
21-30 minutes	**7.86%**	67
31 minutes or more	**3.29%**	28
Not applicable	**1.88%**	16
Total		**852**

Q6: Overall, how easy was it for you to use the online enrollment tool?

Answered: 849 Skipped: 10

Answer Choices	Responses	
Very easy	71.26%	605
Somewhat easy	25.21%	214
Somewhat difficult	1.77%	15
Very difficult	0.24%	2
Not applicable	1.53%	13
Total		**849**

Q7: How many trees did you pick up at the Shade Tree event?

Answered: 853 Skipped: 6

Answer Choices	Responses	
One	28.96%	247
Two	71.04%	606
Total		853

Q8: When did you plant your shade tree?

Answered: 247 Skipped: 612

Answer Choices	Responses	
Same day as the tree pickup	39.68%	98
1-3 days after the tree pickup	44.53%	110
4-7 days after the tree pickup	8.10%	20
More than 1 week after the tree pickup	6.07%	15
Did not plant the tree	1.62%	4
Total		**247**

Q9: On which side of your home did you plant your shade tree?

Answered: 239 Skipped: 620

Answer Choices	Responses	
North	4.18%	10
Northeast	3.35%	8
East	9.62%	23
Southeast	4.60%	11
South	9.21%	22
Southwest	23.85%	57
West	38.08%	91
Northwest	7.11%	17
Total		**239**

Q10: How far from the home did you plant your shade tree?

Answered: 240 Skipped: 619

Answer Choices	Responses	
20 feet or less	41.25%	99
21-40 feet	52.08%	125
41-60 feet	5.83%	14
More than 60 feet	0.83%	2
Total		**240**

Q11: How many shade trees did you plant?

Answered: 606 Skipped: 253

Answer Choices	Responses	
One tree	1.65%	10
Both trees	95.71%	580
Did not plant trees	2.64%	16
Total		**606**

Q12: When did you plant your shade tree?

Answered: 10 Skipped: 849

Answer Choices	Responses	
Same day as the tree pickup	20.00%	2
1-3 days after the tree pickup	50.00%	5
4-7 days after the tree pickup	30.00%	3
More than 1 week after the tree pickup	0.00%	0
Total		**10**

Q13: On which side of your home did you plant your shade tree?

Answered: 10 Skipped: 849

Answer Choices	Responses	
North	0.00%	0
Northeast	10.00%	1
East	10.00%	1
Southeast	10.00%	1
South	20.00%	2
Southwest	10.00%	1
West	30.00%	3
Northwest	10.00%	1
Total		**10**

Q14: How far from the home did you plant your shade tree?

Answered: 10 Skipped: 849

Answer Choices	Responses	
20 feet or less	40.00%	4
21-40 feet	60.00%	6
41-60 feet	0.00%	0
More than 60 feet	0.00%	0
Total		10

Q15: When did you plant your shade trees?

Answered: 580 Skipped: 279

(no label)	Same day as the tree pickup	1-3 days after the tree pickup	4-7 days after the tree pickup	More than 1 week after the tree pickup	Total
Tree 1	**22.69%** 130	**51.13%** 293	**16.06%** 92	**10.12%** 58	573
Tree 2	**20.78%** 117	**49.20%** 277	**17.76%** 100	**12.26%** 69	563

Q16: On which side of your home did you plant your shade trees?

Answered: 547 Skipped: 312

(no label)	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Total
Tree 1	**5.88%** 32	**4.23%** 23	**13.42%** 73	**7.72%** 42	**10.66%** 58	**14.89%** 81	**36.58%** 199	**6.62%** 36	544
Tree 2	**4.60%** 25	**5.16%** 28	**9.76%** 53	**8.66%** 47	**11.05%** 60	**15.47%** 84	**37.20%** 202	**8.10%** 44	543

Q17: How far from the home did you plant your shade trees?

Answered: 562 Skipped: 297

(no label)	20 feet or less	21-40 feet	41-60 feet	More than 60 feet	Total
Tree 1	**34.94%** 196	**47.24%** 265	**15.69%** 88	**2.14%** 12	561
Tree 2	**29.56%** 162	**46.72%** 256	**19.34%** 106	**4.38%** 24	548

Q18: How satisfied are you with the information you received on the planting and care of your shade tree?

Answered: 841 Skipped: 18

Answer Choices	Responses	
Very satisfied	79.67%	670
Somewhat satisfied	16.41%	138
Somewhat dissatisfied	1.55%	13
Very dissatisfied	1.43%	12
Not applicable	0.95%	8
Total		841

Q19: What information did you find most valuable?

Answered: 832 Skipped: 27

Answer Choices	Responses	
Planting depth	53.61%	446
Circling roots	11.30%	94
Staking	8.41%	70
Watering	8.41%	70
Not applicable	9.86%	82
Other (please specify)	8.41%	70
Total		**832**

Q20: How much do you agree with the following statements:

Answered: 835 Skipped: 24

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Total
I am satisfied with the Shade Tree Project pick up event	**91.49%** 763	**7.67%** 64	**0.60%** 5	**0.24%** 2	834
It was easy to plant my shade tree	**86.92%** 718	**11.86%** 98	**0.97%** 8	**0.24%** 2	826
I would recommend the Shade Tree Project to a friend or relative	**95.44%** 795	**4.08%** 34	**0.36%** 3	**0.12%** 1	833
I am satisfied with my overall experience with the Shade Tree Project	**91.34%** 759	**7.34%** 61	**1.08%** 9	**0.24%** 2	831

Q22: May we use your name and comments in Idaho Power's communication efforts?

Answered: 828 Skipped: 31

Answer Choices	Responses	
Yes	59.30%	491
No	40.70%	337
Total		828

Q23: May we follow up with you if we have any questions regarding your responses to the survey questions?

Answered: 826 Skipped: 33

Answer Choices	Responses	
Yes	63.08%	521
No	36.92%	305
Total		826

Q25: When was this residence originally built? (Select when the building was originally constructed, not when it was remodeled, added to, or converted.)

Answered: 826 Skipped: 33

Answer Choices	Responses	
Before 1950	**6.90%**	57
1950–1959	**3.51%**	29
1960–1969	**3.51%**	29
1970–1979	**14.53%**	120
1980–1989	**5.33%**	44
1990–1999	**18.16%**	150
2000–2006	**25.42%**	210
2007–2015	**22.28%**	184
Don't know	**0.36%**	3
Total		**826**

Q26: What one fuel is most often used to heat this residence? (Mark one)

Answered: 826 Skipped: 33

Answer Choices	Responses	
Electricity	19.13%	158
Natural gas	73.97%	611
Propane	2.18%	18
Fuel Oil	0.48%	4
Wood	3.15%	26
Other (please specify)	1.09%	9
Total		**826**

Q27: What type of air conditioning system is used at this residence? (Check all that apply)

Answered: 826 Skipped: 33

Answer Choices	Responses	
None	1.33%	11
Central air conditioner	88.86%	734
Heat pump	7.14%	59
Individual room or window air conditioner	4.12%	34
Evaporative/swamp cooler	0.48%	4
Other (please specify)	1.09%	9
Total Respondents: 826		

Q28: What is your gender?

Answered: 813 Skipped: 46

Answer Choices	Responses	
Female	58.55%	476
Male	41.45%	337
Total		813

Q29: Which of the following best describes your age?

Answered: 815 Skipped: 44

Answer Choices	Responses	
Under 18	**0.00%**	0
18-24	**1.10%**	9
25-34	**18.40%**	150
35-44	**26.63%**	217
45-60	**32.76%**	267
Over 60	**21.10%**	172
Total		**815**

Q30: What is the highest level of education you have completed?

Answered: 817 Skipped: 42

Answer Choices	Responses	
Less than high school	0.37%	3
High school or equivalent	8.20%	67
Some college/technical school	39.05%	319
4-year college degree	29.87%	244
Some graduate courses	6.85%	56
Graduate degree	15.67%	128
Total		**817**

Idaho Power Weatherization Assistance Program

Sunday, January 24, 2016

211

Total Responses

Complete Responses: 211

Q2: Agency/Contractor Name:

Answered: 211 Skipped: 0

Answer Choices	Responses	
CCOA - Aging, Weatherization and Human Services	15.64%	33
Eastern Idaho Community Action Partnership	1.42%	3
El Ada Community Action Partnership	50.24%	106
South Central Community Action Partnership	14.22%	30
Southeastern Idaho Community Action Agency	14.22%	30
Community Connection of Northeast Oregon	0.00%	0
Community in Action	4.27%	9
Energy Zone, LLC	0.00%	0
Home Energy Management	0.00%	0
Savings Around Power	0.00%	0
Power Savers	0.00%	0
	0.00%	0
	0.00%	0
	0.00%	0
Total		**211**

Q4: Idaho Power program name:

Answered: 211 Skipped: 0

Answer Choices	Responses	
Weatherization Assistance for Qualified Customers	100.00%	211
Weatherization Solutions for Eligible Customers	0.00%	0
Total		211

Q5: How did you learn about the weatherization program(s)?

Answered: 204 Skipped: 7

Answer Choices	Responses	
Agency/Contractor flyer	21.57%	44
Idaho Power employee	4.90%	10
Idaho Power web site	4.90%	10
Friend or relative	45.59%	93
Letter in mail	4.90%	10
Other (please specify)	18.14%	37
Total		**204**

Q6: What was your primary reason for participating in the weatherization program?

Answered: 206 Skipped: 5

Answer Choices	Responses	
Reduce utility bills	86.41%	178
Improve comfort of home	44.17%	91
Furnace concerns	33.50%	69
Water heater concerns	13.11%	27
Improve insulation	32.04%	66
Other (please specify)	8.74%	18
Total Respondents: 206		

Q7: If you received any energy efficiency equipment upgrade as part of the weatherization, how well was the equipment's operation explained to you?

Answered: 197 Skipped: 14

Answer Choices	Responses	
Completely	92.39%	182
Somewhat	7.11%	14
Not at all	0.51%	1
Total		197

Q8: Which of the following did you learn about from the auditor or crew during the weatherization process? (Check all that apply)

Answered: 201 Skipped: 10

Answer Choices	Responses	
How air leaks affect energy usage	81.59%	164
How insulation affects energy usage	68.16%	137
How to program the new thermostat	47.76%	96
How to reduce the amount of hot water used	26.87%	54
How to use energy wisely	54.23%	109
How to understand what uses the most energy in my home	43.78%	88
Other (please specify)	3.48%	7
Total Respondents: 201		

Q9: Based on the information you received from the agency/contractor about energy use, how likely are you to change your habits to save energy?

Answered: 200 Skipped: 11

Answer Choices	Responses	
Very likely	83.50%	167
Somewhat likely	14.00%	28
Not very likely	1.50%	3
Not likely at all	1.00%	2
Total		**200**

Q10: How much of the information about energy use have you shared with other members of your household?

Answered: 185 Skipped: 26

Answer Choices	Responses	
All of it	82.16%	152
Some of it	14.59%	27
None of it	3.24%	6
Total		185

Q11: 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?

Answered: 195 Skipped: 16

Answer Choices	Responses	
Very likely	82.56%	161
Somewhat likely	15.90%	31
Somewhat unlikely	1.03%	2
Very unlikely	0.51%	1
Total		**195**

Q12: What habits are you and other members of your household most likely to change to save energy? (check all that apply)

Answered: 198 Skipped: 13

Answer Choices	Responses	
Washing full loads of clothes	**64.65%**	128
Washing full loads of dishes	**46.46%**	92
Turning off lights when not in use	**85.35%**	169
Unplugging electrical equipment when not in use	**57.07%**	113
Turning the thermostat up in the summer	**51.52%**	102
Turning the thermostat down in the winter	**66.16%**	131
Total Respondents: 198		

Q13: How much do you think the weatherization you received will affect the comfort of your home?

Answered: 202 Skipped: 9

Answer Choices	Responses	
Significantly	93.07%	188
Somewhat	6.44%	13
Very little	0.00%	0
Not at all	0.50%	1
Total		202

Q14: Rate the Agency/Contractor based on your interactions with them.

Answered: 203 Skipped: 8

	Excellent	Good	Fair	Poor	Total
Courteousness	**95.07%** 193	**4.93%** 10	**0.00%** 0	**0.00%** 0	203
Professionalism	**92.46%** 184	**7.54%** 15	**0.00%** 0	**0.00%** 0	199
Explanation of work to be performed on your home	**87.06%** 175	**12.44%** 25	**0.00%** 0	**0.50%** 1	201
Overall experience with Agency/Contractor	**92.54%** 186	**6.97%** 14	**0.00%** 0	**0.50%** 1	201

Q15: Were you aware of Idaho Power's role in the weatherization of your home?

Answered: 202 Skipped: 9

Answer Choices	Responses	
Yes	79.21%	160
No	20.79%	42
Total		202

Q16: Overall how satisfied are you with the weatherization program you participated in?

Answered: 203 Skipped: 8

Answer Choices	Responses	
Very satisfied	98.03%	199
Somewhat satisfied	1.48%	3
Somewhat dissatisfied	0.49%	1
Very dissatisfied	0.00%	0
Total		**203**

Q17: How has your opinion of Idaho Power changed as a result of its role in the weatherization program?

Answered: 202 Skipped: 9

Answer Choices	Responses	
Improved	89.11%	180
Stayed the same	10.89%	22
Decreased	0.00%	0
Total		202

Q18: How many people beside yourself live in your home year-round?

Answered: 148 Skipped: 63

Answer Choices	Responses	
1	42.57%	63
2	18.24%	27
3	18.92%	28
4	10.14%	15
5	4.05%	6
6 or more	6.08%	9
Total		148

Q19: How long have you been an Idaho Power customer?

Answered: 205 Skipped: 6

Answer Choices	Responses	
Less than 1 year	1.46%	3
1 - 10 years	26.83%	55
11 - 25 years	27.32%	56
26 years or more	44.39%	91
Total		**205**

Q20: Please select the category below that best describes your age:

Answered: 203 Skipped: 8

Answer Choices	Responses	
Under 25	1.97%	4
25 - 34	12.81%	26
35 - 44	10.84%	22
45 - 54	11.33%	23
55 - 64	27.59%	56
65 - 74	21.67%	44
75 or older	13.79%	28
Total		**203**

Q21: Select the response below that best describes the highest level of education you have attained:

Answered: 202 Skipped: 9

Answer Choices	Responses	
Less than High School	16.34%	33
High School graduate or GED	38.61%	78
Some College or Technical School	30.20%	61
Associate Degree	6.93%	14
College Degree (including any graduate school or graduate degrees)	7.92%	16
Total		**202**

Idaho Power Weatherization Programs

Tuesday, January 26, 2016

133

Total Responses

Complete Responses: 133

Q2: Agency/Contractor Name:

Answered: 133 Skipped: 0

Answer Choices	Responses	
CCOA - Aging, Weatherization and Human Services	0.00%	0
Eastern Idaho Community Action Partnership	0.00%	0
El Ada Community Action Partnership	0.00%	0
South Central Community Action Partnership	0.00%	0
Southeastern Idaho Community Action Agency	0.00%	0
Community Connection of Northeast Oregon	0.00%	0
Community in Action	0.00%	0
Energy Zone, LLC	30.83%	41
Home Energy Management	27.07%	36
Savings Around Power	10.53%	14
Power Savers	31.58%	42
	0.00%	0
	0.00%	0
	0.00%	0
Total		**133**

Q4: Idaho Power program name:

Answered: 133 Skipped: 0

Answer Choices	Responses	
Weatherization Assistance for Qualified Customers	0.00%	0
Weatherization Solutions for Eligible Customers	100.00%	133
Total		133

Q5: How did you learn about the weatherization program(s)?

Answered: 129 Skipped: 4

Answer Choices	Responses	
Agency/Contractor flyer	11.63%	15
Idaho Power employee	5.43%	7
Idaho Power web site	7.75%	10
Friend or relative	31.78%	41
Letter in mail	24.81%	32
Other (please specify)	18.60%	24
Total		**129**

Q6: What was your primary reason for participating in the weatherization program?

Answered: 131 Skipped: 2

Answer Choices	Responses	
Reduce utility bills	83.21%	109
Improve comfort of home	43.51%	57
Furnace concerns	17.56%	23
Water heater concerns	4.58%	6
Improve insulation	27.48%	36
Other (please specify)	9.16%	12
Total Respondents: 131		

Q7: If you received any energy efficiency equipment upgrade as part of the weatherization, how well was the equipment's operation explained to you?

Answered: 99 Skipped: 34

Answer Choices	Responses	
Completely	78.79%	78
Somewhat	11.11%	11
Not at all	10.10%	10
Total		99

Q8: Which of the following did you learn about from the auditor or crew during the weatherization process? (Check all that apply)

Answered: 123 Skipped: 10

Answer Choices	Responses	
How air leaks affect energy usage	80.49%	99
How insulation affects energy usage	73.98%	91
How to program the new thermostat	35.77%	44
How to reduce the amount of hot water used	34.96%	43
How to use energy wisely	53.66%	66
How to understand what uses the most energy in my home	58.54%	72
Other (please specify)	6.50%	8
Total Respondents: 123		

Q9: Based on the information you received from the agency/contractor about energy use, how likely are you to change your habits to save energy?

Answered: 123 Skipped: 10

Answer Choices	Responses	
Very likely	80.49%	99
Somewhat likely	18.70%	23
Not very likely	0.81%	1
Not likely at all	0.00%	0
Total		**123**

Q10: How much of the information about energy use have you shared with other members of your household?

Answered: 121 Skipped: 12

Answer Choices	Responses	
All of it	81.82%	99
Some of it	14.88%	18
None of it	3.31%	4
Total		121

Q11: 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?

Answered: 120 Skipped: 13

Answer Choices	Responses	
Very likely	70.83%	85
Somewhat likely	20.83%	25
Somewhat unlikely	5.00%	6
Very unlikely	3.33%	4
Total		120

Q12: What habits are you and other members of your household most likely to change to save energy? (check all that apply)

Answered: 120 Skipped: 13

Answer Choices	Responses	
Washing full loads of clothes	60.83%	73
Washing full loads of dishes	55.83%	67
Turning off lights when not in use	88.33%	106
Unplugging electrical equipment when not in use	55.00%	66
Turning the thermostat up in the summer	64.17%	77
Turning the thermostat down in the winter	68.33%	82
Total Respondents: 120		

Q13: How much do you think the weatherization you received will affect the comfort of your home?

Answered: 127 Skipped: 6

Answer Choices	Responses	
Significantly	92.91%	118
Somewhat	7.09%	9
Very little	0.00%	0
Not at all	0.00%	0
Total		**127**

Q14: Rate the Agency/Contractor based on your interactions with them.

Answered: 126 Skipped: 7

	Excellent	Good	Fair	Poor	Total
Courteousness	**93.65%** 118	**6.35%** 8	**0.00%** 0	**0.00%** 0	126
Professionalism	**92.86%** 117	**7.14%** 9	**0.00%** 0	**0.00%** 0	126
Explanation of work to be performed on your home	**91.20%** 114	**5.60%** 7	**2.40%** 3	**0.80%** 1	125
Overall experience with Agency/Contractor	**90.48%** 114	**8.73%** 11	**0.79%** 1	**0.00%** 0	126

Q15: Were you aware of Idaho Power's role in the weatherization of your home?

Answered: 125 Skipped: 8

Answer Choices	Responses	
Yes	90.40%	113
No	9.60%	12
Total		125

Q16: Overall how satisfied are you with the weatherization program you participated in?

Answered: 127 Skipped: 6

Answer Choices	Responses	
Very satisfied	94.49%	120
Somewhat satisfied	5.51%	7
Somewhat dissatisfied	0.00%	0
Very dissatisfied	0.00%	0
Total		127

Q17: How has your opinion of Idaho Power changed as a result of its role in the weatherization program?

Answered: 126 Skipped: 7

Answer Choices	Responses	
Improved	81.75%	103
Stayed the same	18.25%	23
Decreased	0.00%	0
Total		**126**

Q18: How many people beside yourself live in your home year-round?

Answered: 114 Skipped: 19

Answer Choices	Responses	
1	50.88%	58
2	16.67%	19
3	12.28%	14
4	11.40%	13
5	3.51%	4
6 or more	5.26%	6
Total		**114**

Q19: How long have you been an Idaho Power customer?

Answered: 128 Skipped: 5

Answer Choices	Responses	
Less than 1 year	1.56%	2
1 - 10 years	24.22%	31
11 - 25 years	23.44%	30
26 years or more	50.78%	65
Total		128

Q20: Please select the category below that best describes your age:

Answered: 129 Skipped: 4

Answer Choices	Responses	
Under 25	2.33%	3
25 - 34	7.75%	10
35 - 44	17.05%	22
45 - 54	12.40%	16
55 - 64	21.71%	28
65 - 74	21.71%	28
75 or older	17.05%	22
Total		**129**

Q21: Select the response below that best describes the highest level of education you have attained:

Answered: 126 Skipped: 7

Answer Choices	Responses	
Less than High School	8.73%	11
High School graduate or GED	30.95%	39
Some College or Technical School	32.54%	41
Associate Degree	12.70%	16
College Degree (including any graduate school or graduate degrees)	15.08%	19
Total		**126**

empowered community

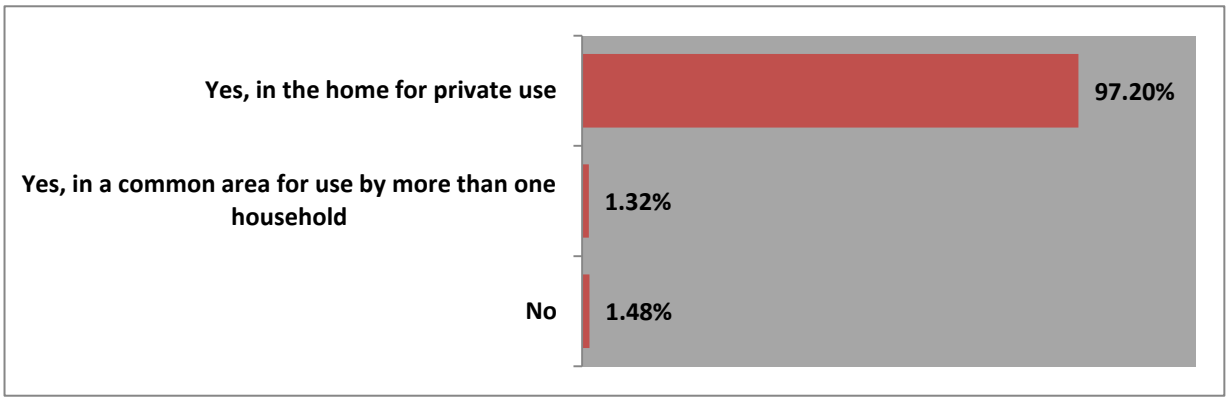
Residential Laundry Habits Survey Results

April 2015

Do you use a clothes washer at your home?

QUESTION TOTAL: 608
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Yes, in the home for private use	591	97.20%
O2	Yes, in a common area for use by more than	8	1.32%
O3	No	9	1.48%



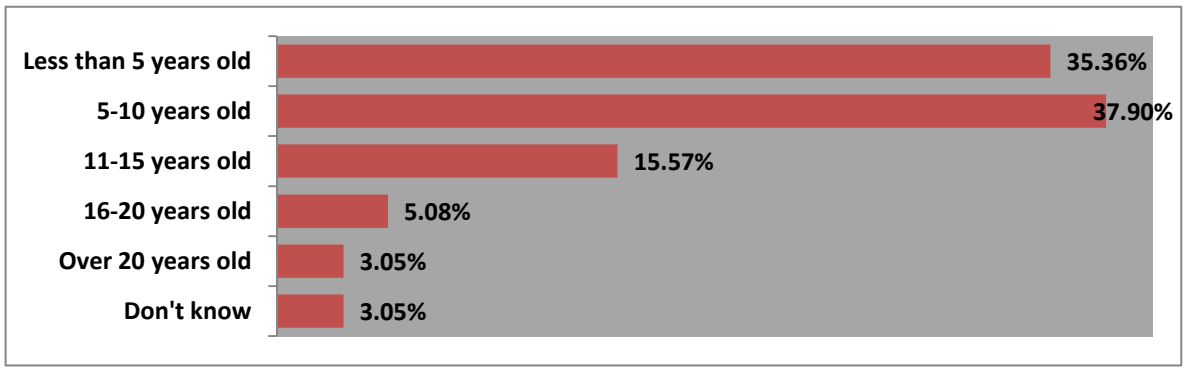
Approximately how old is the clothes washer used at your home?

(asked only of respondents who use a clothes washer at their home)

QUESTION TOTAL: 591

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Less than 5 years old	209	35.36%
O2	5-10 years old	224	37.90%
O3	11-15 years old	92	15.57%
O4	16-20 years old	30	5.08%
O5	Over 20 years old	18	3.05%
O6	Don't know	18	3.05%



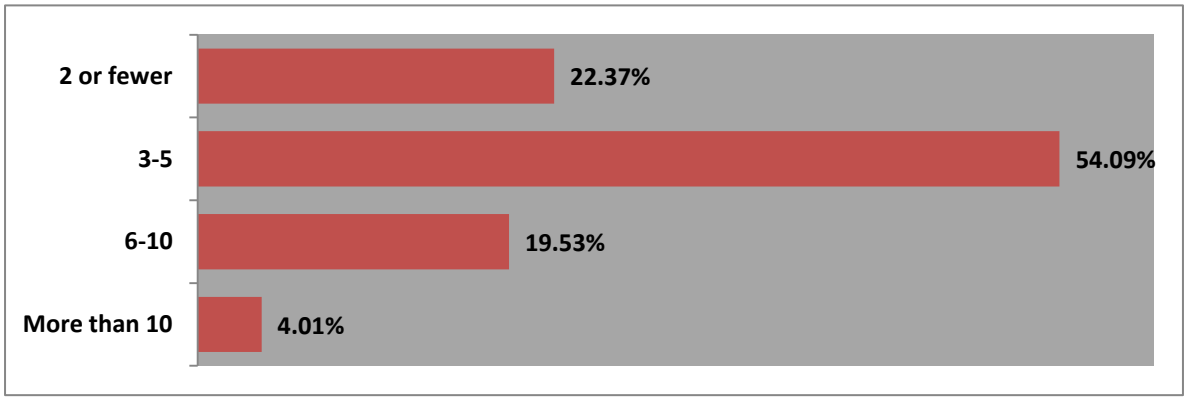
On average, how many washer loads of laundry do you do per week?

(asked only of respondents who use a clothes washer at their home)

QUESTION TOTAL: 599

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	2 or fewer	134	22.37%
O2	3-5	324	54.09%
O3	6-10	117	19.53%
O4	More than 10	24	4.01%

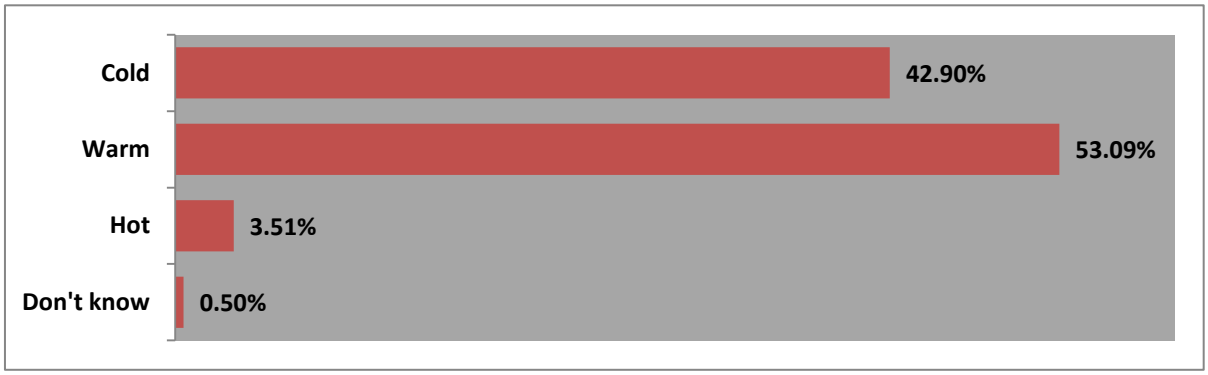


What water temperature do you use most often to wash your laundry?

(asked only of respondents who use a clothes washer at their home)

QUESTION TOTAL:	599
NO RESPONSE:	0

	OPTIONS	TOTAL	PERCENT
O1	Cold	257	42.90%
O2	Warm	318	53.09%
O3	Hot	21	3.51%
O4	Don't know	3	0.50%



What water temperature do you use most often to rinse your laundry?

(asked only of respondents who use a clothes washer at their home)

QUESTION TOTAL: 599

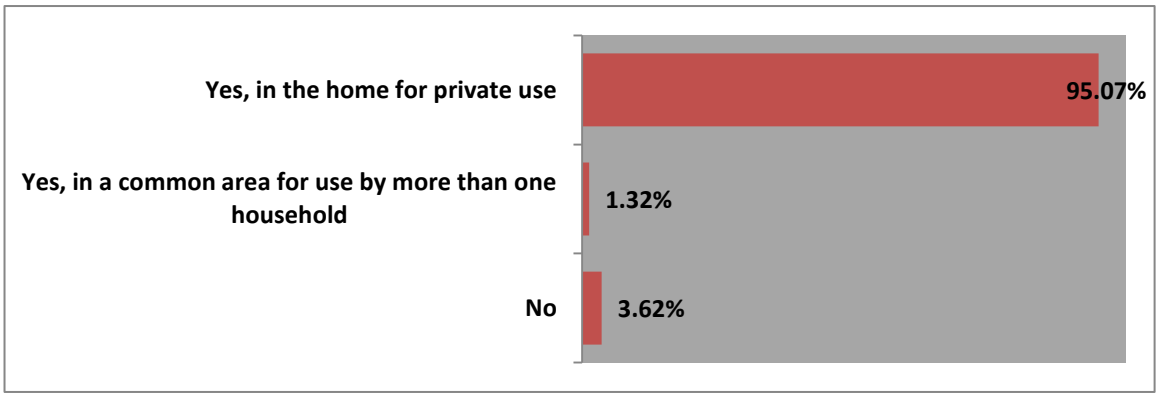
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Cold	506	84.47%
O2	Warm	81	13.52%
O3	Hot	4	0.67%
O4	Don't know	8	1.34%

Do you use a clothes dryer at your home?

QUESTION TOTAL: 608
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Yes, in the home for private use	578	95.07%
O2	Yes, in a common area for use by more than	8	1.32%
O3	No	22	3.62%

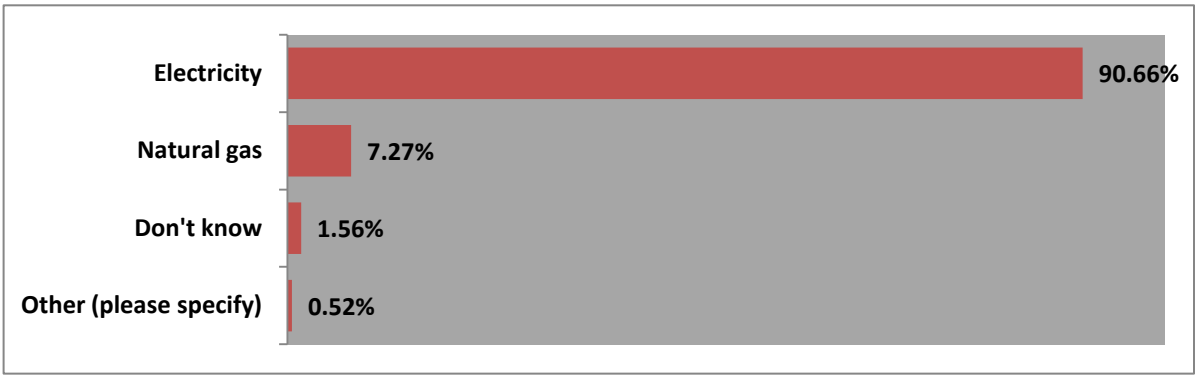


What type of fuel does the clothes dryer at your home use?

(asked only of respondents who use a clothes dryer at their home)

QUESTION TOTAL:	578
NO RESPONSE:	0

	OPTIONS	TOTAL	PERCENT
O1	Electricity	524	90.66%
O2	Natural gas	42	7.27%
O3	Don't know	9	1.56%
O4	Other (please specify)	3	0.52%



What type of fuel does the clothes dryer at your home use? **Other (please specify)**

Verbatim Responses	Total
Propane	3

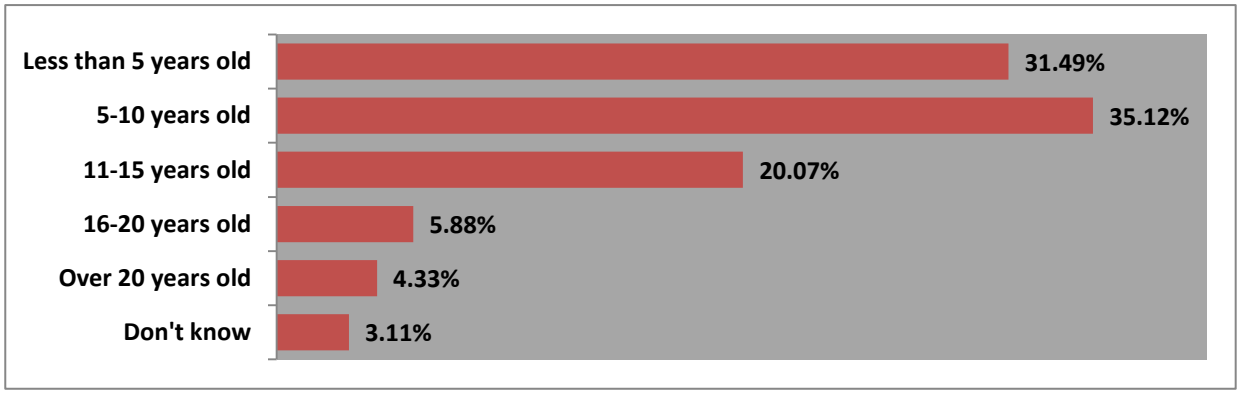
Approximately how old is the clothes dryer that is used at your home?

(asked only of respondents who use a clothes dryer at their home)

QUESTION TOTAL: 578

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Less than 5 years old	182	31.49%
O2	5-10 years old	203	35.12%
O3	11-15 years old	116	20.07%
O4	16-20 years old	34	5.88%
O5	Over 20 years old	25	4.33%
O6	Don't know	18	3.11%

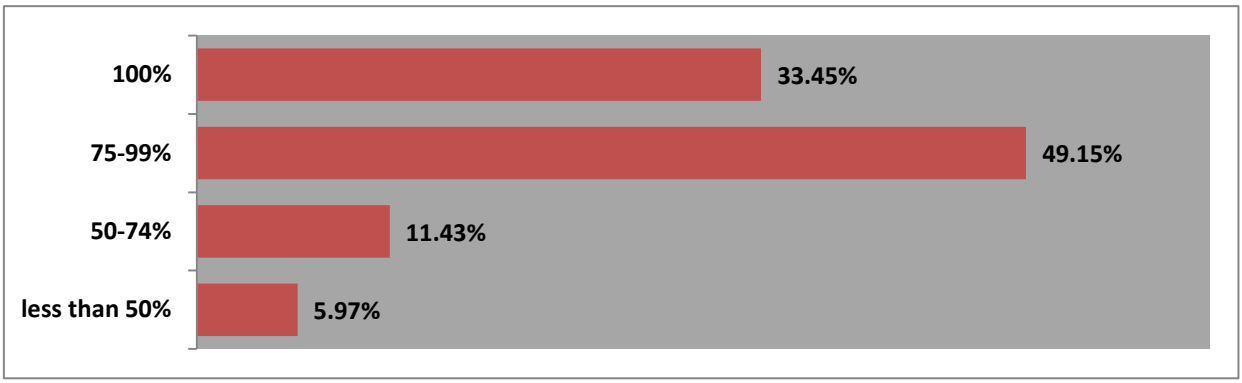


What percent of your laundry do you dry in a dryer?

(asked only of respondents who use a clothes dryer at their home)

QUESTION TOTAL: 586
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	100%	196	33.45%
O2	75-99%	288	49.15%
O3	50-74%	67	11.43%
O4	less than 50%	35	5.97%



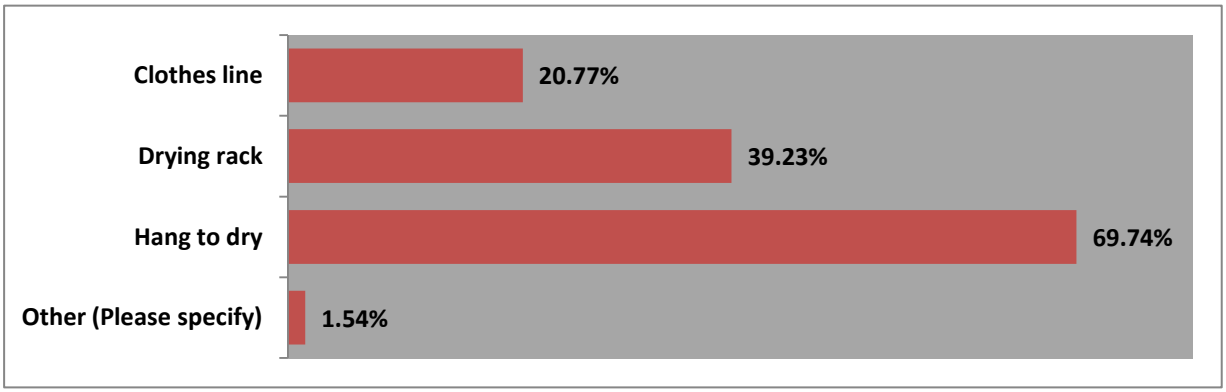
How do you dry the laundry that is not dried in a dryer?

(asked only of respondents who dry less than 100% of their clothes in a dryer)

QUESTION TOTAL: 390

NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Clothes line	81	20.77%
O2	Drying rack	153	39.23%
O3	Hang to dry	272	69.74%
O4	Other (Please specify)	6	1.54%



How do you dry the laundry that is not dried in a dryer? **Other (Please specify)**

Verbatim Responses	Total
lay flat to dry	2
FENCE	1
Lay flat	1
Lay out	1
Shower rod near washer	1

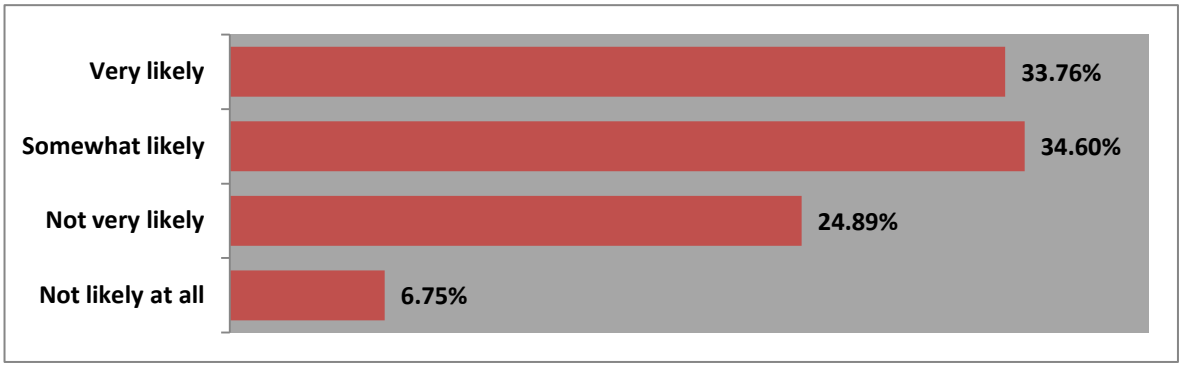
If you had a drying rack that you could use indoors to dry some, or all, of your laundry how likely would you be to use it?

(asked only of respondents who dry less than 100% of their clothes in a dryer and did not say they currently use a drying rack)

QUESTION TOTAL: 237

NO RESPONSE: 0

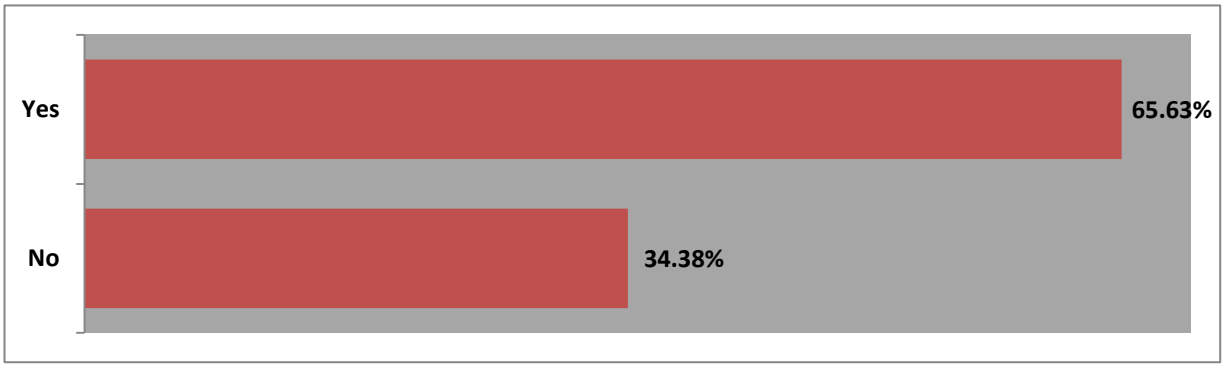
	OPTIONS	TOTAL	PERCENT
O1	Very likely	80	33.76%
O2	Somewhat likely	82	34.60%
O3	Not very likely	59	24.89%
O4	Not likely at all	16	6.75%



Are you aware that Idaho Power offers a variety of energy efficiency programs for residential customers?

QUESTION TOTAL: 608
NO RESPONSE: 0

	OPTIONS	TOTAL	PERCENT
O1	Yes	399	65.63%
O2	No	209	34.38%



What could Idaho Power do to increase your awareness of its energy efficiency programs?

QUESTION TOTAL:	209
NO RESPONSE:	44

Verbatim Responses	Total
Email	5
emails	3
Don't know	2
I don't know	2
newsletter	2
1 quit making me pay the $5 meter fee.	1
a flyer with a list of them (in the mail with the statement)	1
a link thru a social network, online 'n TV ads...include info in emailed/usps sent bills	1
A mailer or an email	1
advertise	1
advertise it	1
advertise more	1
Detailed email	1
direct mail	1
e mail me with new updates/put the information in the monthly bill	1
Educate the sheeple (HaHa good luck) The majority of the energy wasters are the uneducated. Unfortunately, they are all so the majority receiving assistance. If you were given free gas or subsidized for your gas consumption, would you even think about the MPGs of the vehicle you are driving. People only change if it affects their bottom line.	1
Either postal mail or email	1
e-mail	1
Email about rebates and promotions.	1
email and / or physical mailers	1
Email communication and possibly mailed flyers	1
email info to me or post on facebook. mailed flyers end up in the trash.	1
Email me	1
Email me about it. Send a story to local newspapers. Put it in your newsletter.	1
Email or letter	1
Email the info to me please. Mizzweaver@hotmail.com	1
Email the info.	1
Email the link	1
Email with short descriptions	1
Email!	1
email, include them in monthly bill online	1
email, newsletter, mailings.	1
Email, text message	1
Email. Facebook	1

Emails and fliers	1
Emails and mailings to customers	1
Emails or info on our statements.	1
emails to residential users	1
Emails with programs that are currently running and way to be more efficient.	1
emails? I'm more of an email reader than a pamphlet reader.	1
Facebook info	1
Fliers, ads on tv and radio	1
flyers in with the electricity bills	1
Flyers with the Power Bill.	1
Get my attention.	1
give more info on the variety of programs and the cost	1
Give more information about them without having to call or search for the information	1
Give rebate	1
have the link identified in the circular inserted in my bill	1
I am a renter, not a home owner----yet i pay my power bills and have to deal with a tremendously OLD and inefficient lighting, wood stove, and laundry machines. What opportunities are in place for many many limited income people like myself, who want to increase our energy efficiency but are limited by not owning their home? I have yet to see any real incentives for people like myself.	1
I am not aware of any although I new they existed I thought they were customer initiated.	1
I believe flyers are a great idea. If it's sent with the bill, it tends to get over looked.	1
I do not have air conditioning and that seems to be the only energy option I have ever seen.	1
I do not know	1
I don't know. offer a good rack?	1
I have no ideA.	1
I have seen flyer in my billing statement. Also commercials on TV. However, I am not sure these apply for me. I think my appliances are all energy efficent at this time.	1
I know they have a program for refrigerators but I wasn't aware of other ones. Did I miss it in your monthly newsletter? If so list them again in another issue.	1
I like mailings but they have to visually grab my attention. Email communication is also good.	1
I try to be as conservative as possible. I dry everything except better clothing, only till the wrinkles are out then hang to dry on a hanger. In bad weather, I string a cord in the house to dry sheets,sox,work clothes. I pick a day when the weather is better to wash sheets and towels. If there is more I can do, I am happy to learn about it.	1
If emailed to me I could check to see if any would work for us. That would give me the information and possibly a link to enroll That would be a convenient and efficient way for anyone to gain the information and enroll.	1
I'm not sure.	1
I'm not sure. Maybe an email with just one topic.	1
I'm sure you do plenty to raise awareness. I use bill pay and do not receive any paper from you as a result. This may be why I am not aware of some of your programs as I should be.	1

In a flyer with the bill	1
Include an informative flier with the bill on a regular basis such as once every 4 or 6 months.	1
Include in ON-LINE billing statement.	1
include info via email since on e-billing	1
Include info with my bill	1
include information with mailed bill	1
Indicate in the mailing what the energy efficiency programs are, cost, include, etc	1
Info in bills	1
inform me about the different programs	1
Insert in bill, e-mail.	1
just keep reminding us with the bill	1
Keep putting it with the bill. Just found out about duct work and applied.	1
Let us pore people win the $100 to try and buy a newer washers or dryers.	1
Letters, email, customer service rep calls	1
List it on my bill	1
mail	1
mail information	1
mail me the info	1
mailers or email	1
Mailings	1
make it appealing, I hate my new kenmore water saver waher, it runs for twice as long as my old one	1
Maybe inserts for people with paper bills and email for the rest of us.	1
Maybe mention it once in a while, in your advertising.	1
Mention it in the on line billing system.	1
more advertising - television, local newspaper	1
More promotional emails	1
more specific and unique mailings to our home -- not part of the bills	1
More surveys like this	1
N/A	1
na	1
news letters,e-mails, or texts	1
Newspaper article, insert in bill, email	1
Not sure. E-mail would probably be best.	1
Nothing	1
offer energy audits	1
Offer incentives? I guess I am not interested in them because I assume they all involve big costs, like replacing major appliances or windows. I can't afford anything like that.	1
Online advertising	1
Perhaps, identify which programs I could qualify for an notify me of them.	1
Probably by adding a pamphlet with the bill.	1

Provide information for energy efficiency programs that include customers that have natural gas as a heating source. All the programs I have checked into are available for customers that only use electricity. Energy efficiency should include all Idaho Power customers.	1
Provide some incentive to utilize the efficiency upgrades.	1
Put offers in with the bill, with a notice on the envelope - "Special Offers Inside".	1
Run TV commercials detailing the programs. Run radio commercials as well	1
Send a direct link to a website with a summary of the programs available.	1
send a personal letter to the home.	1
send an e-mail, or paper	1
send brochure for all programs for private residency to homes	1
Send brochures with monthly bills.	1
send either an email or normal mail information	1
send email and links in the emails of how to be energy efficent	1
send E-mail of the different energy saving that may help a person.	1
send emails	1
Send e-mails	1
Send emails about programs and rebates. Thanks.	1
Send emails about them	1
Send emails or mail flyers	1
send flyers	1
Send info in monthly bill	1
Send information via mail or email	1
send it in the mail	1
Send me an e-mail listing the energy efficiency programs offered, with links to additional information on each program such as criteria for participating in the program and anticipated benefits and costs for a program participant.	1
send me an email or letter about it with the bill. something different from the newsletter.	1
send me an email, or nice brochure in the mail. I like brochures better.	1
send me information on the programs offered	1
Send me information.	1
Send me some material in the mail separate from the bill.	1
send more info with the power bills. not just tips,but about programs to help needy with no cost efficient homes	1
send more information through the mail	1
Send notice with bills once a season or year? Doesn't help me when I primarily use ebills, though.	1
Send notices or have a website to learn about the energy efficiency programs	1
send out and explain in e-mails	1
Send out flyer	1
Send out flyers in the mail with Titles in big letters, "Idaho power wants you to know about their energy efficiency programs" "Helping you save on your electrical costs today, helps us save resources for you grand children's grand children tomorrow.	1
Send out newsletters in the mail or by email	1

Send out specific information or a call number where you could ask for that information. I think it is time that people need to be able to have an energy audit and then have it redone to see if they were able to fix the problems. Was at the Spring Fair in March, I was told I would be contacted by someone from Idaho power about my large power bill. That someone would go over my bills and my audit, that I paid for and get back with me with some help. I have not heard or been contacted as of this time. I'm quite disappointed. I did talk to 3 different people at the fair, each with the same solution. Give me your information and we will have one of our best people review and get back to you. Well???	1
Send program information through the mail.	1
send them by email	1
send them to me or refer me to a place to review	1
sent information through email or mail. I've tried to save energy to lower the cost but it seems like I couldn't figure out what? We did have a program few months back to save AC energy but that program was shutted down which is sad because it saved me money.	1
Separate mailings from bill inserts. I don't get those as I pay online through mycheckfree.	1
Special mailings.	1
Survey's like this. Fliers in the mail. E-mail, text, website, etc.	1
Tell me about them	1
Tell me about them - offer a specific program at a time.	1
Tell me about them somehow, email, newsletter, etc.	1
Tell me what they are: what is the program name, how it works, how do I access it, and what I should expect if I participate. Focus on one type of program at a time. Too much information given at the same time overwhelms me and I don't have time for that.	1
tell us ways to save on the items we use everyday. Put inserts that specifically address the most common waste of energy in our bill even on line.	1
TV ad	1
Tv commercials	1
We receive our bill and pay on computer. I don't get any information about Idaho Power unless you send me messages on internet	1
What I've seen is for low income or remove an old appliance programs so the "availability" limited to the rest of us.	1
What you are doing is fine	1

Technical Reference Manual 1.7

Prepared for

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Prepared by:

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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.

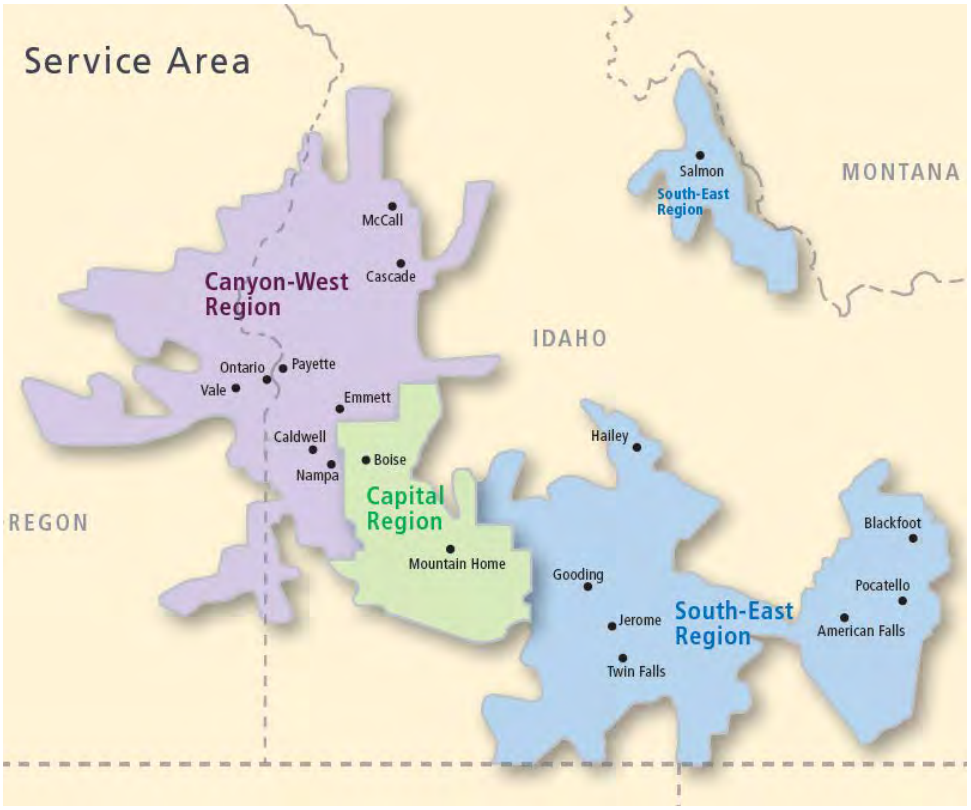

Figure 1-1 Map of Idaho Power Company Service Territory[1]

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.

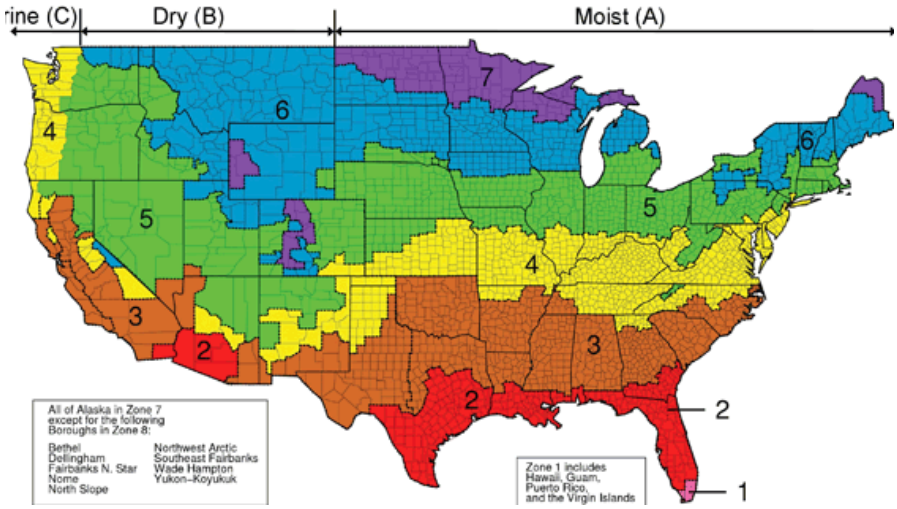

Figure 1-2 Map Illustrating ASHRAE Weather Zones[2]

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

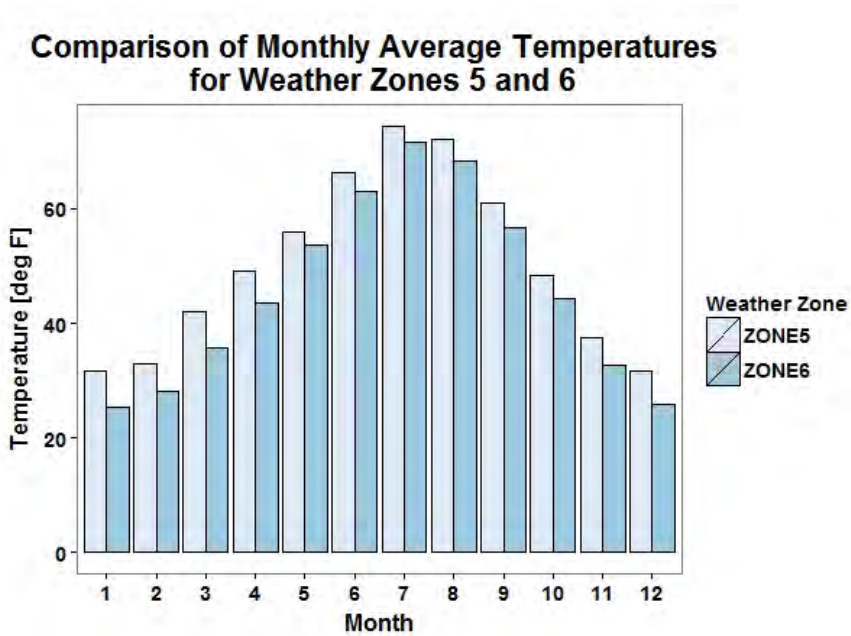

Figure 1-3 Comparison of Monthly Average Temperatures

[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

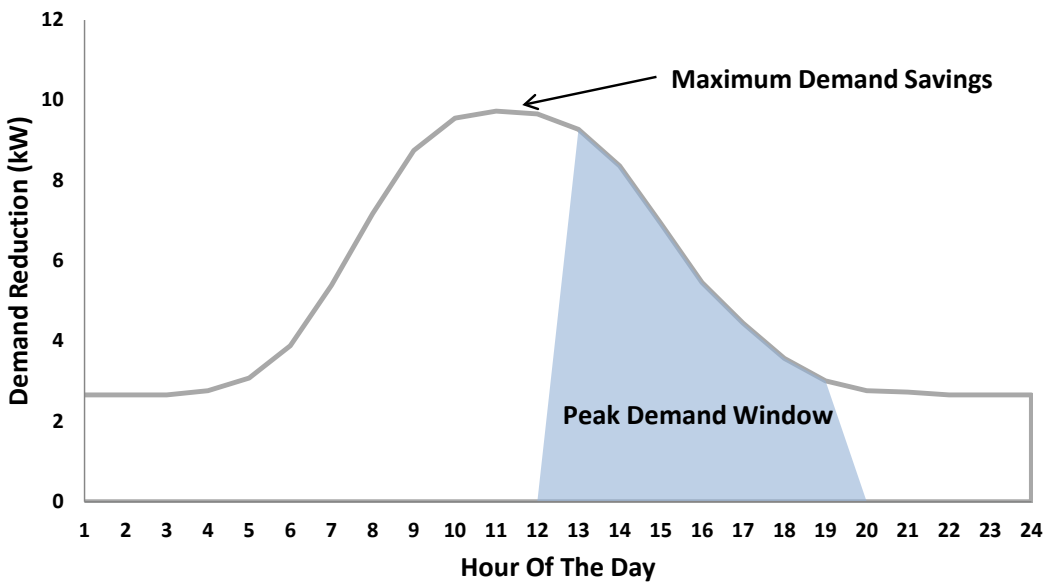

Figure 1-4 Hypothetical Hourly Savings Profile Used to Illustrate Calculation of Coincidence Factor

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**Error! Reference source not found.**.
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.
$\Delta kW/Unit$	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	15 Years	15 Years
Average Material & Labor Cost	$ 7.90	n/a
Average Incremental Cost	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	285 kWh	190 kWh
Average Unit Peak Demand Savings	.0144 kW	.0129 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	0.82 kWh	0.34 kWh
Average Unit Peak Demand Savings	0.08 W	0.03 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	636 kWh	418 kWh
Average Unit Peak Demand Savings	.11 kW	.07 kW
Average Unit Gas Savings	6 Therms	6 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	794 kWh	484 kWh
Average Unit Peak Demand Savings	.13 kW	.08 kW
Average Unit Gas Savings	17 Therms	9 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	Water Source Heat Pump (WSHP)
8	Ground Source Heat Pump (GSHP)
9	Packaged Rooftop Unit / Split System
10	Packaged Rooftop Heat Pump Unit

Note that detailed descriptions for each of the above system types can be found in *ASHRAE Handbook – Systems*. A summary of the system types, their typical configurations, and how they are modeled in eQuest[80] can be found in *Building Energy Use and Cost Analysis Program Volume 3: Topics*.[81]

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.

[80] The software package used to simulate energy impacts for this measure.

[81] http://doe2.com/download/DOE-22/DOE22Vol3-Topics.pdf

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	Water Source Heat Pump (WSHP)	258	0.104
2	Water Source Heat Pump (WSHP)	506	0.106
3	Water Source Heat Pump (WSHP)	566	0.116
4	Water Source Heat Pump (WSHP)	566	0.116
5	Water Source Heat Pump (WSHP)	n/a	n/a
6	Water Source Heat Pump (WSHP)	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	Water Source Heat Pump (WSHP)	155	0.011

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
2	Water Source Heat Pump (WSHP)	320	0.013
3	Water Source Heat Pump (WSHP)	380	0.024
4	Water Source Heat Pump (WSHP)	380	0.024
5	Water Source Heat Pump (WSHP)	n/a	n/a
6	Water Source Heat Pump (WSHP)	n/a	n/a
1	Ground Source Heat Pump (GSHP)	159	0.053
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	Water Source Heat Pump (WSHP)	250	0.082
2	Water Source Heat Pump (WSHP)	478	0.098
3	Water Source Heat Pump (WSHP)	556	0.103
4	Water Source Heat Pump (WSHP)	556	0.103
5	Water Source Heat Pump (WSHP)	n/a	n/a
6	Water Source Heat Pump (WSHP)	n/a	n/a
1	Ground Source Heat Pump (GSHP)	246	0.065
2	Ground Source Heat Pump (GSHP)	397	0.075
3	Ground Source Heat Pump (GSHP)	472	0.077
4	Ground Source Heat Pump (GSHP)	472	0.077
5	Ground Source Heat Pump (GSHP)	n/a	n/a
6	Ground Source Heat Pump (GSHP)	n/a	n/a
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	0.014
2	VAV with chilled water coils	551	0.018
3	VAV with chilled water coils	574	0.028
4	VAV with chilled water coils	577	0.028
5	VAV with chilled water coils	628	0.067
6	VAV with chilled water coils	655	0.081
1	Packaged Variable Air Volume System (PVAVS)	206	0.083
2	Packaged Variable Air Volume System (PVAVS)	480	0.089
3	Packaged Variable Air Volume System (PVAVS)	578	0.101
4	Packaged Variable Air Volume System (PVAVS)	578	0.101
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	0.057
2	Packaged Variable Air Volume System (PVAVS) Gas Heat	247	0.061
3	Packaged Variable Air Volume System (PVAVS) Gas Heat	247	0.069
4	Packaged Variable Air Volume System (PVAVS) Gas Heat	247	0.069
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	0.057
2	Packaged Variable Air Volume System (PVAVS) Electric Reheat	588	0.061
3	Packaged Variable Air Volume System (PVAVS) Electric Reheat	772	0.061
4	Packaged Variable Air Volume System (PVAVS) Electric Reheat	772	0.061
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	0.059
2	Packaged Variable Volume and Temperature (PVVT)	269	0.072
3	Packaged Variable Volume and Temperature (PVVT)	272	0.080
4	Packaged Variable Volume and Temperature (PVVT)	272	0.080
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	0.059
2	Packaged Variable Volume and Temperature (PVVT) Heat Pump	444	0.072
3	Packaged Variable Volume and Temperature (PVVT) Heat Pump	607	0.080
4	Packaged Variable Volume and Temperature (PVVT) Heat Pump	607	0.080
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	Water Source Heat Pump (WSHP)	170	0.112

# of Measures Implemented	HVAC System Type	kWh/Ton	kW/Ton
2	Water Source Heat Pump (WSHP)	315	0.122
3	Water Source Heat Pump (WSHP)	391	0.129
4	Water Source Heat Pump (WSHP)	391	0.129
5	Water Source Heat Pump (WSHP)	n/a	n/a
6	Water Source Heat Pump (WSHP)	n/a	n/a
1	Ground Source Heat Pump (GSHP)	164	0.043
2	Ground Source Heat Pump (GSHP)	264	0.050
3	Ground Source Heat Pump (GSHP)	331	0.053
4	Ground Source Heat Pump (GSHP)	331	0.053
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	0.077
2	Packaged Rooftop Unit / Split System	342	0.090
3	Packaged Rooftop Unit / Split System	342	0.090
4	Packaged Rooftop Unit / Split System	342	0.090
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	0.077
2	Packaged Rooftop Heat Pump Unit	517	0.090
3	Packaged Rooftop Heat Pump Unit	691	0.094
4	Packaged Rooftop Heat Pump Unit	691	0.094
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
Water Source Heat Pump (WSHP)	279	0.0060
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
Water Source Heat Pump (WSHP)	170	-0.0550
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
Water Source Heat Pump (WSHP)	253	0.0210
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
Water Source Heat Pump (WSHP)	165	0.0720
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	W/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
Water Source Heat Pump (WSHP)	0.95	0.04
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	W/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
Water Source Heat Pump (WSHP)	0.67	-0.102
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	W/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
Water Source Heat Pump (WSHP)	0.93	0.053
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	W/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
Water Source Heat Pump (WSHP)	0.71	0.191
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.[82]

Table 2-83 Typical Savings Estimates for GREM (w/o Housekeeping Set-Backs)

	Retrofit	**New Construction**	
		IECC 2009	IECC 2012
Deemed Savings Unit	Ton	Ton	Ton
Average Unit Energy Savings	1,095 kWh	965 kWh	951 kWh
Average Unit Peak Demand Savings	0 kW	0 kW	0 kW
Expected Useful Life	11 Years	11 Years	11 Years
Average Material & Labor Cost	$150.61	-	-
Average Incremental Cost	-	$57.50	$57.50
Stacking Effect End-Use	Heating, Cooling		

Table 2-84 Typical Savings Estimates for GREM (With Housekeeping Set-Backs)

	Retrofit	**New Construction**	
		IECC 2009	IECC 2012
Deemed Savings Unit	Ton	Ton	Ton
Average Unit Energy Savings	235 kWh	196 kWh	194 kWh
Average Unit Peak Demand Savings	0 kW	0 kW	0 kW
Expected Useful Life	11 Years	11 Years	11 Years
Average Material & Labor Cost	$150.61	-	-
Average Incremental Cost	-	$57.50	$57.50
Stacking Effect End-Use	Heating, Cooling		

[82] 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)[83]

	Retrofit	New Construction	
		IECC 2009	IECC 2012
Deemed Savings Unit	Ton	Ton	Ton
Average Unit Energy Savings	665 kWh	581 kWh	572 kWh
Average Unit Peak Demand Savings	0 kW	0 kW	0 kW
Expected Useful Life	11 Years	11 Years	11 Years
Average Material & Labor Cost	$150.61	-	-
Average Incremental Cost	-	$57.50	$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. Recently Idaho adopted IECC 2012 as the energy efficiency standard for new construction. Given the recent adoption the programs are expected to see participants permitted to either of these standards and savings for both are provided.

[83] The savings represented in this table give equal weight to the two prevailing baseline conditions (e.g. with and without a housekeeping set-back).

2.11.3. Algorithms

The following energy and demand savings algorithms are applicable for this measure:

$$\Delta kWh = kWh/Unit * NUnits$$

$$\Delta kWhUnit_{typical} = \Sigma(\Delta kWh/Unit_i * W_i)$$

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.[84]

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

[84] 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 (IECC 2009)

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

Table 2-88 Unit Energy Savings for GREM Systems – New Construction (IECC 2012)

Housekeeping Setback	***Weather Zone 5***			***Weather Zone 6***		
	Heat-Pump	Gas	Electric Resistance	Heat-Pump	Gas	Electric Resistance
Yes	95	25	353	130	21	448
No	600	154	1,555	727	117	1,795

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.[85] 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 2-89 Typical Savings Estimates for High Efficiency Air Conditioning – Base to CEE Tier 1

	Retrofit	**New Construction**	
		IECC 2009	IECC 2012
Deemed Savings Unit	Tons	Tons	Tons
Average Unit Energy Savings	224 kWh	93 kWh	105 kWh
Average Unit Peak Demand Savings	0.15 kW	.06 kW	.07 kW
Expected Useful Life	15 Years	15 Years	15 Years
Average Material & Labor Cost	$ 959.31	n/a	n/a
Average Incremental Cost	n/a	$ 144.49	$ 158.83
Stacking Effect End-Use		Cooling	

Table 2-90 Typical Savings Estimates for High Efficiency Air Conditioning – CEE Tier 1 to CEE Tier 2

	Retrofit	**New Construction**	
		IECC 2009	IECC 2012
Deemed Savings Unit	Tons	Tons	Tons
Average Unit Energy Savings	48 kWh	48 kWh	48 kWh
Average Unit Peak Demand Savings	0.03 kW	.03 kW	.03 kW
Expected Useful Life	15 Years	15 Years	15 Years
Average Material & Labor Cost	n/a	n/a	n/a
Average Incremental Cost	$ 98.54	$ 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

[85] See spreadsheet "11-TypicalCalcs_GREM.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Consortium for Energy Efficiency (CEE) Tier 1 efficiencies. High efficiency chillers are not eligible under this measure, but are included as a separate measure in this document. Note that projects replacing pre-existing heat-pump units with A/C only are eligible under this measure – though no impacts are considered for the heating component. 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. Recently Idaho adopted IECC 2012 as the energy efficiency standard for new construction. Given the recent adoption the programs are expected to see participants permitted to either of these standards and savings for both are provided. Note that this only impacts the savings for CEE Tier 1 units. The baseline efficiency for Tier 1 units is CEE Tier 0 (or code as applicable) 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 2-94.

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: [86]

$$SEER = .0507 * EER^2 + .5773 * EER + .4919$$

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.[87]
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.

[86] Note that this formula is an approximation and should only be applied to EER values up to 15 EER.

[87] 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 2-91 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	0.08	176.5	$1,390.27
Standard 5-11 ton AC unit – 11.6 EER	0.12	181.1	$845.26
Standard 11-19 ton AC unit – 11.6 EER	0.13	170.0	$745.21
Standard 19-64 ton AC unit – 10.4 EER	0.13	179.7	$847.79
Standard 64 ton or greater unit – 9.8 EER	0.14	230.3	$781.57
Standard 5 ton or less unit – Water Cooled 14 EER	0.15	326.1	$855.23
Standard 5-11 ton AC unit – Water Cooled 13.9 EER	0.19	268.4	$767.93
Standard 11 ton or greater unit – Water Cooled 13.9 EER	0.21	286.8	$1,481.90
Standard All Capacities - PTAC	0.10	145.1	$1,020.09
Standard 5 ton or less VRF - 14 SEER	0.09	176.5	$1,142.71
Standard 5-11 ton VRF - 11.7 EER	0.23	268.8	$644.93
Standard 11-19 ton VRF - 11.7 EER	0.22	264.6	$634.98
Standard 19-64 ton VRF - 10.5 EER	0.24	283.2	$805.76

Table 2-92 Deemed Savings for High Efficiency A/C – New Construction (IECC 2009) 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	0.10	145.1	$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 2-93 Deemed Savings for High Efficiency A/C – New Construction (IECC 2012) 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	0.07	101.6	$87.65
Standard 11-19 ton AC unit – 11.6 EER	0.06	87.4	$44.03
Standard 19-64 ton AC unit – 10.4 EER	0.06	99.2	$207.91
Standard 64 ton or greater unit – 9.8 EER	0.07	112.8	$222.02
Standard 5 ton or less unit – Water Cooled 14 EER	0.09	137.8	$107.76
Standard 5-11 ton AC unit – Water Cooled 13.9 EER	0.10	149.8	$298.89
Standard 11 ton or greater unit – Water Cooled 13.9 EER	0.07	105.0	$200.12
Standard All Capacities - PTAC	0.03	36.4	$87.75
Standard 5 ton or less VRF - 14 SEER	0.04	50.9	$271.18
Standard 5-11 ton VRF - 11.7 EER	0.13	190.7	$171.11
Standard 11-19 ton VRF - 11.7 EER	0.13	183.6	$120.60
Standard 19-64 ton VRF - 10.5 EER	0.14	204.4	$318.63

Table 2-94 Deemed Savings for High Efficiency A/C – CEE Tier 1 to CEE Tier 2[88]

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

[88] Note that CEE Tier 2 savings are the incremental savings (and cost) between Tier 1 and Tier 2.

Table 2-95 Stipulated Equivalent Full Load Cooling and Heating Hours (EFLH) by Building Type[89]

	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

[89] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

Table 2-96 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 2-97 CEE Minimum Efficiencies by Unit Type for All Tiers[90]

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

[90] 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 2-97 through Table 2-99 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. [91] Note that the values listed the tables below are averaged across each of the system efficiency and tonnage categories offered by the program. Table 2-103 through Table 2-108 at the end of this section provide individual savings and materials/labor costs.

Table 2-98 Typical Savings Estimates for High Efficiency Heat Pumps - Base to CEE Tier 1 (Cooling Only)

	Retrofit	**New Construction**	
		IECC 2009	IECC 2012
Deemed Savings Unit	Tons	Tons	Tons
Average Unit Energy Savings	213 kWh	79 kWh	87 kWh
Average Unit Peak Demand Savings	0.15 kW	.06 kW	.05 kW
Expected Useful Life	15 Years	15 Years	15 Years
Average Material & Labor Cost	$ 1,103	n/a	n/a
Average Incremental Cost	n/a	$ 339	$ 339
Stacking Effect End-Use		Cooling	

Table 2-99 Typical Savings Estimates for High Efficiency Heat Pumps - Base to CEE Tier 1 (Heating Only)

	Retrofit	**New Construction**	
		IECC 2009	IECC 2012
Deemed Savings Unit	Tons	Tons	Tons
Average Unit Energy Savings	1,098 kWh	685 kWh	245 kWh
Average Unit Peak Demand Savings	0 kW	0 kW	0 kW
Expected Useful Life	15 Years	15 Years	15 Years
Average Material & Labor Cost	$ 1,103	n/a	n/a
Average Incremental Cost	n/a	$ 339	$ 335
Stacking Effect End-Use		Heating	

[91] See spreadsheet "14-TypicalCalcs_HeatPumps_v2.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Table 2-100 Typical Savings Estimates for High Efficiency Heat Pumps - Base to CEE Tier 1 (Heating And Cooling)

	Retrofit	**New Construction**	
		IECC 2009	IECC 2012
Deemed Savings Unit	Tons	Tons	Tons
Average Unit Energy Savings	1,311 kWh	765 kWh	332 kWh
Average Unit Peak Demand Savings	.15 kW	.06 kW	.05 kW
Expected Useful Life	15 Years	15 Years	15 Years
Average Material & Labor Cost	$ 1,103	n/a	n/a
Average Incremental Cost	n/a	$ 339	$ 335
Stacking Effect End-Use	Heating, Cooling		

Table 2-101 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 2-102 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 2-103 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. Note that projects replacing pre-existing A/C only units with heat-pump units are eligible under this measure. In such project the heating component must use a *new construction baseline* whereas the cooling component can use either (retrofit or new construction) baselines as deemed appropriate. 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. Recently Idaho adopted IECC 2012 as the energy efficiency standard for new construction. Given the recent adoption the programs are expected to see participants permitted to either of these standards and savings for both are provided. Note that this only impacts the savings for CEE Tier 1 unit.

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 2-106.

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: [92]

$$SEER = .0507 * EER^2 + .5773 * EER + .4919$$

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)

[92] Note that this formula is an approximation and should only be applied to EER values up to 15 EER.

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.[93]
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 2-104 Deemed Energy Savings for Efficient Heat Pumps – Retrofit base to CEE Tier 1[94]

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	0.13	176	274	450	$1,365
Standard 5-11 ton HP unit – 11.1 EER	0.11	161	1,599	1,760	$810
Standard 11-19 ton HP unit – 10.7 EER	0.12	163	1,869	2,032	$734
Standard 19-64 ton HP unit – 10.1 EER	0.16	237	1,869	2,105	$669
Standard 1.5 ton or less Water Source HP - 14 EER	0.20	275	642	918	$1,056
Standard 1.5-5 ton Water Source HP - 14 EER	0.16	215	751	966	$1,056
Standard 5-11 ton Water Source HP - 14 EER	0.16	215	852	1,068	$1,056
Groundwater-source HP Less than 11 Tons - 16 EER	0.28	371	844	1,215	$1,622
Groundsource HP Less than 11 Tons - 13 EER	0.20	327	1,605	1,932	$5,381
Package Terminal Heat Pump - 10.8 EER	0.10	134	397	530	$1,449
Standard 5 ton or less VRF - 14 SEER	0.15	181	246	427	$1,471
Standard 5-11 ton VRF - 11.2 EER	0.12	274	820	1,094	$879
Standard 11-19 ton VRF - 10.8 EER	0.12	274	790	1,063	$805
Standard greater than 19 ton VRF - 10.2 EER	0.17	355	790	1,145	$736

[93] 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.

[94] 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 2-105 Deemed Energy Savings for Efficient Heat Pumps – New Construction (IECC 2009) 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 2-106 Deemed Energy Savings for Efficient Heat Pumps – New Construction (IECC 2012) 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	13	317	329	$11
Standard 11-19 ton HP unit – 10.7 EER	0.01	82	283	365	$7
Standard 19-64 ton HP unit – 10.1 EER	0.04	109	283	392	$121
Standard 1.5 ton or less Water Source HP - 14 EER	0.11	145	281	426	$455
Standard 1.5-5 ton Water Source HP - 14 EER	0.07	96	281	377	$455
Standard 5-11 ton Water Source HP - 14 EER	0.07	96	281	377	$455
Groundwater-source HP Less than 11 Tons - 16 EER	0.08	106	107	213	$436
Groundsource HP Less than 11 Tons - 13 EER	0.09	206	146	352	$4,433
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	0.04	48	68	115	$216
Standard 5-11 ton VRF - 11.7 EER	0.04	52	79	52	$80
Standard 11-19 ton VRF – 11.3 EER	0.04	58	84	142	$78
Standard greater than 19 ton VRF – 10.1 EER	0.04	65	84	149	$188

Table 2-107 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 2-108 Stipulated Equivalent Full Load Hours (EFLH) by Building Type[95]

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

[95] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

Table 2-109 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 2-110 CEE Baseline Efficiency by Unit Type[96]

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*

[96] 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 2-109 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 2-110 through Table 2-115 at the end of this section provide individual savings and materials/labor costs.

Table 2-111 Typical Savings Estimates for High Efficiency Chillers[97]

	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

[97] 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[98]	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 2-113. 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.[99]

[98] 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.

[99] 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 2-112 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 2-113 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 2-114 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 2-115 Stipulated Equivalent Full Load Hours (EFLH) by Building Type[100]

	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

[100] Prototypical building energy simulations were used to generate Idaho specific heating and cooling equivalent full load hours for various buildings.

Table 2-116 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 2-117 Code Baseline COP and IPLV by Unit Type [101]

Equipment Type	Size	Minimum Efficiency 2004	Minimum Efficiency 2007
Air Cooled, with Condenser, Electronically Operated	All Capacities	2.80 COP 3.05 IPLV [102]	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

[101] 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.

[102] 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. [103]

Table 2-116 through Table 2-118 summarize the 'typical' expected unit energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-118 Typical Savings Estimates for Evaporative Coolers (All) [104]

	Retrofit	**New Construction**	
		IECC 2009	IECC 2012
Deemed Savings Unit	Ton	Ton	Ton
Average Unit Energy Savings	392 kWh	353 kWh	342 kWh
Average Unit Peak Demand Savings	0.28 kW	0.26 kW	0.25 kW
Expected Useful Life	15 Years	15 Years	15 Years
Average Material & Labor Cost	$1,654	-	-
Average Incremental Cost	-	$840	$840
Stacking Effect End-Use		Cooling	

[103] Except by the normal relationship between temperature and relative humidity.

[104] 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 2-119 Typical Savings Estimates for Evaporative Coolers (Direct) [105]

	Retrofit	New Construction	
		IECC 2009	IECC 2012
Deemed Savings Unit	Ton	Ton	Ton
Average Unit Energy Savings	443 kWh	399 kWh	386 kWh
Average Unit Peak Demand Savings	0.32 kW	0.29 kW	0.28 kW
Expected Useful Life	15 Years	15 Years	15 Years
Average Material & Labor Cost	$1,178	-	-
Average Incremental Cost	-	$364	$364
Stacking Effect End-Use		Cooling	

Table 2-120 Typical Savings Estimates for Evaporative Coolers (Indirect) [106]

	Retrofit	New Construction	
		IECC 2009	IECC 2012
Deemed Savings Unit	Ton	Ton	Ton
Average Unit Energy Savings	316 kWh	285 kWh	276 kWh
Average Unit Peak Demand Savings	0.23 kW	0.21 kW	0.20 kW
Expected Useful Life	15 Years	15 Years	15 Years
Average Material & Labor Cost	$2,367	-	-
Average Incremental Cost	-	$1,553	$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. Recently

[105] Ibid. Note that these values are for Direct Evaporative units only.

[106] Ibid. Note that these values are for Indirect Evaporative units only.

Idaho adopted IECC 2012 as the energy efficiency standard for new construction. Given the recent adoption the programs are expected to see participants permitted to either of these standards and savings for both are provided.

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 2-119 and Table 2-120.

kW/Unit Per unit demand savings as stipulated in Table 2-119 and Table 2-120.

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 2-121 Unit Energy Savings for Evaporative Coolers – Weather Zone 5

	Retrofit		*New Construction (IECC 2009)*		*New Construction (IECC 2012)*	
Measure	kWh / Unit	kW / Unit	kWh / Unit	kW / Unit	kWh / Unit	kW / Unit
Direct Evaporative Cooler	456 kWh	0.32 kW	410 kWh	0.29 kW	397 kWh	0.28 kW
Indirect Evaporative Cooler	326 kWh	0.23 kW	293 kWh	0.21 kW	284 kWh	0.20 kW

Table 2-122 Unit Energy Savings for Evaporative Coolers – Weather Zone 6

	Retrofit		*New Construction (IECC 2009)*		*New Construction (IECC 2012)*	
Measure	kWh / Unit	kW / Unit	kWh / Unit	kW / Unit	kWh / Unit	kW / Unit
Direct Evaporative Cooler	391 kWh	0.32 kW	352 kWh	0.29 kW	341 kWh	0.28 kW
Indirect Evaporative Cooler	279 kWh	0..23 kW	251 kWh	0.21 kW	243 kWh	0.20 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 2-123 Typical Savings Estimates for Evaporative Pre-Cooler (Installed on Chillers) [107]

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	106 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
Stacking Effect End-Use	Cooling	

Table 2-124 Typical Savings Estimates for Evaporative Pre-Cooler (Installed on Refrigeration Systems) [108]

	Retrofit	New Construction
Deemed Savings Unit	Ton	Ton
Average Unit Energy Savings	186 kWh	n/a
Average Unit Peak Demand Savings	.16 kW	n/a
Expected Useful Life	15 Years	n/a
Average Material & Labor Cost	$ 173	n/a
Average Incremental Cost	n/a	n/a

[107] See spreadsheet "17-TypicalCalcs_EvapPreCool.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

[108] 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 2-123.
kW/Unit	Per unit demand savings as stipulated in Table 2-123.

2.16.5. Sources

8. Bisbee, Dave & Mort, Dan. Evaporative Precooling System: Customer Advanced Technologies Program Report Technology Evaluation Report. 2010 [109]

[109] https://www.smud.org/en/business/save-energy/energy-management-solutions/documents/evapercool-tech-aug10.pdf

9. Shen, Bo et al. 2010. Direct Evaporative Precooling Model and Analysis. Oak Ridge National Laboratory. ORNL/TM-2010/231 [110]
10. 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 2-125 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)	106	0.09
Evaporative Pre-Cooler (Refrigeration Systems)	186	0.16

[110] http://web.ornl.gov/info/reports/2010/3445605702460.pdf

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 2-124 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 2-126 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 2-127 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 2-126.

ESF Energy Savings Factor. Percent of baseline energy consumption saved by installing a VFD. The appropriate ESF can be found in Table 2-127.

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 2-128 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 2-129 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 2-128 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 2-130 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

11. California DEER Prototypical Simulation models (modified), eQUEST-DEER 3-5002E [111]

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 2-131 Water Side Economizer Savings [112]

Zone	Retrofit Savings (ΔkWh/Ton)	New Construction Savings (ΔkWh/Ton)
5	183	153
6	186	155

[111] Prototypical building energy simulations were used to generate Idaho specific kWh savings for various buildings.

[112] 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 2-130 and Table 2-131 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. [113]

Table 2-132 Typical Savings Estimates for ENERGY STAR Refrigerators (< 30 ft^3) [114]

	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 2-133 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	

[113] 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.

[114] These numbers do not include chest refrigerators. Inclusion of chest refrigerators would increase the 'typical' savings estimates.

Table 2-134 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 2-135 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 2-134 and Table 2-135.
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

12. Regional Technical Forum measure workbooks:
    http://rtf.nwcouncil.org/measures/com/ComFreezer_v3.xlsm &
    http://rtf.nwcouncil.org/measures/com/ComRefrigerator_v3.xlsm
13. 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 2-136 Unit Energy and Demand Savings for Units 15 to 30 cu.ft[115]

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 2-137 Unit Energy and Demand Savings for Units 30 to 50 cu.ft.[116]

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

[115] See spreadsheet "20-TypicalCalcs_KitchFrigFrzrIce.xlsx" for assumptions and calculations used to estimate the typical unit energy saving.

[116] See spreadsheet "20-TypicalCalcs_KitchFrigFrzrIce.xlsx" for assumptions and calculations used to estimate the typical unit energy saving.

Table 2-138 List of Incremental Cost Data For Refrigerators and Freezers. [117]

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

[117] From RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComFreezer_v3.xlsm

Table 2-139 List of Materials Cost Data for Refrigerators and Freezers. [118]

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

[118] 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 2-138 and Table 2-139 summarize the 'typical' expected (per unit) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below. [119]

Table 2-140 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 2-141 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.

[119] 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 2-140.
ΔkW/Unit	Per unit demand savings as stipulated in Table 2-140.
$kWh_{base/Installed}$	Daily energy usage of *base* (baseline) or *installed* ice machines.
$\Delta kWh_{wastewater}$	Annual savings from reduced water usage.
CF	Coincidence Factor = 0.937 [120]
H	Harvest Rate (pounds of ice made per day)
Hours	Annual operating hours = 4400

[120] From Illinois TRM

N_{Units} Number of refrigerators or freezers

2.20.5. Sources

14. Regional Technical Forum measure workbooks:
15. http://rtf.nwcouncil.org/measures/com/ComIceMaker_v1_1.xlsx
16. SDG&E Work Paper: WPSDGENRCC0004, "Commercial Ice Machines"
17. 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 2-142 Unit Energy Savings for Ice Machine [121]

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

[121] Values given are based on assumed weights for harvest rates. Savings vary significantly between harvest rates.

Table 2-143 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 2-142 and Table 2-143 summarize the 'typical' expected (per machine) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below. [122]

Table 2-144 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 2-145 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	

[122] 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 2-146 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 2-147 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 2-148 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 2-149 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 2-149and Table 2-150.
kW/Unit	Per unit demand savings as stipulated in Table 2-149and Table 2-150.
CF	Coincidence Factor [123]
NUnits	Number of dishwashers
Hrs_{Idle}	Annual Idle Hours. Values for this input are stipulated in Table 2-149 and Table 2-150.

[123] From Illinois TRM

2.21.5. Sources

18. Regional Technical Forum measure workbook: http://rtf.nwcouncil.org/measures/com/ComDishwasher_v1_2.xlsm
19. 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 2-150 Coincidence Factor for Kitchen: Efficient Dishwashers 118 [124]

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 2-151 Unit Energy Savings and Incremental Costs for All Electric Kitchen: Efficient Dishwashers [125]

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

[124] From Illinois TRM

[125] See spreadsheet "22-TypicalCalcs_KitchDshWshr.xlsx" for assumptions and calculations used to estimate the typical unit energy savings.

Table 2-152 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 2-151 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 2-153 Typical Savings Estimates for Efficient Refrigerated Cases [126]

	Retrofit	New Construction
Deemed Savings Unit	Linear ft.	n/a
Average Unit Energy Savings	Table 2-152	n/a
Average Unit Peak Demand Savings	Table 2-152	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)

[126] 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 2-152.
ΔkW/Unit	The unit peak reduction. Stipulated values for this input are listed by weather zone in Table 2-152.
N_{Units}	Number of linear feet of refrigerated case

2.22.5. Sources

20. DEER Measure Cost Summary: http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValuesAndDocumentation_080530Rev1.zip
21. 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 2-154 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 2-153 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 2-155 Typical Savings Estimates for ASH Controls [127]

	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 [128]	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.

[127] See spreadsheet "24-TypicalCalcs_ASH.xlsx" for assumptions and calculations used to estimate the typical unit energy savings, expected useful life, and incremental costs.

[128] 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 2-154.
F_{Sav}	ASH run-time reduction Factor. Stipulated values for this figure are provided in Table 2-154.

2.23.5. Sources

22. June 2001 edition of ASHRAE Journal
23. Regional Technical Forum, Measure Workbooks
    http://rtf.nwcouncil.org/measures/Com/ComGroceryAntiSweatHeaters_v1_0.xlsm
24. 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 2-156 Connected Load for Typical Reach-In Case [129]

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

[129] 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 2-155 through Table 2-158 summarize the 'typical' expected (per door) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below. [130]

Table 2-157 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 2-158 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	

[130] See spreadsheet "25-TypicalCalcs_AutoCloser_v2.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

Table 2-159 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 2-160 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 2-159 based on case type and temperature.
ΔkW/Unit	Unit demand savings estimates. Stipulated values for this input are provided in Table 2-159 based on case type and temperature.
N_{Units}	Number of doors onto which this measure is installed.

2.24.5. Sources

25. Regional Technical Forum, Measure Workbooks http://rtf.nwcouncil.org/measures/com/ComGroceryAutoCloser_v1_0.xlsm
26. http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm
27. Workpaper PGECOREF110.1 – Auto-Closers for Main Cooler or Freezer Doors
28. 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 2-161 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 2-160 summarizes the 'typical' expected (per ton) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-162 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 [131]	n/a
Average Incremental Cost	n/a	$ 35.00 [132]
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:

[131] From DEER 2005 Database

[132] 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 2-161.
ΔkW/Unit	Per unit demand savings as stipulated in Table 2-161.
N_{units}	Number of condensers installed on individual systems

2.25.5. Sources

29. 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 2-163 Unit Energy Savings for Efficient Refrigeration Condenser[133]

Measure	kWh/Ton	kW/Ton
Energy Efficient Condenser - Retrofit	120	0.118
Energy Efficient Condenser – New Construction	114	0.112

[133] 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 2-162 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 2-163 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 2-164 summarizes the ‘typical’ expected (per unit) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-164 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 2-165 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 2-166 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 2-165 and Table 2-166 according to building type, building vintage, and baseline refrigeration system type.
ΔW/Unit	Per unit demand savings (in Watts) as stipulated in Table 2-165 and Table 2-166 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

30. DEER Database for Energy-Efficient Resources. Version 2011 4.01
31. DEER Measure Cost Summary: http://www.deeresources.com/deer0911planning/downloads/DEER2008_Costs_ValuesAndDocumentation_080530Rev1.zip
32. 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 2-167 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 2-168 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 2-167 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 2-169 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 [134]	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)

[134] 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 2-168.
ΔW_{unit}	Deemed kW savings stipulated in Table 2-168.
L	Length of gasket replaced in feet.

2.27.5. Sources

33. CPUC Reports of Strip Curtains and Gaskets
    http://rtf.nwcouncil.org/subcommittees/grocery/CPUC%20Strip&Gasket%202010.zip
34. 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
35. 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 2-170 Unit Energy Savings for Door Gaskets [135]

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

[135] 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 2-169 through Table 2-171 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. [136]

Table 2-171 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 2-172 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	

[136] See spreadsheet "29-TypicalCalcs_EvapFans.xlsx" for assumptions and calculations.

Table 2-173 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 2-173 and Table 2-176.
$\eta_{base/Installed}$	Efficiency of baseline (*base*) or *installed* motor(s) - If unknown, see Table 2-173 and Table 2-176.
$kWh_{control,\ i}$	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 2-178.
% Speed	Ratio of low speed to full speed in a percent = 35% see Table 2-178.

2.28.5. Sources

36. 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
37. EnergySmart Grocer Invoice Data
38. AHRI Standard 1200 – 2006
39. Federal Rulemaking for Commercial Refrigeration Equipment, Technical Support Document. 2009
40. 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 2-174 Evaporator Fan Motor Output and Input Power for Reach-ins

Motor Output [137] (watts)	SP Input (watts)	ECM Input (watts)	PSC Input (watts)	ECM Efficiency [138]	PSC Efficiency	SP Efficiency
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%

[137] From RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm

[138] Values from AHRI Standard 1200 - 2006

Table 2-175 Un-Weighted Baseline kWh Savings for Reach-ins [139]

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 2-176 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

[139] kWh algorithms from RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm

Table 2-177 Evaporator Fan Motor Output and Input Power for Walk-ins [140]

Motor Output (watts)	SP Input (watts)	ECM Input (watts)	PSC Input (watts)	ECM Efficiency	PSC Efficiency [141]	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%

[140] All values except PSC Efficiency are from RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryWalkinEvapFanECMController_v1_1.xls

[141] PSC Efficiency from Pennsylvania TRM

Table 2-178 Un-Weighted Baseline kWh Savings for Walk-ins [142]

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)					

[142] kWh algorithms are based on RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryWalkinECM_v1_1.xlsm

Table 2-179 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 2-180 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 2-181 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 2-180 and Table 2-181 summarize the 'typical' expected (per foot) energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-182 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 [143]	n/a
Average Incremental Cost	n/a	n/a
Stacking Effect End-Use	Refrigeration	

Table 2-183 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 [144]	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).

[143] From SCE Work Paper: WPSCNRRN0003.1

[144] 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 2-182.
ΔkW/Unit	Unit demand savings. Stipulated values for this input are listed in Table 2-182.
L	Length of insulation installed.

2.29.5. Sources

41. Southern California Edison Company, "Insulation of Bare Refrigeration Suction Lines", Work Paper WPSCNRRN0003.1
42. 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 2-184 Unit Energy Savings for Suction Line Insulation [145]

Case Type	***ΔkW/ft***	***ΔkWh/ft***
Medium-Temperature Coolers	0.001548	7.5
Low-Temperature Freezers	0.00233	12

[145] 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 2-183 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 2-185 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 [146]	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

146

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 2-184 according to case temperature and climate zone.

2.30.5. Sources

43. SCE Workpaper: "Night Covers for Open Vertical and Horizontal LT and Open Vertical MT Display Cases," SCE13RN005.0
44. RTF Workbook: http://rtf.nwcouncil.org/measures/com/ComGroceryDisplayCaseECMs_v2_2.xlsm
45. 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 2-186 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 2-187 Typical Savings Estimates for Low/No Heat Doors [147]

	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

[147] 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

46. Southern California Edison. Low ASH Display Doors Work Paper: SCE13RN018.0
47. 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 2-188 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 2-187 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 2-189 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 **2-188**.

ΔkW/Unit Per unit demand savings as stipulated in Table **2-188**.

N_{Units} Total number of computers controlled.

2.32.5. Sources

48. 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 2-190 Unit Energy Savings for PC Power Management Software [148]

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

[148] 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 2-189 summarizes the 'typical' expected energy impacts for this measure. Typical values are based on the algorithms and stipulated values described below.

Table 2-191 Variable Frequency Drives (Process Applications) [149]

	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.[150] 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)

[149] See spreadsheet "34-TypicalCalcs_ProcessVFD.xlsx" for assumptions and calculations used to estimate the typical unit energy savings and incremental costs.

[150] 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[151]

$$\Delta\ kWh_{Eng} = \sum P_{motor} * Hr_i * (F_{base,\ i} - F_{meas,\ i})$$

$$\Delta\ kW_{Eng} = P_{motor} * (F_{base,\ i} - F_{meas,\ i}) * CF$$

$$P_{motor} = .745 * P_{Nominal} * LF / \eta$$

$$F_i = \beta_1 + \beta_2 * Spd_i + \beta_3 * Spdi^2 + \beta_4 * Spdi^3$$

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.

[151] 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 2-191. 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

49. Regional Technical Forum Unit Energy Savings calculator for Agricultural: Variable Frequency Drives – Dairy (http://rtf.nwcouncil.org/measures/ag/AgDairyVFD_v1_2.xls)
50. 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)
51. 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 2-192 Deemed Per/HP savings values

Measure	Energy Savings [kWh/HP]	Peak Demand Savings [kW/HP]
Process VFD	1,377	0.16

Table 2-193 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 2-194 Coincidence Factors

Application	CF
Site Specific	As Measured
Other	.77

3. Appendix A: Document Revision History

Table 3-1Document Revision History

Date	Modified Version	Revised Version	Description of Changes
4/01/14	-	1.0	Initial Adoption of TRM.
11/04/14	1.0	1.1	Added *PVVT* and *GSHP* system types to HVAC Controls measure chapter. Updates were made to values in the summary tables which provide a unit savings estimate based on an assumed average of system types. System type specific values were added to the remaining applicable tables in this section. Updated tables include Table 2-65 through Table 2-82.
04/16/15	1.1	1.2	Added *WSHP* system type to HVAC Controls measure chapter. Updates were made to values in the summary tables which provide a unit savings estimate based on an assumed average of system types. System type specific values were added to the remaining applicable tables in this section. Updated tables include Table 2-65 through Table 2-82.
05/19/15	1.2	1.3	Found typo in several tables (Table 2-65 through Table 2-82). Table values updated to reflect corresponding calculator spreadsheets.
05/27/15	1.3	1.4	Found typo in several tables (Table 2-66 through Table 2-67). Table values updated to reflect corresponding calculator spreadsheets.
06/26/15	1.4	1.5	Updated savings values for Evaporative Pre-Cooler measure (Chapter 17) to incorporate data from new source. Accounts for the fact that the studies used to determine savings are biased towards R-22 and that R-410A has higher savings potential. New numbers assume a mix of both refrigerants, but a predominance of R-410A.
08/06/15	1.5	1.6	Made small revisions to three chapters: 1) Sections 2.12 and 2.13: Expanded description of eligible equipment to include changing from A/C only to Heat-Pump and visa versa. 2) Section 2.10: Added references for the reader which provide full descriptions of the listed HVAC system types. 3) Section 2.16: Updated numbers in Table 2-123 to reflect those in summary table and consistent with the previous update.

Date	Modified Version	Revised Version	Description of Changes
10/02/2015	1.6	1.7	Updated (4) measures to include energy savings under IECC 2012. Note that only a handful of measures were affected by the IECC 2012 code update: 1) High Efficiency A/C 2) High Efficiency Heat Pumps 3) Guest Room Occupancy Sensors 4) Direct/Indirect Evaporative Coolers

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Evaluations

EVALUATIONS

Table 4. 2015 Evaluations

Report Title	Program or Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
2015 Flex Peak Program End-of-Season Annual Report	Commercial/Industrial	Idaho Power	Idaho Power	Annual Report
2015 Irrigation Peak Rewards Program Report	Irrigation	Idaho Power	Idaho Power	Annual Report
A/C Cool Credit Impact Evaluation	Residential	CLEAResult	Idaho Power	Impact
Flex Peak Demand Response Program 2015 Impact Evaluation	Commercial/Industrial	CLEAResult	Idaho Power	Impact
Impact and Process Evaluation of Idaho Power's Ductless Heat Pump Program	Residential	Applied Energy Group	Idaho Power	Impact/Process
Impact and Process Evaluation of Idaho Power's Home Improvement Program	Residential	Applied Energy Group	Idaho Power	Impact/Process
Impact and Process Evaluation of Idaho Power's See ya later, refrigerator® Program	Residential	Applied Energy Group	Idaho Power	Impact/Process
Irrigation Peak Rewards Program 2015 Impact Evaluation	Irrigation	CLEAResult	Idaho Power	Impact

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2015 Flex Peak Program
End-of-Season Annual Report

November 3, 2015

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Attachment

CLEAResult 2015 Impact Evaluation

Background

The Flex Peak Program ("Program") is a voluntary demand response ("DR") program available to industrial and large commercial customers that are capable of reducing their electrical energy loads for short periods during summer peak days. By reducing demand on extreme system load days during summer months, the Program reduces the amount of generation and transmission resources required to serve customers. This Program, along with Idaho Power Company's ("Idaho Power" or "Company") other DR programs, Irrigation Peak Rewards and the Residential Air Conditioner Cycling Program, has helped to delay the need to build supply-side resources.

Idaho Power filed an application with the Idaho Public Utilities Commission ("Commission") on February 4, 2015, in Case No. IPC-E-15-03 requesting authority to replace the existing optional FlexPeak Management DR program that was managed by a third-party contractor with an optional DR program that would be managed by the Company. The Commission issued Order No. 33292 on May 7, 2015, authorizing the Company to implement an internally managed Flex Peak Program under Schedule 82 in Idaho and continue recovery of its DR program costs in the manner it had been previously.

As part of Order No. 33292, the Commission ordered the Company to file an annual end-of-season report that should include the number of participants, number of participating sites, megawatts ("MW") of DR under contract, MW of DR realized and incented per dispatch, percent of nominated MW achieved in each dispatch event by participant, and a detailed program cost analysis. This report addresses the annual end-of-season reporting requirements.

Page 8 of the Commission's order also requires Idaho Power to file a separate, one-time report no later than May 7, 2016, that discusses the Company's experience in running the Program, how the Program's costs and benefits compare to those achieved under the prior program, how participants have performed under the structure, and whether changes might improve the Program. The Company will file the one-time report in 2016.

Program Details

The Program pays participants a financial incentive for reducing load within their facility and is active June 15 to August 15, between the hours of 2 p.m. to 8 p.m. on non-holiday weekdays.

Customers with the ability to nominate or provide load reduction of at least 20 kilowatts ("kW") are eligible to enroll in the Program. The 20 kW threshold allows a broad range of customers the ability to participate in the Program. Participants receive notification of a load reduction event ("event") two hours prior to the start of the event, and events last between two to four hours. The Flex Peak Program provided approximately 28 MW at the generation level of committed load reduction based on the 2015 nomination amounts.

The parameters of the Flex Peak Program are in Schedule 82, and include the following:

- A minimum of three load reduction events would occur each Program season
- Events could occur any weekday, excluding July 4, between the hours of 2 p.m. and 8 p.m.
- Events could occur up to four 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 participants two hours prior to the initiation of an event
- If prior notice of a load reduction event had been sent, Idaho Power could choose to cancel the event and notify participants of cancellation 30 minutes prior to the start of the event

Program Incentives

The Flex Peak Program includes both a fixed and variable incentive payment. The fixed incentive is calculated by multiplying the actual kW reduction by $3.25 for weeks when an event is called, or the weekly nominated kW amount by $3.25 for weeks when an event is not called. The variable energy incentive is calculated by multiplying the kW reduction by the event duration hours to achieve the total kilowatt-hour ("kWh") reduction during an event. The variable incentive payment is $0.16 per kWh and is implemented for events that occur after the first three events.

The Program also includes an incentive adjustment of $2.00 when participants do not achieve their nominated amount during load reduction events. This adjustment amount is used for the first three events. After the third event, the adjustment is reduced to $0.25 per kW. Incentives are calculated using Idaho Power's interval metering billing data and participants' incentive checks were mailed within 30 days of the end of the Program season. Participants were mailed their incentive checks by September 15 in 2015. The incentive structure offered for the 2015 season is listed in Table 1.

Table 1.

Fixed Capacity Payment Rate*	**Variable Energy Payment Rate****
$3.25 per Weekly Effective kW Reduction	$0.16 per kWh (Actual kW x Hours of Event)
Adjustment for first three events $2.00 per kW not achieved up to nomination	**Adjustment after first three events** $0.25 per kW not achieved up to nomination
*To be prorated for partial weeks	**Does not apply to first three Program events

Program Results

The results throughout this report are at the generation level and system losses have been taken into account. Idaho Power called three load reduction events in 2015. The first event occurred on June 30, the second on July 21, and the third on August 4. The maximum realization rate during the season was 96.6% and the average for all three events combined was 79.6%. The realization rate is the percentage of load reduction achieved versus the amount of load reduction committed for an event. The highest hourly load reduction achieved was during the July 21 event at 25.6 MW.

Participants had a committed load reduction of 28.1 MW in the first week of the Program, which was the peak committed load reduction for the season. This weekly commitment, or "nomination", was comprised of 38 participants totaling 72 sites. Out of the total number of sites, 57 sites participated in the 2014 season, and 15 sites were newly added in 2015. There were 36 sites that did not re-enroll from the 2014 season. Of the 36 sites that did not re-enroll, 17 were from one customer that chose not to participate in 2015. However, of the sites that did not re-enroll last season, Idaho Power has received information from customers that three sites will be enrolled in 2016. The committed load reduction at the end of the season was 26.37 MW, which was achieved by 71 facility sites. One site dropped out of the Program during the season due to its primary pump being taken down and replaced.

The first event was called on Tuesday, June 30. Participants were notified at 2 p.m. for a four-hour event from 4-8 p.m. The total nomination for this event was 27.72 MW. The average load reduction was 23.6 MW. The highest hourly load reduction was 24.1 MW during hour three. The realization rate for this event was 86.7%.

The second event was called on Tuesday, July 21. Participants were notified at 2 p.m. for a four-hour event from 4-8 p.m. The total nomination for this event was 26.4 MW. The average load reduction was 24.9 MW. The highest hourly load reduction was 25.6 during hour one. The realization rate for this event was 96.6%.

The third event was called on Tuesday, August 4. Participants were notified at 2 p.m. for a three-hour event from 4-7 p.m. The total nomination for this event was 26.2 MW. The average load reduction was 13.8 MW. The highest hourly load reduction was 14.6 MW during hour three. The realization rate for this event was 55.4%. This was primarily due to one customer with two sites that was not able to provide their typical load reduction because of production issues caused by outages from range fires. These two sites achieved a realization rate of 8% in the August 4 event, compared to an average of 113% for the first two events. Had the site's realization rate for the August 4 event been the average of its realization rates from the first two events, the realization rate for this event would have been 94.8%.

Participation

In anticipation of the 2015 Program season, Idaho Power utilized direct customer mailings to encourage both past participants and new customers to enroll. Several communications were sent to former FlexPeak Management program participants prior

to the Commission approving Schedule 82 to advise them about the possible upcoming Program changes. The Commission granted authorization for the new Company-managed Program on May 7, 2015. Idaho Power had just over 30 days to recruit customers for the Flex Peak Program before the season began on June 15, 2015.

In May 2015, Program enrollment mailings were sent to all customers that had participated in prior seasons from 2012 to 2014. Contents of this mailing included Program details, a Program application, the Program's incentive structure, and a listing of the customer's eligible service points. Additionally, the Idaho Power Program Specialist and Customer Representatives answered specific customer questions by phone, email, and face to face contact, which helped inform participants of new Program details.

Despite changes to the Program, most past participants and sites re-enrolled. The number of sites enrolled in the Program for 2015 was 72. Of those 72 sites, 57 were previously enrolled during the 2014 season. Those 57 returning sites accounted for 79% of the 2015 enrolled service points. The Program also retained 34 of the 48 participants from the 2014 season for a 71% customer retention rate.

In 2015, the average nominated kW per site was 378 kW, while the average load reduction was 291 kW per site. The 72 enrolled sites nominated an average of 26.9 MW across the three events and included 38 unique participants. The average number of sites enrolled per participant was 3.1.

Figure 1 represents Idaho Power's service area divided into five regional areas: Western, Canyon, Capital, Southern, and Eastern.

Figure 1.

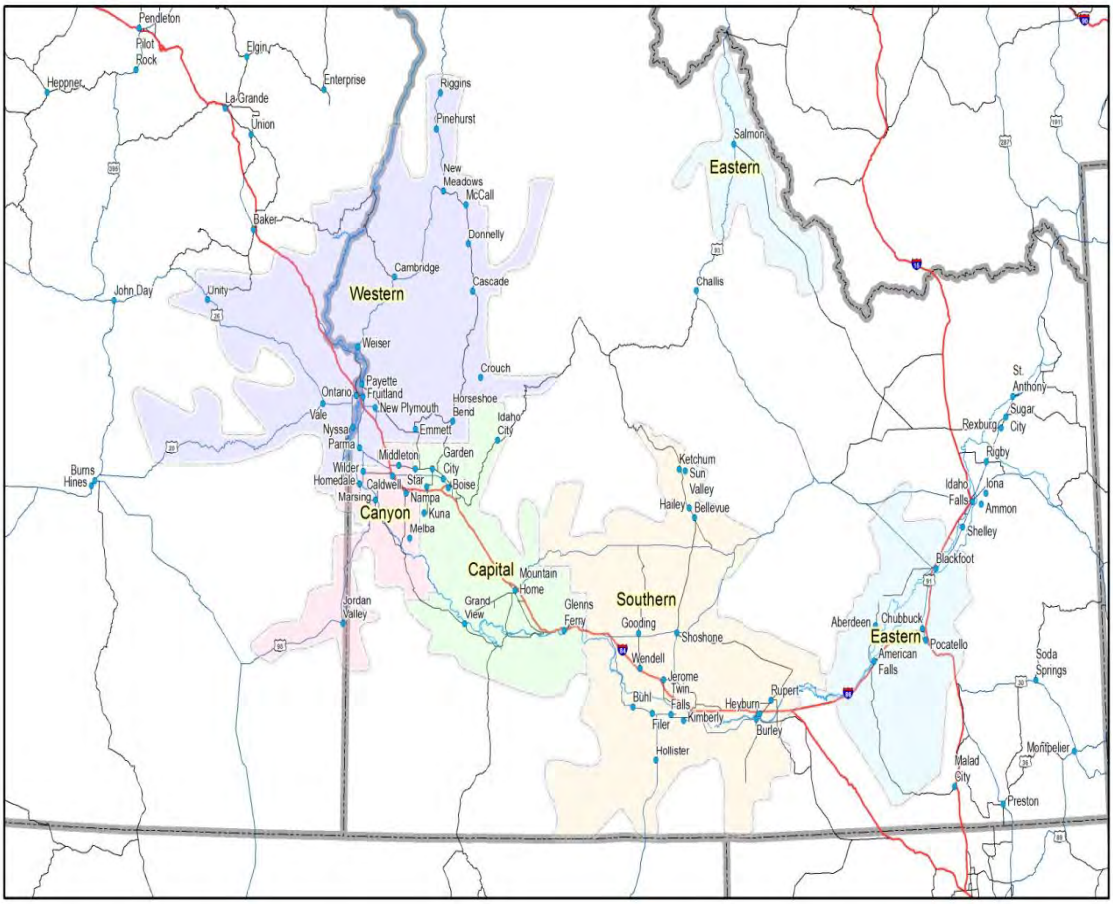


Figure 2 represents the 72 service points that enrolled in 2015 and their distribution by Idaho Power's regional service areas.

Figure 2.

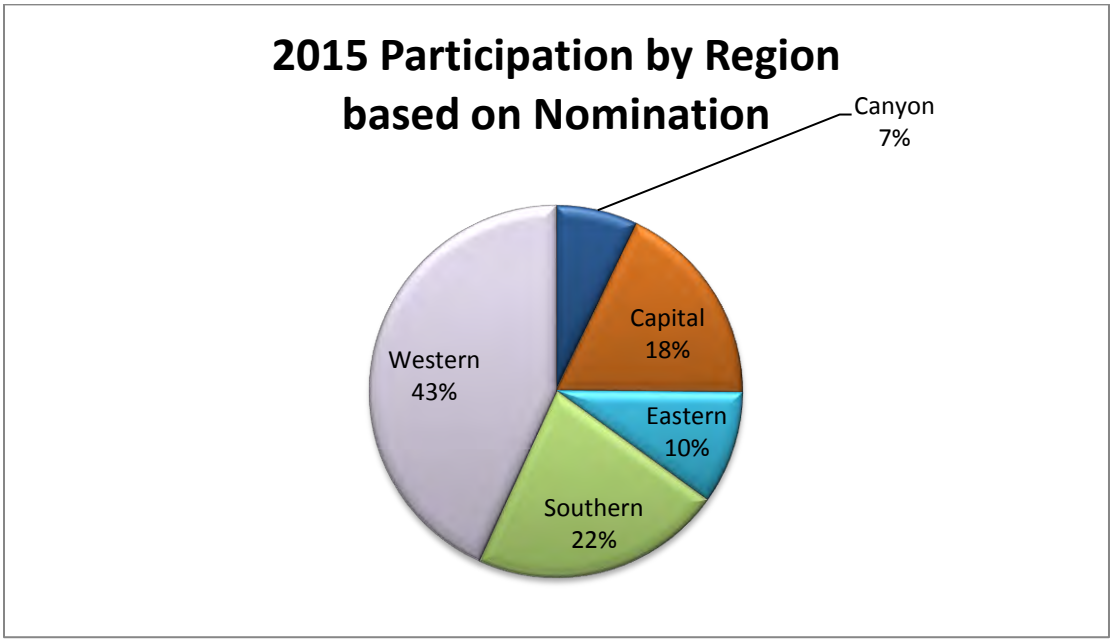
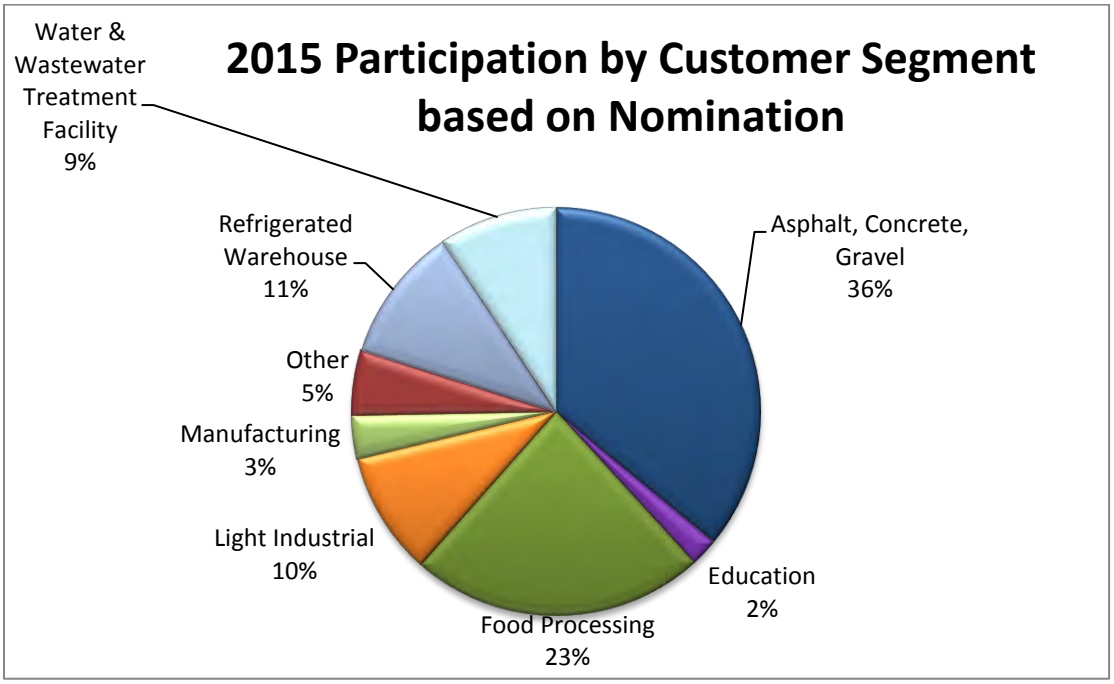


Figure 3 represents the 72 service points that enrolled in 2015 and their diversity per customer segment.

Figure 3.



Operations

Interval metering data provides Idaho Power the ability to view all participants' load after events. This metering data was used to calculate the reduction achieved per site during load reduction events. Using this data, Idaho Power provided participants post-event usage reports that showed hourly baseline, actual usage, and reduction during an event. This tool assisted participants in refining their nomination for future events. This data provides information useful in determining which participating sites may have an opportunity to provide more reduction or change their reduction strategy if nomination amounts were not achieved.

Based on individual event performance, Idaho Power contacted participants if their reduction was 25% less than the nominated amount for the event. When a participant did not achieve at least 75% of their nominated amount, there were often one or more of the following factors that influenced the performance:

- Production requirements prevented the ability to curtail or fully implement all load reduction measures within facility
- Building operators and/or maintenance personnel were out of town or unavailable during event day
- Enrolled facility was offline or not in production during entire load reduction event or baseline period due to reduced hours of operation

Load Reduction Analysis

Potential load reduction impacts in 2015 were verified by an impact evaluation performed by a third-party contractor, CLEAResult. The impact evaluation report performed by CLEAResult is included as an attachment to this report. The goals of the impact evaluation were to calculate load reduction in MW under Idaho Power's methodology, as well as the methodology that was previously used for the Program. The evaluation also analyzed and verified load reduction per site and per event.

The baseline that load reductions are measured against during load reduction events is calculated using a 10-day period. The baseline is the average kW of the highest energy usage days during the event availability time (2-8 p.m.) from the highest three days out of the last 10 non-event weekdays. Individual baselines are calculated for each facility site. Once the original baseline is calculated, there is an additional piece included in the methodology called the Day-of-Adjustment ("DOA") that is used to arrive at the adjusted baseline.

Adjustments address situations where load is lower or higher than it has historically been and the baseline does not accurately reflect the load behavior immediately prior to the event. The DOA is applied to each site's original baseline by accounting for the difference between the average baseline kW and the average curtailment day kW during hours two-three prior to the start of the event. The DOA is calculated as a flat kW and is applied to all baseline hours and capped at +/- 20% of the original baseline

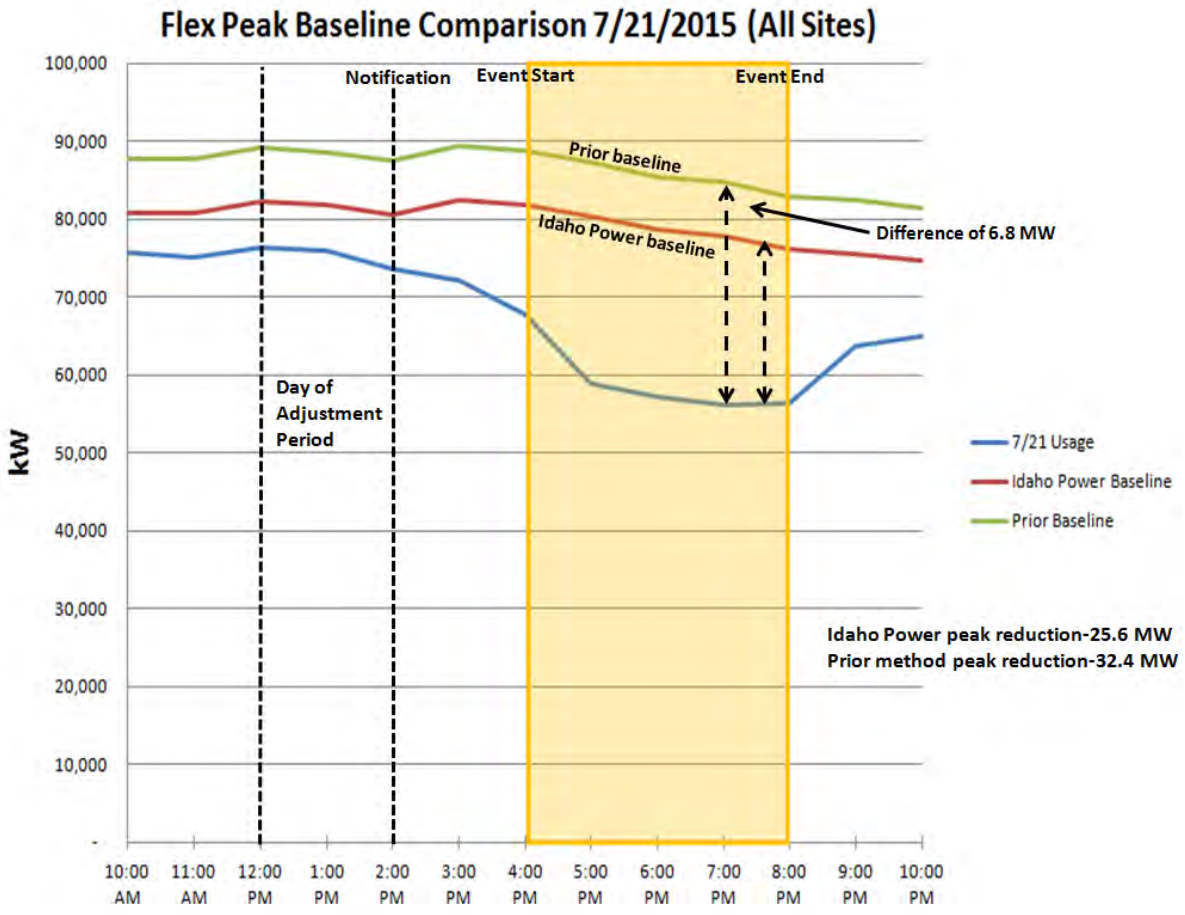
kW. The DOA is symmetrical, having either an upward or downward adjustment to the baseline, and is applied to the original baseline kW for each facility site for each hour during the Program event.

In determining the reduction amount for each event, there was variation from the previous baseline methodology compared to the current baseline methodology used in 2015 due to the DOA.

While both methods are commonly accepted throughout the industry, Idaho Power believes having a symmetrical DOA with caps is a more equitable way to calculate load reduction for both participants and the Company. The baseline and DOA methodologies will be compared in greater detail in the one-time Flex Peak Program report to be filed in 2016 per Order No. 33292.

Figure 4 represents the measured reduction from Idaho Power's baseline and DOA methodology versus the prior program baseline methodology for the second event on July 21, 2015.

Figure 4.



CLEAResult also analyzed the realization rate for each event with all sites aggregated together, as well as on an individual site basis.

Table 2 shows the Program realization rates for 2015 based on peak load reduction per event.

Table 2.

Event Date	Idaho Power Baseline & DOA	Previous Baseline & DOA
June 30, 2015	86.7%	91.3%
July 21, 2015	96.6%	121.1%
August 4, 2015	55.45%	80.2%
Season Average	**79.6%**	**97.5%**

Table 3 shows the realization rate per site for each participant in the Program.

Table 3.

Participant Number	June 30 Event Realization	July 21 Event realization	August 4 Event Realization	Season Realization
1	2%	2%	9%	4%
2	39%	59%	66%	55%
3	100%	129%	62%	97%
4	17%	128%	127%	91%
5	84%	206%	90%	127%
6	51%	69%	34%	51%
7	190%	14%	13%	100%
8	90%	74%	121%	95%
9	156%	70%	76%	101%
10	395%	71%	198%	221%
11	59%	38%	95%	64%
12	0%	11%	7%	6%
13	170%	168%	116%	151%
14	2%	60%	96%	53%
15	1%	92%	38%	44%
16	60%	46%	15%	40%
17	124%	106%	0%	77%
18	159%	163%	157%	160%
19	103%	71%	110%	95%
20	81%	106%	77%	88%
21	1%	61%	54%	39%
22	46%	113%	103%	87%
23	0%	19%	24%	14%
24	35%	0%	109%	48%
25	28%	0%	184%	71%
26	169%	79%	160%	136%
27	392%	277%	19%	229%
28	103%	89%	0%	64%

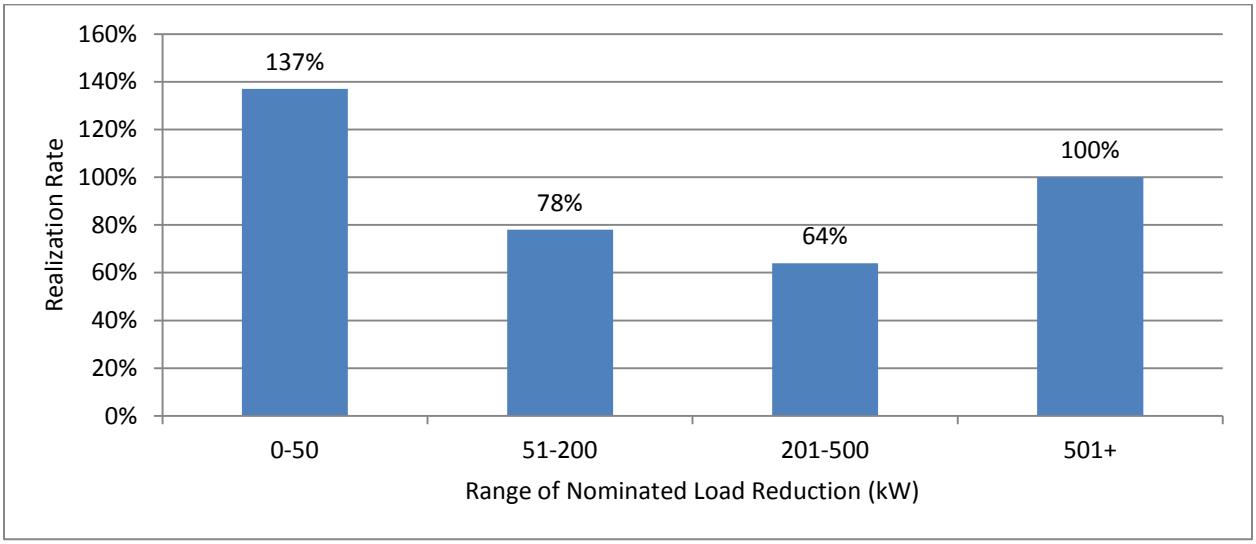
29	635%	80%	155%	290%
30	0%	0%	92%	31%
31	14%	62%	71%	49%
32	93%	76%	108%	92%
33	65%	42%	12%	40%
34	78%	80%	159%	106%
35	95%	76%	83%	85%
36	90%	77%	79%	82%
37	82%	102%	117%	100%
38	55%	74%	71%	67%

When broken out across four size classes, the sites with the smallest nominated load reduction, 0 – 50 kW, achieved the highest average realization rate across the three events: 137%. The highest realization rate among all nomination groups was the smallest at 0-50 kW, which supports that the Program change in allowing smaller participants to enroll helped increase both the Program participation and overall realization rate.

The second largest size class, 201 – 500 kW, achieved the lowest average realization rate: 64%. The 201-500 kW group had the largest portion of sites enrolled for the Program and was very diverse in size and facility type. The lower realization rates for this group were due to production requirements and key personnel being unavailable to implement the full curtailment of the sites. Idaho Power will work with this customer segment to help refine nominations to more closely align with realistic reduction opportunities which will increase the realization rate specific to this group.

Figure 5 below represents the realization rate achieved by each nomination group, averaged across all three events.

Figure 5.



The realization rate analysis results show that maximum load reduction was realized in the middle of the Program season. This time period is the last week of June through the middle of July, which correlates with Idaho Power's overall summer system peak.

Program Costs

Program costs totaled $563,292 through October 1, 2015. Incentive payments were the largest expenditure comprising 87% of total costs. The incentive payments were fixed capacity payments resulting from the three events called during the 2015 Program season. Variable energy payments were not made during the season because the variable energy payment is implemented starting with the fourth event. Total Program costs during 2014 were $1,563,211 or $44.66 per kW based on 35 MW. Total Program costs for 2015 were $22.53 per kW based on 25 MW. By managing the Flex Peak Program internally the Company saved its customers nearly $1 million compared to 2014 program costs.

Table 4 displays the 2015 Program costs through October 1, 2015, by category.

Table 4.

Item	2015 Program Costs
Materials & Equipment	$984
Contract Services	$8,138
Incentive payments	$487,857
Marketing & Administration	$66,313
Total	**$563,292**

Benefit-Cost Analysis

The benefit-cost analysis for the Flex Peak Program is based on a 20-year model that uses financial and demand-side management alternative cost assumptions from the *2015 Integrated Resource Plan* ("IRP"). As part of the public workshops in conjunction with Case No. IPC-E-13-14, Idaho Power and other stakeholders agreed in a settlement agreement ("Settlement") on a new method for valuing DR. The Settlement, as approved in Commission Order No. 32923, determined that the annual cost of operating the three DR programs for the maximum allowable 60 hours must be no more than $16.7 million. This amount was reevaluated in the 2015 IRP, as agreed upon in the Settlement, to be $18.5 million.

The preliminary cost estimate through October 1, 2015, of operating the three DR programs in 2015 was $8.9 million. It is estimated that if the three programs were dispatched for the full 60 hours, the total costs would have been approximately $11.4 million which is still below the total annual costs agreed upon in the 2013 Settlement as revised in the 2015 IRP.

Idaho Power's cost-effectiveness for DR programs is updated annually. A more comprehensive benefit-cost analysis will be included in the Company's annual 2016 Demand-Side Management Report when all the data will be available.

Customer Satisfaction Results

Idaho Power conducted a post-season survey that was sent via email to all participants enrolled in the Program. The survey focused on quantifiable questions that encouraged customer feedback that could be used to improve the Program in future years. Questions were based on a five point rating scale. Idaho Power received a response rate of 51%. The results of the survey were favorable and participants were satisfied, as shown below:

- When asked, overall the application process was easy to understand, 5 being "strongly agree," the average response was 4.5

- When asked, how clear were the notification messages for the Flex Peak Program events, 5 being “very clear,” the average response was 4.9
- When asked, how prepared you were for each of the events called this year, 5 being “very prepared,” the average response was 4.2
- When asked, how helpful was the post-event performance data in helping you refine future nominations for the Program, 5 being “very useful,” the average response was 4.9
- When asked, how helpful was Idaho Power with any questions you had regarding the Flex Peak Program, 5 being “very helpful,” the average response was 4.6
- When asked, how satisfied are you with the timeliness of receiving your incentive payment, 5 being “very satisfied,” the average response was 4.7
- When asked, how satisfied are you with your incentive amount, 5 being “very satisfied,” the average response was 4.2
- When asked, how satisfied are you with your overall experience with the Flex Peak Program, 5 being “very satisfied,” the average response was 4.5
- When asked, how likely you would be to re-enroll in the Flex Peak Program in the future, 5 being “very likely,” the average response was 4.9

Program Activities for 2016

Recruitment efforts for the 2016 season will begin in the fourth quarter of 2015 and first quarter of 2016 to encourage participation for the 2016 Program season. Idaho Power will meet with existing participants during the off-season from either their Idaho Power Customer Representative or the Program Specialist to discuss past season performance and upcoming season details. New customers will be identified mid-winter with field visits and will have a follow up communication in early spring. Several new large customers verbally committed to enrolling for the 2016 season at the end of the 2015 season as the groundwork had been laid during the active season to recruit them for the future. The Company has also published an article promoting the Flex Peak Program in the “Energy at Work” fall edition of Idaho Power’s quarterly newsletter that was sent to all commercial and industrial customers. The article was well received and customers have reached out to the Idaho Power Program Specialist to inquire if the Program is right for them.

Idaho Power plans to launch a marketing campaign early in 2016 with Customer Representatives to recruit new participants. The Company is also developing new Program literature and a new Program brochure. This marketing campaign will focus on identifying customer dynamics that make successful Program participants and will also highlight available incentive amounts based on customers’ load size. The Program will be jointly marketed along with Idaho Power’s other energy efficiency programs. In addition, the marketing campaign goals are to increase the number and size (in terms of nominated load reduction) diversity of sites enrolled. By having a larger diversity of customer sizes enrolled, the Program would be less prone to volatility in its realization rate. The Company will utilize Customer Representative support for the sites with the

largest nominated load reduction with the goal of ensuring all large sites are able to participate when load reduction events are called.

For the upcoming season, Idaho Power plans to complete an educational campaign with both enrolled participants and new customers to inform them of DR strategies with goals of increasing, refining or lowering the amount of nominated load reduction from each site to more realistically align with load reduction potential.

Conclusions

A Company-managed program offers customers several benefits. First, there are significant annual cost savings. The total cost savings this season compared to the prior year was nearly $1 million. These cost savings flow back to customers through the Company's Power Cost Adjustment mechanism. Second, all participants were paid within 30 days of the season ending compared to previous years where the second installment was paid nearly five months after the end of the season. Lastly, because the Program is managed by the Company, Idaho Power could cross-market energy efficiency programs and strengthen the relationship with its participants directly. In addition, the Company concluded the following:

- The Program had a total of 72 sites reducing peak demand by 25.6 MW
- The total Program costs for 2015 through October 1 were $563,292
- There were 15 new sites recruited to enroll in the 2015 season
- The Program shows high customer satisfaction results among participants
- The cost of having this resource available was $22.53 per kW in 2015 based on 25 MW, $26.32 per kW based on average reduction for the season, and $20.01 per kW based on max nomination for the season
- Despite changing to a Company-managed program, a short timeline to implement the Program, and modifications to the load reduction calculation methodology, the Flex Peak Program retained 71% of past participants (34 of 48 participants) from the 2014 season
- When analyzing the Program at the generation level, industrial and commercial customers have made noteworthy contributions to Idaho Power's DR programs. The Flex Peak Program currently contributes approximately 8-10% of the Company's overall DR portfolio and can be relied upon to provide dispatchable load reduction for the electrical grid
- Curtailment event results showed maximum load reductions of 24.1, 25.6, and 14.6 MW, respectively, for the three events, and an average of 21.4 MW. The events achieved realization rates of 86.7%, 96.6%, and 55.4%, respectively, averaging 79.6%

2015 Irrigation Peak Rewards Program Report

March 15, 2015

Idaho Power 2015

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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. In the most recent 2015 IRP, Demand Response (DR) programs were considered as committed resources as part of the load and resource balance. This new way of considering DR, contributed to a new load and resource balance indicating no capacity shortfalls until 2026. There were no changes to the Program for the 2015 program season. This report provides a review of the program's activities and expenditures for 2015 and is a supplement to the 2015 DSM Annual Report.

Summary of Program Results

The following items summarize the key components of the 2015 Irrigation Peak Rewards program.

- In 2015, the program had an estimated generation level load reduction of 305.3 MW resulting from a load control event, but had a maximum estimated load reduction potential of 323 MW.
- Four hundred forty six (446), or nearly 72% of the 623 eligible customers, chose to participate in 2015.
- Two thousand two hundred fifty nine (2,259), or 81% of the 2,775eligible service points, were enrolled in 2015.

- The program achieved a total billing demand enrollment of 403,176 kilowatts (kW).
- The total program costs for 2015 were $7,258,831.

Program Details

Interruption Options

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 previously participated in the Manual Dispatch Option, were eligible to participate. The interruption options allowed Idaho Power to initiate load control events that prevented pumps from operating at participating metered service locations. Participants could choose between three Interruption Options:

Automatic Dispatch Options

- Option 1 – A dispatchable one-way communication Load Control Device installed that allowed only Idaho Power to control all the customer's pumps at a single metered service point.
- Option 2 – A dispatchable two-way communication Load Control Device installed that allowed both Idaho Power and the customer to control all the pumps at a single service point.

All metered service points were assigned to participate in Option 1 unless specifically requested by the customer to be assigned Option 2 in order to retain control and monitoring capabilities.

Manual Dispatch Option

- Option 3 (Manual) - 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 Program included the following:

- Idaho Power would initiate control (dispatch) events on a customized EnerNOC Web site and an Idaho Power owned AMI integrated software platform.
- 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 Dispatch 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 Relations and Billing (CR&B) calculates the bill credits and applies it to the bill. Manual Dispatch Option customers' incentives were calculated using billing kW from 2015 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 2015 are listed in Table 1.

Table 1. 2015 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 metered 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). Opt-out penalty fees would never exceed the incentive amount. Manual Dispatch Option metered service locations were charged opt-out penalty fees based on the nominated kW that was not turned off during a load control event.

In 2015, one hundred thirty eight (138) service points opted out 195 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 has continually made a concerted effort to encourage past participants to re-enroll in the program each year by sponsoring workshops, attending trade shows, and doing direct customer mailings. In 2015, Idaho Power presented the details of the program at six (6) workshops across five regional areas. 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 2015, program enrollment mailings were sent to all customers that currently had a load-control device installed or past participants in the Manual Dispatch Option. 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 in 2014 with a reduction in incentive amounts, three minimum load control events, and modifications to the event notification, the program increased enrollment in 2015. The number of service points enrolled to participate in the program for 2015 was 2,259. 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.

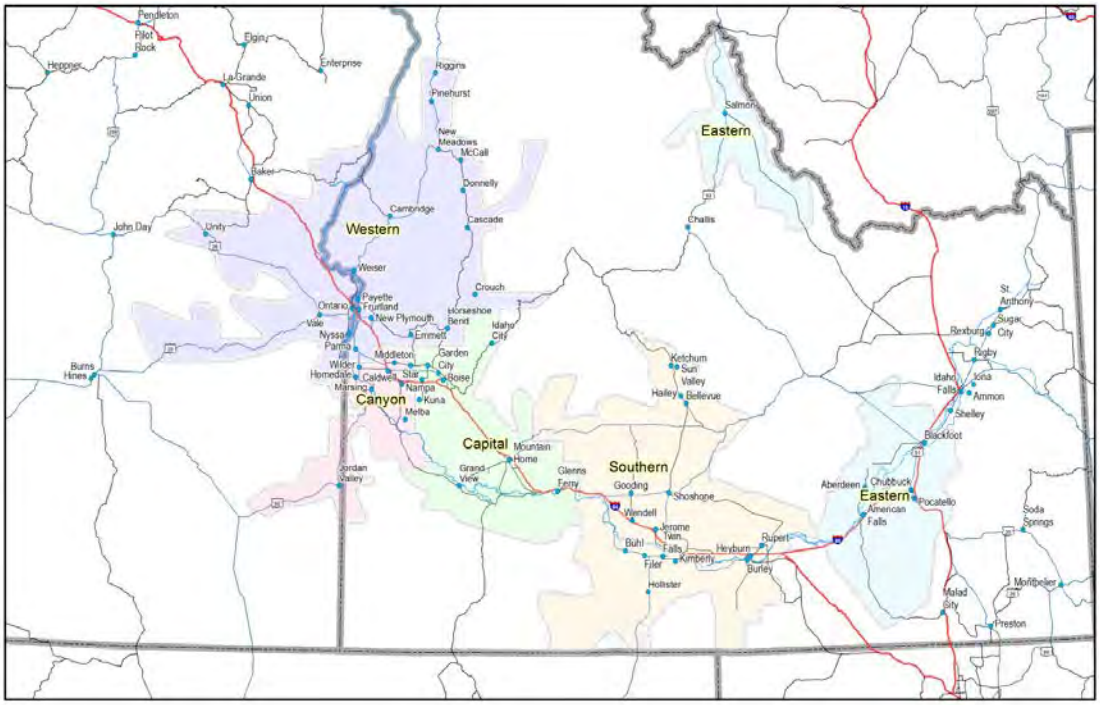


Figure 2 represents the 2,259 irrigation service points that participated in 2015 and their distribution by Idaho Power's regional service areas.

Figure 2. Distribution of participants 2015.

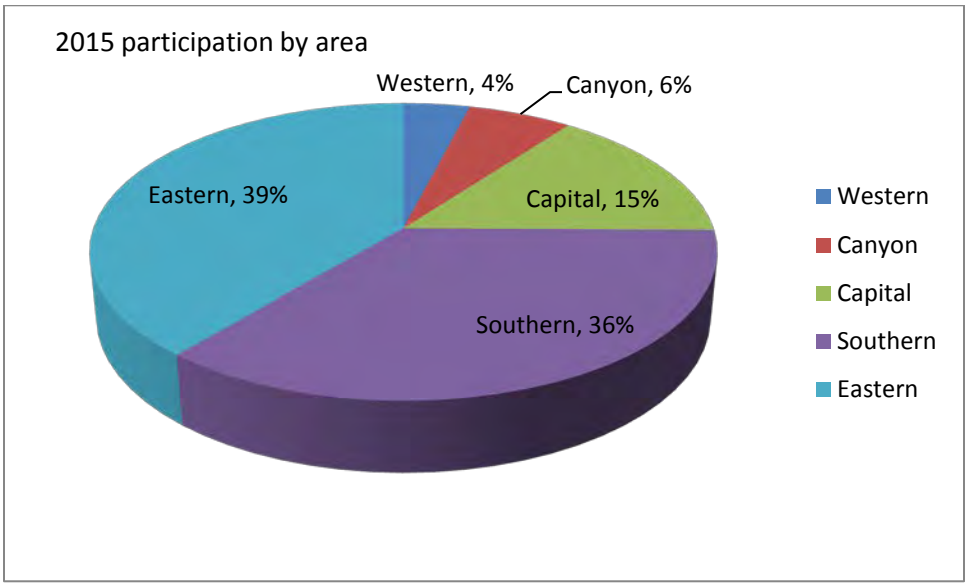


Table 2 lists the total number of eligible service points and the participation levels for each area in 2015.

Table 2. 2015 Eligible service locations and participation levels by area.

2015-Idaho Power Area		Eligible Service Locations	Automatic Device	Manual	Total Enrolled by Area	Percent of eligible enrolled by area
Western	Idaho	60	39	0	39	65%
	Oregon	66	50	3	53	80%
Canyon	Idaho	151	130	8	138	91%
	Oregon	4	3	0	3	75%
Capital		386	309	24	333	86%
Southern	Twin Falls	525	391	3	394	75%
	Mini-Cassia	456	410	0	410	90%
Eastern		1127	889	0	889	79%
	Total Service Points	**2775**	**2221**	**38**	**2259**	

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. 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 2015 were determined in an impact evaluation performed by a third party contractor. In 2015, Idaho Power contracted CLEAResult Consulting Inc., (CLEAResult) to complete an impact evaluation of the 2015 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.

In 2014, the Company contracted with PECI to complete an impact evaluation of the Program. A complete analysis resulted in an expected maximum realization rate of 71.6 percent occurring during the first two weeks of July. Using AMI data, CLEAResult 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.

CLEAResult completed analyses of curtailment events held on June 29, July 2, and August 11, 2015, each containing four dispatch groups that curtailed enrolled irrigation pumps in rolling four-hour increments. The results of the curtailment event analyses showed maximum meter level demand reductions of 278.3, 273.8, and 180.2 MW, respectively, for the three events, and an average of 244.1 MW. The Company has determined that the full value of the demand reductions at the generation level include an average 9.7 percent line loss. When line losses are

included, maximum demand reductions are 305.3, 300.3, and 197.7 MW respectively for the three events. The events achieved realization rates of 69.0 percent, 67.9 percent, and 44.7 percent, respectively, averaging 60.5 percent.

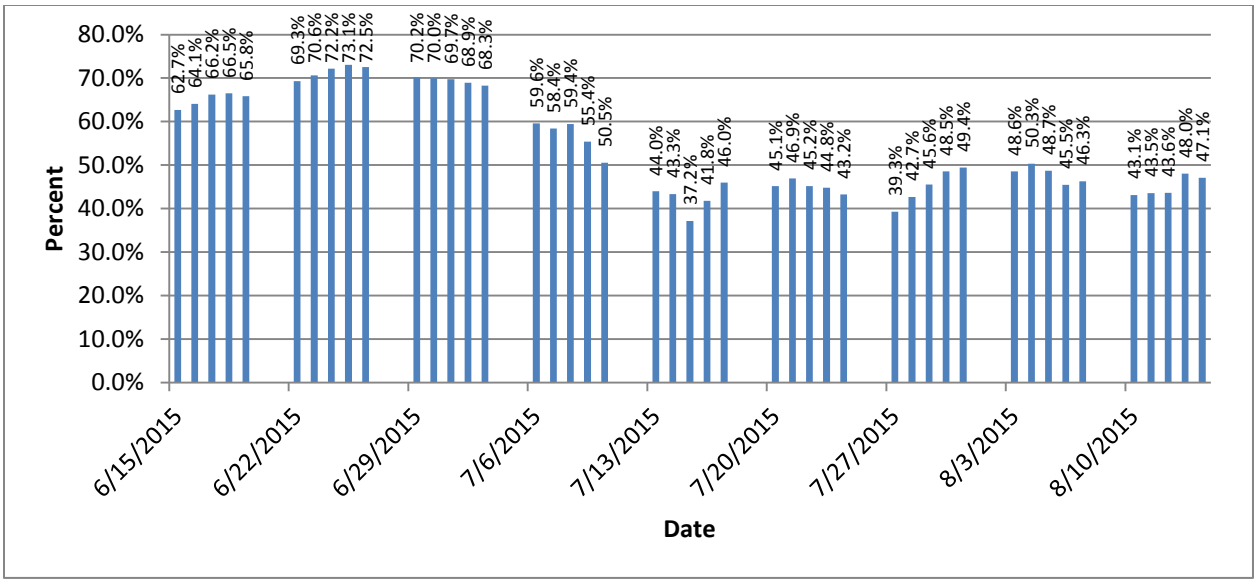
While the first quarter of the program season (June 15–July 30) showed an average expected realization rate of 68.6 percent, the expected realization rate in the last three quarters of the season (July 1–August 15) drops off significantly, to an average of 49.1 percent. This is due to a higher percentage of pumps being shut off during the baseline period in the first two weeks of August. The 2015 counterfactual realization rate peaks in the last two weeks of June, which was two weeks earlier than 2014 due to an earlier start of the growing season. The analysis determined that the highest realization rate of 73.1 percent occurred June 25. Had the program experienced a load control event on that day, it would have resulted in a 295 MW load reduction at the meter level, or a 323 MW maximum load reduction at the utility generation level.

A copy of this evaluation report can be found in *Supplement 2: Evaluation*. Tables 3 and Figure 3 show program realization rates from analysis for 2015.

Table 3: 2015 Program realization rates and the seasonal average percent categorized load expected to not be turned off during a load control event had it occurred during each respective two week period throughout the program season.

Date Range	Average Pump OFF in Baseline Rate	Average Opt-Out Rate	Average Device Failure Rate (options 1&2)	Did not reduce total nominated kW (option 3)	Counterfactual Realization Rate	Total
Jun 15 - 30	22.1%	3.2%	2.9%	3.3%	68.6%	100.0%
Jul 1 - 15	34.8%	3.2%	2.9%	3.3%	55.9%	100.0%
Jul 16 - 31	45.8%	3.2%	2.9%	3.3%	44.9%	100.0%
Aug 1 - 15	44.2%	3.2%	2.9%	3.3%	46.5%	100.0%

Figure 3: Figure three graphically presents the expected realization rate for all non-holiday and non-weekend days of the 2015 program season. The expected realization rate peaks on June 25th at 73.1%.



The results of the 2015 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 2015, this program had a total cost of $7,258,831 with the incentive credit being the largest expenditure at 85 % of total costs. The program was not marketed to new participants in 2015.

Table 4 displays the annual program costs by category.

Table 4. Annual program costs 2015.

Item	2015 Program Costs
Materials and Equipment	$139,957
Installation and Contract Services	$855,184
Incentive payments	$6,167,226
Marketing and Administration	$96,464
Total	**$7,258,831**

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 2015, the cost of operating the three demand response programs was $9 million. It is estimated that if the three programs were dispatched for the full 60 hours, the total costs would have been approximately $12.4 million and remain cost-effective.

Conclusions

- The Irrigation Peak Rewards program increased its enrollment from 2014 to include over 81% of eligible service locations in 2015.
- The program had a total of 2,259 service locations reducing peak demand by 305.3 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 $23.77 per kW in 2015

CLEAResult

A/C Cool Credit Program

2015 Impact Evaluation

September 25, 2015

PREPARED BY CLEAResult

PREPARED FOR Idaho Power Company

REPORTING PERIOD July – August 2015

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Executive Summary

Idaho Power Company contracted CLEAResult to complete an impact evaluation of the 2015 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 events and update the program's existing predictive model to account for the 2015 curtailment event results.

CLEAResult completed analyses of curtailment events held on June 30th, July 21st, and July 31st, 2015, each with a three hour duration. The results of the analyses showed maximum single hour demand reductions of 1.11, 0.65, and 0.82 kW per participant, respectively, for the three events. The average hourly demand reduction was 1.04, 0.62, and 0.74 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.

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 has been reinstated since 2014 on a limited basis, completing three curtailment events each year during the June 15th through August 15th program season as required under the provisions of the program. 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 with a maximum of 60 hours per curtailment season (with the exception of a system emergency). In exchange for having their A/C units curtailed, program participants receive a $5 credit on their July, August, and September electric bills.

CLEAResult completed impact evaluations on the A/C Cool Credit program in 2011, 2012 and 2014. 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 that 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 calculator has been updated with every impact evaluation, resulting in the sample size of events informing the calculator's regression formulas, as well as the calculator's accuracy, to increase with each passing season.

The goals of this 2015 impact evaluation were to:

- Determine and verify the demand reduction (MW) during a minimum of three events in 2015
- 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 and 2014 AC Cool Credit research projects was utilized to complete the analysis for each 2015 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. Participants were not analyzed if their interval meter data included an error code during the curtailment event period of the baseline period. With an average of 99.7% of all participants analyzed, the results calculated from the analyzed participants have been extrapolated to all participants in the results section.

Table 1: Unit Counts by Curtailment Event

Curtailment Event	Count of Total Participants	Count of Participants Analyzed	Percent of Total Participants Analyzed
June 30	29,874	29,758	99.6%
July 21	29,432	29,342	99.7%
July 31	28,288	28,244	99.8%
Average	29,198	29,115	99.7%

Demand Reduction Analysis

A. 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.

B. 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 calculator was then updated after the 2014 impact evaluation to include regression formulas that accounted for both 2012 and 2014 event results.

The calculator 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 and 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 2015 impact evaluation, the predictive model was updated to account for the results of the 2015 curtailment events. This entailed developing new regression formulas that used as inputs results from 2012, 2014, and 2015 curtailment events

Results

Curtailment Events Summary

A total of three curtailment events were completed as part of the 2015 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 102 degrees on June 30th to 98 degrees on July 21st. The maximum temperature in Pocatello during event days ranged from 94 degrees on June 30th and July 31st to 89 degrees on July 21st.

Table 2: 2015 Curtailment Event Schedule

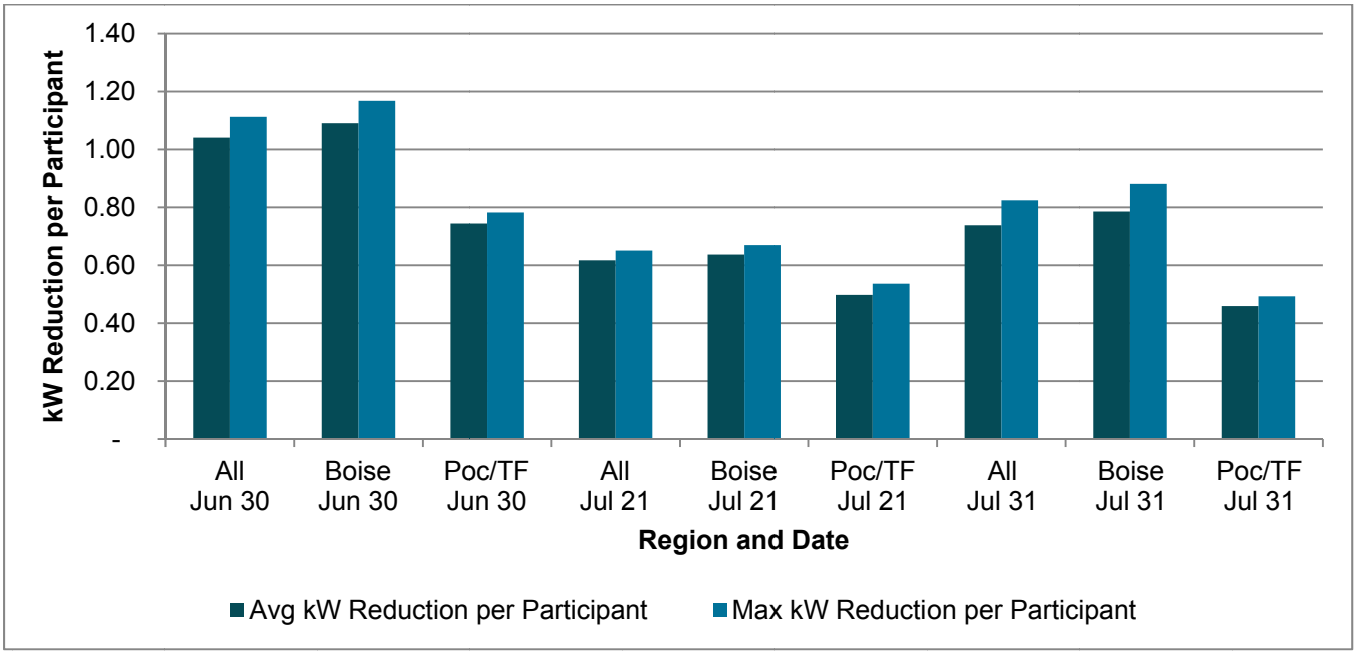
Curtailment Event	Boise Temp (high)	TF/Pocatell Temp (high)	Control Event Start Time	Control Event End Time	Length (hrs)	Cycling Percent
June 30	102	94	4:00pm	7:00pm	3	55%
July 21	94	89	4:00pm	7:00pm	3	55%
July 31	98	94	4:00pm	7:00pm	3	55%

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 in kilowatt (kW) reduction at the meter level. The meter level results do not include line losses. Because temperatures in Boise differ from the Twin Falls/Pocatello area, they are treated as separate events and results are reported individually. The June 30th event showed the highest maximum and average kW reductions for both Boise and Pocatello/Twin Falls regions.

Table 3: 2015 Summary Results of Executed Control Events

Date and High Temp	Percent Curtailment	Region	Avg. kW Reduction per Participant	Max kW Reduction per Participant	Avg. kW Reduction - Total	Max kW Reduction - Total
June 30 Boise: 102° Poc/TF: 94°	55%	All	1.04	1.11	30,985	33,113
		Boise	1.09	1.16	27,830	29,792
		Poc/TF	0.74	0.78	3,163	3,326
July 21 Boise: 94° Poc/TF: 89°	55%	All	0.62	0.65	18,115	19,093
		Boise	0.64	0.67	16,003	16,820
		Poc/TF	0.50	0.54	2,103	2,267
July 31 Boise: 98° Poc/TF: 94°	55%	All	0.74	0.82	20,845	23,287
		Boise	0.79	0.88	18,890	21,185
		Poc/TF	0.46	0.49	1,933	2,074

Figure 1: Summary of 2015 Events



June 30th Curtailment

The event called on June 30th implemented a 55 percent curtailment strategy and resulted in a system wide average demand reduction of 1.04 kW per participant across the three hours of the event, and a maximum single hour demand reduction of 1.11 kW per participant. In the Boise region, the average demand reduction for the event was 1.09 kW per participant, whereas in Pocatello/Twin Falls it was 0.74 kW per participant. The maximum demand reduction for the Boise area was 1.16 kW per participant and in Pocatello/Twin Falls it was 0.78 kW per participant. Figure 2 and 3 below present the aggregate load profiles for the Boise and Pocatello/Twin Falls participants, respectively, for the June 30th curtailment event.

Figure 2: June 30 Curtailment Event Results - Boise

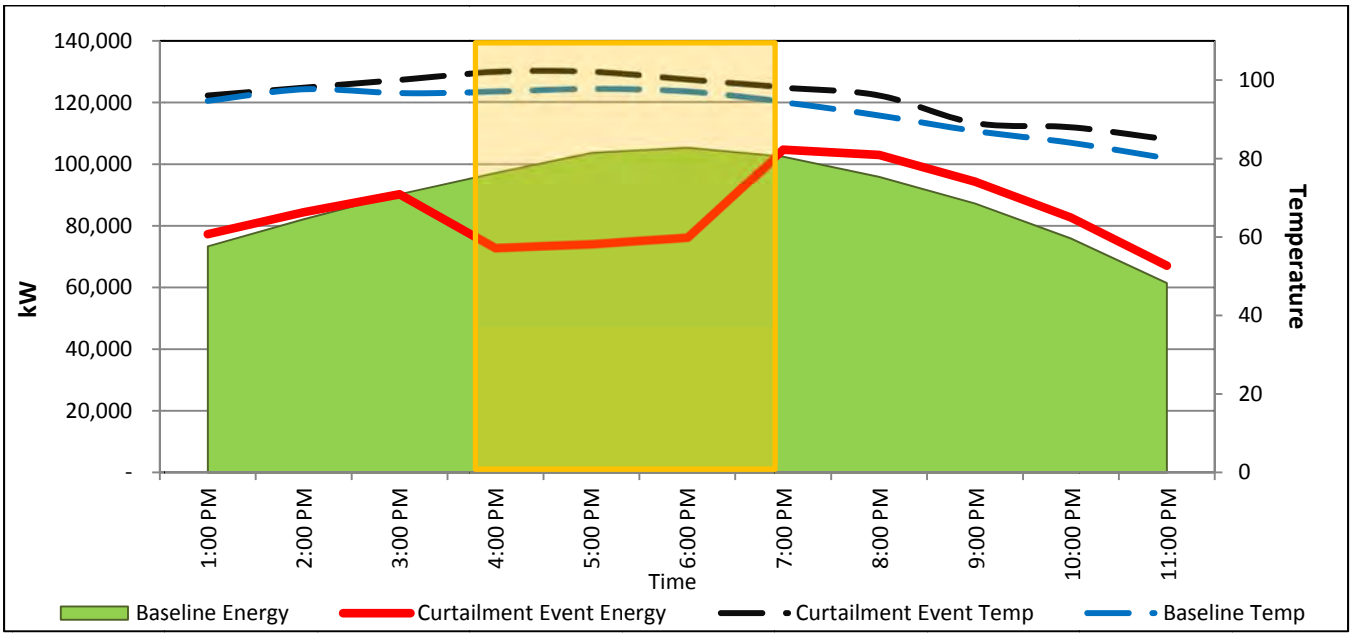
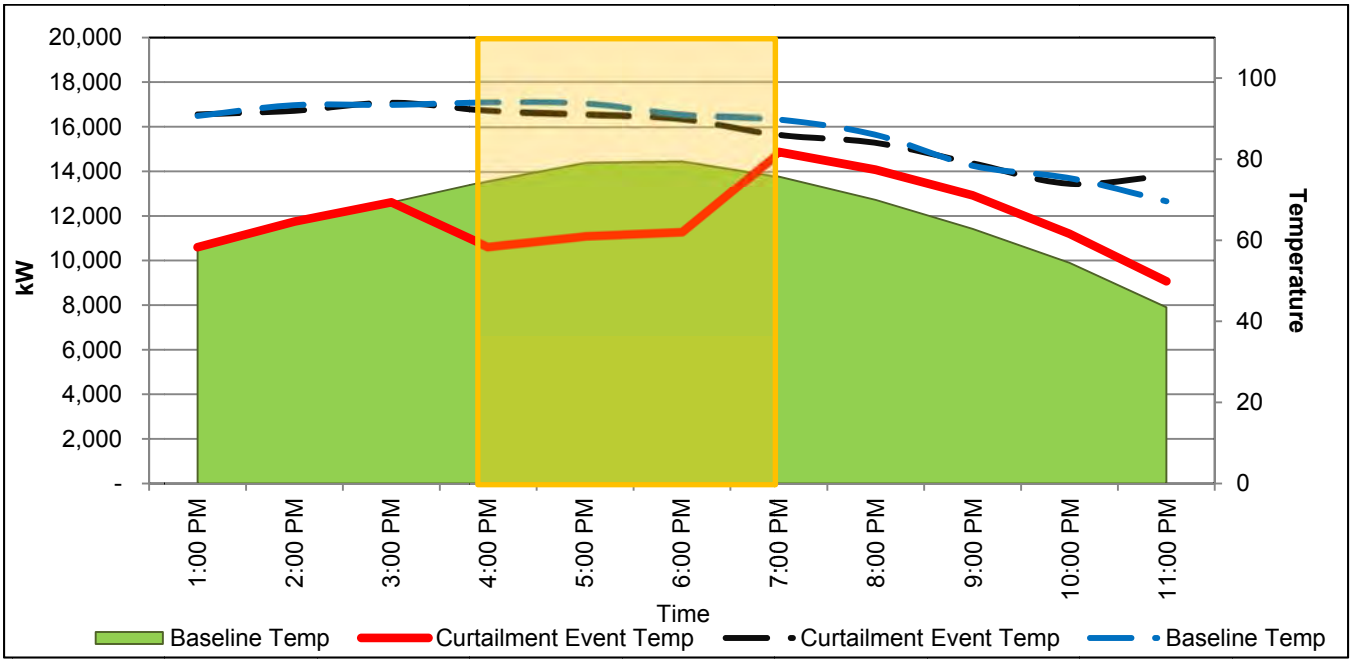


Figure 3: June 30 Curtailment Event Results - Pocatello/Twin Falls



July 21st Curtailment

The event called on July 21st implemented a 55 percent curtailment strategy and resulted in a system wide average demand reduction of 0.62 kW per participant across the three hours of the event, and a maximum single hour demand reduction of 0.65 kW per participant. In the Boise area, the average demand reduction for the event was 0.64 kW per participant, whereas in Pocatello/Twin Falls it was 0.50 kW per participant. The maximum demand reduction for the Boise area was 0.67 kW per participant and in Pocatello/Twin Falls it was 0.54 kW per participant. Figure 4 and 5 below present the aggregate load profiles for the Boise and Pocatello/Twin Falls participants, respectively, for the July 21st curtailment event.

Figure 4: July 21 Curtailment Event Results - Boise

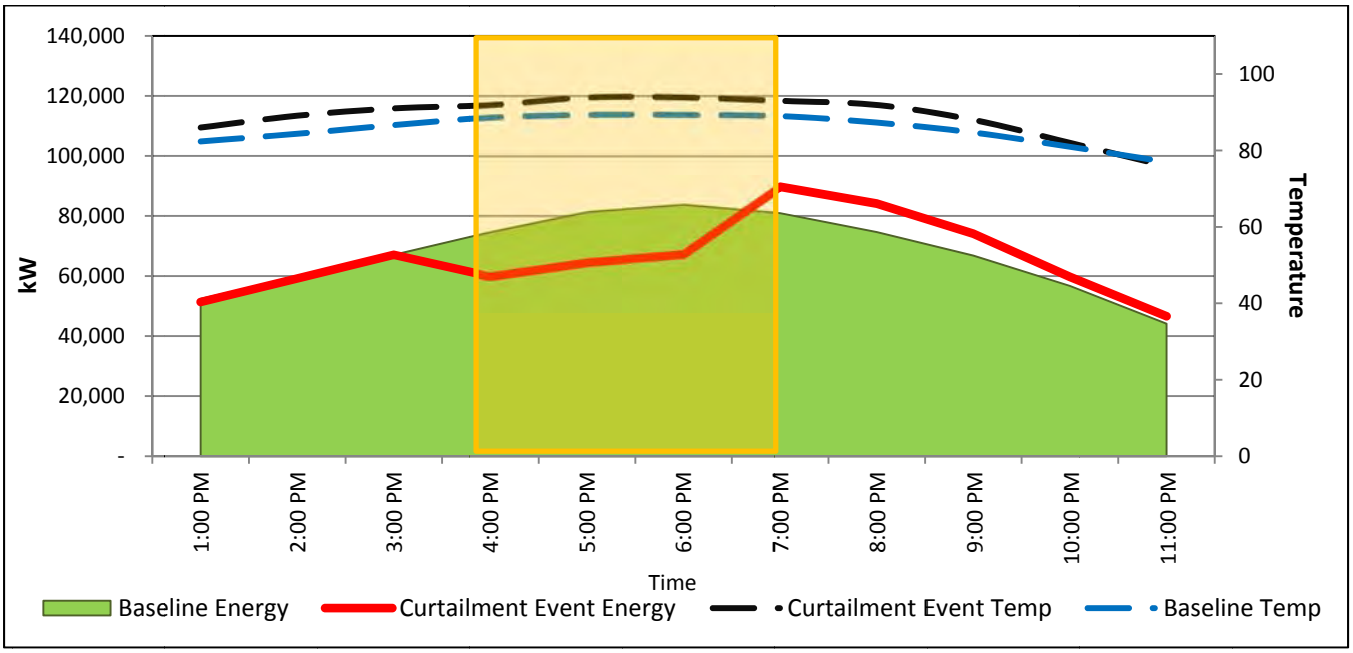
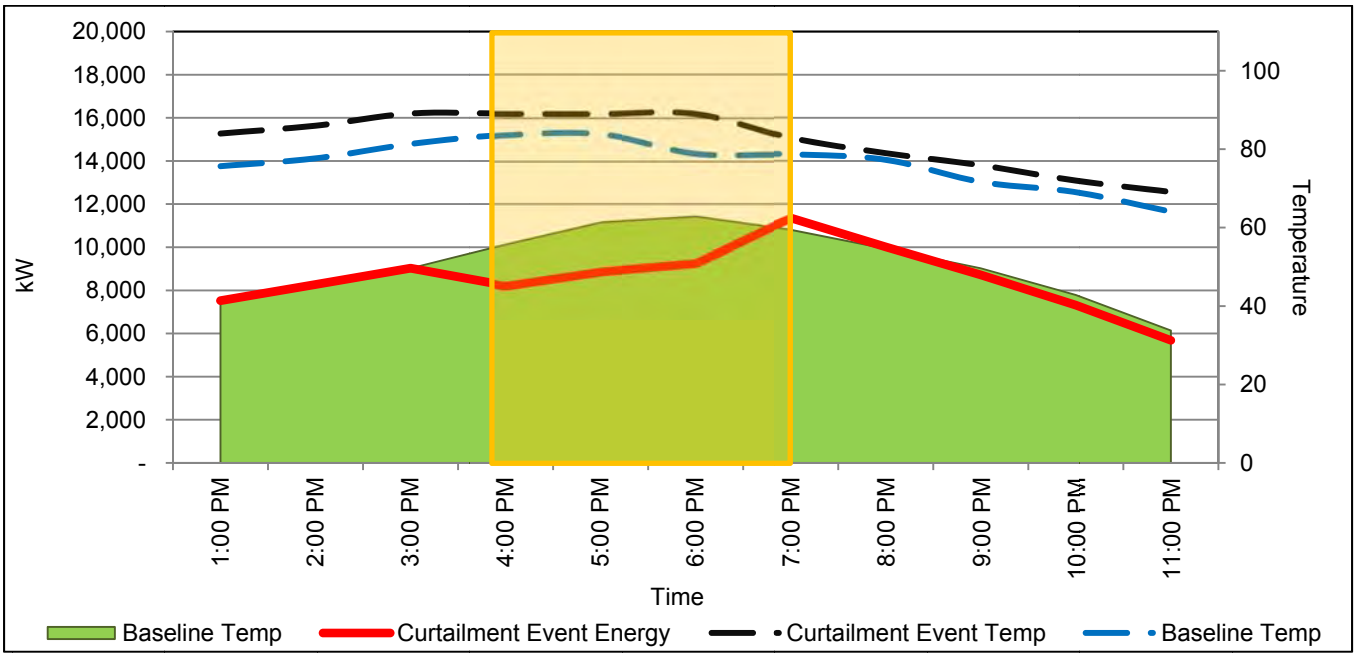


Figure 5: July 21 Curtailment Event Results - Pocatello/Idaho Falls



July 31st Curtailment

The event called on July 31st implemented a 55 percent curtailment strategy and resulted in a system wide average demand reduction of 0.74 kW per participant across the three hours of the event, and a maximum single hour demand reduction of 0.82 kW per participant. In the Boise area, the average demand reduction for the event was 0.79 kW per participant, whereas in Pocatello/Twin Falls it was 0.46 kW per participant. The maximum demand reduction for the Boise area was 0.88 kW per participant and in Pocatello/Twin Falls it was 0.49 kW per participant. Figure 6 and 7 below present the aggregate load profiles for the Boise and Pocatello/Twin Falls participants, respectively, for the July 31st curtailment event.

Figure 6: July 31 Curtailment Event Results - Boise

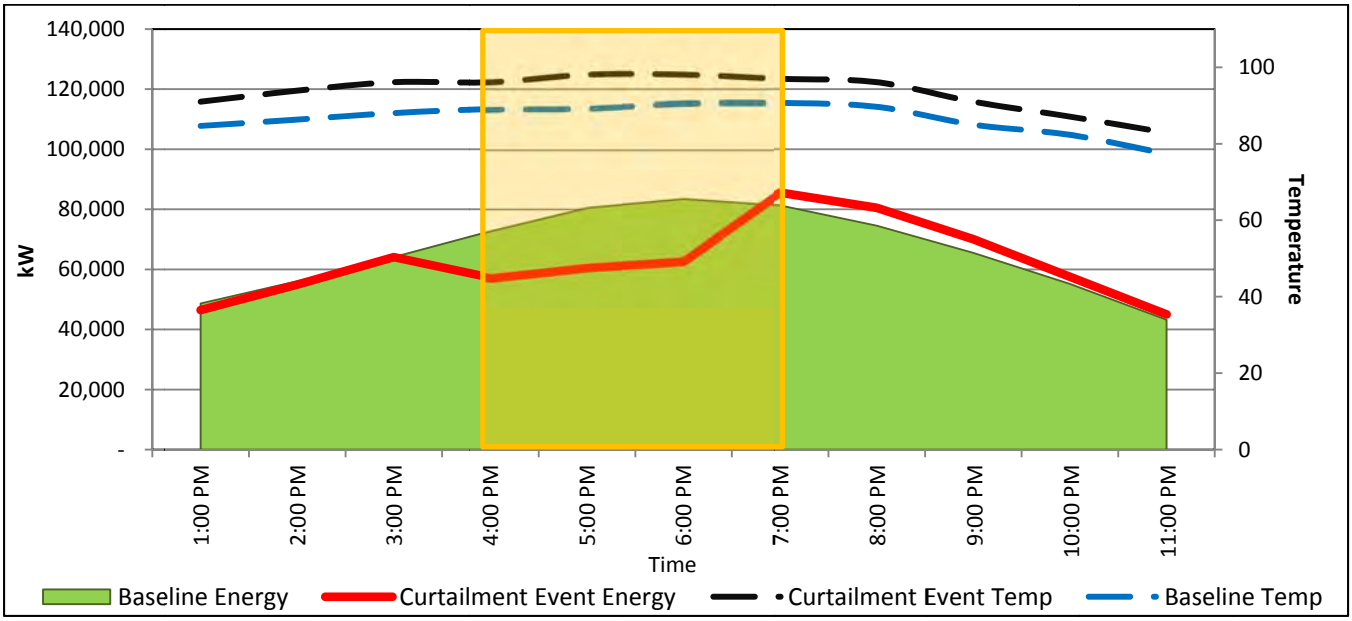
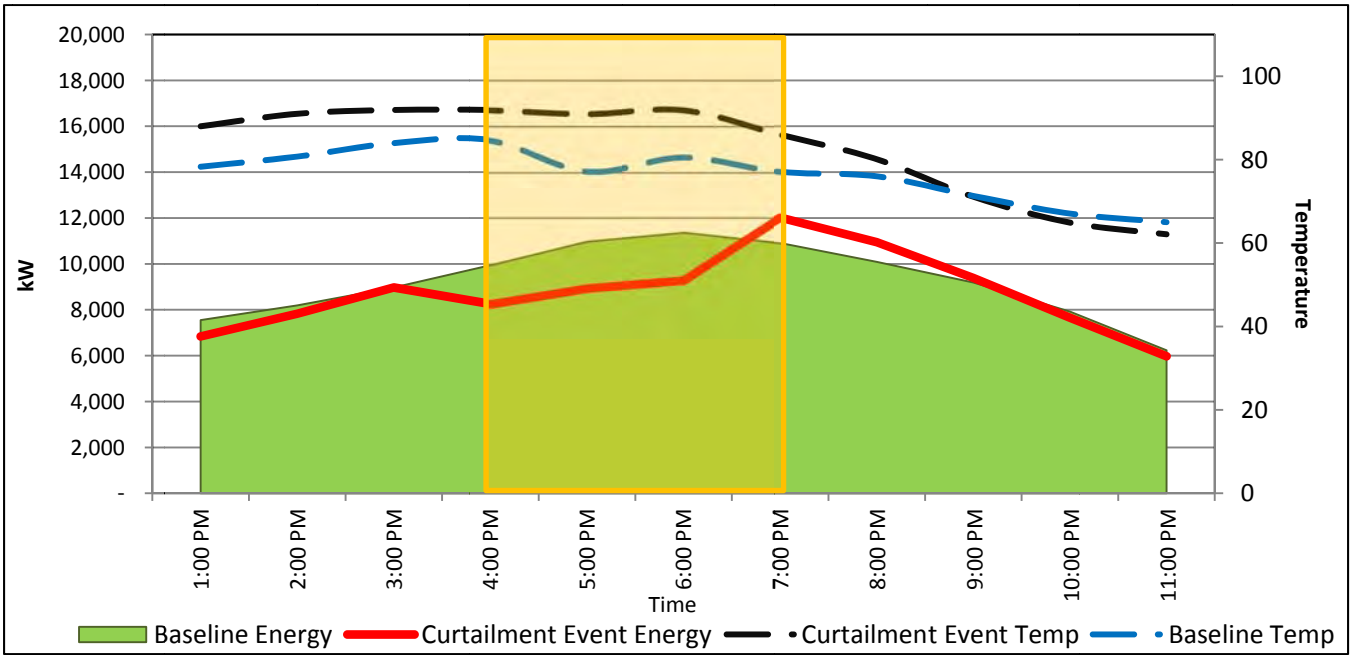


Figure 7: July 31 Curtailment Event Results - Pocatello/Idaho Falls



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 and 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 2015 to account for the results of the 2012, 2014, and 2015 curtailment events.

Table 4 and 5 below compare the actual maximum demand reduction results in the 2012, 2014, and 2015 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 both regions. For 2014 and 2015 curtailment events, the model predicted lower demand reduction than actual demand reduction for most events. Conversely, for most 2012 curtailment events, the model predicted significantly higher demand reduction than actual demand reduction for most events.

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%	1.05	1.14	-8.0%
19-Jul-12	104	65%	1.10	0.99	11.3%
31-Jul-12	97	70%	0.99	0.89	11.9%
13-Aug-12	97	50%	0.76	0.40	90.3%
16-Aug-12	93	75%	0.94	0.83	12.8%
20-Aug-12	93	65%	0.84	0.58	44.7%
22-Aug-12	90	100%	1.09	0.86	26.3%
14-Jul-14	100	65%	1.01	1.34	-24.6%
31-Jul-14	93	55%	0.73	0.98	-25.4%
11-Aug-14	101	55%	0.90	1.15	-21.6%
30-Jun-15	102	55%	0.92	1.16	-20.7%
21-Jul-15	92	55%	0.71	0.67	6.0%
31-Jul-15	96	55%	0.80	0.88	-9.1%
Average	97	63%	0.91	0.91	7.2%

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	5.5%
19-Jul-12	93	65%	0.67	0.66	1.8%
31-Jul-12	94	70%	0.73	0.90	-19.0%
13-Aug-12	93	50%	0.55	0.44	27.4%
16-Aug-12	91	75%	0.70	0.59	19.3%
20-Aug-12	85	65%	0.53	0.52	1.4%
22-Aug-12	87	100%	0.77	0.75	3.0%
31-Jul-14	89	55%	0.53	0.56	-5.3%
11-Aug-14	93	55%	0.59	0.60	-1.3%
30-Jun-15	92	55%	0.58	0.78	-26.0%
21-Jul-15	89	55%	0.53	0.54	-0.7%
31-Jul-15	93	55%	0.59	0.49	20.9%
Average	92	55%	0.63	0.63	2.2%

The discrepancy between the model's output for 2012 events and the 2014 and 2015 events is presumably due to the 2012 program's device communication challenges. When the model's regression formula is updated to include only 2014 and 2015 events, the discrepancy between model-predicted and actual results is minimized. Table 6 below includes the results from a predictive model that does not include 2012 events for the Boise region. Note that only Boise region results are shown due to Pocatello/Twin Falls region results not being statistically significant when 2012 events are removed.

Table 6. Predictive Model Outputs Compared to Actual – Boise (2012 events removed)

Curtailment Event	Temp at Start of Event	Percent Cycling	Max kW Reduction Predicted by Model	Actual Maximum kW Reduction	Percent Difference
14-Jul-14	100	65%	1.34	1.34	-0.1%
31-Jul-14	93	55%	0.81	0.98	-16.9%
11-Aug-14	101	55%	1.13	1.15	-1.8%
30-Jun-15	102	55%	1.17	1.16	0.5%
21-Jul-15	92	55%	0.77	0.67	15.6%
31-Jul-15	96.1	55%	0.93	0.88	6.2%
Average	97	63%	1.03	1.03	0.6%

Conclusions

The 2015 impact evaluation of the A/C Cool Credit program's curtailment 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 1.11, 0.65, and 0.82 kW per participant, respectively, for the curtailment events held on June 30th, July 21st, and July 31s. The average hourly demand reduction was 1.04, 0.62, and 0.74 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 2015 maximum demand reductions seen in the Pocatello/Twin Falls region were on average 33 percent less than those in the Boise region. For all curtailment events from 2012, 2014, and 2015 seasons, the maximum demand reductions seen in the Pocatello/Twin Falls region were on average 31 percent less than those in the Boise region.

To better understand the program's demand reduction potential, it's recommended to utilize a variety of cycling percentages (other than 55%) during future curtailment events. Doing so will provide a broader set of data points for the program's predictive model, increasing the statistical significance of its regression formulas (i.e. increasing its accuracy), and providing more value to Idaho Power and grid operators when demand response resources are more urgently needed.

CLEAResult

Flex Peak Demand Response Program

2015 Impact Evaluation

October 2015

PREPARED BY CLEAResult

PREPARED FOR Idaho Power Company

REPORTING PERIOD June 15th – August 15th, 2015

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Executive Summary

Idaho Power Company contracted CLEAResult to complete an impact evaluation of the 2015 Flex Peak program, a voluntary demand response (DR) program that has been available to Idaho Power's commercial and industrial customers. In 2015, there were 38 customers and a total of 71 sites enrolled in the program. The goals of the impact evaluation were to determine the demand reduction (in MW) and realization rate for at least three curtailment events during the program's June 15th - August 15th season.

CLEAResult completed analyses of curtailment events held on June 30th (4-8pm), July 21st (4-8pm), and August 4th (4-7pm), 2015. The results of the curtailment event analyses showed maximum demand reductions of 21.9, 23.3, and 13.3 MW, respectively, for the three events, and an average of 19.5 MW at the meter level. The events achieved realization rates of 86.7%, 96.6%, and 55.4%, respectively, averaging 79.6%. All three events included 71 unique sites, with the aggregate nominated load reduction averaging 24.5 MW across the three events.

The 71 sites enrolled in the program contributed a median nominated reduction of 175 kW. When broken out across four size classes, the sites with the smallest nominated load reduction, 0-50 kW, achieved the highest average realization rate across the three events at 137%. The second largest size class, 201-500 kW, achieved the lowest average realization rate at 64%.

The results of the impact evaluation show that Idaho Power's 2015 Flex Peak program functioned as intended and provided up to 23 MW to the electricity grid at the meter level. In addition, the Flex Peak program is scalable and with additional participants and more diversity among participants, could contribute more reduction as future capacity requirements dictate.

Introduction

Background

The Flex Peak Program is a voluntary demand response (DR) program available to Idaho Power's commercial and industrial customers. The program's objective is to reduce the demand on Idaho Power's system during periods of extreme peak electricity use. The program is designed to reduce peak load by paying a financial incentive to customers to turn off or reduce electrical system load at their facilities during called events. The program has a fixed payment amount of $3.25/kW per week of nominated load reduction (or actual load reduction if an event was called) during the program season, and a variable payment amount of $0.16/kWh for energy savings achieved during curtailment events after the third event.

The Flex Peak program provides customers with a notification two hours prior to the start of curtailment events via phone and email. Events can be called from June 15th - August 15th anytime from 2 - 8pm and can last from 2 - 4 hours.

Impact Evaluation Goals

Idaho Power contracted CLEAResult to complete an impact evaluation of the 2015 Flex Peak Program. This 2015 impact evaluation has two primary goals:

1. Determine and verify the demand reduction (MW) during 2015 curtailment events
2. Determine realization rate for each event

The results contained in this report 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 in the future.

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 baseline, calculating the demand reduction, and determining the curtailment event realization rates. Note that the methodology detailed below is aligned with the program's baseline and demand reduction calculation methodology. Two additional baseline methodologies were tested, with results reported in the accompanying memo "Flex Peak Demand Response Program 2015 Impact Evaluation: Alternative Methodologies."

Data Sources

CLEAResult conducted the 2015 Flex Peak impact evaluation through the use of two primary data sources: interval data (hourly kW readings) and an event-specific participant list. The participant list included site ID, nomination kW, and the customer's aggregated option. Some interval meter data included error codes for cases where the source data was missing or estimated. See Table 1 for a list of error codes included in the data. Note that no site IDs needed to be removed from the analyses due to the presence of errors codes because error codes were not present during the curtailment event or baseline periods.

Table 1. Error Code Key

Error Code	Description
1	Power Outage
9	Missing Reading
Q	Estimated Reading

Sampling Plan

The use of hourly interval metering 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

CLEAResult 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. The interval metering data was reviewed to identify the presence of error codes during the curtailment event period or in the baseline period, however no occurrences were found.

Determine the Baseline

CLEAResult determined site-specific baselines by first identifying the three days with the greatest demand from the previous ten non-weekend/holiday and non-curtailment days (hereto called comparison days). The greatest demand was determined as the day with the highest average demand during the hours of 2pm - 8pm. CLEAResult then determined each site's unadjusted baseline demand during the event timeframe by averaging the demand for each hour across all three comparison days.

CLEAResult then calculated a day-of-adjustment (DOA) for each site. The DOA was calculated using the average of hours 12pm and 1pm (hours 3 and 4 prior to the beginning of the curtailment period) for both the comparison days and the event day. The DOA was calculated as a flat kW, and was capped at +/- 20% of the value for the

same time period during the original baseline window. The DOA was applied to all baseline hours. This was done to avoid the baseline being affected by participant action to prepare for the curtailment event (e.g. pre-cool the building). This DOA approach was applied to each service location and summed to arrive at the program's aggregate baseline.

Calculate Demand Reduction

CLEAResult calculated the demand reduction for each participant by subtracting its load during each hour of the curtailment event from the participant's adjusted baseline load (determined in the previous steps). The hourly demand reductions were then aggregated for all participants. The total event impact (both average and maximum reduction) was calculated by aggregating each participant's results.

Determine Curtailment Event Realization Rate

CLEAResult determined the realization rates for each curtailment event by dividing the aggregate maximum demand reductions calculated in the previous step by the total nominated load for the all participants included in the analysis.

Findings

The section below presents the findings of the 2015 Flex Peak program impact evaluation, beginning with a characterization of the sites enrolled in the program and ending with a presentation of the results of each curtailment event. Note that numbers presented in tables are expressed in MW at meter level, unless otherwise indicated. Idaho Power line losses are 9.7% for demand to convert from meter level to generation level load reduction.

Participant Characterization

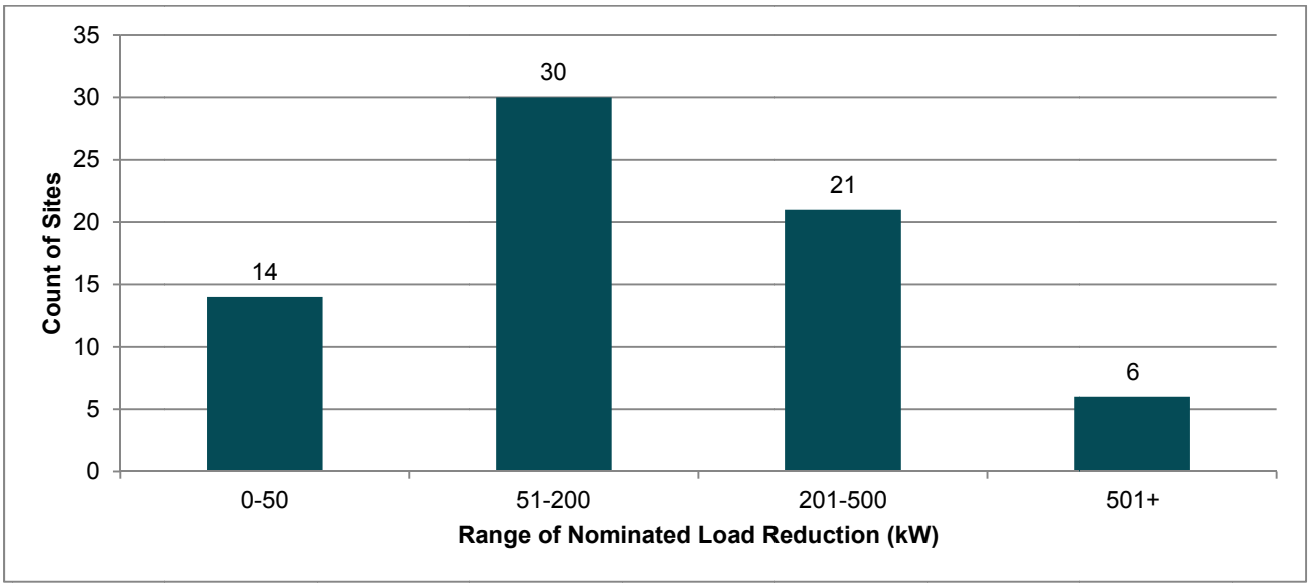
The 2015 Flex Peak program included 71 enrolled sites, accounting for an average of 24.5 nominated MW across the three events. The 71 sites were accounted for by 38 unique customers.

Table 2: Number of Sites by Processing Step

Curtailment Event	Nominated MW	Count of Total Sites	Count of Sites Analyzed	Percent of Total Sites Analyzed
June 30th	25.3	71	71	100%
July 21st	24.1	71	71	100%
August 4th	24.0	71	71	100%
Average	24.5	71	71	100%

When site's nominated kW was averaged across the three events, the average nominated load reduction was 344.4 kW, while the median reduction was 175 kW. As Figure 1 below depicts, the most common nominated load reduction was in the 51-200 kW range, accounting for 42% of the sites.

Figure 1. Count of Sites by Nominated Reduction Group



Curtailment Event Results

Table 3 and Figure 3 below summarize 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 13.3 MW for the August 4th event to a high of 23.3 MW for the July 21st event. The August 4th event's 13.3 MW reduction resulted in a realization rate of 55.4%, while the July 31st event's 23.3 MW reduction equated to a 96.6% realization rate. When considered together, the three events had an average realization rate of 79.6%.

Table 3: Summary of Demand Reduction and Resulting Realization Rate (MW)

Curtailment Event	Event Timeframe	Nominated Demand Reduction	Avg. Demand Reduction (MW)	Max Demand Reduction (MW)	Realization Rate*
June 30th	4-8pm	25.3	21.5	21.9	86.7%
July 21st	4-8pm	24.1	22.6	23.3	96.6%
August 4th	4-7pm	24.0	12.6	13.3	55.4%
Average		24.5	18.9	19.5	79.6%

** Based on maximum reduction*

Figure 2: Summary of Demand Reduction (MW)

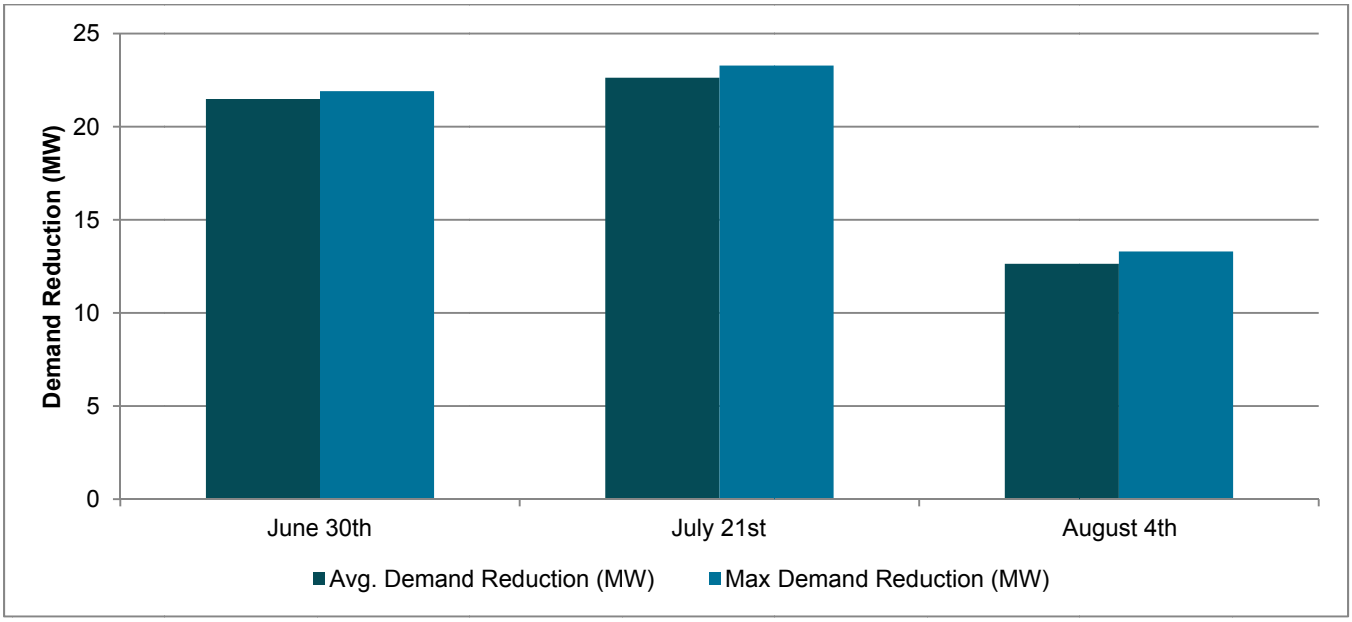
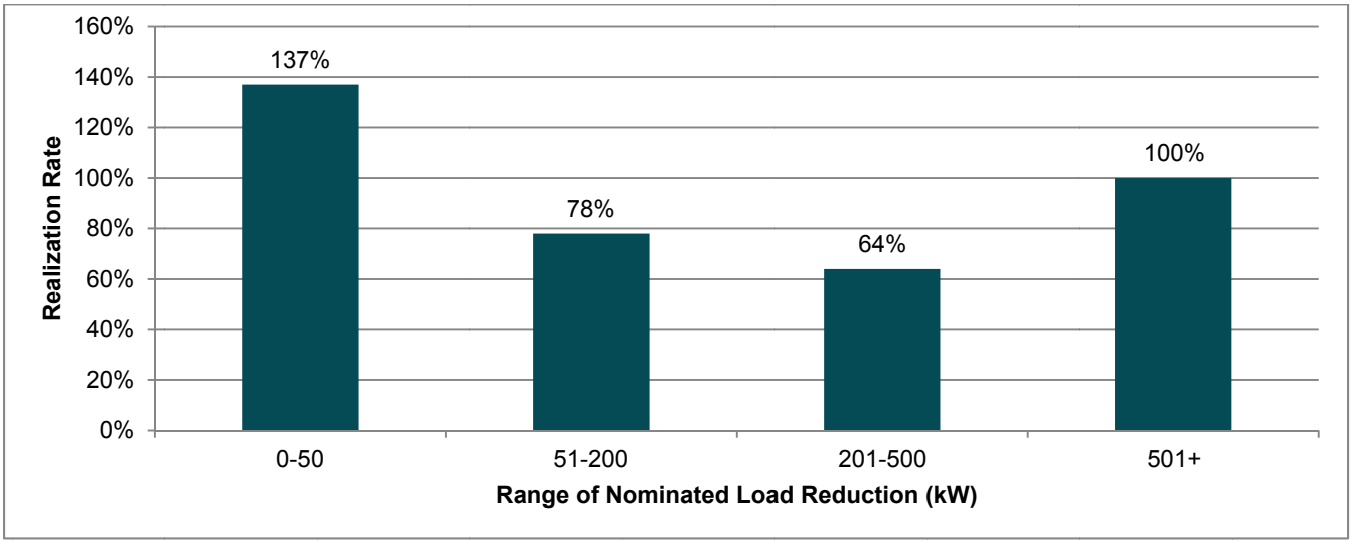


Figure 4 below presents the realization rate achieved by each site group. To calculate the results, each Site IDs average load reduction (across three events) was divided by their average nomination across the three events. Sites in the smallest group (0-50 kW of nominated load reduction) achieved the highest average realization rate (137%), while the second largest group (201-500 kW of nominated reduction) achieved the lowest average realization rate (64%).

Figure 3. Average Realization Rate by Nominated Reduction Group



June 30th Curtailment Event

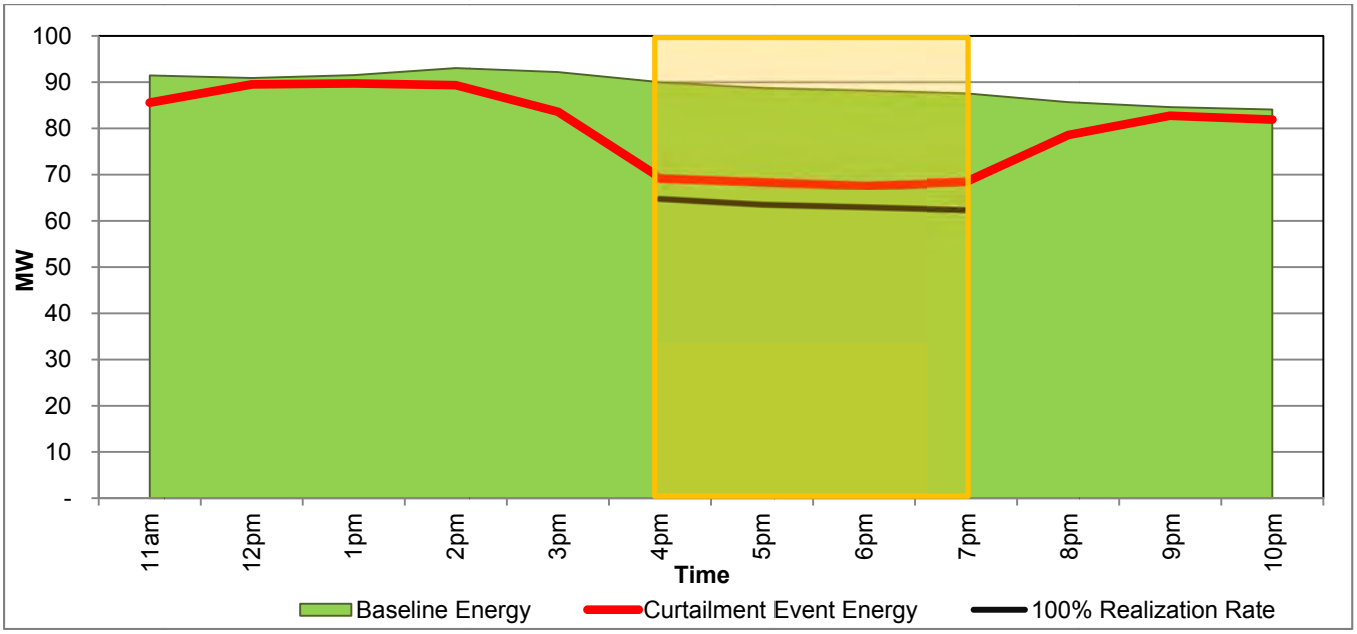
Table 5 below breaks out demand reduction for each hour of the curtailment event. The hour between 6pm and 7pm experienced the largest total reduction (21.9 MW, 86.7% of the total nominated load).

Table 4: June 30th Curtailment Event Results by Hour (MW)

Method	4-5pm	5-6pm	6-7pm	7-8pm	Avg. Reduction	Max. Reduction
June 30th	21.9	21.6	21.9	20.5	21.5	21.9

Figure 5 below presents the load profile of the June 30th curtailment event and its baseline, graphically depicting the results from Table 5 above. The black line during the curtailment event period depicts the level the curtailment event energy load profile would have to reach in order to achieve a 100% realization rate.

Figure 4. June 30th Curtailment Event Load Profile



Notes:

- Energy usage for a given hour is reported in the time reading at the beginning of the hour. For example, energy usage from 4-5pm is depicted in the 4pm reading.

- The Baseline Energy and Curtailment Event Energy lines do not intersect at the beginning of the event due to the Day-of-Adjustment (DOA) being calculated prior to the event start time.

July 21st Curtailment Event

The second Flex Peak event was called in the third week of July. The July 21st event achieved the highest demand reduction results out of the three events.

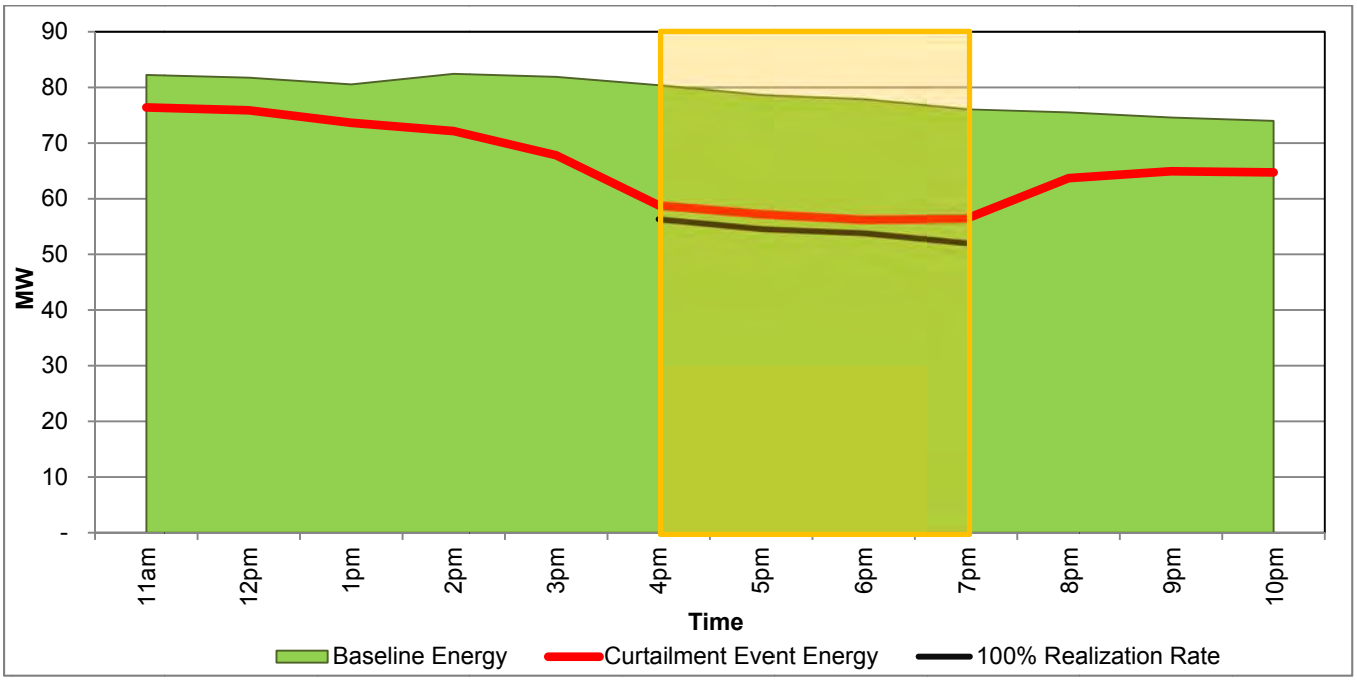
Table 7 below breaks out demand reduction for each hour of the curtailment event by dispatch group. The hour between 4pm and 5pm experienced the largest total reduction (23.3 MW, 96.6% of the total nominated load).

Table 5: July 21st Curtailment Event: Baseline Results by Hour (MW)

Method	4-5pm	5-6pm	6-7pm	7-8pm	Avg. Reduction	Max. Reduction
July 21st	23.3	22.9	22.9	21.5	22.6	23.3

Figure 6 below presents the load profile of the July 21st curtailment event and its baseline, graphically depicting the results from Table 7 above. The black line during the curtailment event period depicts the level the curtailment event energy load profile would have to reach in order to achieve a 100% realization rate.

Figure 5. July 21st Curtailment Event Load Profile



Notes:

- Energy usage for a given hour is reported in the time reading at the beginning of the hour. For example, energy usage from 4-5pm is depicted in the 4pm reading.

- The Baseline Energy and Curtailment Event Energy lines do not intersect at the beginning of the event due to the Day-of-Adjustment (DOA) being calculated prior to the event start time.

August 4th Curtailment Event

The third Flex Peak event was called in the first week of August. The August 4th event saw the lowest demand reduction out of the three events.

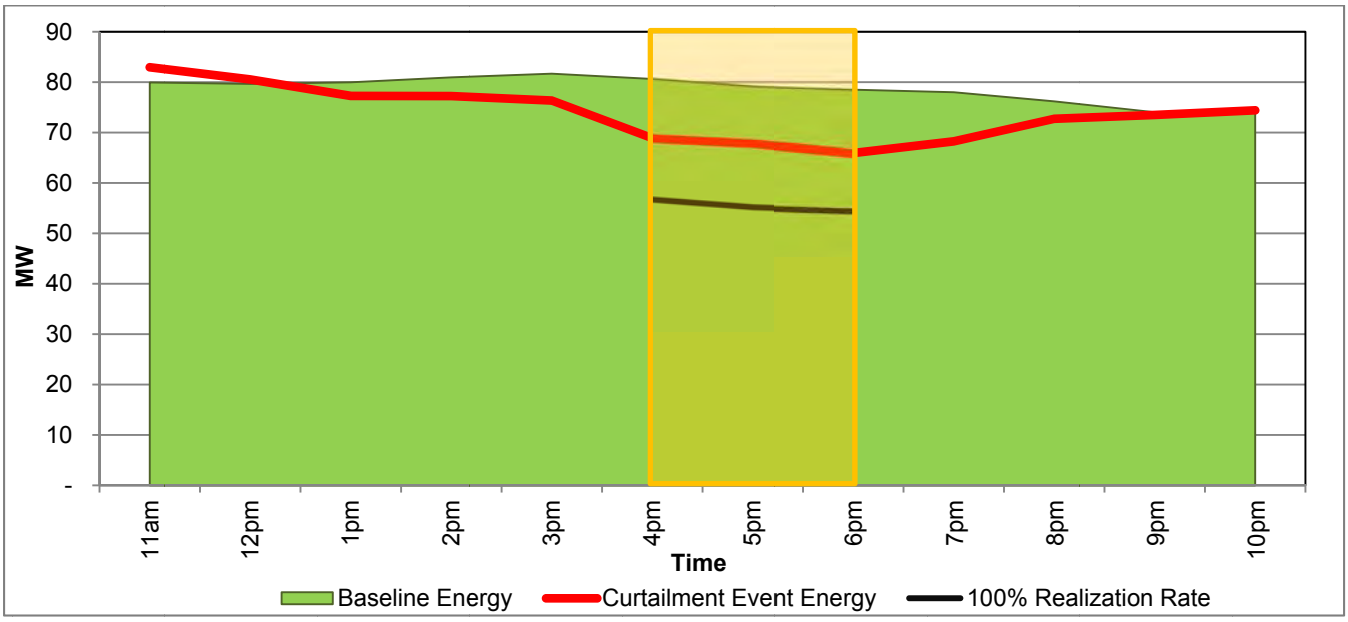
Table 9 below breaks out demand reduction for each hour of the curtailment event by dispatch group. The hour between 6pm and 7pm experienced the largest total reduction (13.3 MW).

Table 6: August 4th Curtailment Event Results by Hour (MW)

Method	4-5pm	5-6pm	6-7pm	Avg. Reduction	Max. Reduction
August 4th	12.2	12.4	13.3	12.6	13.3

Figure 7 below presents the load profile of the August 4th curtailment event and its baseline, graphically depicting the results from Table 9 above. The black line during the curtailment event period depicts the level the curtailment event energy load profile would have to reach in order to achieve a 100% realization rate.

Figure 6. August 4th Curtailment Event Load Profile



Notes:

- Energy usage for a given hour is reported in the time reading at the beginning of the hour. For example, energy usage from 4-5pm is depicted in the 4pm reading.

- The Baseline Energy and Curtailment Event Energy lines do not intersect at the beginning of the event due to the Day-of-Adjustment (DOA) being calculated prior to the event start time.

When considering the poor performance of the August 4th event, compared to the other two events, the reduced realization rate can be singly attributed to a lack of performance by the site with the largest nominated load

reduction in the program. That site achieving a realization rate of 8% in the August 4th event, compared to an average of 113% across the first two events. Had the site's realization rate for the August 4th event been the average of its realization rates from the first two events, the event's realization rate would've increased by 39.4% to 94.8%.

Conclusions

The goals of the 2015 Flex Peak impact evaluation were to determine and verify the demand reduction (MW) during curtailment events and determine the realization rate for each event.

CLEAResult completed analyses of curtailment events held on June 30th (4 – 8pm), July 21st (4 – 8pm), and August 4th (4 – 7pm). All three events included 71 unique sites, with the aggregate nominated load reduction averaging 24.5 MW across the three events. The results of the analyses showed maximum demand reductions of 21.9, 23.3, and 13.3 MW, respectively, for the three events, and an average of 19.5 MW. The events achieved realization rates of 86.7%, 96.6%, and 55.4%, respectively, averaging 79.6%.

The results of the impact evaluation show that Idaho Power's 2015 Flex Peak program functioned as intended and provided up to 23 MW to the electricity grid at the meter level. In addition, the Flex Peak program is scalable and with additional participants and more diversity among participants, could contribute more reduction as future capacity requirements dictate.

Impact and Process Evaluation of Idaho Power's Ductless Heat Pump Program

Final Report

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Executive Summary

The Northwest Energy Efficiency Alliance (NEEA) initiated the Northwest Ductless Heat Pump Pilot project (DHP) in 2008 and Idaho Power (IPC) joined the project in 2009, implementing the pilot throughout its service area. The company extended the project as an Idaho Power DHP Pilot through 2014 offering customers a $750 incentive payment to have a qualified DHP installed.

IPC works with a network of participating contractors to deliver the program. Currently there are approximately 75 participating contractors, although that number changes as contractors continue to be added to the program. Honeywell performs on-site verification for the program.

Conclusions

The results of the impact analysis show that the Ductless Heat Pump program saved 451,391 kWh achieving 97.5% of its goal. For non-electric benefits the ex-ante realization rate is 109.2%.

Table ES-1 Ductless Heat Pump Program Results

Metric	Program Goal	Reported	AEG-Evaluated	Overall Realization Rate
Annual Energy Savings (kWh)	460,000	462,747	451,391	97.5%
Non-Electric Benefits (NEBs)	NA	$178,221	$194,605	109.2%

Other key findings from the process and impact evaluations include:

- The program is very well run, has an involved program specialist, and adheres to best practices in the industry.
- The program has high satisfaction among participating contractors and customers, and the technology is well received.
- Contractor/retailers, bill inserts, and word of mouth are the main ways 2014 participants heard about the program.
- The price of the technology has remained steady and the perceived high cost can be a barrier to program participation. The incentive helps address this barrier for some but not all eligible customers.
- Low performing contractors could become more engaged with additional technical training and development.

- According to IPC staff, the contractor portal is rarely being used, but the high- and mid-performing contractors interviewed say they have used the portal and are satisfied with the materials.

1.1 Recommendations

Based on this evaluation, the following recommendations should be considered to enhance program effectiveness and improve the accuracy and transparency of reported savings:

- Consider expanding the target market to new construction and small commercial businesses.
- Conduct more outreach with contractors. Interviews with contractors revealed that they could benefit from more marketing and outreach. The program specialist is very busy and does not have enough time to do the outreach on his own. Customer Representatives (CR) could help the program specialist reach out more frequently to participating contractors. Contacts made by the CR are tracked by the Program Specialist. Visits to contractors could also be coordinated with other HVAC programs to inform them about all the energy efficiency rebates available from IPC.
- Work with ductless heat pump manufacturers to provide training materials and workshops for participating contractors.
- Remind contractors who are not using the portal about the availability of the contractor portal. Data is available on who has logged in to the portal and the frequency of visits. Idaho Power reports that the contractor portal is underutilized, however, the highest performing contractors interviewed said they use the portal. Let all contractors know when new materials are available through the portal.
- When calculating NEBs, make sure that the correct inflator is used to convert to current year values. Also IPC is currently using the Present Value Non-Electric System Benefits $/kWh for calculating NEBs and that is incorrect as this value is not based on site energy savings. The "PV Regional Non-E Value" parameter should be used directly or in conjunction with the site savings.
- When a home's ZIP code is in two counties, use the street address to determine the correct climate and heating zone.

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Introduction

1.1 Program Description

The Northwest Energy Efficiency Alliance (NEEA) initiated the Northwest Ductless Heat Pump Pilot project (DHP) in 2008 and Idaho Power joined the project in 2009, implementing the pilot throughout its service area. The company extended the project as an Idaho Power DHP Pilot through 2014 offering customers a $750 incentive payment to have a qualified DHP installed.

The primary goal of the Northwest DHP Pilot project is to promote DHP technology as an energy-saving alternative for customers who primarily heat their homes with electricity. Other Northwest DHP Pilot goals are to identify DHP energy savings, help inform Regional Technical Forum (RTF) deemed-savings amounts, and obtain customer satisfaction and behavior patterns regarding this technology.

The program targets existing homes heated with electric zonal systems. Typically, these homes do not have air ducting and therefore cannot easily have a forced-air heat pump system installed. The types of electric zonal systems in the targeted homes include baseboard, ceiling cable, and wall-mounted units. Homes heated with fossil fuel forced-air systems or electric forced-air systems do not qualify. Qualifications include having one DHP indoor unit installed in the main living area of the home, since this is where most occupants spend the majority of their time.

IPC works with a network of participating contractors to deliver the program. Currently there are approximately 75 participating contractors, although that number changes as contractors continue to be added to the program. Honeywell performs on-site verification for the program.

In 2014, the Ductless Heat Pump program reported 463 MWh of savings (Table 1-1).

Table 1-1 Ductless Heat Pump Program Reported Savings vs. 2014 Goals

Year		Units	MWh Savings
PY2014	IPC Goals	NA	460
	IPC-Reported	179	463
Percent of IPC-Reported to Goals		**NA**	**101%**

1.2 Purpose of the Evaluation

Idaho Power Company (IPC) contracted with Applied Energy Group (AEG) to conduct a process evaluation of the Ductless Heat Pump program and an impact

evaluation for program year 2014. The key objectives addressed in the process evaluation were to:

- Evaluate program design including program mission, logic, and use of best practices.
- Evaluate program implementation including quality control, operational practice, and outreach.
- Evaluate program administration including program oversight, staffing, management, training, documentation, and reporting.
- Evaluate participant and stakeholder response including customer interaction and satisfaction.
- Report findings and observations and provide recommendations that enhance program effectiveness.

The key objectives addressed by the impact evaluation were to:

- Measure and verify the energy (kWh), and non-electric impacts attributable to the 2014 program.
- Provide credible and reliable ex-post program energy savings and realization rates and non-electric impact estimates attributed to the program for the 2014 program year.
- Report findings and observations, and provide recommendations that would enhance the effectiveness of future analysis and the accurate and transparent reporting of program savings.

1.3 Report Structure

Following this introductory chapter are the following chapters:

- Chapter 2 – Methodology: Description of the evaluation methods, sampling design, and data collection and analysis process.
- Chapter 3 – Process Evaluation Findings: Description and discussion of the program processes and best practices review.
- Chapter 4 – Impact Evaluation Findings: Description and discussion of the result of the engineering review including kWh savings estimates, non-electric benefits and realization rates.
- Chapter 5 – Conclusions and Recommendations: Conclusions reached based on the process and impact evaluation including the best practices review and recommendations to improve the program.

Methodology

This section describes the approach AEG used to evaluate the Ductless Heat Pump program.

2.1 Process Evaluation

Process evaluations focus on determining the overall effectiveness of program delivery, identifying opportunities for program improvements, and assessing key program metrics including participation rates, market barriers, and overall program operations. The process evaluation for the Ductless Heat Pump program consisted of the following research activities:

- Interviews with program staff
- A detailed review of the program documentation and tracking database
- Interviews with participating contractors
- A best practices review

Interviews with Program Staff

AEG conducted an in-depth qualitative interview with the IPC Program Specialist. The interview included questions surrounding the goals for the program offering from the interviewee's perspective; policies, processes and procedures surrounding recruitment and delivery of the program; what is working and what is not; and the strengths and weaknesses of the program.

Documentation Review

AEG reviewed several sources of data as metrics to evaluate the program and the program offerings. The data sources included the program implementation plan, strategic marketing plan, application, contractor training slides, marketing copy, database of participating contractors, and example on-site verification forms.

Insight gained from this document review was used to provide a background for conducting the process evaluation and to inform the resulting conclusions and recommendations.

Contractor Interviews

AEG conducted interviews with 10 participating contractors that have attended training for the Ductless Heat Pump program. The goal of these interviews was to explore contractors' knowledge, experience and suggestions for the program. Specific topics addressed during the interviews included:

- Contractor's skills and knowledge about the technology and the program
- Use and satisfaction with IPC's portal
- Program participation
- Possible strategies for getting contractors more involved in the program (e.g., increasing the number of projects they complete for the program)

Participating contractors were stratified by the number of projects completed. Interviews were completed with the three top performers in terms of projects completed (10 – 51 projects), along with three mid-performing contractors (3-9 projects), two low performer contractors (1-2 projects) and two contractors who did not complete any projects. Table 2-1 shows the number of contractor interviews completed in each stratum and the number of projects they represent.

Table 2-1 Ductless Heat Pump Program Contractor Interviews

Stratum	Total Number of Projects	Total Number of Contractors	Contractors Interviewed	Projects Completed by Contractors Interviewed
High Performer (10 or more projects)	77	3	3	77
Mid-Performer (3 – 9 projects)	75	13	3	17
Low Performer (1 – 2 projects)	27	19	2	2
Non-Performer (0 projects)	0	40	2	0
Total	**179**	**75**	**10**	**96**

Best Practices Review

AEG conducted a literature review of industry publications to identify an appropriate set of best practices to compare with IPC's Ductless Heat Pump program. AEG conducted the best practices review as follows:

- Reviewed regulatory filings, evaluation reports, conference presentations, marketing materials and industry publications
- Created a list of best practices/innovations and the rationale behind the best practice/innovation
- Benchmarked IPC's program against each best practice listed

2.2 Impact Evaluation

The main objective of the impact evaluation was to estimate the annual kWh savings achieved by the program. This was accomplished by conducting a detailed engineering review that included a two-step process: a savings replication and a documentation review. Non-electric benefits were also verified for the program.

Engineering Review

For the savings replication, AEG applied the RTF deemed algorithms to the tracked parameters for all program participants to verify that the algorithms were applied correctly, identify errors or issues, and adjust savings estimates at the project level if necessary. This step yielded verified or adjusted savings estimates for all projects in the program. Because this step is done for all program participants, there is no sampling error from this step.

For the documentation review, AEG designed a stratified random sample using reported climate zone as the stratification variable. The Ductless Heat Pump engineering review consisted of a review of 20 of the 179 projects (Table 2-2).

Table 2-2 Ductless Heat Pump Program Sample Design

Stratum	Definition	Population	Sample Size
1	Cooling Zone = 1 Heating Zone = 3 Savings = 292 kWh/yr	25	4
2	Cooling Zone = 1 Heating Zone = 2 Savings = 2,585 kWh/yr	2	2
3	Cooling Zone = 2 Heating Zone = 2 Savings = 2,746 kWh/yr	63	5
4	Cooling Zone = 3 Heating Zone = 2 Savings = 3,016 kWh/yr	12	3
5	Cooling Zone = 3 Heating Zone = 1 Savings = 3,131 kWh/yr	77	6
Total		**179**	**20**

Detailed documentation (rebate applications, invoices, etc.) for each project in the sample was reviewed. Any adjustments needed based on this documentation review would result in an overall adjustment to the savings, along with associated sampling error. However, in this case, based on the findings from those project files, no additional adjustments to savings calculations were necessary for this step. The savings for the sample were expanded to the population using a combined ratio

estimate, which leverages the correlation between the replicated savings and the verified savings to create a more precise estimate of the total verified savings for the program. Because there were no adjustments needed, the replicated savings and the verified savings were identical, resulting in a perfect correlation of 1.0 between the two savings estimates. The uncertainty in the ratio estimate is driven by that correlation, and because the correlation is 1.0, the analysis results show no uncertainty. The resulting 90% confidence interval becomes zero, so no confidence intervals are reported here.

Non-Electric Benefits

Non-electric benefits (NEBs) were evaluated for this program according to the values set out in the RTF Unit Energy Savings (UES) workbook (v2.0) and Supplement 1 of the Idaho Power 2014 Annual Report.

Process Evaluation Findings

The process evaluation for the Ductless Heat Pump program focused on conducting interviews with program staff and participating contractors and reviewing program processes to assess the program operations, quality control, staffing, and outreach. The evaluation also included secondary research to determine if the program is currently using established best practices prevalent in the industry. The process evaluation found that the program is well run, adheres to industry best practices, and that the program and the DHP technology is well received by customers and contractors, resulting in high satisfaction.

3.1 Program and Implementation Staff Interviews

AEG conducted an in-depth interview with the program specialist for the Ductless Heat Pump program. The following are some of the key points from the interview.

Program Design and Operations

- Currently, 75 contractors are participating in the program. Number of projects per contractor ranges from 0 – 51 in 2014.
- When people install DHPs, they replace systems that are more expensive to operate. According to the program specialist, these devices "have a way of shaping the market" because they are providing customers lower heating costs.
- The initial cost of DHPs has remained steady and is perceived to be high. The cost has not come down as expected.

Marketing and Outreach

- An algorithm is used to identify IPC customers who have higher energy usage. This algorithm has identified approximately 95,000 customers.
- The eligible customer list is sorted by energy use from highest to lowest. The top 30,000 are the target market and are sent direct mail letters. These are more likely to have electric heat.
- Bill inserts and direct mail have been successful in encouraging participation.
- Awareness of the program and the technology is low. This has been determined by surveys and studies performed by IPC and NEEA.

Program Staffing

- The program specialist is largely responsible for all aspects of administering the program. He is responsible for handling all the data entry of the applications, signing up new contractors, supporting existing contractors in

the field, creating and managing the budget, implementing the marketing strategy, developing trade show props to support the program, and handling questions from customers.

- Support is provided by Honeywell to conduct the onsite verification visits. Honeywell also provides some technical support for contractors in the field.

Customer Satisfaction

- The most recent IPC customer survey had a very high response rate and the respondents were very positive about the program.
- The program specialist believes the equipment has performed very well. This can be a concern with new technology, but DHPs have been received favorably by the market.
- The program specialist says he talks to customers routinely who say they are satisfied with the program and the product.

3.2 Program Processes

The program is supported by 75 participating contractors. In order to participate in the program, contractors are required to attend a NEEA webinar, obtain factory brand training, obtain and have a discussion with the program specialist. Participating contractors are listed on the company website.

Customers interested in participating in the program call one or more participating contractors. The contractor determines if the customer qualifies for the program and provides them with a price quotation. The customer approves the price quotation, the equipment is installed, the contractor fills out the paperwork, and the customer receives a check ($750) within 3 - 5 weeks of submission.

Quality Assurance/Quality Control

For quality assurance/control, IPC contracts with Honeywell, who provides on-site verification. According to the QA/QC plan ten percent of installations should be verified each program year. Most projects are selected randomly by IPC, but under certain conditions specific projects must be verified. If, for example, a project is the first project completed by a contractor, it must be included in the verification sample. Also if a contractor fails an earlier verification, the next two projects completed by that contractor must be included in the verification sample. During the on-site visit, Honeywell ensures the proper equipment was installed, is connected correctly, and placed correctly. Honeywell also asks customers (as able) if they are satisfied with the contractor, program and equipment and records their response on the verification form. Contractors and IPC are invited, but not required to attend the verification visit. Honeywell notifies the contractor and IPC of the result of the visit within 2 business days. Hard copies of verification forms are completed by Honeywell and submitted to IPC electronically.

IPC also has an internal research assistant who verifies that the data entered into the program database matches the data provided on the application.

3.3 Program Marketing

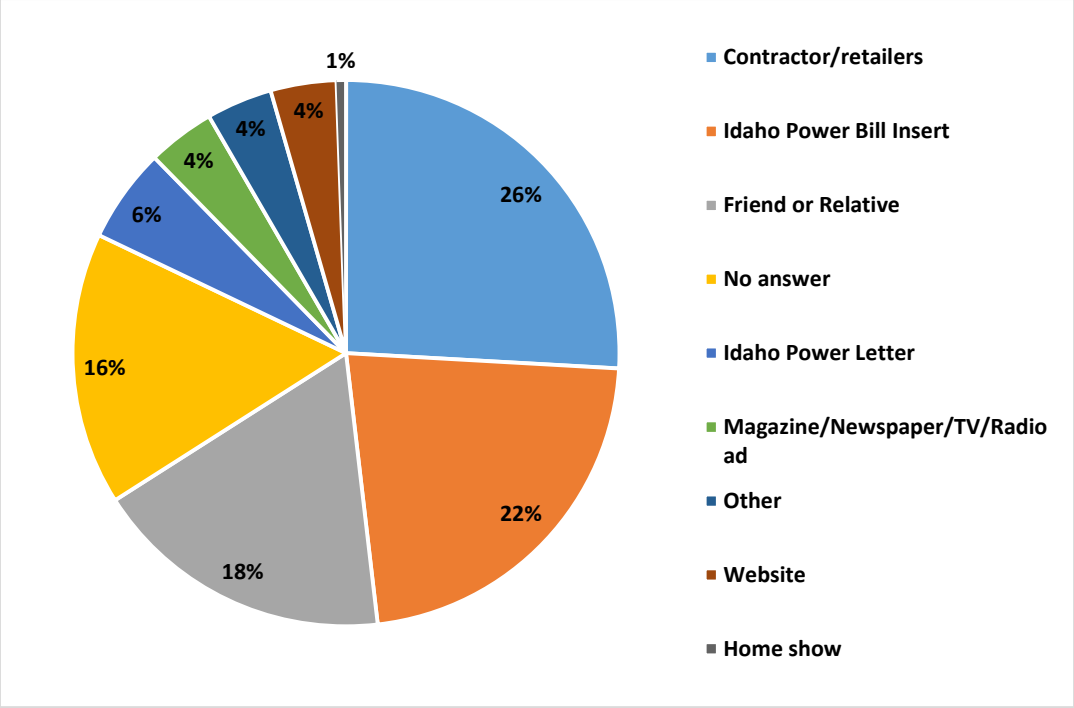
Over the years, the program has been marketed in various ways including advertising in rural newspapers where electric zonal heat is more prevalent, direct mail letters, bill inserts to all residential customers, retail coupon mailers, trade shows, and social media. Table 3-1 shows the marketing methods used in 2014.

Table 3-1 Marketing Methods Used in 2014

Method	Date
Direct mail letters to customers with new homes	February, May & August
Print ads in designated areas more likely to have high electric usage	January, May & September
Online behavioral ads	March thru June
Bill insert	January, May & September
Social media mentions	Spring & Fall
Facebook ads	February, March & April
Energy efficiency campaigns	February & August

Source: IPC Ductless Heat Pump program 2014 Strategic Marketing Plan

During installation, participating customers were asked how they heard about the program. This information is stored in the program tracking database. In 2014, contractors/retailers, bill inserts, and word of mouth were the most frequently mentioned ways customers reporting hearing about the program (Figure 3-1).



Source: IPC Ductless Heat Pump 2014 program tracking database

Figure 3-1 How 2014 Participants Heard about the Ductless Heat Pump Program

IPC also implemented a new contractor portal in 2014 where the participating contractors can download pre-made marketing collateral artwork for advertising – this makes it easy for them to advertise the program.

3.4 Participating Contractor Interviews

During August and September 2015, AEG conducted in-depth interviews with 10 participating contractors in IPC's Ductless Heat Pump Program. (See Appendices for the interview guide.) The main objectives of the interviews were to assess the contractors' skills and knowledge related to the technology and the program, gauge the use of IPC's contractor portal, identify any barriers to program participation, assess customer satisfaction, and identify any strategies to increase contractor involvement in the program.

Contractors' Skills and Knowledge

Most contractors say they are very familiar with the technology and the program requirements. One high performing contractor said his company joined the program because they wanted to start selling DHPs. Most contractors say that projects from the program account for very small percentages of the contractors overall business providing ranges of 2-5% of their total business. Mid-performers, however, seem collectively to have the highest proportion of projects through the program, saying

such projects account for of 12-15% of their business. All of the high-performing and one non-performing contractor expect the number of projects they complete through the program to grow in the next 2 years. The other contractors expect the number of projects to stay about the same.

All contractors who have had at least one project through the program, said they have adequate staff trained who are knowledgeable about the program. These employees are able to answer customers' questions and explain the benefits of the technology to the customer.

> *"We take the time to train the customers on the system to ensure that they understand the benefits."*

Non-performing contractors felt that more training would be helpful. Specifically training about proper sizing for certain applications.

High and mid-performing contractors said the program helps them sell more DHPs and gives them an edge over the competition.

> *"The program gives us a chance to sell more ductless heat pumps, increase our business and employ more people. I think it gives us a competitive edge."*

Low performing contractors like the rebate and feel it helps their sales. They do not feel the program gives them a competitive edge because all their competitors participate in the program.

IPC's Contractor Portal

Most of the high and mid-performing contractors interviewed say they have used IPC's contractor portal and are satisfied with the materials.

Low performing contractors do not use IPC's contractor portal, mainly because they didn't feel the need to do more marketing or change their existing marketing.

> *"I get a ton of referrals. I don't need to market a lot."*

> *"I have no need for the IPC materials."*

Non-performing contractors and one mid-performing contractor were not aware of the IPC contractor portal.

Program Participation

Contractors' views on customer awareness of the program are mixed. Some said customers are aware of the program. One non-performing contractor said he is participating in the program because a customer asked him about the rebate. Others say they usually tell customers about the program, and the majority of eligible customers are not aware.

All contractors who had one or more projects in the program say customers who participate are very satisfied with the program and the equipment. The high cost of DHPs is a barrier to installing the technology and participating in the program. The rebate helps some customers, but for others it still isn't enough to overcome the high price of the technology.

"The program is well thought out and executed."

"The customers are generally aware of the program but are often surprised by the high cost of the equipment."

Overall, contractors are very satisfied with the help and support they get from the IPC program specialist.

"It's very helpful to have someone knowledgeable about the program. He came over and talked about the program and the benefits to my company and the customers. He was very influential."

Suggestions for Improvement

Most of the suggestions for improvement centered on increasing marketing/outreach and training:

- One high performing contractor felt that IPC could do a better job getting the word out to people who live in small towns.
- A mid-performing contractor said he would like IPC to reach out to him more and tell him about other HVAC programs that could benefit customers.
- Two contractors (one mid, one low performing) would like to see more advertising from IPC and/or from DHP manufacturers.
- Non-performing contractors felt more training from IPC would be helpful.

  "I would like to have more documentation to take to the site that listed the benefits of ductless heat pumps. We also need more technical education. A forum with manufacturers and contractors would be helpful"

Summary

The following conclusions can be drawn from the information gained in the contractor interviews:

- High and mid-performing contractors are savvy about the program and technology. They have adequate staff, can explain the benefits of the technology to customers, and make use of the contractor portal. They are also more optimistic about the growth of the market.
- Low performers do not complete more projects because they have all the work they need. As a result, little can be done to move these contractors to the mid or high performing categories.
- Non-performing contractors would benefit from more training.
- All contractors interviewed said they were satisfied with the program, the support they receive from IPC, and the technology.

3.5 Best Practices

AEG conducted a literature review of industry publications to identify an appropriate set of best practices to compare with the DHP program. AEG reviewed the following sources to create a list of best practices/innovations in the industry:

- Publicly available best practices reports
- Conference papers and presentation
- Evaluations of other ductless heat pump programs

Table 3-2 below shows each best practice/ innovation and whether IPC currently uses the practice. In all cases, either IPC is already doing the best practice, or it relates to something not eligible in the IPC program.

Table 3-2 Best Practices/Innovation for Ductless Heat Pump Programs

Best Practice/Innovation	Ductless Heat Pump Program	
	Standard Practice?	Explanation
Provide contractor training	✓	Training required to be a participating contractor
Provide customer education	✓	Video provided on website. Contractors provide customer education
Target DHPs to replace electric resistance heating	✓	Electric heat is the target market for the program
Consider promoting DHPs to residential new construction	x	New construction is not eligible
Promote improved comfort	✓	Mentioned in marketing plan, website, and in marketing materials
Consider commercial markets	x	Commercial customers are not eligible
Train contractors on proper placement of DHPs	✓	Proper placement required by program and verified through random on-site visits
Target manufactured homes	✓	Although not specifically targeted, manufactured homes are included in the electric heat target market
Promote marketing by contractors/installers	✓	Contractor portal created

Impact Evaluation Findings

The impact evaluation for the Ductless Heat Pump program consisted of a detailed engineering review that included a two-step process: a savings replication and a documentation review. Non-electric benefits were also verified.

4.1 Engineering Review

The Idaho Power Ductless Heat Pump conversion measure refers specifically to conversion from electric zonal (baseboard, ceiling cable, or wall) heating. The Ductless Heat Pump Pilot program used Version 2.0 of the RTF Ductless Heat Pump unit energy savings (UES) workbook for deemed savings in 2014. This version was approved by the RTF on March 18, 2014 and was also used by AEG for savings replication in the 2014 evaluation. This workbook provides annual energy savings for DHP conversions from zonal heating systems by heating zone (HZ) and cooling zone (CZ). Only the "No Screen" options, unscreened for supplemental fuel use, were used for the reported savings and the analysis.

In the savings replication analysis, AEG identified four sites that showed ambiguous mapping between ZIP code, county, and climate zone. There were four homes with a recorded climate zone of HZ1/CZ3 in the tracking database whose county of residence was recorded as Boise County, which would result in a climate zone of HZ3/CZ1 based on the lookups in the RTF Climate Zone file. However, the ZIP code for these homes was 83716, which indicates Ada County and a climate zone of HZ1/CZ3 (according to the climate zone lookup provided by IPC). Through the review of the homes' addresses, it was found that the homes do in fact reside in Boise County and should have a climate zone designation of HZ3/CZ1. AEG applied this change to database in the savings replication analysis resulting in a replicated savings realization rate of 97.5%. No other issues or discrepancies were found in the savings replication analysis.

Twenty homes were sampled for a more thorough documentation review. AEG reviewed application forms and on-site verification reports (if available) to determine if all information in the program tracking database for these projects was correct. There were no issues or errors found in the review sample. Half of the homes in the sample were found to have installed more than one DHP unit; this did not change the deemed savings since these are prescribed on a per-home basis. Because there were no errors or issues found that affected the savings, the realization rate for the documentation review step was 100%. Because of the perfect correlation between the savings that came out of the replication step and the verified savings from the documentation review, the ratio estimate of savings has no uncertainty.

1.2 Non-Electric Benefits

Non-electric benefits (NEBs) were evaluated for this program according to the values set out in the RTF Unit Energy Savings (UES) workbook v2.0 and Supplement 1 of the Idaho Power 2014 Annual Report. During the replication review, AEG determined that non-energy benefits (NEBs) were being incorrectly calculated. The NEBs reported in Supplement 1 of the Idaho Power 2014 Annual Report were based on the "Present Value Non-Electric System Benefits ($/kWh)" values (in 2006 dollars) provided by the RTF, multiplied by the total site savings per measure, and converted from 2006 to 2014 dollars with an incorrect inflator of 1.175023. The correct RTF inflator for converting from 2006 to 2014 dollars is 1.136889 based on the RTF Standard Information Workbook v2.2; the one used by IPC inflated the dollar amounts from 2005 to 2014 dollars. Furthermore, the "Present Value Non-Electric System Benefits ($/kWh)" values (located in Column AJ of the "MeasureTable" sheet in the RTF UES workbook) should not be used for calculating NEBs based on site energy savings. These NEB values are calculated in RTF UES workbooks by dividing the "PV Regional Non-E Value" parameter (Column BV of the "Measure_InputOutput" sheet, output by ProCost) by the "Wholesale Electric Energy (kWh)" parameter (Column L of the "Measure_InputOutput" sheet, output by ProCost). Since the $/kWh PV(NEB) value is based on wholesale electricity savings at the generator busbar, this value should not be multiplied by the deemed site electricity savings to result in the NEB for the measure. Rather, the "PV Regional Non-E Value" parameter should be used directly or in conjunction with the site savings. Even though the corrected dollar year deflator is lower than the one used by IPC, the overall AEG correction resulted in an increase in NEBs due to the higher site-based $/kWh PV(NEB) values. These corrections resulted in an increase in NEBs for the program of about 9%.

1.3 Results

Table 4-1 shows the results of the impact analysis. The program saved 451,391 kWh and achieved $194,605 in non-electric benefits. The realization rates from the replication step are 97.5% for energy savings and 109.2% for NEBs. The realization rates from the documentation review step relative to the replication step are 100% for both energy savings and NEBs. There is no sampling error in AEG's evaluated impacts since all adjustments were made in the replication step and no additional adjustments were needed as a result of the documentation review step.

Table 4-1 Impact Evaluation Results for the Ductless Heat Pump program

	Reported	AEG Evaluated	Replication RR %	Documentation Review RR % [1]
Savings (kWh)	462,747	451,391	97.5%	100%
NEB (2014$)	$178,221	$194,605	109.2%	100%

[1] The document review realization rate is relative to the replicated savings, not the reported savings.

Conclusions and Recommendations

The results of the impact analysis show that the Ductless Heat Pump program saved 451,391 kWh achieving 97.5% of its goal.

Table 5 1 Ductless Heat Pump Program Results

Metric	Program Goal	Reported	AEG-Evaluated	Overall Realization Rate
Annual Energy Savings (kWh)	460,000	462,747	451,391	97.5%
Non-Electric Benefits (NEBs)	NA	$178,221	$194,605	109.2%

Other key findings from the process and impact evaluations include:

- The program is very well run, has an involved program specialist, and adheres to best practices in the industry.
- The program has high satisfaction among participating contractors and customers, and the technology is well received.
- Contractor/retailers, bill inserts, and word of mouth are the main ways 2014 participants heard about the program.
- The price of the technology has remained steady and the perceived high cost can be a barrier to program participation. The incentive helps address this barrier for some but not all eligible customers.
- Low performing contractors could become more engaged with additional technical training and development.
- According to IPC staff, the contractor portal is rarely being used, but the high- and mid-performing contractors interviewed say they have used the portal and are satisfied with the materials.

5.1 Recommendations

Based on this evaluation, the following recommendations should be considered to enhance program effectiveness and improve the accuracy and transparency of reported savings:

- Consider expanding the target market to new construction and small commercial businesses.
  - ➔ **Rationale:** Growing the target market is an industry best practice and will increase participation and savings if expanding to these new markets are determined to be cost effective.
- Conduct more outreach with contractors. Interviews with contractors revealed that they could benefit from more marketing and outreach. Customer Representatives (CR) could help the program specialist reach out more frequently to participating contractors. Contacts made by the CR are tracked by the Program Specialist. Visits to contractors could also be coordinated with other HVAC programs to inform them about all the energy efficiency rebates available from IPC.
  - ➔ **Rationale**: The program specialist has a large workload supporting this program and little extra time to conduct the outreach with contractors that is required. Outreach to contractors is also an industry best practice.
- Work with ductless heat pump manufacturers to provide training materials and workshops for participating contractors.
  - ➔ **Rationale**: Non-performing contractors identified a need for more training about the technology.
- Remind contractors who are not using the portal about the availability of the contractor portal. Data is available on who has logged in to the portal and the frequency of visits. Let all contractors know when new materials are available through the portal.
  - ➔ **Rationale:** Idaho Power reports that the contractor portal is underutilized, however, the highest performing contractors interviewed said they use the portal. Use of the portal may help lower performing contractors increase their number of projects through the program.
- When calculating NEBs, make sure that the correct inflator is used to convert to current year values. Also do not use the Present Value Non-Electric System Benefits $/kWh for calculating NEBs this value is not based on site energy savings. The "PV Regional Non-E Value" parameter should be used directly or in conjunction with the site savings.
  - ➔ **Rationale:** Calculating the NEBs according to the RTF rules will result in more accurate savings estimates.
- When a home's ZIP code is in two counties, use the street address to determine the correct climate and heating zone.

- ➔ **Rationale:** Savings vary greatly by climate and heating zone. Ensuring the correct zones are used will result in more accurate savings estimates. . This was primarily found to be an issue between Boise and Ada counties, in ZIP Code 83706**.**

Program Staff and Implementation Contractor Interview Guides

Program Manager Interview Guide – Final –IPC Residential

NAME

TITLE

PROGRAM

DATE

PHONE

EMAIL

INTERVIEWER

SUMMARY OF FINDINGS

[Once the interview is complete, please complete interview notes within this document. First, provide a high-level summary of findings below. Then, within each section summarize the findings.]

[Some of the answers to these questions will be filled in prior to the interview, based on information learned during the kick off meeting in Boise on June 8, 2015]

BACKGROUND

1. Please provide a brief description of the programs you are directly responsible for?
2. Please describe your job responsibilities related to the program.
3. How long have you been responsible for administration of this program?
4. On average, what percent of your time is spent on the program you are directly responsible for?
5. What other staff work on the program? What is their role regarding the program (i.e. what are the responsible for with regard to the program)? Who, if anyone, provides you with support? What support do they provide?

PROGRAM GOALS

6. What metrics are used to track the success of the program? (Probe for electric savings, participation rates, number of units)?
7. How are goals for this program established?

8. Did the program meet its goals in 2014? If not, what kept the program from meeting its goals?

9. Has the program met its annual goals in previous years? Is it on track to meet its goals for 2015?

PROGRAM IMPLEMENTATION AND MARKETING

10. Do you work with an implementation contractor or trade allies to help deliver the program? Who is/are the implementation contractor and/or trade allies you work with on this program? Do you have any issues or concerns about the implementation contractor or trade allies? If yes, what are your concerns?

11. What is the target market for the program? How are potential customers identified?

12. What are the main barriers to participation? How does the program address these barriers?

13. What has been done to market the program? How successful have these strategies been? Are some marketing strategies or messages more beneficial than others? How is success of the marketing strategies or messages measured?

PROGRAM OPERATIONS

14. What are the participation steps from the customers' perspective? Have these changed over time? If so, why were they changed?

15. Are there any specific aspects of the program that are working very well? Any not working well? (Probe for details) What could be done to improve?

16. What quality control/quality assurance procedures are in place? Are these documented? Is any verification done? What does this entail? Who does the verification?

17. Do the incentive levels seem appropriate? If not, why not? What, if any, changes in the incentive levels do you think may be needed?

18. What is your opinion of free ridership for this program? Meaning do you think customers would pay for the measures on their own, outside of the program. Why do you say that?

19. Do you think the program is changing customers' energy efficiency attitudes and actions? (Probe for specifics)

20. Are customers satisfied with the program overall? With the measures installed? Are they satisfied with the incentive amount? With the savings achieved? How is satisfaction with the program measured? (i.e. is this based on survey information or is it anecdotal?)

PROGRAM IMPACTS

21. Deemed savings from the RTF are used to determine program impacts – correct? Do you know what version of the RTF workbook you are using? If no, who should I ask for that information?

22. We plan to do a review of detailed project documentation for a sample of participants, including cross-checking the project documentation with the tracking spreadsheets. What is the best way to get this data in an electronic form? How is it currently stored?

PROGRAM DATA AND DOCUMENTATION

23. Does the tracking database collect all the information you need? Is there information/data that you wish were available but are not? Is there information in the database that you don't use?

24. What type of documentation is required to support the purchase and installation of the measure?

EVALUATION

25. What do you hope to learn from this evaluation? Are there specific issues you would like the evaluation to address?

Contractor Interview Guide – FINAL–IPC Ductless Heat Pump Program

NAME

TITLE

COMPANY

DATE

PHONE

EMAIL

INTERVIEWER

SUMMARY OF FINDINGS

[Once the interview is complete, please complete interview notes within this document. First, provide a high-level summary of findings below. Then, within each section summarize the findings.]

INTRODUCTION

Hi, my name is ___ and I am calling from Applied Energy Group on behalf of Idaho Power Company. We are working with Idaho Power to evaluate their Ductless Heat Pump Pilot Program. I'm calling to ask you a few questions about your participation as a contractor in that program to help determine what is working and what might be improved. Are you familiar with your company's participation in the Ductless Heat Pump Pilot Program? If not, who would be the best person to speak with at your company about this subject?

All of your answers will be confidential. For our analysis your responses will be anonymously aggregated with those from other companies that participated in the program.

[IF THEY DON'T WANT TO TALK NOW, TRY TO GET A GOOD TIME TO CALL THEM BACK.]

[IF RESPONDENT PROPOSES AN ALTERNATE CONTACT, OBTAIN NAME, BEST NUMBER AT WHICH TO REACH THE CONTACT, AND ANY INFO REGARDING BEST TIME TO CALL]

[IF THEY HAVE QUESTIONS ABOUT OUR LEGITIMACY, THEY CAN CONTACT:]

Gary Grayson at 208-388-2395

[NOTE THAT TODD GREENWELL IS THE PROGRAM SPECIALIST AND HE IS THE PERSON THEY ARE MOST FAMILIAR WITH. GARY IS THE MANAGER IN CHARGE OF EVALUATIONS]

[IF THEY ASK ABOUT TIME LENGTH OF SURVEY, SAY BETWEEN 15 AND 30__ MINUTES]

[IF THEY AGREE TO TALK SAY: THANKS FOR TAKING THE TIME TO SPEAK WITH US. LET'S GET STARTED.]

ABOUT THE CONTRACTOR

Let me start by getting a little information about you and your company.

1. What is your job title or role?

2. What are your company's main products and/or services?

3. When did your company begin participating in IPC's Ductless Heat Pump (DHP) program?

4. Why did you or your company decide to participate in the program?

5. Had your company installed DHPs before participating in the program? [IF YES] How long have you been installing DHPs?

6. What percentage of your business comes from installing DHPs? Have all these projects completed in 2014 received a rebate from Idaho Power? [IF NO] Why not?

   In 2014? _____% 999. DK

7. Do you expect that percentage to grow, stay the same or decrease in the next 2 years (2015 2016)?

CONTRACTOR SKILLS AND KNOWLEDGE

8. How many employees at your company have been trained/ are knowledgeable about the Ductless Heat Pump program?

9. Is the number of employees you have trained enough to meet your customer demand for ductless heat pumps? If you had more employees knowledgeable about ductless heat pump installations and/or the Idaho Power program would you be able to complete more projects?

10. How well would you say you and your employees understand and are able to communicate the benefits of DHPs? If don't understand well, what additional knowledge/training is needed?

11. Do you feel the customers you installed DHPs for understand the benefits of the system you installed? If not, what was not clear?

12. Did customers adequately understand the Idaho Power program eligibility requirements, enrollment process, and the amount of the incentive? If not, what was not clear?

PROGRAM PARTICIPATION

13. Please describe your company's process for marketing DHPs to customers. Do you tell your customers about DHPs and the IPC program? Or do they typically come to you requesting DHPs?

14. Do you think eligible customers (those with electric zonal heat) are generally aware of the program? If not, what else could be done to inform eligible customers about the program?

15. If anything, what things about the program make it difficult for customers to participate (e.g., paperwork, measures, incentives too low, etc.)?

16. Have you received any complaints from customers who feel the equipment doesn't meet their expectations? [IF YES] What specifically were they disappointed in? How did you address their concerns?

17. How influential was the Idaho Power DHP program manager in your decision to participate? How helpful is the program manager if you have questions or concerns? Does having access to a knowledgeable program manager increase the value of your participation in the program?

18. Does the program make it easier for you to sell DHPs and/or identify prospects?

19. Do you use Idaho Power's contractor portal to access marketing materials?

    a. [IF NO] Why not? How could it be made more valuable/useful to you?

    b. [IF YES] Has it been helpful to your business? Are you satisfied with the materials available through the portal?

20. What, if anything, do you think is particularly good about the IPC program?

21. Do you have any suggestions for improvement to the program?

PROGRAM EFFECTIVENESS

22. What are the benefits to your company to participate in the program? Do you think the program helps your business? Does it give you a competitive advantage over other contractors in your area? [Probe for reasons?]

23. If the program was no longer available would you continue to install the DHPs in homes? Why or why not?

24. Is there anything else Idaho Power could do to help you increase the number of DHPs you install in their service territory?

CONCLUSION

25. Is there anything else that you think Idaho Power should think about as they continue to offer and improve this program?

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Impact and Process Evaluation of Idaho Power's Home Improvement Program

Final Report

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Executive Summary

The Home Improvement Program offers incentives to homeowners for upgrading insulation and windows in electrically heated homes. To qualify for an incentive under this program, the home must be a single-family home, a multifamily structure three stories or under, or a manufactured home in Idaho Power's service area in Idaho. The home must have an electric heating system serving at least 80 percent of the home's conditioned floor area. The heating system can be a permanently installed electric furnace, heat pump, or electric zonal heating system. Insulation must be professionally installed between conditioned and unconditioned space by an insulation contractor.

Conclusions

The results of the impact analysis show that in 2014, the Home Improvement program more than doubled its savings goal, achieving 845 MWh of savings with a realization rate of 100.7%.

Table ES-1 Home Improvement Program 2014 Results

Metric	Program Goal	Reported	AEG Evaluation	Realization Rate
Annual Energy Savings (kWh)	370,000	838,929	845,085	100.7%

Other key findings from the process and impact evaluations include:

- Contractors and the program specialist report that participants are satisfied with the program, the savings achieved and the improved comfort of their homes.
- The network of installation contractors are engaged in the program.
- The target market is small and eligibility criteria (e.g., existing insulation levels) is strict, which may make achieving future participation and savings goals more challenging, although this has not been a problem to date.
- Marketing is effective and most contractors would like to see these efforts increased.

Recommendations

Based on this evaluation, the following recommendations should be considered to enhance program effectiveness and improve the transparency and accuracy of reported savings:

- Increase consistency/clarity between supporting documentation and the program database. Require more standardized documentation to prevent errors in the estimations of savings. More consistent documentation should be required in the project application and submitted materials to clearly identify all variables

necessary for the calculation of savings. The submitted documentation was often disorganized and sometimes incomplete. Recently IPC improved their application, adding a checklist for customers on the application itemizing the documentation required. IPC should have a standardized documentation package for each project that includes a similar checklist completed by IPC that verifies that all required information has been submitted. The information should then be carefully and completely input in the tracking database.

- Use the current versions of the RTF Unit Energy Savings (UES) workbooks to discern between different residential segments, to estimate Non-Electric Benefits (NEBs), and to improve the overall accuracy of impact estimates. The project application discerns between standard single family, manufactured, and multifamily homes. These entries should be emphasized, recorded in the tracking database, and used to determine the correct savings for the respective residential building segment. In addition, adopting the current versions of the Single Family and Manufactured Home Weatherization workbooks would allow IPC to estimate NEBs for the Home Improvement program.
- Add sliding glass doors to the measure description on the application. Since sliding glass doors are specifically included in the RTF UES workbook for the window upgrade weatherization measures, "sliding glass doors" should be also included in the measure description in the project application.
- Require that contractors match U-factors (taken from the NFRC window stickers) to each window on the invoice. Since the RTF only prescribes savings for U-30 and U-22 window upgrades, consider a cutoff (e.g. U-25) where windows with lower than U-25 would be evaluated with savings for U-22 window upgrades. This would require calculating an average U-value weighted by window area.
- Increase marketing. Or if that's not possible due to cost effectiveness issues, focus marketing dollars on the more proven strategies: contractor outreach and bill inserts.

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Introduction

1.1 Program Description

The Home Improvement Program (HIP) offers incentives to homeowners for upgrading insulation and windows in electrically heated homes. To qualify for an incentive under this program, the home must be a single-family home, a multifamily structure three stories or under, or a manufactured home in Idaho Power's service area in Idaho. The home must have an electric heating system serving at least 80 percent of the home's conditioned floor area. The heating system can be a permanently installed electric furnace, heat pump, or electric zonal heating system. Insulation must be professionally installed between conditioned and unconditioned space by an insulation contractor.

Customers must use a participating contractor to qualify for the Idaho Power incentive. Incentives are processed by Idaho Power. Two third-party contractors perform on-site verification for the program.

In 2014, the Home Improvement program exceeded its unit goal and more than doubled its savings goal, reporting 839 MWh of savings across 555 projects (Table 1-1).

Table 1-1 Home Improvement Program Reported Savings vs. 2014 Goals

Year		Projects	MWh Savings
PY2014	IPC Goals	400	370
	IPC-Reported	555	839
Percent of IPC-Reported to Goals		**139%**	**227%**

1.2 Purpose of the Evaluation

Idaho Power Company (IPC) contracted with Applied Energy Group (AEG) to conduct a process evaluation of the Home Improvement program and an impact evaluation for program year 2014. The key objectives addressed in the process evaluation were to:

- Evaluate program design including program mission, logic, and use of best practices.
- Evaluate program implementation including quality control, operational practice, and outreach.

- Evaluate program administration including program oversight, staffing, management, training, documentation, and reporting.
- Evaluate participant and stakeholder response including customer interaction and satisfaction.
- Report findings and observations and provide recommendations that enhance program effectiveness.

The key objectives addressed by the impact evaluation were to:

- Measure and verify the energy (kWh) and non-electric impacts attributable to the 2014 program.
- Provide credible and reliable ex-post program energy savings and realization rates for the 2014 program year.
- Report findings and observations, and provide recommendations that would enhance the effectiveness of future analysis and the accurate and transparent reporting of program savings.

1.3 Report Structure

Following this introductory chapter are the following chapters:

- Chapter 2 – Methodology: Description of the evaluation methods, sampling design, and data collection and analysis process.
- Chapter 3 – Process Evaluation Findings: Description and discussion of the program processes and best practices review.
- Chapter 4 – Impact Evaluation Findings: Description and discussion of the result of the engineering review including kWh savings estimates, non-electric benefits and realization rates.
- Chapter 5 – Conclusions and Recommendations: Conclusions reached based on the process and impact evaluation including the best practices review and recommendations to improve the program.

Methodology

This section describes the approach AEG used to evaluate the Home Improvement program.

2.1 Process Evaluation

Process evaluations focus on determining the overall effectiveness of program delivery, identifying opportunities for program improvements, and assessing key program metrics including participation rates, market barriers, and overall program operations. The process evaluation for the Home Improvement program consisted of the following research activities:

- Interviews with program staff
- A detailed review of the program documentation and tracking database
- Interviews with participating contractors
- A best practices review

Interviews with Program Staff

AEG conducted an in-depth qualitative interview with the IPC Program Specialist. The interview included questions surrounding the goals for the program offering from the interviewee's perspective; policies, processes and procedures surrounding recruitment and delivery of the program; what is working and what is not; and the strengths and weaknesses of the program.

Documentation Review

AEG reviewed several sources of data as metrics to evaluate the program and the program offerings. The data sources included the program tracking database, application, marketing plan, marketing copy, example QA forms, and the program history. Insight gained from this document review was used to provide a background for conducting the process evaluation and to inform the resulting conclusions and recommendations.

Contractor Interviews

AEG conducted interviews with 8 participating contractors, including 5 insulation contractors and 3 window contractors. The goal of these interviews was to qualitatively explore contractors' knowledge and experience with the program. Specific topics addressed during the interviews included:

- Contractor's skills and knowledge about the program and the measures

- Program participation; barriers and satisfaction
- Suggestions for improvement

Best Practices Review

AEG conducted a literature review of industry publications to identify an appropriate set of best practices to compare with IPC's Home Improvement program. AEG conducted the best practices review as follows:

- Reviewed regulatory filings, evaluation reports, conference presentations, marketing materials and industry publications
- Created a list of best practices/innovations and the rationale behind the best practice/innovation
- Benchmarked IPC's program against each best practice listed

2.2 Impact Evaluation

The main objective of the impact evaluation was to estimate the annual kWh savings achieved by the program. This was accomplished by conducting a detailed engineering review that included a two-step process: a savings replication and a documentation review.

Engineering Review

For the savings replication step, AEG applied the RTF deemed algorithms to the tracked parameters for all program participants to verify that the algorithms were applied correctly, identify errors or issues, and adjust savings estimates at the project level if necessary. This step yielded replicated savings estimates for all projects in the program. Because this step is done for all program participants, there is no sampling error from this step.

AEG designed a stratified random sample to select projects for the documentation review. While a simple random sample selects sample points at random from the entire population, a stratified random sample selects sample points at random from the population within mutually exclusive groups called strata. In this analysis, the reported kWh savings was used as the stratification variable. As long as the stratification variable is correlated with the variable of interest, in this case the final verified savings that is not yet known, then using a stratified design increases the precision of the estimates holding sample size constant, or decreases sample size holding precision constant.

The first step was to specify the sample frame, which consisted of the 555 projects in program year 2014. The next step was to determine the stratification variable and number of strata. The magnitude of kWh savings was used for stratification resulting in 4 strata for the original sample design: 1) low savings; 2) medium savings; 3) high savings; and 4) highest savings (which was a census stratum comprising the three

projects with highest kWh savings). The Delanius-Hodges method was applied to determine the stratum boundaries. Sample sizes by stratum were calculated using a Neyman Allocation, which assigns sampling points to each stratum based on a combination of the weights and standard deviation for each stratum. Finally, sample points were randomly selected for Strata 1, 2 and 3 (Strata 4 was a census strata with all projects included).

During the data collection process, AEG requested project files by customer ID number. Several customers in the sample had more than one project. AEG reviewed all projects for those customers and placed the additional projects in a fifth census stratum called "additional projects." In addition, one extra project file was inadvertently provided to AEG. AEG reviewed that file as well and grouped the findings in the additional projects stratum. Adding these projects as part of the random sample could introduce bias, since they were not part of the original sample selected and would not necessarily be representative of other projects. However, rather than discarding the results, we included them as another census stratum, where each of these additional projects represents only themselves, thereby eliminating the bias from including them. This served to increase the overall precision of the results slightly with minimal incremental effort.

The sample for the Home Improvement review consisted of 30 projects from the original sample selection process plus the six additional projects. Therefore, 36 of the 555 projects were reviewed (Table 2-2).

Table 2-1 Home Improvement Program Sample Design

Stratum	Reported Savings (kWh/yr)	# in Population	# in Sample
1. Low Savings	<1100	251	7
2. Medium Savings	≥1100 and <2400	201	9
3. High Savings	≥2400 and <7000	94	11
4. Highest Savings (Census)	≥7000	3	3
5. Additional Projects (Census)	NA	6	6
	Total	**555**	**36**

Detailed documentation (rebate applications, invoices, etc.) for each project in the sample was reviewed. Any adjustments needed based on this documentation review would result in an overall adjustment to the savings, along with associated sampling error. The resulting savings are referred to here as "verified savings."

Estimating Total Program Impacts

AEG expanded the verified savings results from the sample to estimate the savings for the population of projects in program year 2014 using a combined ratio estimate according to the steps below.

1. Calculated the per-project average replicated savings (from the first engineering review step) by stratum for the sample. Calculated the per-

project average verified savings (second engineering review step) by stratum for the sample.

2. Calculated a weighted average replicated savings and a weighted average verified savings for 2014 using weights that reflect the proportion of projects in each stratum in the population.
3. Calculated the ratio of the sample verified weighted average for 2014 to the sample replicated weighted average.
4. Applied this combined ratio to the program's total replicated population savings to estimate the evaluated gross savings for the program in 2014.
5. Determined the overall realization rate for the 2014 program by dividing the estimated evaluated gross savings from step 4 by the reported population savings.

The combined ratio estimate results in a more precise estimate of savings because it leverages the correlation between the replicated savings, known for all customers, and the verified savings, known only for the sample.

Non-Electric Benefits

IPC did not claim non-electric benefits (NEBs) for the Home Improvement program in 2014. The RTF workbook used by IPC for 2014 savings is version 2.5. That version does not include NEBs. NEBs are calculated only in v3.0 and later, and these are heavily dependent on the savings analysis methodology that changed significantly since v2.5. Therefore, AEG used the latest RTF workbook (version 3.3) to estimate non-electric benefits associated with supplemental non-electric heating energy use. To make those estimates, electric energy savings were calculated using the version 3.3 workbook because the non-electric benefits are based on the version 3.3 electric savings. Since it is not appropriate to use the version 3.3 non-electric benefits in the evaluated impacts without also using the version 3.3 electric savings, AEG only provides the version 3.3 electric savings and non-electric benefits to IPC for comparison with the electric-only savings from version 2.5. The non-electric benefits are not included in our final evaluated impacts.

Process Evaluation Findings

The process evaluation for the Home Improvement program focused on conducting interviews with program staff and participating contractors and reviewing program processes to assess the program operations, quality control, staffing, and outreach. The evaluation also included secondary research to determine if the program is currently using established best practices prevalent in the industry. The process evaluation found that customers and contractors are very satisfied with the program, the marketing is very effective, but the target market of eligible customers is small and often hard to reach.

3.1 Program Staff Interview

AEG conducted an in-depth interview with the program specialist for the Home Improvement program. The following are some of the key points from the interview.

Program Design and Operations

- Although the program has consistently met its goals, it is currently running a little behind in program year 2015.
- According to the program specialist, the biggest challenge for the program is "beating the bushes" to find the all-electric customers and make them aware of the program and its benefits. Most IPC customers are not eligible for the program because they have natural gas heat.
- There are 18 participating insulation contractors and 115 participating window contractors in the program.

Marketing and Outreach

- An algorithm is used to identify IPC customers who are likely to have electric heat. These customers are targeted through direct mail.
- Customers who participate in the audit program and have electric heat are also the target market for the program.
- Marketing for the program includes bill inserts, Facebook ads, direct mail letters and ads in rural newspapers where residents are more likely to have electric heat.

Program Staffing

- The program specialist is responsible for all aspects of administering the program. The program takes about 80% of her time.
- The program specialist has an internal marketing partner who helps with the marketing of the program.

Customer Satisfaction

- The QA contractor asks customers about satisfaction with the program and the results have consistently been positive.
- According to the program specialist, customers are generally happy with the energy savings and the improved comfort achieved from the increased insulation.

3.2 Program Processes

The program is delivered by the participating contractors. In order to participate in the program, contractors are required to attend a two-day training. Participating contractors are listed on the company website.

Customers interested in participating in the program call one or more participating contractors. The contractor determines if the customer qualifies for the program and provides them with a bid. The program application must be sent to IPC within 90 days of installation. Rebate checks are required to be mailed within 6-8 weeks of receipt of application.

Quality Assurance/Quality Control

For quality assurance/control, IPC works with two independent contractors to do inspections. The QA/QC plan requires contractors to inspect 5% of all projects completed. The participants to be inspected are randomly selected by the QA/QC contractor. During the visit, the inspectors measure the insulation installed to make sure it matches the contractor's invoice, verify that the windows are installed correctly and the window measurements match the invoice, and ask the participants some customer satisfaction questions.

3.3 Program Marketing

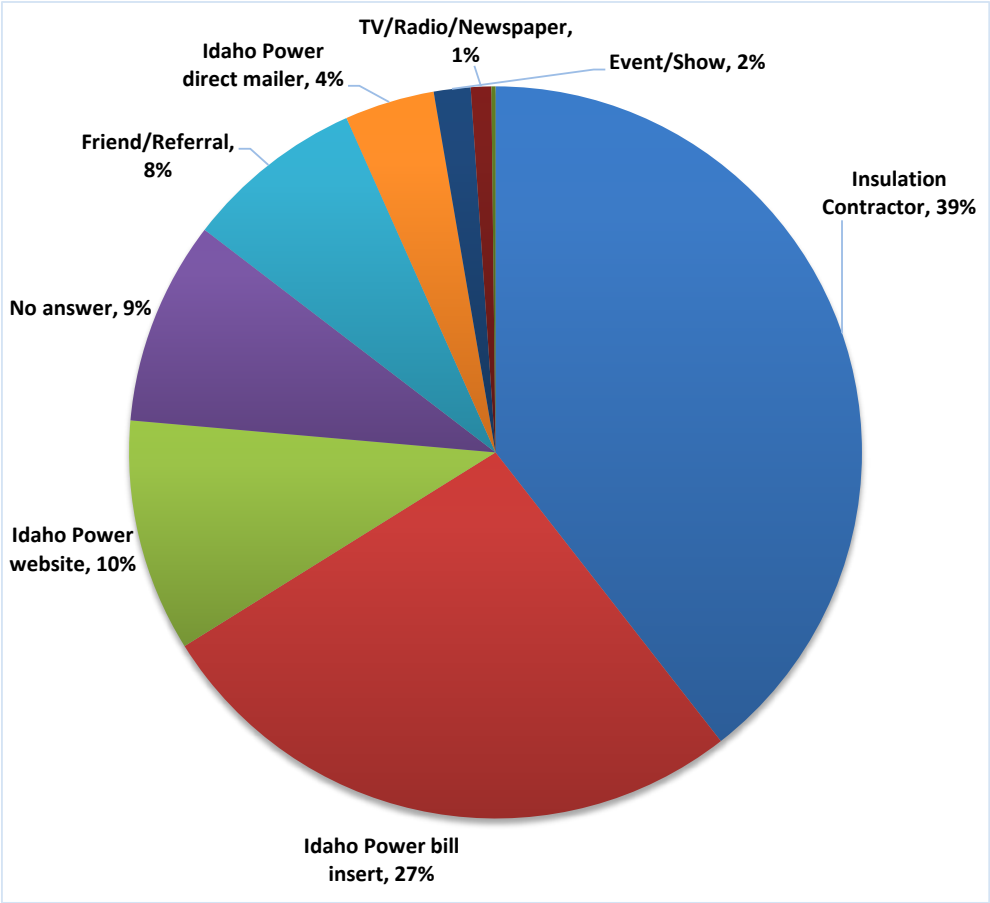
Table 3-1 shows the marketing methods used in 2014 to promote the Home Improvement program.

Table 3-1 Marketing Methods Used in 2014

Method	Date
Bill insert	Jan, Apr, Sep
Print ads in select rural newspapers	Feb, May, Oct
Direct mail letter	Feb, Sep
Facebook ads	Jun - Aug
Ad network digital ads	Mar – May
Social media	Ongoing

Source: 2014 HIP Marketing Plan

During installation, participating customers were asked how they heard about the program. This information is stored in the program tracking database. In 2014, insulation contractors and bill inserts were the most frequently mentioned ways customers reported hearing about the program (Figure 3-1).



Source: 2014 HIP Marketing Plan

Figure 3-1 How Participants Heard about the Home Improvement Program

IPC also implemented a new contractor portal in 2014 where the participating contractors can download artwork for advertising – this was designed to make it easy for contractors to customize advertising about the program.

3.4 Participating Contractor Interviews

During August and September 2015, AEG conducted in-depth interviews with 8 participating contractors in IPC's Home Improvement Program: 5 insulation contractors and 3 window contractors. (See Appendices for the interview guide.) The main objectives of the interviews were to qualitatively assess the contractors' skills and knowledge related to the program, gauge the use of IPC's contractor

portal, identify any barriers to program participation, assess customer satisfaction, and identify any strategies to improve the program.

Contractors' Skills and Knowledge

Most contractors feel they are knowledgeable about the program and are able to explain the benefits to customers. No contractors reported any problems with employee turnover or getting new employees trained on the program.

> *"The program is very easy to explain to customers, especially those with electric heat."*
>
> *"One of the services my company offers is to explain all the program details to customers. Our first question is -- what is their heat source? If they say electric we tell them about IPC."*

One contractor said he had a very large project and the IPC program specialist sent a person on-site to train the seven person crew.

IPC's Contractor Portal

Most contractors are not aware of the portal or do not use it. One contractor said he had no need to advertise. Another contractor said that IPC sends him boxes of marketing materials whenever he runs low and therefore has no need for the portal.

One contractor said that when he went to the website it said he could not use the IPC logo. The materials available through the portal were not useful to him without the IPC logo.

Program Participation

Contractors say customers experience substantial savings from participating in the program. The feedback they get from customers about the program and the measures is positive.

> *"It's a great program. Customers love it. Contractors love it."*

Contractors say awareness of the program is split. Some customers come to them asking about the program, while in other instances the contractor informs customers that they might be eligible for rebates. One contractor said about 40% of the customers who are eligible for the program were not aware before he told them. Another contractor said that most customers come to him asking about the program.

> *"They've got a great marketing campaign. I see it on Facebook, radio and TV. They do a great job. A lot of our calls come from bill stuffers. They are doing a good job getting the word out."*

Contractors generally complete the paperwork for the customers. Contractors described the process as straightforward and easy.

Contractors were very positive about their interaction with the program specialist. They said she is knowledgeable and able to answer any questions that they have.

> *"I do interact with Becky regularly. She is very helpful. Does a great job."*

Contractors believe the rebate is very influential in convincing all-electric customers to add insulation. Some contractors are able to convince customers to add wall or floor insulation when they come in asking about increasing insulation in their attic. The rebate is very helpful in up selling these customers.

> *"80% of people add floor insulation to the job. It's a decent incentive."*
>
> *"The rebate makes the sale so easy for all-electric homes. All bids are basically the same. The IPC rebate gives us an edge."*

The existing insulation levels and electric-heat only requirements are seen as unnecessarily strict by some contractors. Other, savvier contractors understand that cost effectiveness is an issue with rebate programs.

> *"The program is too narrow. R19 or less really cuts the amount of people that are eligible. Homes that were built in the 70's – 40 years ago – you put in at least an R30. I can't believe that anyone would put in less than that. When I first started doing this R30 was the standard for the attic. R19 is not something you see very often."*
>
> *"It's hard to explain to gas customers why they don't qualify. I wish they could qualify if they have AC."*
>
> *"I would love it if they would allow existing insulation levels of R25 or R26, but I know they have to deal with cost effectiveness."*

Window contractors appreciated the fact that sliding glass doors are eligible[1] and that customers don't have to do all their windows at once. They can spread the upgrades out over several years.

Suggestions for Improvement

Most of the suggestions for improvement centered on expanding the program and increasing marketing. Specific suggestions included the following:

- Expand the program to make customers with higher existing insulation levels and/or central air conditioning eligible.
- Increase marketing. The marketing that IPC does is effective but there are still customers who are not aware of the program and the benefits.
- Provide contractors with lists of customers who have all-electric homes so they could market directly to them.

Summary

The following conclusions can be drawn from the information gained in the contractor interviews:

[1] Sliding glass doors are allowed by the program, but are not individually specified on the program application form.

- Satisfaction with the program is high. The contractors interviewed and the customers they serve are very satisfied with the program, the program specialist, and the measures installed.
- The limited target market is a barrier to program participation. Given the all-electric and existing insulation requirements, only a small percentage of customers are eligible to participate.
- Marketing is very effective and should be increased if possible.
- The contractor portal is not being used by the contractors interviewed.
- The incentive is very helpful in influencing people to add insulation. It also makes it easier to up sell customers who are interested in attic insulation to also add floor and/or wall insulation.

3.5 Best Practices

AEG conducted a literature review of industry publications to identify an appropriate set of best practices to compare with the Home Improvement program. AEG reviewed the following sources to create a list of best practices/innovations in the industry:

- Publicly available best practices reports
- Conference papers and presentation
- Evaluations of other weatherization programs

Table 3-2 below shows each best practice/ innovation and whether IPC currently uses the practice. In all cases, either IPC is already doing the best practice, or it relates to something that is covered by a different IPC program.

Table 3-2 Best Practices/Innovation for Weatherization Programs

Best Practice/Innovation	Home Improvement Program	
	Standard Practice?	Explanation
Emphasize non-energy benefits such as improved comfort and home improvement	✓	Improved comfort emphasized in promotional ads
Conduct tests to pinpoint where homes are losing energy	X	Not required; likely covered in IPC's audit program
Cross promote with HVAC rebate programs	✓	Cross promotion with heat pumps listed in marketing plan
Cross promote with audit programs	✓	Project specialist says she uses audit participants as one of the target markets
Develop a network of local installers	✓	Participating contractors deliver the program
Provide contractor training	✓	2-day training required
Require third party verification of installations	✓	Verification of 5% of projects conducted by third party
Process rebates in 8 weeks or less	✓	Rebate check required to be sent within 6-8 weeks. Most actually sent in less than 2 weeks.
Emphasize affordability of measures	✓	Cited as a strength in the marketing plan

Impact Evaluation Findings

The impact evaluation for the Home Improvement program consisted of a detailed engineering review that included a two-step process: a savings replication and a documentation review.

4.1 Engineering Review

The Home Improvement Program used Version 2.5 of the RTF Single Family Weatherization Unit Energy Saving (UES) workbook that was specifically developed with separate cooling zones for Idaho Power for deemed savings in program year 2014. This version was provided as a program specific measure workbook by the RTF on December 31, 2011 and was used by AEG for savings replication in this evaluation. This RTF UES workbook provides annual heating and cooling energy savings per square foot of installed measure for multiple types of weatherization measures, multiple levels of upgrade, multiple heating and cooling zone combinations, and multiple heating systems. Cooling savings were only reported for those homes that had a central AC or heat pump system. Of the measures covered by the RTF UES workbook, wall insulation, attic insulation, floor insulation, and window upgrades were among the measures installed in the Home Improvement Program. During the savings replication effort, all deemed savings from the RTF were rounded to two decimal points for significant figure consistency with the IPC analysis. Every record in the database was checked and savings were replicated.

The AEG-replicated energy savings for this program were 839,124 kWh/yr. The realization rate was 100.02%, and the replicated energy savings exceeded the reported savings by 195 kWh/year. There were a number of minor discrepancies found through the tracking database review and replication effort. The most significant discrepancy was found for wall insulation in HZ1 with zonal heat; the RTF deemed heating savings for this measure were 1.60 kWh/square foot (sqft), while the HIP savings logic file provided by IPC reported savings of 1.56 kWh/sqft. This discrepancy was found in 13 measures and accounted for a total difference of 284.8 kWh/year between the reported and replicated savings for these measures. Other small discrepancies included floor insulation (R-0 to R-30) with an electric furnace heating system in HZ2/CZ3 and attic insulation (R-19 to R-49) with an electric furnace heating system in HZ1/CZ3. These were due to 0.01 kWh/sqft differences in deemed savings values between the RTF deemed values and the reported IPC values, most likely attributable to rounding error. The following table is the replication summary for measures in the 2014 Home Improvement Program.

Table 4-1 Replication Summary for IPC PY 2014 Home Improvement Program

Measure	Count	Reported Savings (kWh/yr)	Replicated Savings (kWh/yr)
Attic Insulation	133	179,877	179,633
Floor Insulation	64	88,755	88,823
Wall Insulation	29	32,386	32,670
Window Replacement	329	537,912	537,998
Total	**555**	**838,929**	**839,124**

For step two of the engineering review, AEG reviewed a statistically representative sample of 36 out of 555 total projects through the Home Improvement Program. Customer background documents (invoices and rebate forms) were requested from IPC and reviewed. The "per-sqft" heating and cooling savings for these projects are deemed by the RTF on a climate zone basis in the UES workbook v2_5.

AEG verified that each customer address and ZIP code matched the appropriate climate zone and checked that variables such as heating and cooling type, square footage of the measure in question, baseline weatherization level, and proposed weatherization level were reported and used correctly in the IPC tracking database. The Heating Zone/Cooling Zone (HZ/CZ) match was checked for each site with ZIP codes and counties in the "ZoneLookup" sheet of the "IPC home improvement savings logic.xlsx" workbook provided by IPC as well as the "PNWClimateZones.xlsx" workbook from the RTF. No issues with the climate zone assignments were found in the sample. AEG found the following issues in the sample through the documentation review:

- Four instances where the reported HVAC system type had to be changed based on evidence in the submitted documentation;
- Two instances where the reported window area had to be changed based on evidence in the submitted documentation;
- One instance where the final R-value had to be changed based on evidence in the submitted documentation;
- Two instances where the HVAC system type was not reported or unclear in the documentation;
- Three instances where the home in question was a multifamily apartment;
- One instance where the home in question was a manufactured home;
- Two instances where the final wall insulation level was much greater than the R-11 level specified by the RTF;
- Two instances where the existing window type was not provided in the documentation.

Table 4-2 shows the results of the document review by project.

Table 4-2 Project Level Results of HIP Document Review

Site ID	Sample Point	Stratum	# of Projects	Reported Savings (kWh/yr)	Replicated Savings (kWh/yr)	Verified Savings (kWh/yr)	Realization Rate (%)
10730	1	1	1	933.6	933.6	933.6	100.0%
11047	2	1	1	313.5	313.5	313.5	100.0%
10847	3	1	1	252.7	252.7	252.7	100.0%
	Add'l Census	5	2	3,886.3	3,886.3	3,886.3	100.0%
11110	4	1	1	292.1	292.1	292.1	100.0%
	Add'l Census	5	1	614.64	630.4	630.4	102.6%
10942	5	1	1	432.8	432.8	432.8	100.0%
10934	6	1	1	432.8	432.8	432.8	100.0%
11118	7	1	1	231.0	231.0	231.0	100.0%
	Add'l Census	5	1	1,110.7	1,139.2	1,139.2	102.6%
11144	8	2	1	1,674.0	1,676.8	1,676.8	100.2%
10701	9	2	1	2,278.0	2,278.0	2,278.0	100.0%
11077	10	2	1	1,926.0	1,929.2	2,253.8	117.0%
10806	11	2	1	1,120.1	1,121.8	792.3	70.7%
10759	12	2	1	1,420.8	1,420.8	1,142.4	80.4%
10666	13	2	1	1,584	1,584	1,392	87.9%
10793	14	2	1	1,796.8	1,796.8	1,796.8	100.0%
	Add'l Census	5	1	209.04	214.4	214.4	102.6%
11059	15	2	1	1,626.3	1,626.3	1,626.3	100.0%
10867	16	2	1	1,690.6	1,690.6	1,690.6	100.0%
11171	17	3	1	2,515.9	2,515.9	2,867.0	114.0%
10842	18	3	1	4,445.2	4,445.2	4,445.2	100.0%
10801	19	3	1	2,907.7	2,907.7	4,601.9	158.3%
11061	20	3	1	2,910	2,925	2,925	100.5%
11096	21	3	1	2,524.0	2,524.0	2,524.0	100.0%
10989	22	3	1	2,870.3	2,870.3	2,870.3	100.0%
10981	23	3	1	4,523.5	4,523.5	4,523.5	100.0%
10854	24	3	1	6,121.6	6,121.6	6,121.6	100.0%
10727	25	3	1	2,641.7	2,643.4	2,643.4	100.1%
11135	26	3	1	4,087.2	4,093.4	4,093.4	100.2%
10902	27	3	1	4,241.2	4,234.7	4,234.7	99.8%
10869	28	4	1	7,330.4	7,319.2	7,293.1	99.5%
10692	29	4	1	8,450.2	8,450.2	7,396.6	87.5%
11153	30	4	1	10,795.0	10,795.0	10,795.0	100.0%
10728	Add'l Census	5	1	198.5	198.6	198.6	100.1%

4.2 Non-Electric Benefits

AEG analyzed the "SFWx_v3_3.xlsm" (Version 3.3) UES workbook to determine the latest savings values for the measures and evaluate Non-Electric Benefits (NEBs) for the program. Since this UES workbook did not separate cooling savings by cooling zone, AEG accessed the cooling zone-specific savings from the "SEEM_SingleFamilyExistingHVACandWeatherization_May2015.xlsm" (SEEM) file available on the RTF website. The cooling savings in the SEEM file were weighted by central air conditioning and room air conditioning saturation values from a Northwest Power Conservation Council forecast of Residential Building Stock Assessment (RBSA) data. Central air conditioning savings were assumed by the RTF to be identical to heat pump cooling savings, while zonal cooling system savings were assumed to be 50% of the heat pump cooling savings based on RTF best judgment. AEG separated the cooling savings by "Central Cooling", "Zonal Cooling", and "Unknown" system savings. The savings per cooling zone were then applied to each corresponding measure in each heating zone to result in unique HZ/CZ mappings with heating systems and three different types of cooling savings. While for 2014, the Home Improvement Program only included cooling savings for homes with central cooling systems, AEG also applied "Zonal Cooling" system savings from Version 3.3 for homes with room air conditioning and evaporative coolers and applied "Unknown" system savings to projects that had blank or "Other" entries for the cooling system in the tracking database[2]. Non-Electric Benefits (NEBs) were also evaluated based on the RTF Phase II Non-Electric Heat Adjustment in the SEEM file and the Idaho Wood Fuel Credit of $0.078/kWh (2006 dollars) from the RTF Standard Information Workbook v2.2; the NEB was then converted to 2014 dollars[3].

Table 4-3 Home Improvement Program Non-Electric Benefits (using Workbook v3.3)

Measure	Count	Reported Savings (kWh/yr)	Savings Replicated with v2.5 (kWh/yr)	Savings Replicated with v3.3 (kWh/yr)	Non-Electric Benefits with v3.3 ($2014)
Attic Insulation	133	179,877	179,633	106,035	$1,354.28
Floor Insulation	64	88,755	88,823	45,726	$739.68
Wall Insulation	29	32,386	32,670	32,179	$474.87
Window Replacement	329	537,912	537,998	235,677	$2,910.53
Total	**555**	**838,929**	**839,124**	**419,618**	**$5,479.36**

[2] Two attic insulation projects that were reported as R-0 to R-19 upgrades had to be evaluated with savings for the R-0 to R-38 upgrade because the current version of the workbook does not include R-19 as an efficient case for attic insulation level.
[3] This wood fuel credit is lower than the regional average of $0.081/kWh as listed in the RTF Standard Information Workbook

4.3 Results

Table 4-3 shows the results of the impact analysis. The program saved 845,085 kWh in 2014 with a realization rate of 100.7%. The evaluated savings relative precision is 3.63% at the 90% confidence interval.

Table 4-4 Home Improvement Program Impact Evaluation Results

Reported Savings (kWh/yr)	Replicated Savings (kWh/yr)	Combined Ratio	Evaluated Savings* (kWh/yr)	Realization Rate** (%)
838,929	839,124	1.007	845,085	100.7%

*Evaluated savings equal replicated savings multiplied by combined ratio
**Ratio of evaluated savings to reported savings, expressed as a percentage

CHAPTER | 5

Conclusions and Recommendations

The results of the impact analysis show that the Home Improvement program saved 845,085 kWh in 2014, more than doubling its goal, with a realization rate of 100.7%.

Table 5-1 Home Improvement Program Results

Metric	Program Goal	Reported	AEG-Evaluated	Overall Realization Rate
Annual Energy Savings (kWh)	370,000	838,929	845,085	100.7%

Other key findings from the process and impact evaluations include:

- Participants are satisfied with the program, the savings achieved and the improved comfort of their homes.
- The network of installation contractors are engaged in the program.
- The target market is small and eligibility criteria (e.g., existing insulation levels) is strict, which may make achieving future participation and savings goals more challenging, although this has not been a problem to date.
- Marketing is effective and most contractors would like to see these efforts increased.

Recommendations

Based on this evaluation, the following recommendations should be considered to enhance program effectiveness and improve the transparency and accuracy of reported savings:

- Increase consistency/clarity between supporting documentation and the program database. Require more standardized documentation to prevent errors in the estimations of savings. More consistent documentation should be required in the project application and submitted materials to clearly identify all variables necessary for the calculation of savings. The submitted documentation was often disorganized and sometimes incomplete. Recently IPC improved their application, adding a checklist for customers on the application itemizing the documentation required. IPC should have a standardized documentation package for each project that includes a similar

checklist completed by IPC that verifies that all required information has been submitted. The information should then be carefully and completely input in the tracking database.

➔ **Rationale:** Helps ensure the correct variables are used to look up deemed savings, which ensures more defensible results and a more accurate impact analysis.

- Use the current versions of the RTF UES workbooks to discern between different residential segments, to estimate NEBs, and to improve the overall accuracy of impact estimates. The project application discerns between standard single family, manufactured, and multifamily homes. These entries should be emphasized, recorded in the tracking database, and used to determine the correct savings for the respective residential building segment. In addition, adopting the current versions of the Single Family and Manufactured Home Weatherization workbooks would allow IPC to estimate NEBs for the Home Improvement program[4].

  ➔ **Rationale:** Although the energy savings associated with the Single Family Version 3.3 weatherization workbook are smaller than those associated with Version 2.5, the impacts in Version 3.3 are more accurate and defensible than those in Version 2.5. The current weatherization workbook represents RTF's best estimate of savings, uses "Option 3" to take measure interactions into account, and uses two phases of calibration to more accurately represent savings for homes in the Pacific Northwest and incorporate non-electric benefits. One shortcoming, however, is that the UES workbooks do not separate savings by cooling zone. These savings can be separated by cooling zone using data from the underlying SEEM model workbook, as RTF has previously done for IPC in Version 2.5 and AEG has demonstrated for Version 3.3.

- Add sliding doors to measure description on the application. Since sliding glass doors are specifically included in the RTF UES workbook for the window upgrade weatherization measures, "sliding glass doors" should be also included in the measure description in the project application.

  ➔ **Rationale**: Avoids confusion during evaluation.

- Require that contractors match U-factors (taken from the NFRC window stickers) to each window on the invoice. Since the RTF only prescribes

[4] AEG acknowledges that the UES workbook for multifamily weatherization is currently out of compliance with a sunset date of 12/31/2015, and that the newly approved UES workbook for manufactured homes has not been QCed as of the date of this report. However, AEG encourages IPC to differentiate between residential building segments for the Home Improvement Program.

savings for U-30 and U-22 window upgrades, consider a cutoff (e.g. U-25) where windows with lower than U-25 would be evaluated with savings for U-22 window upgrades. This would require calculating an average U-value weighted by window area.

➔ **Rationale:** Though window upgrade savings were evaluated with a final rating of U-30, many of the projects had installed windows with U-factors below 0.30. Making this change would result in more accurate savings estimates.

- Increase marketing. Or if that's not possible due to cost effectiveness issues, focus marketing dollars on the more proven strategies: contractor outreach and bill inserts.

  ➔ **Rationale:** These two methods were cited by 2/3 of participants when asked how they heard about the program. Contractors said marketing is effective and would like to see more.

Program Staff and Implementation Contractor Interview Guides

Program Manager Interview Guide – Final –IPC Residential

NAME

TITLE

PROGRAM

DATE

PHONE

EMAIL

INTERVIEWER

SUMMARY OF FINDINGS

[Once the interview is complete, please complete interview notes within this document. First, provide a high-level summary of findings below. Then, within each section summarize the findings.]

[Some of the answers to these questions will be filled in prior to the interview, based on information learned during the kick off meeting in Boise on June 8, 2015]

BACKGROUND

1. Please provide a brief description of the programs you are directly responsible for?
2. Please describe your job responsibilities related to the program.
3. How long have you been responsible for administration of this program?
4. On average, what percent of your time is spent on the program you are directly responsible for?
5. What other staff work on the program? What is their role regarding the program (i.e. what are the responsible for with regard to the program)? Who, if anyone, provides you with support? What support do they provide?

PROGRAM GOALS

6. What metrics are used to track the success of the program? (Probe for electric savings, participation rates, number of units)?
7. How are goals for this program established?

8. Did the program meet its goals in 2014? If not, what kept the program from meeting its goals?

9. Has the program met its annual goals in previous years? Is it on track to meet its goals for 2015?

PROGRAM IMPLEMENTATION AND MARKETING

10. Do you work with an implementation contractor or trade allies to help deliver the program? Who is/are the implementation contractor and/or trade allies you work with on this program? Do you have any issues or concerns about the implementation contractor or trade allies? If yes, what are your concerns?

11. What is the target market for the program? How are potential customers identified?

12. What are the main barriers to participation? How does the program address these barriers?

13. What has been done to market the program? How successful have these strategies been? Are some marketing strategies or messages more beneficial than others? How is success of the marketing strategies or messages measured?

PROGRAM OPERATIONS

14. What are the participation steps from the customers' perspective? Have these changed over time? If so, why were they changed?

15. Are there any specific aspects of the program that are working very well? Any not working well? (Probe for details) What could be done to improve?

16. What quality control/quality assurance procedures are in place? Are these documented? Is any verification done? What does this entail? Who does the verification?

17. Do the incentive levels seem appropriate? If not, why not? What, if any, changes in the incentive levels do you think may be needed?

18. What is your opinion of free ridership for this program? Meaning do you think customers would pay for the measures on their own, outside of the program. Why do you say that?

19. Do you think the program is changing customers' energy efficiency attitudes and actions? (Probe for specifics)

20. Are customers satisfied with the program overall? With the measures installed? Are they satisfied with the incentive amount? With the savings achieved? How is satisfaction with the program measured? (i.e. is this based on survey information or is it anecdotal?)

PROGRAM IMPACTS

21. Deemed savings from the RTF are used to determine program impacts – correct? Do you know what version of the RTF workbook you are using? If no, who should I ask for that information?

22. We plan to do a review of detailed project documentation for a sample of participants, including cross-checking the project documentation with the tracking spreadsheets. What is the best way to get this data in an electronic form? How is it currently stored?

PROGRAM DATA AND DOCUMENTATION

23. Does the tracking database collect all the information you need? Is there information/data that you wish were available but are not? Is there information in the database that you don't use?

24. What type of documentation is required to support the purchase and installation of the measure?

EVALUATION

25. What do you hope to learn from this evaluation? Are there specific issues you would like the evaluation to address?

Contractor Interview Guide – FINAL–IPC Home Improvement Program

NAME

TITLE

COMPANY

DATE

PHONE

EMAIL

INTERVIEWER

SUMMARY OF FINDINGS

[Once the interview is complete, please complete interview notes within this document. First, provide a high-level summary of findings below. Then, within each section summarize the findings.]

INTRODUCTION

Hi, my name is ___ and I am calling from Applied Energy Group on behalf of Idaho Power Company. We are working with Idaho Power to evaluate their Home Improvement Program. I'm calling to ask you a few questions about your participation as a contractor in that program to help determine what is working and what might be improved. Are you familiar with your company's participation in the program? If not, who would be the best person to speak with at your company about this subject?

All of your answers will be confidential. For our analysis your responses will be anonymously aggregated with those from other companies that participated in the program.

[IF THEY DON'T WANT TO TALK NOW, TRY TO GET A GOOD TIME TO CALL THEM BACK.]

[IF RESPONDENT PROPOSES AN ALTERNATE CONTACT, OBTAIN NAME, BEST NUMBER AT WHICH TO REACH THE CONTACT, AND ANY INFO REGARDING BEST TIME TO CALL]

[IF THEY HAVE QUESTIONS ABOUT OUR LEGITIMACY, THEY CAN CONTACT:]

Gary Grayson at 208-388-2395

[NOTE THAT BECKY ARTE HOWELL IS THE PROGRAM SPECIALIST AND SHE IS THE PERSON THEY ARE MOST FAMILIAR WITH. GARY IS THE MANAGER IN CHARGE OF EVALUATIONS]

[IF THEY ASK ABOUT TIME LENGTH OF SURVEY, SAY BETWEEN 15 AND 30__ MINUTES]

[IF THEY AGREE TO TALK SAY: THANKS FOR TAKING THE TIME TO SPEAK WITH US. LET'S GET STARTED.]

ABOUT THE CONTRACTOR

Let me start by getting a little information about you and your company.

1. What is your job title or role?

2. What are your company's main products and/or services?

3. When did your company begin participating in IPC's Home Improvement program?

4. Why did you or your company decide to participate in the program?

5. What percentage of your business comes from projects through the program? Have all these projects completed in 2014 received a rebate from Idaho Power? [IF NO] Why not?

In 2014? _____% 999. DK

7. Do you expect that percentage to grow, stay the same or decrease in the next 2 years (2015 2016)?

CONTRACTOR SKILLS AND KNOWLEDGE

8. How many employees at your company have been trained/ are knowledgeable about the Home Improvement program?

9. Is the number of employees you have trained enough to meet your customer demand for insulation/windows? If you had more employees knowledgeable about the Idaho Power program would you be able to complete more projects?

10. How well would you say you and your employees understand and are able to communicate the benefits of increased insulation/window upgrades? If don't understand well, what additional knowledge/training is needed?

11. Do you feel the customers understand the benefits of the measures you installed? If not, what was not clear?

12. Did customers adequately understand the Idaho Power program eligibility requirements, enrollment process, and the amount of the incentive? If not, what was not clear?

PROGRAM PARTICIPATION

13. Please describe your company's process for marketing to customers. Do you tell your customers about the IPC program? Or do they typically come to you requesting the rebate?

14. Do you think eligible customers (those with electric zonal heat) are generally aware of the program? If not, what else could be done to inform eligible customers about the program?

15. If anything, what things about the program make it difficult for customers to participate (e.g., paperwork, measures, incentives too low, etc.)?

16. Have you received any complaints from customers who feel the measures don't meet their expectations? [IF YES] What specifically were they disappointed in? How did you address their concerns?

17. How influential was the Idaho Power program manager in your decision to participate? How helpful is the program manager if you have questions or concerns? Does having access to a knowledgeable program manager increase the value of your participation in the program?

18. Does the program make it easier for you to sell projects and/or identify prospects?

19. Do you use Idaho Power's contractor portal to access marketing materials?

    a. [IF NO] Why not? How could it be made more valuable/useful to you?

    b. [IF YES] Has it been helpful to your business? Are you satisfied with the materials available through the portal?

20. What, if anything, do you think is particularly good about the IPC program?

21. Do you have any suggestions for improvement to the program?

PROGRAM EFFECTIVENESS

22. What are the benefits to your company to participate in the program? Do you think the program helps your business? Does it give you a competitive advantage over other contractors in your area? [Probe for reasons?]

24. Is there anything else Idaho Power could do to help you increase the number of projects in their service territory?

CONCLUSION

25. Is there anything else that you think Idaho Power should think about as they continue to offer and improve this program?

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Impact and Process Evaluation of Idaho Power's See Ya Later, Refrigerator Program

Final Report

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Executive Summary

Idaho Power's See Ya Later, Refrigerator® program acquires energy savings through the removal of qualified refrigerators and stand-alone freezers in residential homes throughout Idaho Power's service area. The goal of the program is to reduce the number of old, inefficient refrigerators and freezers that customers have moved to their garages or other locations such as basements and patios. The program makes a concerted effort to maximize savings by focusing on secondary/spare units and minimizing free riders (customers who will replace the unit with another, or would have removed the unit anyway through another service).

Idaho Power Company (IPC) contracted with Applied Energy Group (AEG) to conduct a process evaluation of the See Ya Later, Refrigerator program and an impact evaluation for program year 2014.

Conclusions

The results of the impact analysis show that the See Ya Later, Refrigerator program surpassed its goals, achieving 1,390,760 kWh in savings in 2014 with a 100% realization rate.

Table ES-1 See Ya Later, Refrigerator 2014 ResultsMetric	Program Goal	Reported	Realization Rate	AEG-Evaluated	Non-Electric Benefits
Annual Energy Savings (kWh)	837,000	1,390,760	100%	1,390,760	$137,560.39

Other key findings from the process and impact evaluations include:

- The program is very well run and complies with most of the best practices in the industry.
- The program has adequate staffing and a very competent and engaged implementation contractor.
- The program has high customer satisfaction.
- The program has the necessary quality control procedures in place and is extremely well documented.
- The wealth of data captured by the program is exemplary and is analyzed by IPC staff to continuously provide insight and improve the program.

Recommendations

Based on this evaluation, the following recommendations should be considered to enhance program effectiveness and improve the transparency of reported savings:

- If no savings are associated with a measure, explain why in the program tracking database.
- Decrease the time between scheduling and pick up to 7 days or less.
- Experiment with different promotional offerings to see if they increase program participation. An example would be to offer an incentive for a limited time (e.g., one month) for secondary refrigerators only.
- Use the updated RTF workbook (v.3.2) in the future and include non-electric benefits in the cost effectiveness analysis.

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Introduction

1.1 Program Description

Idaho Power's See Ya Later, Refrigerator® program acquires energy savings through the removal of qualified refrigerators and stand-alone freezers in residential homes throughout Idaho Power's service area. The goal of the program is to reduce the number of old, inefficient refrigerators and freezers that customers have moved to their garages or other locations such as basements and patios. The program makes a concerted effort to maximize savings by focusing on secondary/spare units and minimizing free riders (customers who will replace the unit with another, or would have removed the unit anyway through another service).

IPC contracts with JACO Environmental (JACO) to provide turnkey services for the See Ya Later, Refrigerator program including customer service and scheduling, unit pickup, unit recycling, reporting, marketing assistance, and incentive payments. Marketing assistance is provided by JACO, through Runyon Saltzman Einhorn, a marketing company that assists utility appliance recycling programs throughout the country. IPC provides participant confirmation, additional marketing, and internal program administration.

In 2014, the See Ya Later, Refrigerator program reported 1,391 MWh of savings by recycling 3,194 refrigerators/freezers (Table 1-1), exceeding the program goals by over 50%.

Table 1-1 See Ya Later, Refrigerator Program Reported Savings vs. 2014 Goals

Year		Units	MWh Savings
PY2014	IPC Goals	2,100	837
	IPC-Reported	3,194	1,391
Percent of IPC-Reported to Goals		**152%**	**166%**

1.2 Purpose of the Evaluation

Idaho Power Company (IPC) contracted with Applied Energy Group (AEG) to conduct a process evaluation of the See Ya Later, Refrigerator program and an impact evaluation for program year 2014. The key objectives addressed in the process evaluation were to:

- Evaluate program design including program mission, logic, and use of best practices.

- Evaluate program implementation including quality control, operational practice, and outreach.
- Evaluate program administration including program oversight, staffing, management, training, documentation, and reporting.
- Evaluate participant and stakeholder response including customer interaction and satisfaction.
- Report findings and observations and provide recommendations that enhance program effectiveness.

The key objectives addressed by the impact evaluation were to:

- Measure and verify the energy (kWh) and non-electric impacts attributable to the 2014 program.
- Provide credible and reliable ex-post program energy savings and realization rates and non-electric impact estimates attributed to the program for the 2014 program year.
- Report findings and observations, and provide recommendations that would enhance the effectiveness of future analysis and the accurate and transparent reporting of program savings.

1.3 Report Structure

Following this introductory chapter are the following chapters:

- Chapter 2 – Methodology: Description of the evaluation methods, sampling design, and data collection and analysis process.
- Chapter 3 – Process Evaluation Findings: Description and discussion of the program processes and best practices review.
- Chapter 4 – Impact Evaluation Findings: Description and discussion of the result of the engineering review including kWh savings estimates, non-electric benefits and realization rates.
- Chapter 5 – Conclusions and Recommendations: Conclusions reached based on the process and impact evaluation including results of the best practices review and recommendations to improve the program.

Methodology

This section describes the approach AEG used to evaluate the See Ya Later, Refrigerator program.

2.1 Process Evaluation

Process evaluations focus on determining the overall effectiveness of program delivery, identifying opportunities for program improvements, and assessing key program metrics including participation rates, market barriers, and overall program operations. The process evaluation for the See Ya Later, Refrigerator program consisted of the following research activities:

- Interviews with program and implementation staff.
- A detailed review of the program documentation and tracking database.
- A best practices review.

Interviews with Program and Implementation Staff

AEG conducted in-depth qualitative interviews with the IPC Program Specialists for the program. This included the outgoing program specialist and her replacement. The interview included questions surrounding the goals for the program offering from the interviewee's perspective; policies, processes and procedures surrounding recruitment and delivery of the program; what is working and what is not; and the strengths and weaknesses of the program.

AEG also conducted an interview with the program manager for the implementation contractor, JACO. The interview included questions about program operations and marketing, program implementation, the relationship with IPC staff, how the See Ya Later, Refrigerator program compares to other appliance recycling programs implemented by JACO, and strategies to overcome barriers to program participation.

Documentation Review

AEG reviewed several sources of data as metrics to evaluate the program and the program offerings. The data sources included the program implementation plan, quality control plan, past evaluation reports, the program tracking database, program application, marketing materials and marketing results from 2009 - 2014. Insight gained from this document review was used to provide a background for conducting the process evaluation and to inform the resulting conclusions and recommendations.

Best Practices Review

AEG conducted a literature review of industry publications to identify an appropriate set of best practices to compare with the IPC programs. AEG conducted the best practices review as follows:

- Reviewed regulatory filings, evaluation reports, conference presentations, marketing materials and industry publications.
- Created a list of best practices/innovations and the rationale behind the best practice/innovation.
- Benchmarked IPC's program against each best practice listed.

2.2 Impact Evaluation

The main objective of the impact evaluation was to estimate the annual kWh savings achieved by the program. This was accomplished by conducting an engineering review and replicating the savings for all of the projects in the 2014 program tracking database using the RTF-approved deemed savings algorithms for program year 2014. AEG also estimated non-electric benefits for the program.

Engineering Review

The See Ya Later, Refrigerator program used Version 2.5 of the Regional Technical Forum (RTF) Refrigerator and Freezer Decommissioning Unit Energy Savings (UES) workbook for deemed savings in program year 2014. This version was approved by the RTF on December 11, 2012 and was used by AEG for savings replication in this evaluation. This workbook provides annual energy savings of 424 kWh/year for refrigerators and 478 kWh/year for freezers.

AEG applied the deemed algorithms to the tracked parameters for all program participants to verify that the algorithms were applied correctly, identify errors or issues, and adjust savings estimates at the project level if necessary. While impact evaluations normally also include the selection of a sample for a more detailed further review, that was not necessary here, since all the information needed to calculate the RTF-approved deemed savings was included in the tracking database. As a result, there is no sampling error or associated confidence interval to report.

Non-Electric Benefits

IPC did not report non-electric benefits for the See Ya Later, Refrigerator program because the RTF workbook version used for program year 2014 ("ResFridgeFreezeDecommissiong_v2_5") does not specify deemed values for non-electric benefits. As a result, AEG used the latest RTF workbook (version 3.2) to estimate non-electric benefits associated with greenhouse gas emission reduction and avoided mercury and oil contamination. The resulting non-electric benefits are included in the evaluated impacts along with the electric savings evaluated using the version 2.5 workbook.

Process Evaluation Findings

The process evaluation for the See Ya Later, Refrigerator program focused on conducting interviews with program and implementation staff and reviewing program processes to assess the program operations, quality control, staffing, and outreach. The evaluation also included secondary research to determine if the program is currently using established best practices prevalent in the industry. The process evaluation found that the program is very well run, has adequate staffing, a very competent and engaged implementation contractor, and high customer satisfaction.

3.1 Program and Implementation Staff Interviews

AEG conducted in-depth interviews with the program specialists (outgoing and recent replacement) and the implementation contractor for the See Ya Later, Refrigerator program. The following are some of the key points from the interviews with the program specialists and the implementation contractor.

Program Design and Operations

- A major challenge of the program is cost effectiveness. In order to stay cost effective, IPC had to eliminate the incentive and reduce their marketing budget in 2015.
- Beginning in the summer of 2015, IPC began offering 2 free LED bulbs to customers. The results of that effort are unknown at the time of this report. JACO feels this won't convince someone to recycle their appliance, but for customers who have been considering getting rid of an extra appliance, it may help motivate them to enroll in the program.
- JACO upgraded some of their systems and as a result, both IPC and JACO experienced some technical/IT problems during the transition. These problems have been addressed and the upgrades should lead to improved processes.

Marketing and Outreach

- IPC sends targeted mailings to a segment of customers with "empty nester" characteristics to encourage recycling secondary or extra units.
- IPC has found that bill inserts are the most effective means of marketing – in terms of convincing customers to participate. JACO confirmed that bill inserts are the most effective marketing approach for other appliance recycling programs around the country as well.

- IPC sends bill inserts to all customers, not just the defined "empty nester" target market. Bill inserts are inexpensive and limiting the number sent would not save much money in the marketing budget.
- Customers in rural areas are a more challenging market. Many are hunters and fisherman who need freezers and second refrigerators to store their meat and fish. They also tend to stock up at warehouse stores like Costco. Winter road conditions can also present a challenge for scheduling pickups in rural areas.
- Rocky Mountain Power has a similar program that also uses JACO as the implementer. Similar marketing messages are used by the two programs, providing each other with some marketing lift.
- JACO is only aware of one other utility that discontinued their incentive. This utility attempted to boost participation rates by offering product giveaways such as cooler bags.

Program Staffing

- The outgoing program specialist had limited time in recent years to devote to the program. The new program specialist should be able to devote more time to the program.
- The working relationship between IPC and JACO is excellent. The two companies work well together and provide support in an effort to continuously improve the program and meet participation goals.

Customer Satisfaction

- Surveys conducted in the past by JACO and IPC show very high customer satisfaction with the program.
- This program is one of the few programs that is offered to all residential customers (not just all-electric customers) providing additional value to IPC's portfolio.

Program Life Cycle

- JACO feels that there is plenty of secondary refrigerator and freezer stock in Idaho Power's service territory to be able to support the program for another decade or more.
- According to JACO, 25% of households in the northwest have second refrigerators or freezers. Only about 1% are of those are recycled through the program each year.

3.2 Program Processes

Applicants may enroll online or by phone. In 2014, 70% of participants enrolled by phone. IPC screens each applicant to confirm eligibility (i.e., verifying the applicant is an IPC residential customer). JACO screens each applicant to confirm the refrigerator or freezer unit under consideration meets all program eligibility

requirements, including the requirement that a unit be of residential-grade, a minimum of 10 cubic feet as measured using inside dimensions, no larger than 30 cubic feet, and in working condition. In 2014, customers received a $30 incentive check mailed after the removal of the unit, but that incentive has been discontinued in 2015 in order to make the program cost effective. In July 2015, the program began offering 2 free LED light bulbs to participants and began targeting older, secondary units for maximum savings.

JACO uses a sophisticated scheduling system to optimize collection routes. Participants are given a choice of one or more days for pickup based on the scheduling routes. In 2014, pick up occurred an average of 13 days after the customer called. Participants are required to be present during the pickup and must sign an appliance turn-in form.

Quality Assurance/Quality Control

IPC may only accept units from active residential accounts and must verify the energy savings at the account level. IPC performs daily checks to verify participants signed up for the program through JACO. This requires a daily data transfer between JACO and IPC. If a participant can't immediately be verified as either a confirmed customer or not a customer, it is marked as pending. IPC works to resolve issues with pending files each day.

IPC also performs monthly quality control reconciling the invoices with the tracking database.

In October, 2012 the program specialists toured the JACO recycling facility in Salt Lake City and determined that the facility was well organized and appliances were being recycled in compliance with IPC's requirements.

3.3 Program Marketing

Since the program began in 2009, a variety of marketing methods have been used to promote the program. Table 3-1 below shows the various methods used each program year. In 2015 the program decreased the overall marketing budget for the program due to cost effectiveness concerns. As a result, fewer marketing activities are scheduled for 2015.

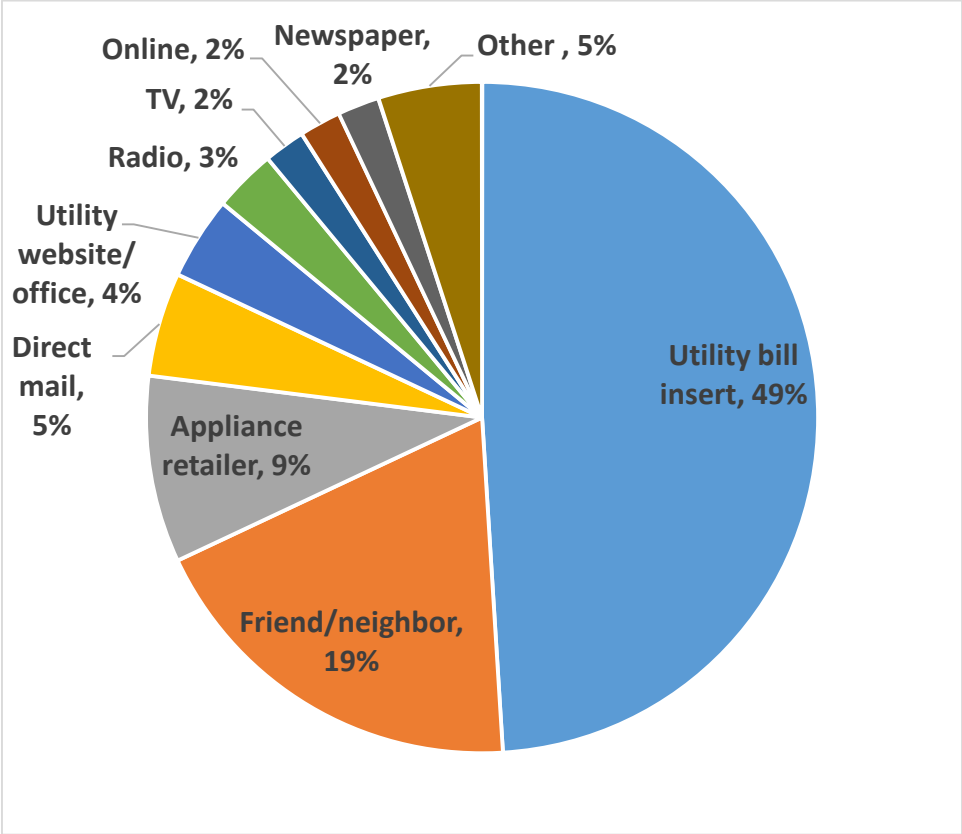
Table 3-1 Marketing Methods Used Each Year

Method	2009	2010	2011	2012	2013	2014	2015
Bill inserts	1	3	4	4	5	7	6
Newspaper ads	X	X	X	X	X	X	
Google Ad Words	X	X	X	X	X	X	X
Direct Mail			2	3	1	1	
Web Site	X	X	X	X	X	X	X
Events	X	X	X	X	X	X	X
Radio		X			X	X	
ValPak		X	X	X	X		
Customer Connections	X	X	X	X	X		
PR Event	X		X	X	X	X	
Cross Marketing	X	X	X	X		X	X
Craigslist		X					
Truck Wrap	X	X	X	X	X	X	X
Fair Fans		X	X	X	X	X	
Uhaul		X					
Movie Trailer				X			
Brochures	X	X	X	X	X	X	X

Source: See Ya Later, Refrigerator Marketing Results 2009 – 2014 DSM Reporting Years

IPC tracks the marketing effectiveness for the program in several ways. Participants are asked how they heard about the program when they enroll, and the date of customer enrollment is tracked and can be attributed to specific marketing activities. Acquisition costs are also tracked by marketing method.

Figure 3-1 below shows that almost half of 2014 participants heard about the program from the utility bill insert.



Source: See Ya Later, Refrigerator Marketing Results 2009 – 2014 DSM Reporting Years

Figure 3-1 How 2014 Participants Heard about the See Ya Later, Refrigerator Program

Table 3-2 below provides the estimated acquisition cost per participant for several marketing efforts. Although direct mail has the highest response rate, it's almost 3 times as costly as bill inserts. Bill inserts has the overall lowest average cost per participant.

Table 3-2 2014 Marketing Response Rates and Costs

Activity	Average Response Rate	Average Acquisition Cost ($/participant)
Bill inserts	.35%	$11.93
Direct Mail	.88%	$37.74
Newspaper	.06%	$265.08
Radio	NA	$275.76

Source: See Ya Later, Refrigerator Marketing Results 2009 – 2014 DSM Reporting Years

3.4 Best Practices

AEG conducted a literature review of industry publications to identify an appropriate set of best practices to compare with the IPC programs. AEG reviewed the following sources to create a list of best practices/innovations in the industry:

- Publicly available best practices reports
- Conference papers and presentation
- Evaluations of other appliance recycling programs

Using these resources, AEG created a list of best practices/innovations that applied to the See Ya Later, Refrigerator program. Table 3-3 below shows each best practice/ innovation and whether IPC currently uses the practice.

Table 3-3 Best Practices/Innovation for Appliance Recycling Programs

Best Practice/Innovation	See Ya Later, Refrigerator Program	
	Standard Practice?	Explanation
Offer on-line scheduling	✓	Available; 30% of participants use this method
Pick up units within one week of request	X	Average pick up in 2014 was 13 days
Provide pick up on Saturdays	✓	Saturdays are included
Use bill inserts to market the program	✓	Several each year
Show cost savings from removing second refrigerator	✓	"Can save up to $100 a year"
Contact people a couple of days prior to appointment as reminder	✓	Called one to two days before and 30 minutes before
Program staff should visit recycling center and see how it works	✓	Completed in 2012
Prioritize removal of secondary refrigerator	✓	Targets empty nesters; marketing messages focus on secondary or extra units
Provide a financial incentive	X	Incentive discontinued in 2015
Provide an energy savings kit as an additional incentive	✓	2 LED bulbs are provided to participants beginning in summer of 2015
Stress free removal and safe disposal	✓	Marketing materials highlight free pick up. Facebook and local news showed how refrigerators are recycled
Stress convenience	✓	"Let us do the heavy lifting"

Impact Evaluation Findings

The impact evaluation for the See Ya Later, Refrigerator program consisted of an engineering review that replicated the savings estimates for all of the projects in the 2014 program tracking database.

4.1 Engineering Review

The AEG-replicated energy savings for this program were 1,390,760 kWh/yr, with a realization rate of 100%. Only one issue was found through the tracking database review and replication effort. There was one decommissioned freezer measure in the program year 2014 population for which the "Count Savings" parameter in the tracking database was listed as "N". Savings for this entry were not reported and were not replicated. More information was requested and the IPC program specialist said the unit was in a mobile home park that was classified as a commercial rate and therefore not eligible for the program. In order to preserve customer satisfaction, however, IPC allowed the unit to be picked up but did not count the savings. While impact evaluations normally also include the selection of a sample for a more detailed further review, that was not necessary here, since all the information needed to calculate the RTF-approved deemed savings was included in the tracking database. Since sufficient information was in available in the database, the savings for all units were recalculated and verified. As a result, since no sample was used, there is no sampling error or associated confidence interval to report.

The following table depicts the summary for refrigerators and freezers in the 2014 See Ya Later, Refrigerator Program.

Table 4-1 Replicated Savings Results for See Ya Later, Refrigerator Program

Measure	Measure Count	Reported Savings (kWh/yr)	Replicated Savings (kWh/yr)	Realization Rate (%)
Refrigerator	2,518	1,067,632	1,067,632	100%
Freezer	676	323,128	323,128	100%
Freezer*	1	0	0	--
Total	**3,195**	**1,390,760**	**1,390,760**	**100%**

* Not eligible because customer was on a commercial rate.

1.2 Non-Electric Benefits

IPC did not report non-electric benefits for the See Ya Later, Refrigerator program because the RTF workbook version used for program year 2014 ("ResFridgeFreezeDecommissiong_v2_5") does not specify deemed values for non-electric benefits. As a result AEG used the latest RTF workbook (version 3.2) to estimate non-electric benefits associated with greenhouse gas emission reduction and avoided mercury and oil contamination. The resulting non-electric benefits are included in the evaluated impacts along with the electric savings evaluated using the version 2.5 workbook.

The non-energy benefits (NEBs) in the RTF workbook (v3.2) are $7.12/yr and $8.74/yr for refrigerator and freezer decommissioning, respectively. The reason for the difference is the expected useful lifetime (EUL) of the measures (6 years for refrigerators, 5 years for freezers) by which the overall incremental benefit ($45.58) is divided. This incremental non-energy benefit is a total net value of benefits attributable to the program from the monetization of greenhouse gas (GHG) emission reduction as well as avoided mercury and oil contamination. Reclaimed materials such as aluminum, copper, ferrous metal, foam, oil, and plastic were monetized in the RTF analysis but were not included in the final net NEB value.

These NEB values are the net environmental benefits as the difference between the gross benefits (sum of all benefits realized under the program) and the average benefits that would have been realized in the program's absence. The GHG emissions were calculated for each environmental benefit/raw material using specified conversion factors. These materials and their conversion to metric tons of CO_2 equivalents ($MTCO_2eq$) can be seen in the Table 4-2 below.

Table 4-2 Environmental Benefit CO_2 Conversion Table

Raw Material	Disposal Type	Units	Conversion to $MTCO_2eq$
CFC-12	All	lbs.	3.67
HFC-134a	All	lbs.	0.59
HCFC-22	All	lbs.	0.68
CFC-11	All	lbs.	1.72
HCFC-141b	All	lbs.	1.02
HFC-134a	All	lbs.	0.59
Used Oil	All	lbs.	0.010
Ferrous Metal	Recycled	lbs.	0.00027
Non-Ferrous Metal	Recycled	lbs.	0.00027
Rubber	Recycled	lbs.	0.00027
Plastic	Recycled	lbs.	0.00027
Glass	Recycled	lbs.	0.00027
Mercury-Containing Components	All	(components)	0
PCB-Containing Capacitors	All	(components)	0.00027
Non PCB-Containing Capacitors	Recycled	(components)	1.7E-05
Non PCB-Containing Capacitors	Disposed	(components)	0.063
Foam	Recycled	lbs.	0.00027
Fiberglass	Recycled	lbs.	0.00027

These conversion factors were multiplied by values for each of five scenarios seen in Table 4-3 and then further analyzed to produce the GHG emissions totals seen in Table 4-4 below.

Table 4-3 *Environmental Benefit CO_2 Conversion Table*

Scenario	Description	Distribution w/o Program	Distribution w/ Program
1	Unit destroyed in an environmentally irresponsible way, disposed of in a way such that no materials would be recovered	15%	0%
2	Unit destroyed in an environmentally irresponsible way, disposed of in a way such that materials with retail value would be recovered	23%	0%
3	Taken to dump	23%	0%
4	Recycled, non-RAD, non-utility	39%	0%
5	Current program	0%	100%

Table 4-4 *Final RTF Non-Electric Benefits, Gross and Net (2006 Dollars)*

Material	Gross (2006 costs)	Ratio	Net	Included in the NEB Value?
GHG Emissions	$50.77	74%	$37.38	Yes
Avoided Mercury Contamination	$4.28	49%	$2.10	Yes
Avoided Oil Contamination	$16.21	38%	$6.10	Yes
Reclaimed aluminum	$4.52	11%	$0.49	No
Reclaimed copper	$15.46	12%	$1.82	No
Reclaimed ferrous metal	$15.39	11%	$1.68	No
Reclaimed foam	$1.33	100%	$1.33	No
Reclaimed oil	$0.92	38%	$0.35	No
Reclaimed plastic	$4.01	55%	$2.20	No

Non-electric benefits for the See Ya Later, Refrigerator program were calculated using the "Present Value (PV) Regional Non-E Value" from Version 3.2 of the RTF UES Workbook. Since these values were in 2006 dollars, they were inflated to 2014 dollars using a factor of 1.136889 from the RTF Standard Information Workbook v3.2. Thus, each recycled refrigerator was assigned a present value of non-electric benefits (PV(NEB)) of $41.08 and each recycled freezer was assigned a PV(NEB) of a $50.46.

Table 4-5 *See Ya Later, Refrigerator Program PV NEBs*

Measure	Measure Count	Reported Savings (kWh/yr)	Replicated Savings (kWh/yr)	Realization Rate (%)	Total PV(NEB)
Refrigerator	2,518	1,067,632	1,067,632	100%	$103,450.83
Freezer	676	323,128	323,128	100%	$34,109.56
Total	**3,195**	**1,390,760**	**1,390,760**	**100%**	**$137,560.39**

Conclusions and Recommendations

The results of the impact analysis show that the See Ya Later, Refrigerator program surpassed its goals, achieving 1,390,760 kWh in savings in 2014 with a 100% realization rate.

Table 5-1 See Ya Later, Refrigerator Program 2014 Results

Metric	Program Goal	Reported	Realization Rate	AEG-Evaluated	Non-Electric Benefits
Annual Energy Savings (kWh)	837,000	1,390,760	100%	1,390,760	$137,560.39

Other key findings from the process and impact evaluations include:

- The program is very well run and complies with most of the best practices in the industry.
- The program has adequate staffing and a very competent and engaged implementation contractor.
- The program has high customer satisfaction.
- The program has the necessary quality control procedures in place and is extremely well documented.
- The wealth of data captured by the program is exemplary and is analyzed by IPC staff to continuously provide insight and improve the program.

5.1 Recommendations

Based on this evaluation, the following recommendations should be considered to enhance program effectiveness and improve the transparency of reported savings:

- If no savings are associated with a measure, explain why in the program tracking database.
  - ➔ **Rationale:** This is a very minor issue for IPC but including an explanation would improve the transparency of the data and provide necessary information for the evaluator without requiring follow up.
- Decrease the time between scheduling and pick up to 7 days or less.
  - ➔ **Rationale**: Best practices in the industry call for pick up within 7 days of scheduling appointment. This change may also improve participation rates.

- Experiment with different promotional offerings to see if they increase program participation. An example would be to offer an incentive for a limited time (one month) for secondary fridges only.
    - ➔ **Rationale**: Creativity is necessary to overcome the discontinuation of the incentive. This is unchartered territory for the program, as very few other programs are not offering an incentive. Several other programs have offered limited time increases in incentives to "bump" participation rates. A limited time incentive may provide IPC with the necessary lift in participation to meet annual goals. The incentive could replace the free LEDs to help cover the cost.
- In the future, use the RTF Workbook 3.2 and include non-electric benefits in the cost effectiveness analysis.
    - ➔ **Rationale:** Including non-electric benefits in the analysis should improve the cost effectiveness. As a result IPC may be able to bring back an incentive and/or increase the marketing to its former levels.

Program Staff and Implementation Contractor Interview Guides

Program Manager Interview Guide – Final –IPC Residential

NAME

TITLE

PROGRAM

DATE

PHONE

EMAIL

INTERVIEWER

SUMMARY OF FINDINGS

[Once the interview is complete, please complete interview notes within this document. First, provide a high-level summary of findings below. Then, within each section summarize the findings.]

[Some of the answers to these questions will be filled in prior to the interview, based on information learned during the kick off meeting in Boise on June 8, 2015]

BACKGROUND

1. Please provide a brief description of the programs you are directly responsible for?
2. Please describe your job responsibilities related to the program.
3. How long have you been responsible for administration of this program?
4. On average, what percent of your time is spent on the program you are directly responsible for?
5. What other staff work on the program? What is their role regarding the program (i.e. what are the responsible for with regard to the program)? Who, if anyone, provides you with support? What support do they provide?

PROGRAM GOALS

6. What metrics are used to track the success of the program? (Probe for electric savings, participation rates, number of units)?
7. How are goals for this program established?

8. Did the program meet its goals in 2014? If not, what kept the program from meeting its goals?

9. Has the program met its annual goals in previous years? Is it on track to meet its goals for 2015?

PROGRAM IMPLEMENTATION AND MARKETING

10. Do you work with an implementation contractor or trade allies to help deliver the program? Who is/are the implementation contractor and/or trade allies you work with on this program? Do you have any issues or concerns about the implementation contractor or trade allies? If yes, what are your concerns?

11. What is the target market for the program? How are potential customers identified?

12. What are the main barriers to participation? How does the program address these barriers?

13. What has been done to market the program? How successful have these strategies been? Are some marketing strategies or messages more beneficial than others? How is success of the marketing strategies or messages measured?

PROGRAM OPERATIONS

14. What are the participation steps from the customers' perspective? Have these changed over time? If so, why were they changed?

15. Are there any specific aspects of the program that are working very well? Any not working well? (Probe for details) What could be done to improve?

16. What quality control/quality assurance procedures are in place? Are these documented? Is any verification done? What does this entail? Who does the verification?

17. Do the incentive levels seem appropriate? If not, why not? What, if any, changes in the incentive levels do you think may be needed?

18. What is your opinion of free ridership for this program? Meaning do you think customers would pay for the measures on their own, outside of the program. Why do you say that?

19. Do you think the program is changing customers' energy efficiency attitudes and actions? (Probe for specifics)

20. Are customers satisfied with the program overall? With the measures installed? Are they satisfied with the incentive amount? With the savings achieved? How is satisfaction with the program measured? (i.e. is this based on survey information or is it anecdotal?)

PROGRAM IMPACTS

21. Deemed savings from the RTF are used to determine program impacts – correct? Do you know what version of the RTF workbook you are using? If no, who should I ask for that information?

22. We plan to do a review of detailed project documentation for a sample of participants, including cross-checking the project documentation with the tracking spreadsheets. What is the best way to get this data in an electronic form? How is it currently stored?

PROGRAM DATA AND DOCUMENTATION

23. Does the tracking database collect all the information you need? Is there information/data that you wish were available but are not? Is there information in the database that you don't use?

24. What type of documentation is required to support the purchase and installation of the measure?

EVALUATION

25. What do you hope to learn from this evaluation? Are there specific issues you would like the evaluation to address?

Implementation Contractor Interview Guide – FINAL–See Ya Later, Refrigerator program

NAME

TITLE

PROGRAM

DATE

PHONE

EMAIL

INTERVIEWER

SUMMARY OF FINDINGS

[Include highlights of interview here]

INTRODUCTION

Hi, my name is ___ and I am calling from Applied Energy Group on behalf of Idaho Power Company. We are working with Idaho Power to evaluate their See Ya Later, Refrigerator program. I'm calling to ask you a few questions about the implementation of the program to help determine what is working and what might be improved.

- [IF THEY DON'T WANT TO TALK NOW, TRY TO GET A GOOD TIME TO CALL THEM BACK.]
- [IF RESPONDENT PROPOSES AN ALTERNATE CONTACT, OBTAIN NAME, BEST NUMBER AT WHICH TO REACH THE CONTACT, AND ANY INFO REGARDING BEST TIME TO CALL]

BACKGROUND

1. Please provide a brief description of the services you provide for Idaho Power's See Ya Later, Refrigerator Program.
2. Please describe your job responsibilities related to the program.
3. What other staff at your company work on the program? What is their role regarding the program (i.e. what are the responsible for with regard to the program)? Who, if anyone, provides you with support? What support do they provide?

PROGRAM GOALS

4. What metrics do you use to track your success implementing this program? (e.g. participation rates, number of units)?
5. How is the program performing in regards to these metrics?

PROGRAM IMPLEMENTATION AND MARKETING

6. Describe your communications and working relationship with Idaho Power? Are there areas that could be improved?
7. What is the target market for the program? How are potential customers identified?

8. What are the main barriers to participation? What is being done to address these barriers?
9. What has been done to market the program? How successful have these strategies been?

PROGRAM OPERATIONS

10. Please briefly describe how the program operates? What is the sequence of steps for the implementation?
11. Are there any specific aspects of the program that are working very well? Any not working well? (Probe for details) What could be done to improve the program?
12. How has the elimination of the incentive affected the program? What strategies could be implemented to help overcome any negative effectives of eliminating the incentive?
13. How does this program compare to other programs appliance cycling programs you implement? Any lessons learned or take-a-ways from other programs that could benefit Idaho Power?
14. Are customers satisfied with the program overall? Have you heard any feedback about eliminating the incentive?
15. What is the typical program life cycle for appliance recycling programs? Is there a predictable ebb and flow in terms of participation? What strategies do other utilities use to reach their participation goals?
16. What do you see as future challenges to the program?

CONCLUSION

17. Is there anything else about the program that you feel is important, that I haven't discussed in this interview? Do you have any other suggestions for improvements or changes to the program?

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CLEAResult

Irrigation Peak Rewards Program

2015 Impact Evaluation

December 23, 2015

PREPARED BY CLEAResult

PREPARED FOR Idaho Power Company

REPORTING PERIOD July 15 – August 15 2015

We change the way people use energy™

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Executive Summary

Idaho Power Company contracted CLEAResult to complete an impact evaluation of the 2015 Irrigation Peak Rewards program, a voluntary demand response (DR) program that has been available to Idaho Power's agricultural irrigation customers since 2004. There were approximately 2,250 irrigation service locations enrolled in the program in 2015. 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.

CLEAResult completed analyses of curtailment events held on June 29th, July 2nd, and August 11th, 2015, 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 278.3, 273.8, and 180.2 MW, respectively, for the three events, and an average of 244.1 MW measured at the meter. These results do not include line losses which according to Idaho Power, average 9.7 percent. When line losses are included, maximum demand reductions are 305.3, 300.3, and 197.7 MW respectively. Analysis and tables contained in this report do not include line losses. The events achieved realization rates of 69.0%, 67.9%, and 44.7%, respectively, averaging 60.5%.

The results of the counterfactual realization rate analysis demonstrated that date has a large influence on the expected realization rate. While the first quarter of the program season (June 15 - July 30) showed an average expected realization rate of 68.6%, the expected realization rate in the last three quarters of the season (July 1 – August 15) drops off significantly, to an average of 49.1%. This is due to a higher percentage of pumps being shut off during the baseline period in the first two weeks of August. The counterfactual realization rate peaks in the last two weeks of June, which is a shift of two weeks from 2014 peak counterfactual realization timeframe. This corresponds to a shift to an earlier growing season in 2015.

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 last week of June and first week of July, however it is dependent on weather and the timing of the launch of the growing season.

The results of the impact evaluation show that Idaho Power's Irrigation Peak Rewards Program functions as intended, and, if properly maintained, can be relied on to provide dispatchable demand reduction to the electricity grid.

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 future 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 agreed to reinstate the program in 2014 on a limited basis for the purpose of maintaining the program infrastructure. In 2014, and again in 2015, the program completed three curtailment events during the June 15 - August 15 program season.

Impact Evaluation Goals

Idaho Power contracted CLEAResult to complete an impact evaluation of the 2015 Irrigation Peak Rewards Program. This 2015 impact evaluation had 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 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 and inform as to which days during the program season could 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, the methodology for gathering and processing data, determining the baseline, calculating the demand reduction, and determining the curtailment event and counterfactual realization rates.

Data Sources

CLEAResult conducted the 2015 Irrigation Peak Rewards impact evaluation through the use of three primary data sources provided by Idaho Power: 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, 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 1 for a list of error codes included in the data.

Table 1. Error Code Key

Error Code	Description
1	Power Outage
9	Missing Reading
Q	Estimated Reading

Sampling Plan

The use of AMI and MV-90 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

CLEAResult 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. CLEAResult's processing (i.e. cleaning) of the data involved identifying and addressing error codes in the source AMI data. To address the presence of error codes, all AMI data with one or more error code in the interval readings during the curtailment period or in the baseline period were removed from the analysis. In the 2014 Peak Rewards impact evaluation, the results of this method showed statistically significant results compared to an alternative method tested whereby missing values were estimated using linear interpolation.

Finally, before completing the following steps below, two distinct datasets were created: one including options 1 and 2 pumps (which have direct load control devices installed), and the other including option 3 pumps (which are typically larger and manually controlled). This was done to account for different device failure rates between the two groups, and the fact that the results from pumps analyzed were extrapolated to pumps that did not have sufficient data to analyze (see the beginning of the Findings section for details). Extrapolating the device failure rate from option 1 and 2 pumps in the analysis dataset to option 3 pumps not in the analysis dataset would lead to misleading results.

Determine Baseline

CLEAResult 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. CLEAResult then summed each pump's baseline by dispatch group to arrive at a unique baseline for each dispatch group.

Calculate Demand Reduction

CLEAResult 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). CLEAResult 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 above, some pumps were removed from the analysis due to the presence of error codes during the curtailment event and/or baseline period. CLEAResult applied the realization rate (see section 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

CLEAResult 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

In order to inform future program planning, CLEAResult used AMI data to estimate 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%, CLEAResult subtracted the percent of nominated load that was not present during each pump's baseline period. From that total, CLEAResult subtracted the average opt-out, device failure, and "did not reduce total nominated kW" rates during the three 2015 curtailment events to arrive at the estimated counterfactual realization rate for each day.

Findings

The 2015 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.

Table 2 below details 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.

Table 2. Number of Pumps by Processing Step

Processing Step	June 29	July 2	August 11
Included in Participant List	2,259	2,259	2,259
No AMI data available	295	295	295
Removed due to 'estimated reading' error code Q	112	50	177
Removed due to 'missing reading' error code 9	3	1	1
Removed due to 'power outage' error code 1	4	3	71
Removed due to unreasonable AMI data	5	7	6
Included in final analysis dataset	1,840	1,903	1,780

Curtailment Event Results

Table 3 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 180.2 MW (realization rate of 44.7%) for the August 11th event to a high of 278.3 MW (realization rate of 69.0%) for the June 29th event.

Of the factors that drove down the realization rate, pumps being shut off during the baseline period had the highest impact (average of 29.8% of the load), followed by load remaining (6.5% of the load), and opt-outs (3.2% of the load).

Table 3: Estimated Demand Reduction and the Resulting Realization Rate

Curtailment Event	Nominated Demand Reduction (MW)	Max Demand Reduction (MW)	Realization Rate	Opt-Out Rate	Load Remaining Rate	Pump OFF in Baseline Rate	Total
June 29	403.2	278.3	69.0%	2.8%	7.6%	20.5%	100.0%
July 2	403.2	273.8	67.9%	3.7%	6.8%	21.7%	100.0%
August 11	403.2	180.2	44.7%	3.0%	5.2%	47.1%	100.0%
Average	403.2	244.1	60.5%	3.2%	6.5%	29.8%	100.0%

Load Remaining Investigation

In the 2014 Peak Rewards program impact evaluation, the “Load Remaining Rate” was included in the “Device Failure Rate.” In this evaluation, the project team did further analysis to identify the reasons for load not being curtailed, with the aim of determining to what extent it was due to device failures. In order to do so, the project team completed a “ground up” analysis that categorized each pump into one of the following categories: reduced load (i.e. contributed to the realization rate), opt-out, load remaining, or off in the baseline. This approach differed from the methodology of the primary analysis, which employed a “top down” approach, where the load in all categories was considered on an aggregate-basis.

After considering the load on a pump-by-pumps basis, it became clear that the 6.5% of total nominated load in the load remaining category could not be entirely considered “device failures.” This is due to the fact that ~50% of the load that contributed to the load remaining rate was tied to option three pumps, which unlike option one and two pumps, are larger and manually turned off by their operators (i.e. there is no device to fail). While the option three pumps cannot technically have device failures, they can fail to reduce the full amount of load that they nominated. To make this distinction clear, the pump-by-pump analysis created two new categories to better characterize the load originally in the load remaining category: “Device Failure (option 1 and 2 pumps)” and “Did Not Reduce Total Nominated kW.” Table 4 below shows the pump-by-pumps analysis’s results for these two categories.

Table 4. Load Remaining Rate Investigation Results

Curtailment Event	Device Failure (option 1 & 2 pumps)	Did Not Reduce Total Nominated kW (option 3 pumps)	Total
June 29	3.5%	5.2%	8.7%
July 2	3.6%	2.2%	5.8%
August 11	1.6%	2.4%	4.0%
Average	2.9%	3.3%	6.2%

Note that the sum of the two new categories do not equate exactly to the primary analysis's load remaining rate (6.2% compared to 6.5%). This is due to the primary analysis considering the load remaining rate on an aggregate approach (i.e. a single pump's load may be contributing to multiple categories); whereas, the pump-by-pump approach categorizes 100% of each pump's load into a single category. Because of this discrepancy, the event-specific results below do not separate the load remaining category into the two new categories.

June 29th 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 5 below presents the maximum and average demand reductions achieved and resulting realization rates for the June 29th 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 98.0 MW for the 5-9 p.m. dispatch group to 45.5 MW for the 4-8 p.m. dispatch group. The 3-7 p.m. dispatch group achieved the highest realization rate of all groups (81.0%), while the 4-8 p.m. dispatch group had the lowest realization rate at 60.3%. The overall realization rate for all dispatch groups was 69.0%., which was the highest of the three curtailment events called in 2015.

Table 5: June 29th Curtailment Event Results

Dispatch Group	Nominated MW	Baseline MW	Max Demand Reduction (MW)	Avg. Demand Reduction (MW)	Realization Rate
2 - 6 p.m.	87.6	73.1	64.0	58.3	73.1%
3 - 7 p.m.	91.2	70.5	73.9	56.1	81.0%
4 - 8 p.m.	75.4	54.4	45.5	20.2	60.3%
5 - 9 p.m.	149.0	111.1	98.0	88.6	65.7%
Total (2 - 9 p.m.)	403.2	309.1	278.3	223.2	69.0%

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 6 below breaks out demand reduction for each hour of the curtailment event by dispatch group. As expected, the 5-6pm hour experienced the largest total reduction (278.3 MW) as this is the single hour when all dispatch groups are actively curtailing.

Table 6: June 29th Curtailment Event Results by Hour

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	309.1	309.1	309.1	309.1	309.1	309.1	309.1
Total Load (MW)	239.9	164.8	119.7	30.8	68.3	130.3	182.3
Total Reduction from Baseline (MW)	69.2	144.3	189.4	278.3	240.8	178.8	126.8
2-6pm DG Reduction from Baseline (MW)	63.0	63.9	63.8	64.0	24.5	5.9	4.8
3-7pm DG Reduction from Baseline (MW)	6.5	73.4	73.9	73.5	72.8	30.9	8.7
4-8pm DG Reduction from Baseline (MW)	0.0	6.6	44.7	45.5	45.4	44.5	16.8
5-9pm DG Reduction from Baseline (MW)	(0.4)	0.4	7.1	95.3	98.0	97.6	96.5

Figure 1 below presents the load profile of the June 29th curtailment event and its baseline, graphically depicting the results from Table 6 above. The overall demand reduction peaks in the 5-6pm hour and gradually decreases as the various dispatch groups' curtailment periods come to an end.

Figure 1: June 29th Curtailment Event Load Profile (All Dispatch Groups)

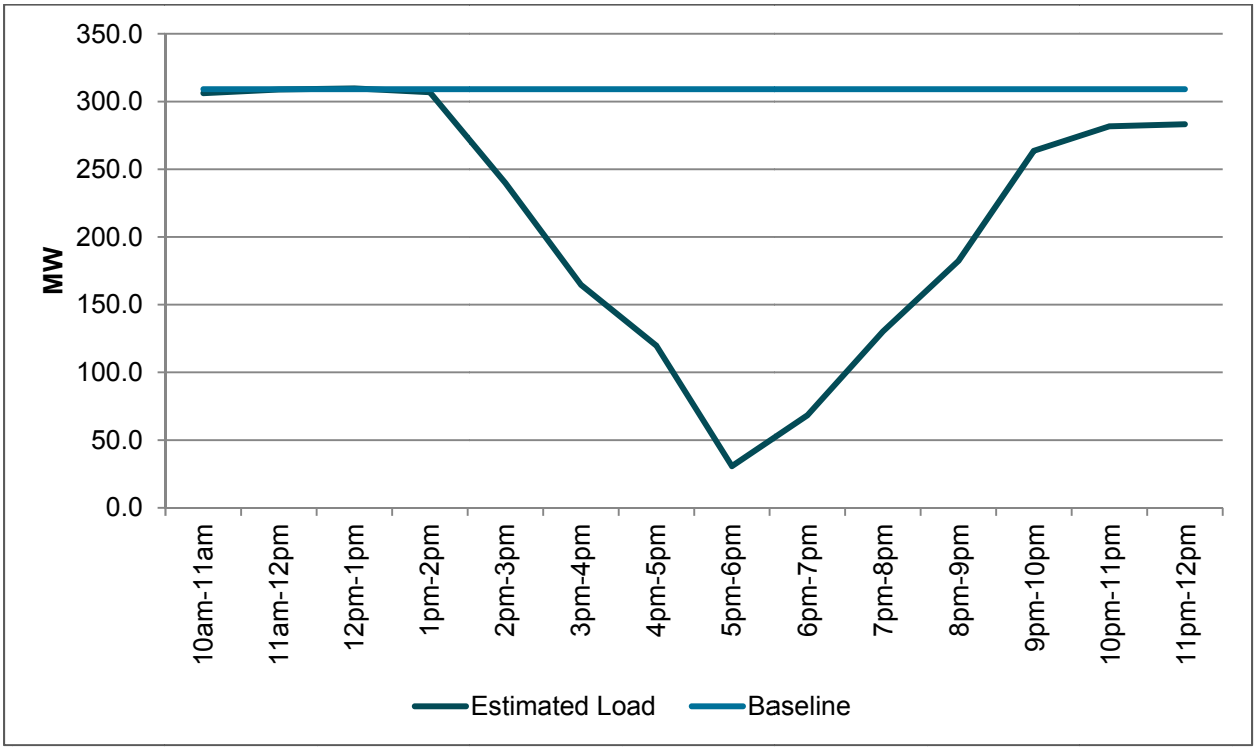
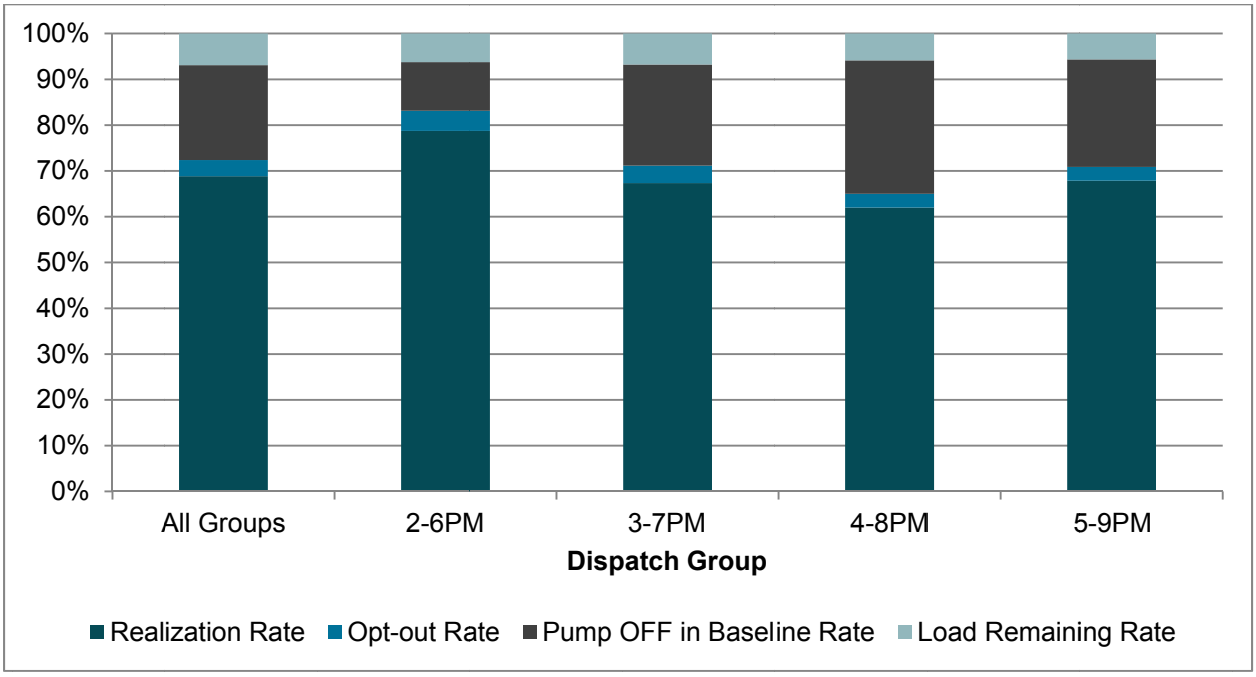


Figure 2 below depicts each dispatch group's realization rate, which is the percent of nominated load that was successfully curtailed, as well as the components that make up the remainder of the load that was not curtailed. The reasons for load not being successfully curtailed include customers opting out of the curtailment event, pumps being shut off during the baseline period (and thus not contributing to load reduction), device failures (option 1 and 2 pumps), and pumps not curtailing to total nominated kW (option 3 pumps). The latter two categories are combined into the load remaining category.

The 4-8 p.m. dispatch group experienced the highest rate of the pumps being shut off during the baseline period (29.1% of the group's nominated load). All of the dispatch groups had a moderate opt-out rate, ranging from 3.0% to 4.4%. Realization rate variability between the dispatch groups was highest during the June 29th event.

Figure 2: June 29th Curtailment Event Realization Rate



July 2nd Curtailment Event

The July 2nd curtailment event was the second event called of the 2015 program season. As in the June 29th event, the 2-6p.m. dispatch group achieved the highest realization rate (77.3%) of all dispatch groups. The overall realization rate for all dispatch groups was 67.9%, which was the second highest of the three curtailment events called in 2015.

Table 7: July 2nd Curtailment Event Results

Dispatch Group	Nominated MW	Baseline MW	Max Demand Reduction (MW)	Avg. Demand Reduction (MW)	Realization Rate
2 - 6pm	87.6	73.9	67.7	65.0	77.3%
3 - 7pm	91.2	64.7	66.1	66.1	72.5%
4 - 8pm	75.4	55.4	49.3	48.9	65.5%
5 - 9pm	149.0	107.1	93.2	92.1	62.5%
Total (2 - 9PM)	403.2	301.1	273.8	272.1	67.9%

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 8 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 (273.8 MW), as this is the single hour when all dispatch groups are actively curtailing.

Table 8: July 2nd Curtailment Event: Baseline Results by Hour

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	301.1	301.1	301.1	301.1	301.1	301.1	301.1
Total Load (MW)	234.2	162.4	113.9	27.2	65.6	129.5	185.3
Total Reduction from Baseline (MW)	66.8	138.6	187.2	273.8	235.5	171.6	115.7
2-6pm DG Reduction from Baseline (MW)	63.3	63.4	65.6	67.6	27.0	7.8	4.7
3-7pm DG Reduction from Baseline (MW)	4.3	66.1	66.1	66.1	66.1	22.6	4.4
4-8pm DG Reduction from Baseline (MW)	0.2	8.3	49.1	49.3	49.3	48.1	15.2
5-9pm DG Reduction from Baseline (MW)	(0.9)	0.9	6.4	90.7	93.2	93.1	91.5

Figure 3 below presents the load profile of the July 2nd curtailment event and its baseline, graphically depicting the results from Table 8 above. The overall demand reduction peaks in the 5-6pm hour and gradually decreases as the various dispatch groups' curtailment periods come to an end.

Figure 3: July 2nd Curtailment Event Load Profile (All Dispatch Groups)

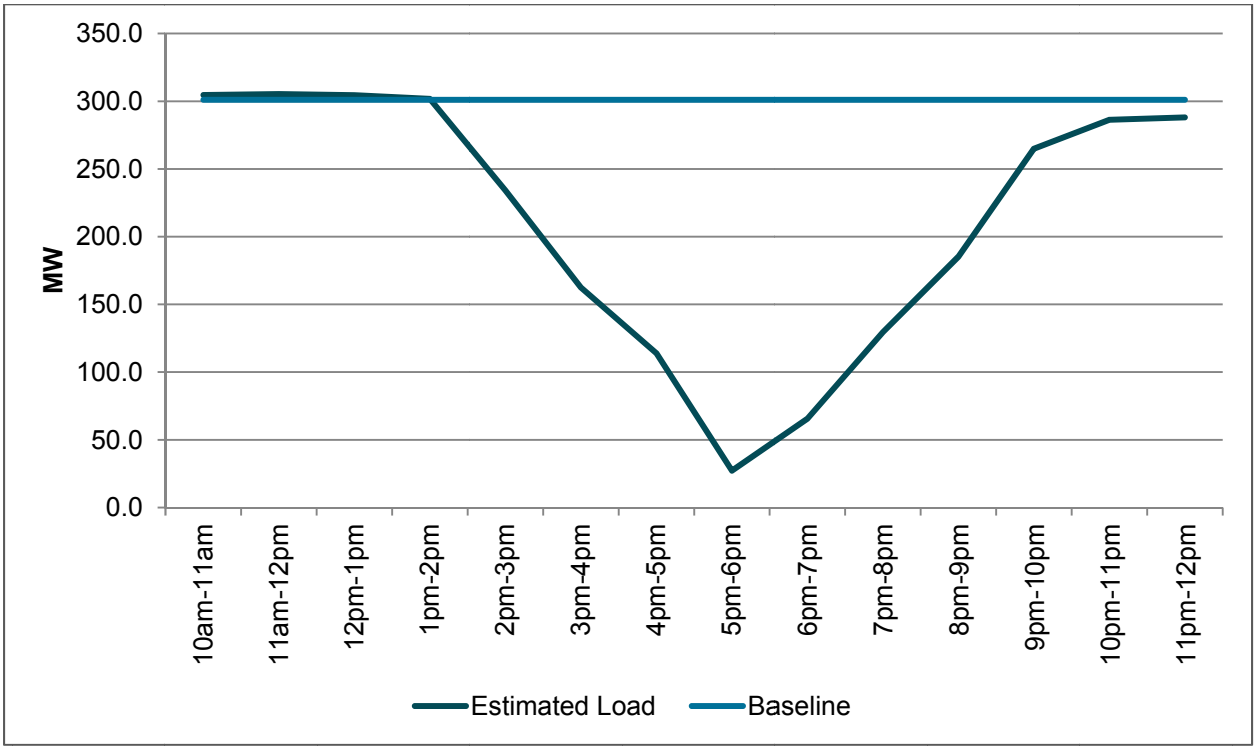
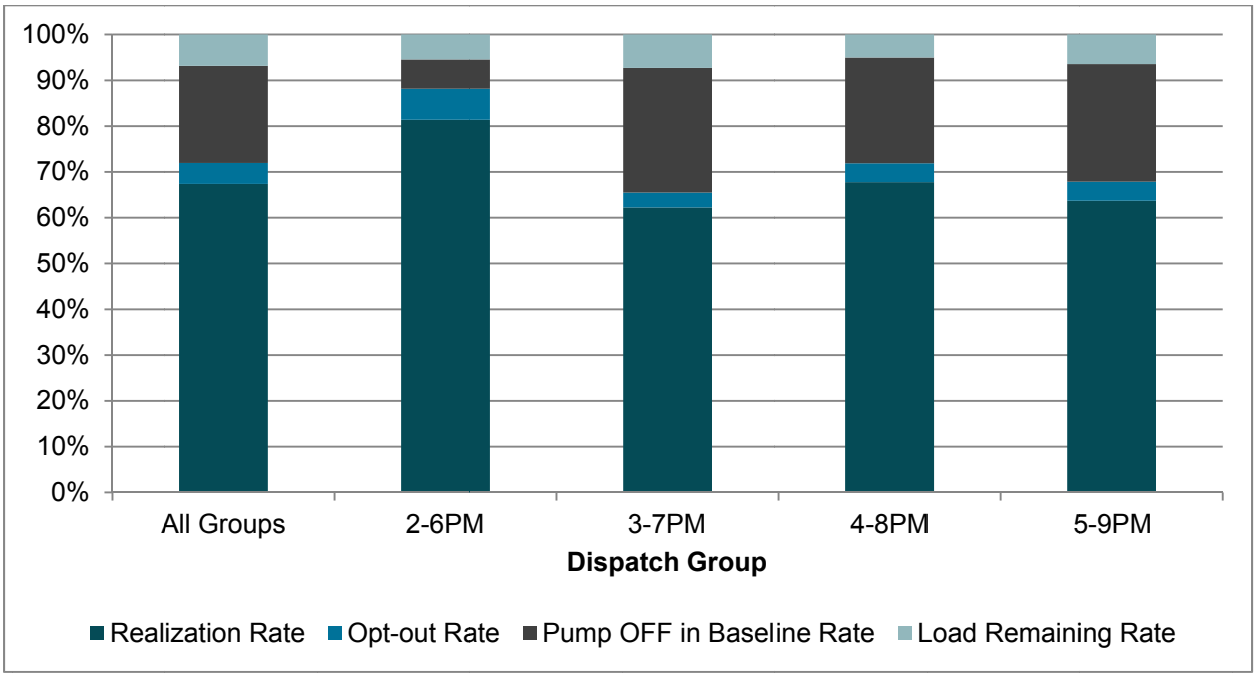


Figure 4 below depicts each dispatch group's realization rate for the July 2nd event. The 3-7 p.m. dispatch group experienced the highest rate of the pumps being shut off during the baseline period (27.2% of the group's nominated load), while the 3-7 p.m. dispatch group had the highest load remaining rate (7.3%). The 2-6p.m. dispatch group's rate of pumps being shut off during the baseline was 6.4%, compared to the other three dispatch groups having a rate of 23-27%.

Figure 4: July 2nd Curtailment Event Realization Rate



August 11th Curtailment Event

The third curtailment event of the 2015 program season was held on August 11th, which is the latest date an event has been called in the 2014 and 2015 seasons. With the irrigation season nearly finished, the event achieved the lowest realization rate (44.7%) of all three events, driven by a high rate of pumps off in the baseline period (49.2%). The realization rates were fairly consistent across all dispatch groups, with a high of 48.5% for the 3-7 p.m. dispatch group and a low of 42.4% for the 5-9 p.m. dispatch group.

Table 9: August 11th Curtailment Event Results

Dispatch Group	Nominated MW	Baseline MW	Max Demand Reduction (MW)	Avg. Demand Reduction (MW)	Realization Rate
2 - 6pm	87.6	43.6	40.4	39.9	46.1%
3 - 7pm	91.2	45.4	44.2	43.6	48.5%
4 - 8pm	75.4	41.1	35.4	35.1	46.9%
5 - 9pm	149.0	71.0	63.1	62.5	42.4%
Total (2 - 9PM)	403.2	201.0	180.2	181.1	44.7%

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 10 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 (180.2 MW), as this is the single hour when all dispatch groups are actively curtailing.

Table 10: August 11th Curtailment Event Results by Hour

Metric	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm	7-8pm	8-9pm
Baseline (MW)	201.0	201.0	201.0	201.0	201.0	201.0	201.0
Total Load (MW)	156.8	114.1	78.4	20.8	44.9	79.6	114.9
Total Reduction from Baseline (MW)	44.2	86.9	122.6	180.2	156.2	121.4	86.1
2-6pm DG Reduction from Baseline (MW)	40.1	39.5	39.5	40.3	15.0	4.1	1.1
3-7pm DG Reduction from Baseline (MW)	4.3	44.2	44.1	43.2	42.9	18.8	10.4
4-8pm DG Reduction from Baseline (MW)	(0.3)	3.4	34.7	35.1	35.3	35.4	12.3
5-9pm DG Reduction from Baseline (MW)	0.2	(0.2)	4.4	61.6	63.1	63.1	62.3

Figure 5 below presents the load profile of the August 11th curtailment event and its baseline, graphically depicting the results from Table 10 above. The overall demand reduction peaks in the 5-6p.m. hour and gradually decreases as the various dispatch groups' curtailment periods come to an end. Interestingly, unlike the other two events, the estimated load does not come close to regaining its pre-event level after the event ends. This is likely due to the tapering off of the irrigation season and irrigators turning off their pumps permanently during this time period.

Figure 5: August 11th Curtailment Event Load Profile (All Dispatch Groups)

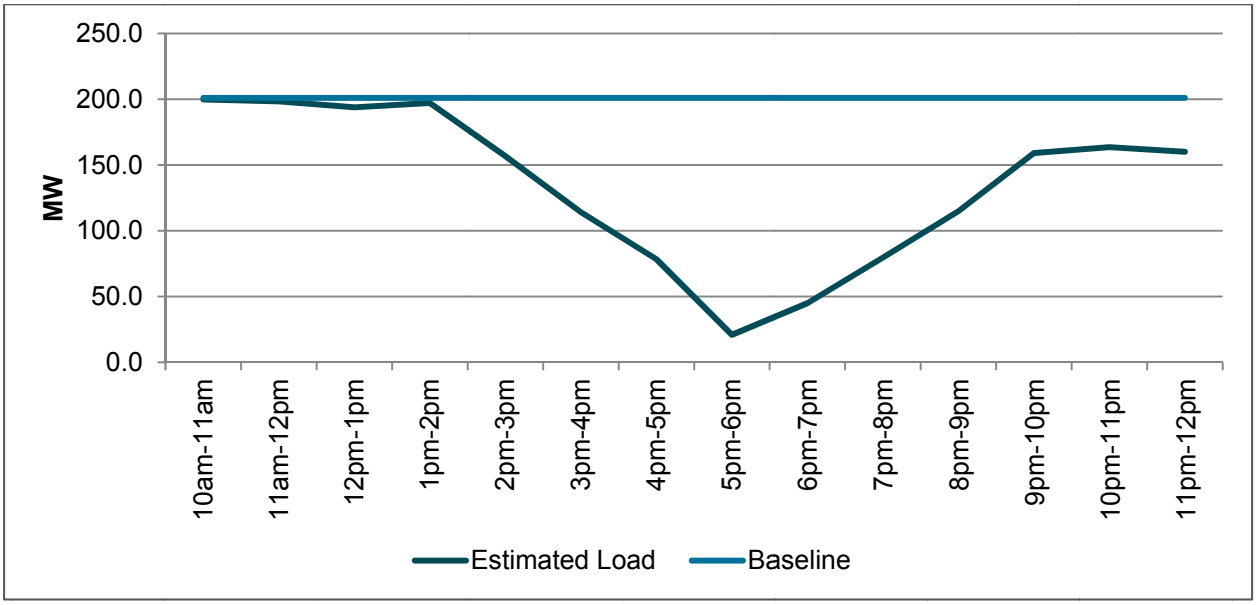
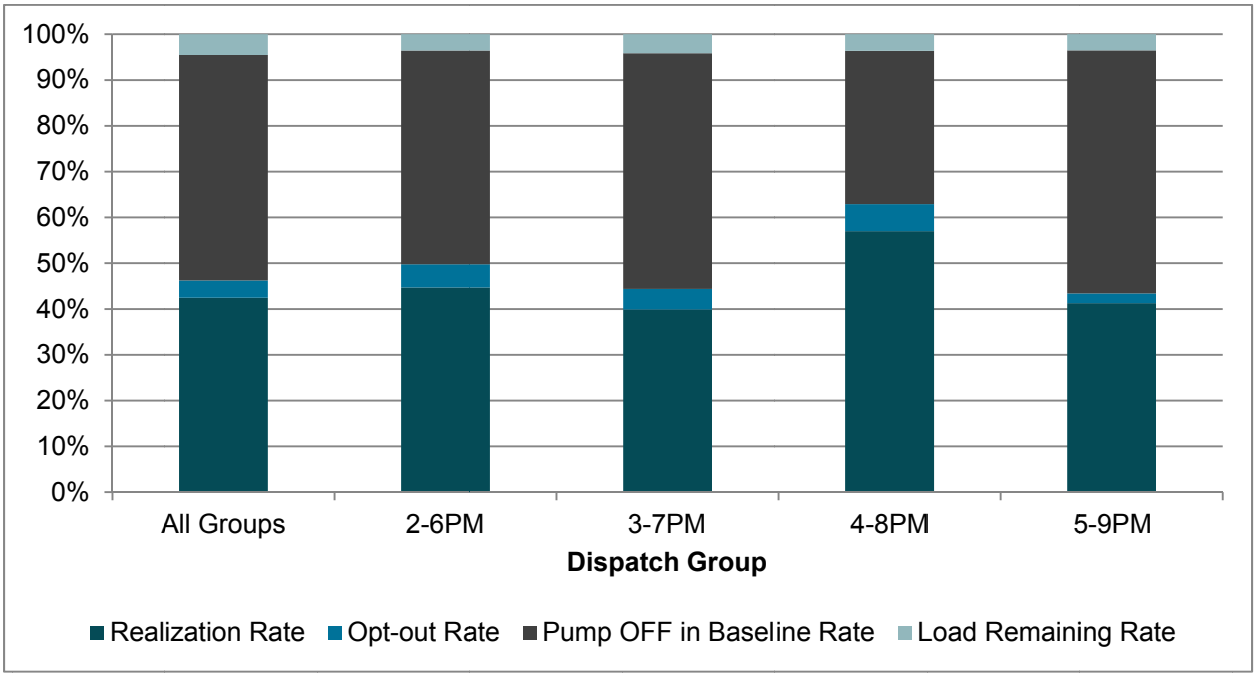


Figure 6 below depicts each dispatch group's realization rate for the August 11th event. The 4-8 p.m. dispatch group experienced the highest realization rate of all the dispatch groups at 57.0%. Realization rate variability between the dispatch groups was lowest in the August 11th event of all three 2015 events.

Figure 6: August 11th Curtailment Event Realization Rate



Counterfactual Realization Rate Results

The 2015 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 business 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.

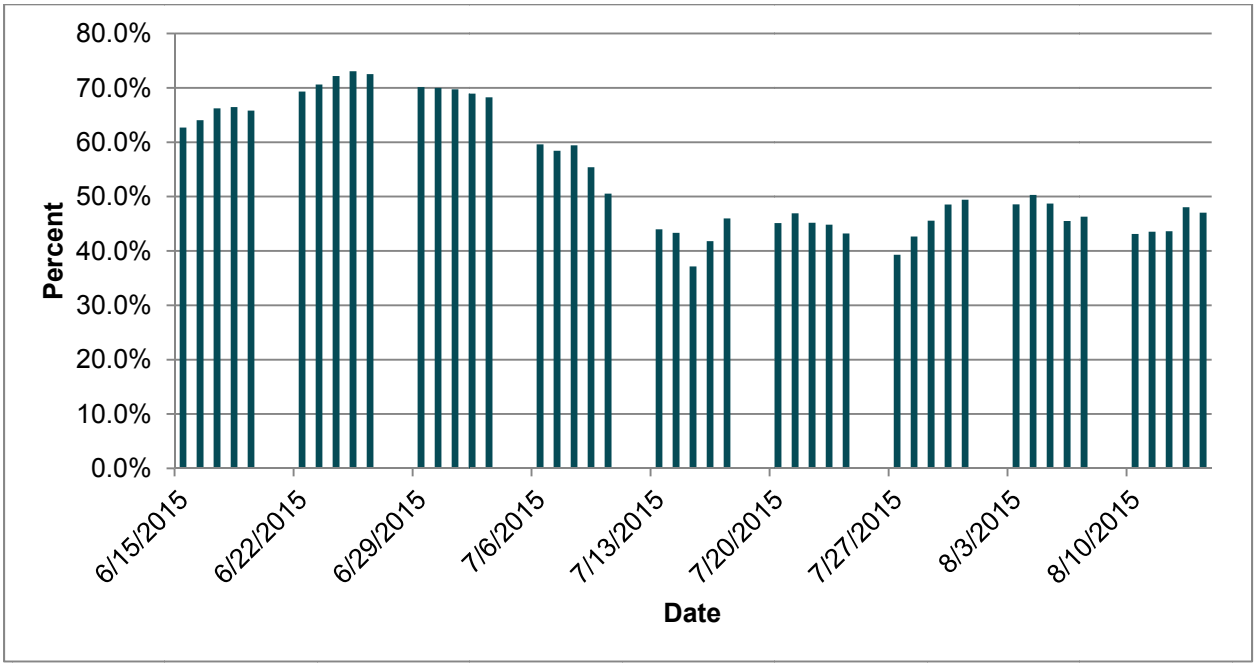
Table 11 below demonstrates that date has a large influence on the expected realization rate. While the first 25% of the program season averages an expected realization rate of 68.6%, the expected realization rate in the last 75% of the season drops off significantly, to an average of 49.1%. This is due to the percentage of pumps being shut off during the baseline period increasing as the season progresses.

Table 11. Counterfactual realization rates for 15-day summer periods in 2015

Date Range	Average Pump OFF in Baseline Rate	Average Opt-Out Rate	Average Device Failure Rate (option 1 & 2 pumps)	Average Did Not Reduce Total Nominated kW Rate (option 3 pumps)	Counterfactual Realization Rate	Total
Jun 15 - 30	22.1%	3.2%	2.9%	3.3%	68.6%	100.0%
Jul 1 - 15	34.8%	3.2%	2.9%	3.3%	55.9%	100.0%
Jul 16 - 31	45.8%	3.2%	2.9%	3.3%	44.9%	100.0%
Aug 1 - 15	44.2%	3.2%	2.9%	3.3%	46.5%	100.0%

Figure 7 below graphically presents the expected realization rate for all non-holiday and non-weekend days of the 2015 program season. The expected realization rate peaks on June 25th at 73.1%. Interestingly, the 2014 program season's counterfactual realization rate peaked on July 10th (at 71.6%). This shift in realization rates peaking earlier in the program season is likely due to southern Idaho having an early spring in 2015, and the irrigation season beginning earlier than in 2014.

Figure 7: Counterfactual Realization Rate by Date



Conclusions

The goals of the 2015 Peak Rewards impact evaluation were to determine the demand reduction (MW) during three 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.

CLEAResult completed analyses of curtailment events held on June 29th, July 2nd, and August 11th, 2015, 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 278.3, 273.8, and 180.2 MW, respectively for the three events, and an average of 244.1 MW without line losses and 305.3, 300.3, and 197.7 respectively with line losses. The events achieved realization rates of 69.0%, 67.9%, and 44.7%, respectively, averaging 60.5%.

The results of the counterfactual realization rate analysis demonstrated that date has a large influence on the expected realization rate. While the first quarter of the program season (June 15 - July 30) showed an average expected realization rate of 68.6%, the expected realization rate in the last three quarters of the season (July 1 – August 15) drops off significantly, to an average of 49.1%. This is due to a higher percentage of pumps being shut off during the baseline period as the season progresses. The counterfactual realization rate peaks in the last week of June and the first week of July, which is a shift of two weeks earlier compared to the 2014 peak counterfactual realization rates. 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. Typically, this time period generally equates to the last week of June and first week of July, however it is dependent on weather and the timing of the launch of the irrigation season. Based on the counterfactual realization rate analysis, the maximum evaluated potential capacity would have occurred on June 25th with 294.5 MW without line losses and 323.3 MW with line losses.

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.

Success Stories

SUCCESS STORIES

Table 5. 2015 Success Stories

Title	Program	Author*
Idaho Power Incentives Help Turn Wastewater into Useable Water	Custom Efficiency	Idaho Power
What was Dark is Now Light at Meyers Alignment	Easy Upgrades	Idaho Power

*All success stories written under contract with Writers, Ink. LLC.

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Custom Efficiency

For Complex Projects

Idaho Power incentives help turn wastewater into useable water

To modernize and streamline its potato processing operation, the J.R. Simplot Company announced in 2012 that it would consolidate three of its older french fry plants into one state-of-the-art facility at its Food Group campus in Caldwell, Idaho.

"This new, larger factory uses much less water than the previous plants but uses more water than the old factory that was here before," said Don Strickler, Simplot's energy efficiency engineer, "so we knew we had to upgrade our wastewater treatment plant."

Wastewater that's not wasted

Simplot uses water throughout the potato product manufacturing process and looks for opportunities to reduce its water use wherever possible. "We use water to wash the potatoes when they come in off the field," Don explained, "move them from one station to the other, push them through the cutters and carry off the potato waste." And every drop of water goes through the treatment plant at the end of a shift.

"We don't discharge to municipalities or the river," said John Prigge, a Simplot environmental manager. "The water we don't recycle back to the plant, we use to irrigate our own fields."

What's more, the water produced from the treatment plant meets drinking-water standards. "You could drink the water from that plant," John noted.

ENERGY STAR® certification for french fry plant

There is a specific ENERGY STAR program for frozen fried-potato factories in the US," Don said, "and we have to qualify every year." To meet its strict standards, Simplot evaluates each potato plant for how many pounds of potato products it makes and how much energy—including electricity, natural gas and hydrogen—it uses.

"Then we enter it into an ENERGY STAR model, and it gives us a score," he explained. "A score 75 or above and you're certified for that year. Our two factories in Washington and the one in Aberdeen that's been consolidated into this one have all been certified by ENERGY STAR."

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"While Idaho Power incentives help, Simplot invests in saving energy because it's the right thing to do for the environment."

—Don Strickland, Energy Efficiency Engineer, J.R. Simplot Company

The savings

Idaho Power incentives helped upgrade multiple components in the plant. Two components of the upgrade included the following:

1. High-efficiency turbo blowers aerate the water in the holding ponds saving the company over 700,000 kilowatt-hours (kWh) per year.
2. Variable-frequency drives (VFD) allow Simplot to control flows by adjusting the speed of its reverse osmosis feed pumps and return water pumps. Annual estimated power savings compared to fixed-speed pumps are close to 1,000,000 kWh for this portion of the project.

"While we spent more money up front," Don said, "we knew the incentive would offset a lot of that cost."

Estimated savings from Idaho Power's Easy Upgrade projects for J.R. Simplot Caldwell French Fry Plant

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out of Pocket	Payback in Years
1,711,599	$980,700	$94,138	$205,392	$775,308	8

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 the J.R. Simplot Company.

The above success story was produced in cooperation with, and approval from, the J.R. Simplot Company.

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Easy Upgrades

For Simple Retrofits

What was dark is now light at Myers Alignment

"It used to be like a cave in here," said Richie Myers as he stood in the middle of his shop at Myers Alignment on the western edge of Ontario, Oregon. "We do a lot of restoration work on classic cars. It's mostly custom alignments, suspensions and frame work, but it's fun to see these old classics look like new again."

Richie bought the business two years ago and immediately noticed the building's most glaring need. "The lighting was horrible. There was one row of eight-foot-long strips down the middle," he said, pointing up to the ceiling. "Some lights over near the west wall, but no lights at all on the east wall."

"We had to depend on drop lights that came down from the ceiling to do our work." Idaho Power's Easy Upgrades program helped change all that.

The project

"We put in two rows of new four-foot fixtures up top," he explained, "then a row of fixtures around the walls about midway up."

While the shop needed the most help, Richie overhauled lighting on the entire building. Twenty-two T12 fixtures in the office and customer lounge were upgraded to 20 T8 fixtures. Nine 400-watt, metal halide bulbs in the shop were replaced with 16 T5s. Incandescent lamps in the restrooms became four high-efficiency LED lamps. And finally, a high-efficiency LED lighting package replaced the mercury vapor wall pack to light the parking lot.

"We haven't had a winter with the new lights yet," Richie said with a smile, "but we're looking forward to shutting the doors and still being able to see."

Enjoying the classics

On Myers Alignment's website is a photo of a beautifully restored 1967 Pontiac Firebird.

"We do a lot of restoration work on classic cars," Richie said. "It's mostly custom alignments, suspensions and frame work, but it's fun to see these old classics look like new again."

Richie's reputation for his work on oldies-but-goodies is growing. "People just keep rolling them in," he said, "so it's helping out."

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"More light. Less money. It works out great for us."

– Richie Myers, Owner
Myers Alignment

The savings

The primary goal of the lighting upgrade was improving working conditions, but it also reduced the shop's energy use and, in the process, its power bill. "It's not a huge amount, because we added extra lights," Richie pointed out, "but the power bill has definitely gone down."

Even with the additional lights, Richie's annual energy usage dropped by 5,786 kilowatt-hours (kWh), saving him $328 a year. Richie realized additional savings when Idaho Power's Easy Upgrades incentive paid more than a third ($2,504) of the project's $7,394 cost.

Estimated savings from Idaho Power's Easy Upgrade projects for Myers Alighment

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Incentive	Customer Out of Pocket	Payback in Years
5,786	$7,394	$328	$2,504	$4,890	14.9

Uncommon savings are quite common

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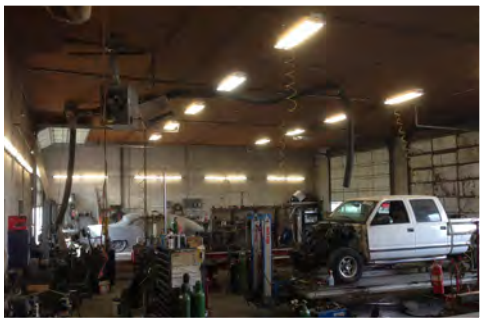

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WEATHERIZATION ASSISTANCE FOR QUALIFIED CUSTOMERS 2014 ANNUAL REPORT

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Weatherization Assistance
for Qualified Customers

2014 Annual Report
April 1, 2015

2014

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. Weatherization customers also receive educational materials and efficiency ideas on using energy wisely in their homes. Local CAP agencies determine participant 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 supplemental 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 oversees the program in Idaho through five regional CAP agencies. The company has an agreement with each CAP agency that specifies the funding allotment, billing requirements, and program guidelines. 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 submits this *Weatherization Assistance for Qualified Customers 2014 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 2015

REVIEW OF WEATHERIZED HOMES AND NON-PROFIT BUILDINGS BY COUNTY

In 2014, Idaho Power made $1,302,609 available to Idaho CAP agencies. Of the funds provided, $1,190,073 were paid in 2014, while $112,536 were accrued for future funding. Of the funds paid in 2014, $1,019,463 directly funded audits, energy efficiency measures, and health and safety measures for qualified customers' homes (production costs) in Idaho, and $101,946 funded administration costs to Idaho CAP agencies for those homes weatherized. Idaho Power funding provided for the weatherization of 239 Idaho homes and 5 Idaho non-profit buildings in 2014. The production cost of the non-profit building weatherization measures was $62,422, while $6,242 in administrative costs were paid for the Idaho non-profit building weatherization jobs. In Oregon, Idaho Power paid $45,475 in production costs for 11 qualified homes and $4,547 in CAP agency administrative costs for homes in Malheur and Baker counties. Table 1 shows each CAP agency, the number of homes weatherized, production costs, average cost per home, administration payments, and total payments per county made by Idaho Power.

Table 1
2014 WAQC 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	Boise	2	$ 15,022	$ 7,511	$ 1,502	$ 16,524
	Canyon	64	247,625	3,869	24,762	272,387
	Gem	1	3,534	3,534	353	3,887
	Payette	1	7,566	7,566	757	8,323
	Agency Total	**68**	**$ 273,747**	**$ 4,026**	**$ 27,374**	**$ 301,121**
EICAP	Lemhi	3	11,625	3,875	1,163	12,788
	Agency Total	**3**	**$ 11,625**	**$ 3,875**	**$ 1,163**	**$ 12,788**
EL ADA	Ada	85	427,110	5,025	42,711	469,821
	Elmore	6	36,683	6,114	3,668	40,351
	Owyhee	10	53,007	5,301	5,301	58,308
	Agency Total	**101**	**$ 516,799**	**$ 5,117**	**$ 51,680**	**$ 568,479**
SCCAP	Cassia	1	1,831	1,831	183	2,014
	Gooding	2	8,752	4,376	875	9,627
	Jerome	1	2,883	2,883	288	3,172
	Lincoln	3	9,835	3,278	984	10,819
	Twin Falls	15	77,607	5,174	7,761	85,368
	Agency Total	**22**	**$ 100,908**	**$ 4,587**	**$ 10,091**	**$ 110,999**
SEICAA	Bannock	24	63,459	2,644	6,346	69,805
	Bingham	8	15,747	1,968	1,575	17,321
	Power	13	37,178	2,860	3,718	40,895
	Agency Total	**45**	**$ 116,383**	**$ 2,586**	**$ 11,638**	**$ 128,022**
Total Idaho Homes		**239**	**$ 1,019,463**	**$ 4,266**	**$ 101,946**	**$ 1,121,409**
Idaho Non-Profit Buildings	Lemhi	1	5,834	–	583	6,418
	Ada	1	15,360	–	1,536	16,896
	Twin Falls	2	38,526	–	3,853	42,378
	Blaine	1	2,702	–	270	2,972
Total Idaho Non-Profit Buildings		**5**	**$ 62,422**	**–**	**$ 6,242**	**$ 68,664**
Total Idaho		**244**	**$ 1,081,884**	**–**	**$ 108,188**	**$ 1,190,073**
Oregon						
CCNO	Baker	2	7,487	3,744	749	8236
	Agency Total	**2**	**$ 7,487**	**3,744**	**$ 749**	**$ 8,236**
CINA	Malheur	9	37,987	4,221	3,799	41,786
	Agency Total	**9**	**$ 37,987**	**4,221**	**$ 3,799**	**$ 41,786**
Total Oregon homes		**11**	**$ 45,475**	**4,134**	**$ 4,547**	**$ 50,022**
Total Program		**255**	**$ 1,127,359**	**–**	**$ 112,736**	**$ 1,240,094**

[1] Agency average cost total is equal to the production cost divided by the number of jobs.
Note: Dollars are rounded.

The base funding for Idaho CAP agencies is $1,212,534 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 of 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 provide the 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 each CAP agency was allowed under the 2014 agreement was $6,000. In 2014, Idaho CAP agencies had a combined average cost per home served of $4,266, and Oregon CAP agencies averaged $4,134 per home. No CAP agency exceeded their maximum average cost.

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 2014 was $427, and the average administration cost paid to Oregon agencies per Oregon home weatherized during the same period was $413. Not included in the dollar totals reflected in Table 1 are additional Idaho Power staff labor, marketing, evaluation, home verification, and support costs for the WAQC program totaling $57,556 for 2014. 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 2014, $90,075 in unspent funds from 2013 were made available for expenditures in Idaho.

Table 2 details the base funding and unspent funds from 2013 that were available in 2014 and the total amount of 2014 spending.

Table 2
2014 Idaho WAQC base funding and unspent funds made available

Agency	2014 Base Funding	Available Funds from 2013	Total 2014 Allotment	Total 2014 Spending
Idaho				
CCOA	$ 302,259	–	$ 302,259	$ 301,120
EICAP	12,788	–	12,788	12,788
EL ADA	568,479	–	568,479	568,479
SCCAP	167,405	–	167,405	110,999
SEICAA	111,603	$ 38,211	149,814	128,022
Non-profit buildings	50,000	51,864	101,864	68,664
Idaho Total	**$ 1,212,534**	**$ 90,075**	**$ 1,302,609**	**$ 1,190,073**

Note: Dollars are rounded.

REVIEW OF MEASURES INSTALLED

Table 3 details home counts for which Idaho Power paid all or a portion of the measure costs during 2014. 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 the total homes weatherized because the number of measures installed in each home varies. For example, Table 3 shows 72 homes received a compact fluorescent lamp/light (CFL) measure. Each home received more than one bulb. 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 necessary electrical upgrades. The EA5 energy audit program (EA5) is a software program approved for use by the U.S. Department of Energy (DOE) and chosen by the Idaho Department of Health and Welfare (IDHW) for use in the Idaho state WAP and, therefore, it is used by 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
2014 WAQC review of measures installed

	Home Counts	Production Costs
Idaho Home and Non-Profit Measures		
Windows	126	$ 176,377
Doors	113	75,717
Wall insulation	11	10,323
Ceiling insulation	99	72,536
Vents	12	1,262
Floor insulation	85	68,982
Infiltration	133	29,888
Ducts	45	26,385
Health and safety	33	13,662
Other	22	7,336
Water heater	4	3,868
Pipes	32	1,688
Refrigerator*	6	19,384
Furnace tune	3	688
Furnace repair	9	9,100
Furnace replace	164	550,279
CFL	72	2,311
Audit	143	12,098
Total Idaho Homes and Non-Profit Measures		**$ 1,081,884**

Continued on next page.

Table 3 (continued)

	Home Counts	Production Costs
Oregon Home Measures		
Windows	4	$ 10,359
Ceiling insulation	7	11,056
Floor insulation	5	15,438
Infiltration	4	3,530
Ducts	1	468
Health and safety	5	4,302
Pipes	2	322
Total Oregon Homes Measures		**$ 45,475**

*One Idaho refrigerator replacement was a commercial refrigerator for a non-profit food bank.
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 monitoring process that reviews weatherized homes. The process involves utility representatives; weatherization personnel from CAP agencies; Community Action Partnership Association of Idaho, Inc. (CAPAI); and the 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. The Energy Auditor 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 and in Idaho Power's Oregon service area.

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, reported annual savings and individual project screening for the WAQC program were determined solely using annual savings estimates from the 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 of Idaho and Idaho Power for each completed 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 and translates that change into savings-to-investment ratio (SIR). The output of the EA5 SIR is similar to the participant cost test (PCT) ratio. If the EA5 computes an SIR of 1.0 or higher, the CAP agency is authorized to complete 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 2014, the total utility cost (UC) benefit/cost (B/C) ratio for the WAQC program was 0.51, while the B/C ratio from the total resource cost (TRC) perspective was 0.42. In 2014, the B/C ratios declined compared to 2013 due to the downward change in the DSM alternative costs from the *2013 Integrated Resource Plan* (IRP) that Idaho Power uses to value energy efficiency. In 2013, the UC B/C ratio was 0.95, while the TRC B/C ratio was 0.74. Based on 2014 savings and costs, the WAQC program continued to not be a cost-effective program in 2014.

In 2012, Idaho Power contracted with D&R International, Ltd., to conduct an impact evaluation of 2011 WAQC activities. 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. The average per-home savings reported in the impact evaluation were 2,684 kilowatt-hours (kWh). As a result of the evaluation results and recommendations by the evaluator, the EA5 was no longer deemed an accurate source for annual savings estimates for WAQC projects. For reported savings in 2012 and 2013, the evaluated average per-home savings of 2,684 kWh were used.

In 2014, Idaho Power conducted a billing analysis on participants' billing data from 2012, and the results were used to report savings for 2014. The additional billing data analysis was done to increase Idaho Power's understanding of savings resulting from the program and to incorporate one of the recommendations from D&R International—to use a control group. This would account for non-weather related changes in energy use not attributable to the program's weatherization measures. Homes where WAQC weatherization projects were completed during 2010 were used as a control group to eliminate change in energy consumption due to factors other than program weatherization. For the updated billing analysis, Idaho Power also wanted to explore whether savings could be further differentiated between housing type (single-family versus manufactured home), heating footprint of the home, and number of occupants in the home. In contrast, the D&R International 2012 analysis only compared customer's billing data before and after weatherization.

All updated billing analysis and data preparation was done in accordance with the *Whole-building Retrofit with Consumption Data Analysis Evaluation Protocol* document published in April 2013 by the DOE at energy.gov/eere/about-us/ump-protocols.

Similar methods of consumption analysis of billing data were also used in recent regional studies, including the *Final Summary Report for the Ductless Heat Pump Impact and Process Evaluation* prepared by Ecotope, Inc., and published by the Northwest Energy Efficiency Alliance (NEEA) in February 2014 at neea.org/docs/default-source/reports/e14-274-dhp-final-summary-report-(final).pdf?sfvrsn=8 and *SEEM Calibration, Phase 1*, published by the Regional Technical Forum (RTF) in May 2014 at rtf.nwcouncil.org/measures/support/SEEM/Default.asp.

Total claimed estimated savings for 2014 projects were 533,800 kWh, with 184,587 kWh from single-family homes and 336,401 kWh from manufactured homes. An additional 12,812 kWh resulted from weatherization projects at non-profit sites. Idaho Power's analysis results showed differences between average savings in manufactured and single-family type homes. Manufactured home savings per home were similar to the findings of the previous D&R International analysis evaluation results, with savings of 2,568 kWh per year. Single-family homes, when analyzed independently from manufactured homes, revealed fewer savings than the 2012 evaluation results provided to Idaho Power in 2013, with an updated estimate of 1,551 kWh per year per home. The effects of further segregating savings analyses by the heating footprint of the home, number of occupants, and climate were not statistically significant across all housing types and therefore were not factored into saving estimates. Idaho Power plans to continue monitoring savings from WAQC through further billing analyses. Additionally, the RTF is analyzing manufactured-home audit data from 2011 to 2012 to validate regional savings models used for manufactured-home savings estimates for heat pumps and weatherization. The resulting collaboration with the RTF will provide insights into how to potentially enhance analysis methods and techniques of the program.

For the five WAQC non-profit projects in 2014, Idaho Power used the savings estimated at 1.03 kWh per square foot of weatherized heated space. This was based on the average decrease in annual energy intensity from the billing analysis of single-family homes resulting in an annual savings for non-profits of 1.03 kWh/heated square foot. The small number of projects and the lack of homogeneity among non-profit projects did not allow for a billing analysis based on previous projects. Non-profit projects were excluded from the D&R International impact evaluation. Idaho Power continues to look for methods to best estimate savings for non-profit-type projects.

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 agency and Idaho Power 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 areas.

The recommendations from the IPUC staff's report and IPUC Order No. 32788 were used for a cost-effectiveness analysis for 2014. 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 contract was signed with Kearns ENTerprises™ to develop a home audit tool to be used in Idaho Power's Weatherization Solutions for Eligible Customers program starting in 2015. The updated tool was designed to capture key data and more details regarding measures installed for health and safety. Updated calculations for estimates of energy savings and measure information to more accurately report program effectiveness were built into the program. The new Home Audit Tool (HAT 14.1) was distributed in January 2015 to contractors participating in the Weatherization Solutions for Eligible Customers program and will be tested throughout 2015 in that program. The WAQC program will use the tool if the Idaho state WAP adopts it.

Updates to the energy audit tool included the following:

- Heating degree days and lives of measures to be used in calculating SIRs and estimated energy savings were updated.
- Data-entry points were programmed into the tool as checkboxes to better categorize items installed under the Health and Safety category. This will allow consistency between agencies and will add quantitative capabilities for future reporting of NEBs.
- Data-entry points were added to the tool to more easily calculate SIRs and estimated savings for refrigerator replacements.

- Housing-type data-entry points were added to clarify housing types and increase the capability of estimating savings by housing type.

- A support cost was hard-coded into the new program to calculate a maximum percentage of support cost per measure. Sub-contracted labor no longer receives this financial support.

- A data-entry point calculating a minimum percent of Idaho Power costs required to be paid by the landlord for participation when a home is not owner-occupied was hard-coded into the program.

- Data-entry points were added to count the number of CFL and light-emitting diode (LED) installations to better estimate savings.

- All necessary items to ensure information is transmitted into an Idaho Power database through proper file transfer protocol were included for the security of customer information.

In addition, the University of Idaho Integrated Design Laboratory (IDL) developed a weatherization heat pump calculator to check estimated energy savings reported by the new HAT 14.1 when a heating system has been replaced as a part of weatherization in a home. HAT 14.1 will be used for jobs submitted through Idaho Power's Weatherization Solutions for Eligible Customers program in 2015.

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 booklets *30 Simple Things You Can Do to Save Energy* and *Energy Saving Tips*, which describe energy conservation tips for the heating and cooling seasons, and a pamphlet that describes the energy-saving benefits of using CFLs, LEDs, and other tips for choosing the right bulb. Idaho Power actively informs customers about WAQC through energy and resource fairs and other customer contacts. Idaho Power's Customer Service Center regularly informs customers about the program.

To stay current with new programs and services, Idaho Power attends state and federal energy assistance/weatherization meetings and other weatherization-specific conferences, such as the Affordable Comfort Conference by the Building Performance Institute. Idaho Power is also active in the Policy Advisory Council, helping advise and direct Idaho's state weatherization application for funding 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 the stated measures are installed in the homes of participating customers and discuss the program with these customers. Home verifiers visited 44 homes, requesting feedback about the program in 2014. When asked how much customers learned about saving electricity, 35 customers answered they learned "a lot" or "some." When asked how many ways they tried to save electricity, 39 customers responded "a lot" or "some."

As recommended by Johnson Consulting Group in the 2013 process evaluation, a customer survey was developed to assess major indicators of customers' satisfaction and program operations consistently throughout the service area. The 2014 Weatherization Programs Customer Survey was provided to all program participants in all regions upon completion of weatherization in their homes. Survey questions gathered information about how customers learned about the program, reasons for participating, how much customers learned about saving energy in their homes, and the likelihood of household members changing behaviors to use energy wisely.

Idaho Power received survey results from 237 of the 250 households weatherized by the program in 2014. Of the 237 surveys received back from customers, 228 were from Idaho customers and 9 from Oregon customers. Some key highlights include the following:

- Over 47 percent of respondents learned of the program from a friend or relative, and another almost 15 percent learned of the program from an agency flyer. Nearly 6 percent learned about the weatherization program by receiving a letter in the mail.

- Almost 90 percent of the respondents reported that their primary reason for participating in the weatherization program was to reduce utility bills, and over 45 percent wanted to improve the comfort of their home.

- Almost 74 percent reported they learned how air leaks affect energy usage, and just over 65 percent indicated they learned how insulation affects energy usage during the weatherization process. Another almost 57 percent of respondents said they learned how to use energy wisely.

- Over 79 percent reported they were very likely to change habits to save energy, and almost 80 percent reported they have shared all of the information about energy use with members of their household.

- Over 86 percent of the respondents reported that they think the weatherization they received will significantly affect the comfort of their home, and nearly 94 percent said they were very satisfied with the program.

- Over 86 percent of the respondents reported that the habits they were most likely to change was turning off lights when not in use, and over 61 percent said that washing full loads of clothes was a habit they were likely to change to save energy. Turning the thermostat up in the summer was reported by nearly 51 percent, and turning the thermostat down in the winter was reported by almost 58 percent as a habit they and members of the household were most likely to change to save energy.

A summary of the above survey is included in the *Demand-Side Management 2014 Annual Report's Supplement 2: Evaluation* available online at idahopower.com/EnergyEfficiency/reports.cfm.

Also recommended in the Johnson Consulting Group 2013 process evaluation was that Idaho Power begin developing a new energy audit tool. The tool was completed in 2014 for Idaho Power's Weatherization Solutions for Eligible Customers program and may be accepted by the Idaho state WAP.

In Oregon, Idaho Power filed an updated tariff for the program. The tariff removed funding for the non-profit pooled funds. This change allowed Idaho Power to increase funds used to

weatherize homes. This funding shift occurred in 2014 and allowed additional funds to be spent on efficiency improvements in qualified customers' homes in Oregon.

PLANS FOR 2015

As in previous years, unless directed otherwise, Idaho Power will continue to provide financial assistance to CAP agencies while exploring changes to improve program delivery and continue to provide the most benefit possible to special needs customers while working with Idaho and Oregon state WAP personnel. Unless the IPUC directs otherwise, Idaho Power will continue its efforts to improve this program while at the same time offering it to the company's customers on an ongoing basis.

Idaho Power will continue to participate in the Idaho and the Oregon state monitoring 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 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.

Idaho Power plans to selectively market the WAQC program throughout 2015. The program will be promoted at resource fairs, community special-needs populations' service-provider meetings, and CAP agency functions to reach customers who may benefit from the program. Additional marketing for this program will be 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 overall WAQC program.

In 2015, Idaho Power will support the whole-house philosophy of the WAQC program and the Idaho and Oregon WAP by continuing to contract a $6,000 annual maximum average per-home cost. Based on the required funding, Idaho Power estimates 195 homes in Idaho and Oregon and approximately 6 non-profit buildings in Idaho will be weatherized in 2015. In Idaho during 2015, Idaho Power expects to fund the base amount plus available funds from 2014 to total $1,325,070 in weatherization measures and agency administration fees. Of this amount, $83,200 will be provided to the non-profit pooled fund to weatherize buildings housing non-profit agencies that primarily serve qualified customers in Idaho.

Service-area wide, Idaho Power will provide the WAQC program $1,375,642 in funding in 2015 for the weatherization of homes and buildings of non-profit agencies serving qualified customers.

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