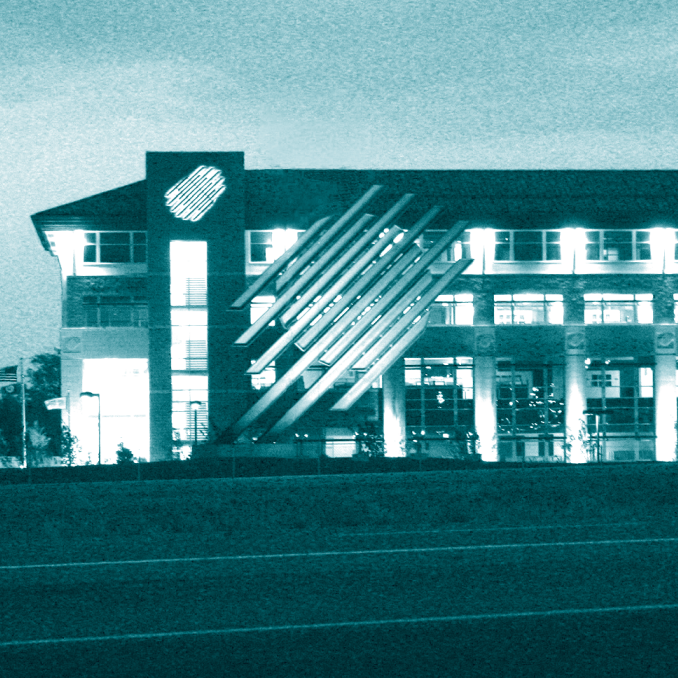


IDAHO POWER®
An IDACORP Company

Demand-Side Management 2011 Annual Report

March 15, 2012

Supplement 2: Evaluation

Photo Captions

Top Photo:
Courtesy of the Idaho Central Credit Union
The Idaho Central Credit Union's corporate office in Chubbuck, Idaho incorporates numerous energy efficient measures provided through Idaho Power's Building Efficiency program.

Middle Photo:
Idaho Power offers an energy efficiency program and a demand-response program for irrigation customers.

Bottom Photo:
Idaho Power offers numerous energy efficient programs for residential customers.

Printed on recycled paper

TABLE OF CONTENTS

Table of Contents i
List of Tables i
Evaluation Summary 1
Evaluation Plan 3
Energy Efficiency Advisory Group Minutes 5
NEEA Market Effects Evaluations 25
Research 27
Evaluations 209
Surveys 579
Success Stories 711
Weatherization Assistance for Qualified Customers 2010 Annual Report 737

LIST OF TABLES

Table 1. 2011 NEEA Market Effects Evaluations 25
Table 2. 2011 Research 27
Table 3. 2011 Evaluations 209
Table 4. 2011 Surveys 579
Table 5. 2011 Success Stories 711

EVALUATION SUMMARY

Program evaluation is a fundamental component of Idaho Power's demand-side management (DSM) operational activities. The company contracts with third-party contractors to provide impact and process evaluations. Third-party studies and evaluations are generally awarded through a competitive bidding process and managed by Idaho Power's Procurement department. In some cases, internal studies and analyses are managed by Idaho Power's Research and Analysis team within the Customer Relations and Energy Efficiency organization. Evaluations are specifically coordinated by the company's energy efficiency evaluator, while surveys are performed in consultation with the customer research coordinator.

The company also supports regional studies to ensure the ongoing cost effectiveness of programs, validation of energy savings and demand reduction, and the efficient management of its programs. Idaho Power considers research studies; cost-effectiveness analyses; surveys; market-potential assessments; and impact, process, and market-effects evaluations important tools to improve its DSM activities. The results of Idaho Power's program evaluation efforts are used to enhance program reporting accuracy and initiate appropriate program modifications.

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*, *Database for Energy Efficiency Resources* (DEER), and the Regional Technical Forum's (RTF) evaluation protocols. The company is active in the Northwest Research Group, the Pacific Northwest Demand Response Project, and the Regional Technical Forum (RTF) meetings. In addition, Idaho Power partners with several regional entities to evaluate energy efficiency technologies and advancements.

Idaho Power continued its efforts in 2011, to comply with the 2010 Memorandum of Understanding (MOU), where Idaho Power joined with the Idaho Public Utilities Commission (IPUC) staff and other Idaho investor-owned utilities to sign a MOU in IPUC Case No. IPC-E-09-09. The MOU reflects how Idaho Power intends to manage, plan, evaluate, and report its DSM activities. The MOU includes specific requirements for timing and reporting of evaluation of Idaho Power's energy efficiency and demand response programs.

In 2011, Idaho Power implemented its broad evaluation plan for its energy efficiency and demand response programs with a focus on completing impact evaluations. ADM Associates, Inc., was chosen to perform program impact evaluations of Energy House Calls, Home Improvement Program, Rebate Advantage, Home Products Program, and Custom Efficiency and a program process evaluation of See ya later, refrigerator®. Portland Energy Conservation, Inc. (PECI), who specializes in evaluation of demand response programs, was also retained to perform an impact evaluation of the A/C Cool Credit program and a process evaluation of the Irrigation Peak Rewards program.

As part of its evaluation efforts, Idaho Power is actively participating in several local and regional studies to identify and promote emerging technologies that may further enhance opportunities for new

program deployment. Included in *Supplement 2: Evaluation* are copies or summaries of all evaluations, research studies, and customer surveys that Idaho Power either performed, or was a participant, in 2011.

An evaluation plan for 2012–2013 is included in this supplement. Although this evaluation plan is expected to be used for scheduling evaluations, the implementation of specific program evaluations will be based on considerations regarding program needs, evaluation timing, and other relevant regional studies. When necessary, resources may be reallocated to programs with the most urgent needs.

EVALUATION PLAN

Idaho Power Company Customer Relations and Energy Efficiency Program 2011–2013 Evaluation Plan

Segment	Program	Program Type	Evaluation Selection	2011	2012	2013
Residential				1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12
	A/C Cool Credit	Demand Response	Impact		3	
			Process			
			Cost Effectiveness			
	Ductless Heat Pump Pilot	Pilot	Impact			
			Process	1		
			Cost Effectiveness			
	Energy Efficient Lighting	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	Energy House Calls	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	ENERGY STAR® Homes Northwest	Energy Efficiency	Impact			
			Process	1		
			Cost Effectiveness			
	Heating and Cooling Efficiency Program	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	Home Improvement Program	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	Home Products Program	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	Rebate Advantage	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	See ya later, refrigerator®	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	Residential Energy Efficiency Education Initiative	Education/Outreach	Impact			
			Process			
			Cost Effectiveness			
	Weatherization Assistance for Qualified Customers	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	Weatherization Solutions for Eligible Customers	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
Commercial/Industrial						
	Building Efficiency	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	Custom Efficiency	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	Easy Upgrades	Energy Efficiency	Impact			
			Process			
			Cost Effectiveness			
	FlexPeak Management	Demand Response	Impact	2	2	2
			Process			
			Cost Effectiveness			
	Commercial Energy Efficiency Education Initiative	Education/Outreach	Impact			
			Process			
			Cost Effectiveness			
Irrigation						
	Irrigation Efficiency Rewards	Energy Efficiency	Impact		3	
			Process			
			Cost Effectiveness			
	Irrigation Peak Rewards	Demand Response	Impact	2	2	2
			Process			
			Cost Effectiveness			

[1] Performed by NEEA
[2] Performed by Idaho Power
[3] Research

This page left blank intentionally.

ENERGY EFFICIENCY ADVISORY GROUP MINUTES

The following pages include minutes from EEAG meetings held on February 23, 2011, June 27, 2011, and October 14, 2011.

This page left blank intentionally.

Energy Efficiency Advisory Group (EEAG)
Minutes dated February 23rd, 2011

Present:

Catherine Chertudi–City of Boise, Public Works Dept.
Ken Robinette–South Central Comm. Action Partnership
Lynn Anderson–Idaho Public Utilities Commission
Ron Whitney–Northwest Energy Coalition
Mike Youngblood–Idaho Power
Celeste Becia*–Idaho Power
Tom Eckman–Northwest Power & Conservation Council
Don Sturtevant–Simplot
Lynn Young–AARP
Sue Siefert–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Kent Hanway-CSHQA
Ben Otto-Idaho Conservation League

Not Present:

Nancy Hirsh-Northwest Energy Coalition

Guests and Presenters*:

Pete Pengilly–Idaho Power*
Kathy Yi–Idaho Power
Todd Schultz–Idaho Power*
Warren Kline–Idaho Power
Gary Grayson-Idaho Power
Patti Best-Idaho Power
Dennis Merrick-Idaho Power
Chris Pollow-Idaho Power
David Davis-Idaho Power
Ryan Hartnett-Idaho Power
Stacy Donahue-Idaho Public Utilities Commission
Cheryl Paoli–Idaho Power
Theresa Drake–Idaho Power
Andrea Simmonsen–Idaho Power
Sheree Willhite-Idaho Power
Becky Andersohn-Idaho Power*
Becky Arte-Howell-Idaho Power
Randy Thorn-Idaho Power
Chellie Jensen-Idaho Power
Shelley Martin-Idaho Power
Bev Barker-Idaho Public Utilities Commission
Ken Miller-Snake River Alliance

Recording Secretary:

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

Meeting Convened at 9:30am

Housekeeping and agenda were reviewed. Celeste introduced Ben Otto as a new EEAG member. Ben gave the group a brief overview of his job at the Idaho Conservation League. Guest and member introductions were made. The meeting minutes from the last meeting were reviewed.

2010 Year in Review/2011 Preview-Celeste Becia, Todd Schultz

9:40 Residential Programs-Celeste Becia

The Estimated 2010 results slide shows energy savings for programs only, NEEA savings is not included in this. Lighting projects were captured by the Custom Efficiency program this year, which is the reason the industrial program numbers are much higher. Demand Response experienced a good year, 356 MW of energy savings. A

peaker plant is 50-60 MW, so this program is the equivalent of 5-6 peaker plants. The 2010 Highlights slide was shown and one member asked if there was still the Solar for our Schools program that is not rider funded. Celeste answered that yes there is. It is primarily to educate customers and students on how their solar pv systems work. It is funded by customer contributions to the Green Power program. The Idaho Power Easy Savings program works with local Community Action Partnership agencies to educate low income customers on ways to save energy in their homes. One member asked what the definition of special needs people were. Celeste answered that they were low income and senior citizens. Another member clarified that these customers are classified as income eligible as opposed to special needs.

The A/C Cool Credit program has 6095 net new participants. This program experiences at 1%-2% drop out rate per year. Most of the dropouts can be attributed to people moving, not dissatisfaction with the program. This program should be able to reach 40,000 participants when Pocatello and Twin Falls are back up again. Idaho Power will have one of the highest penetration rates for an A/C Demand Response program. One member asked how Idaho Power knows which customers have air conditioners. Celeste answered that it is based on an algorithm that's applied to customer usage patterns, and that the company doesn't have enough detail on customers to know what type of cooling system they have. It is an estimate. The End Use Study should also provide information about the proportion of customers who have air conditioning.

The Boise City Home Audit Project has completed 215 homes as of February 21st 2011. Idaho Power is doing direct mail solicitation and customers can sign up online. There has been a high customer satisfaction rate. The company will be tracking to see what kind of action customers have taken after the audit. One member asked what kind of diagnostics are part of the audit. Celeste said that the audit consist of a visual inspection and blower door test, along with installation of CFL's, pipe wrap, shower heads, and mastic on furnaces. The homeowner is involved during the audit which takes about 2-3 hours. The customer is provided with a full report based on the findings from the audit process. One member asked if Idaho Power will be doing any analysis on the data that comes from these audits. Celeste stated that the company will be looking at a 6 and 12 month view. Another member asked what the greatest potential return is on the upgrades. Andrea answered that insulation is a common recommendation as well as duct sealing. CFL replacement seems to be the most common measure installed at the time of the audit.

The Energy House Calls program has been running since 2002-2003. The third party implementor's contract ends June 30, after which the program will be managed in-house. Depending on the results of this in-house management, it may be outsourced again in the future depending on its market penetration. Idaho Power is looking at how this program can be integrated with the Home Improvement Program to provide duct sealing to site-built homes.

The Heating and Cooling program underwent some changes in 2009-2010 by removing some measures. This year the company wants to work with existing HVAC Contractors to ramp up training. There are about 10-15% of contractors doing 90% of the work. One member stated that due to code changes, contractors are being retrained in the sizing of equipment and duct blaster testing. The new codes are requiring equipment that most of the contractors don't have, which means they have to invest money into their companies to be compliant

Idaho Power is looking at capturing more measures within the Home Improvement program. One member asked if for 2011, Idaho Power is requiring professional installation of insulation and if there is a requirement for fiberglass instead of cellulose. Becky Arte-Howell answered that installation of fiberglass tends to be the insulation of choice by contractors, but both are eligible for the program and professional installation has always been required.

The Rebate Advantage Program has suffered due to the recession. This particular industry has been hit hard. There are only 14 dealerships still in business as opposed to 23 that were open in 2008.

Residential Education has done a lot with its allocated funds. There is no energy savings attributed to this program. One member asked if the company is able to follow up with customers who check out the Kill-a-Watt meter from the library. Celeste explained that from a confidentiality perspective, the company cannot access library records to utilize their private information. One member suggested a form or card at the checkout to see if people would be interested in having someone follow up with the findings from the Kill-a-Watt meter.

There was some discussion surrounding the Weatherization Assistance program. It is not a rider funded program. One member asked if we had an evaluation of this program. It was stated that at this time, Idaho Power has not done an evaluation but one is planned for 2012. The Weatherization Solutions program has a higher qualifying income tier that WAQC and was made available in the Eastern part of the service territory in 2011.

10:45 Commercial Programs-Todd Schultz

Idaho Power has a contract with a new writer to help the commercial programs create success stories that are posted on Idaho Powers website, David Davis gave job training to field staff and target materials were developed for specific industries. Idaho Power is looking at discontinuing the Holiday Lighting program. Stores are marketing LED's to customers more and more. The Idaho Botanical Garden features a holiday lighting display that mostly features LED lighting.

The Building Efficiency Program had a very successful year in 2010. There is now a full time program manager in place. The 2009 IECC (International Energy Conservation Codes) will be implemented January 1st 2011 in Idaho and the company has adapted the current measures to meet the new codes going forward. One member commented that he appreciated the "per year" savings that was on the Building Efficiency slide. Sheree stated that the incentives have decreased because the code standards have increased. One member asked if Idaho Power works with realtors for commercial programs as well as residential. Todd answered that yes, it is with both programs.

The Easy Upgrades program has undergone a lot of changes for 2011. The incentive levels were reviewed, a new lighting tool was developed. A custom line on the new tool looks at the cost effectiveness of the measure at the Pre Application level. This program now requires more information from customers and contractors on the front end. More site inspections are being done pre and post project completion. Idaho Power wants to raise the bar for contractors. One member asked if Idaho Power is advertising tax credits for lighting customers to take advantage of to help them save money. Shelley answered that a meeting was just held to look at ways to get that information on the website.

The Custom Efficiency program continues to grow. 2010 was another successful year for the program. The technical trainings in 2010 were well received and had good participation. Two big drivers in energy savings were lighting and fan projects. Those two alone contributed around 12 million kWh savings. One new thing that was done with this program was to align it more with Easy Upgrades and requiring the lighting tool. By requiring both programs to have this tool, it allows the customer to see what their options are. The custom program will still pay 12 cents or 70% of the project cost. One member asked how much was paid out on customer incentives for 2010. Pete answered that around 8 million total was paid out for custom incentives. It was later clarified that the cost was 7.8 million total.

The Irrigation Effiency program will be reviewed and changes will be made in July. Dennis, Quentin and the Ag Reps have done a terrific job with this program and have also completed certification training. This training was to become certified irrigation designers thru the IA (Irrigation Association). One member made the comment that

it seems as if the MWh savings for this program is declining and asked what could be the cause of it. Todd answered that it could be the numbers of farms have decreased, it could possibly be market transformation or that it could also be commodity driven. The same member asked if Idaho Power thinks there is less opportunity for this program now. Dennis answered that the company knew that once the low hanging fruit was attained, there would be a time where this program leveled out with replacing equipment and maintenance. Quentin added that what Dennis spoke of was in regards to the Menu portion of the program. The Custom part of this program still has more potential.

The Flex Peak Management program continues to see customer commitments grow over time. Customers that are enrolled usually over perform from their initial commitments. The Idaho Power building that we are in is currently enrolled in the program, outside of rider funds of course. The company wants to show that we practice what they preach. Oregon became eligible to participate in the beginning of 2010.

.

11:20-Break

11:37 2010 Financial & Savings Report (Est.)-Pete Pengilly

Appendix one was explained. The Oregon rider balance should adjust faster than Idaho. In June it went to 3%. Just having one participant in the Flex Peak Program or Industrial program could swing that balance significantly. The company has changed the way NEEA is paid. Actual expenses are paid for now. 2.9 million has been paid so far. One member asked how long it took to acquire the deficit on Idaho rider. Pete stated that when he started in this department 6 years ago, the rider had a 6 million dollar positive balance. The forecast for next year is that the rider will collect 38-39 million and the budget is 41 million.

Appendix two was explained and one member asked on what line item are the majority of the costs in. Pete answered that the majority is in program expenses with some being in indirect cost. The process evaluations are allocated to the programs. The end use survey is out of Pete's budget, partially out of rider and base rate. One of the company's goals is to provide programs for all customer groups. Residential is a hard market. There is usually less savings for the money, but the company is pursuing all cost effective energy efficiency. One member suggested having the columns that show cost per kWh. Pete stated that in the Demand Side Management (DSM) report, levelized costs are used and those costs are shown in the appendix every year. In reference to the slides that were shown, Pete stated that even though these numbers are pretty solid, they could still change until the annual report comes out. Process evaluations were done on four residential programs and all of the commercial programs. The end use survey was completed and the findings are in the process of being evaluated. One member asked if impact evaluations have been done. Pete replied that there weren't any done in 2010 but this year one will be done for the A/C Cool Credit program. The same member pointed out that the Regional Technical Forum (RTF) is looking at who has plans and what they are doing so that maybe there is a possibility of being able to leverage and share the findings.

11:50 Idaho DSM Business Model Filing/EE Research Initiative-Ric Gale

Ric thanked the members of EEAG for their service to Idaho Power and expressed how much the company appreciates and values their input. Ric updated the group on the company's Demand Side Management business model. The objective is to whittle down the rider balance without raising the amount to fund it. Increasing customer costs is not something the company wants to do. Idaho Power is looking at the possibility of taking the Demand Response incentives and prospectively moving them to the Power Cost Adjustment (PCA) account thereby taking them out of future rider funding. The company is also looking at taking Custom Efficiency out of the rider fund and capitalizing it. These changes have not been filed with the Idaho Public Utilities Commission (IPUC). One member asked what the life of the capitalization would be. Ric answered that a four year amortization will be proposed.

Ric informed the group of Idaho Power's involvement with the new Energy Efficiency Institute. Three years ago Idaho Power wanted to get one established in this area, but due to the falling economy, it fell thru. The company has been working with Ralph Cavanaugh on this project, which has been instrumental in helping other regions get started. The focus will be on deliverables that are in the public interest. The first year outreach will focus on leveraging education, energy efficiency at the kindergarten thru high school level. It will also include consumers. It will be a place where they can come be engaged and learn about energy efficiency. The second year outreach will be workforce development in high school education. The third outreach is expanding the professional degrees to add an energy efficiency component. The fourth outreach will be the research itself. In the next couple months governance needs to be set up and the fine tuning of the deliverables will need to be done.

12:10 Lunch- Kevin Winslow presented Social Media at Idaho Power to the members of EEAG during the lunch break.

Time Meeting Reconvened

1:15 2010 Residential End Use Survey-Becky Andersohn

Becky informed the group that she just received the results of this survey last week so that she might not be able to answer certain questions pertaining to the data. The purpose of this study was to get a better picture of customer housing characteristics. The last survey was done in 2004 and before that it was 1994. Idaho Power is looking at doing these surveys's every five years from now on. The information from these surveys is also being used by the load forecasting group. The entire service territory was sampled. An over sample was done in Oregon due to limited population numbers in that area. The Dillman method was used in this survey. This year, there was an option for taking the survey online. One member asked if the written responses were scanned into the computer. Becky informed her that the surveys were sent to the survey company. Another member asked if EEAG members or the IPUC would get a copy of the report. Pete Pengilly answered that it will be part of the DSM report as supplement two. During the presentation of the Oregon Snapshot slide, there was discussion among the group about customer interpretation of whether or not natural gas was available to their homes. Celeste answered that the questions were defined based on how customers might interpret it. One member asked if it was known, geographically, where the customer information came from, what area sent back the most information. Becky answered that we do have information by geographical region and we made certain that there were representative responses across the service territory. One member expressed concern of potentially biased answers from people with seasonal or vacation homes. Pete commented that the mailings went to the billing address, but the survey was for the actual service point. It was clear that the survey was specifically for the service point listed. During the Own vs. Rent slide, one member asked if any questions were asked about what customers did in their home all day. Was it a home office, were they stay at home parents or work from home. Becky answered that those are more behavioral questions and the survey focus was on housing and appliance stock.

Becky explained that the data extracted from the survey will help Idaho Power to understand the energy usage patterns of different types of customers. One member asked if there was any intent to do further data analysis such as how much usage households have. Becky answered that yes, there will be more data analysis. One member asked if customers were asked financial, age or gender questions. Becky replied that we didn't ask income level questions because research has shown that that type of data is unreliable. Education correlates to income and people are usually more forthcoming regarding education.

2:05 Break

2:15 Timely Topics-Celeste Becia

Celeste informed the group of the proposed Customer Relationship Management tool in conjunction with the Smart Grid project that Stimulus funds help to finance. This system will help allow Idaho Power to keep track of marketing campaigns. It will have an email interface component and also include a text message interface.

The Economizer Project is being looked at for this summer. These systems utilize outdoor air to cool the home when the outside temperature is lower than indoor temperature. This could be a substitute for air conditioning, or at least minimize the need for constant air conditioning use in the summer. Arzel and Famco are two manufacturers that currently have market ready systems. Monitoring will be done during the project to determine energy savings. Installation costs are about $1000 per home. The cost of the study is estimated at less than $100,000 including the costs for installing products in fifty homes and evaluating the results). One member asked if small scale commercial is going to be included in this study. These smaller commercial spaces are likely to have day long a/c load so the potential savings could be greater. He gave examples of old houses that were converted to office space.

Energy Efficiency month for Idaho Power employees will be held this March. The results from this usually result in higher levels of participation after the month is over. Idaho Power also has a “Green Team” that sponsors monthly lunch and learn events for employees. One member asked if Idaho Power uses employees for potential focus groups for rolling out programs for future customers. Celeste answered that doesn’t usually happen because on average, employees are more likely to participate and that there are also confidentiality hurdles that make it harder to have employees involved.

2:53- Meeting Adjourned

Energy Efficiency Advisory Group (EEAG)
Minutes dated June 27th, 2011

Present:

Catherine Chertudi–City of Boise, Public Works Dept.
Ken Robinette–South Central Comm. Action Partnership
Lynn Anderson–Idaho Public Utilities Commission
Ron Whitney–Northwest Energy Coalition
Mike Youngblood*–Idaho Power
Tom Eckman–Northwest Power & Conservation Council
Ben Otto-Idaho Conservation League
Lynn Young–AARP
Sue Seifert–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Kent Hanway-CSHQA
Celeste Becia*–Idaho Power

Not Present:

Don Sturtevant–Simplot
Nancy Hirsh–Northwest Energy Coalition

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Cory Read–Idaho Power
Gary Grayson–Idaho Power
Ric Gale–Idaho Power
Mark Stokes*-Idaho Power
Andrea Simmonsen-Idaho Power
Phil Anderson-Idaho Power
Jan Bryant*–Idaho Power
Theresa Drake–Idaho Power
Quentin Nesbit–Idaho Power
Bryan Hobson*-Idaho Power
Matt Elam-Idaho Public Utilities Commission
Stacy Donahue-Idaho Public Utilities Commission
Kevin Van Den Wymelenberg-Integrated Design Lab

Recording Secretary:

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

Meeting Convened at 9:35

Kevin from the Integrated Design Lab introduced himself to the group, gave a brief overview of the company and discussed a few housekeeping items. The members introduced themselves and the minutes were reviewed.

9:45 Demand Response & Power Supply Planning-Pete Pengilly, Mark Stokes

Pete Pengilly

Pete gave an overview of the Demand Response programs. All of the Demand Response programs are offered throughout the service territory except the A/C Cool Credit program which has a few exceptions. There is a potential for approximately 410 MW Demand Reduction for the summer of 2011. A/C Cool Credit and Flex Peak have gone up a bit and the irrigation programs have gone up significantly. For perspective, Idaho Power's all time summer peak was approximately 3250 Mw. Pete explained that the graph on slide 11(Demand Response Potential Dispatch) is the load shape out of the 2011 Integrated Resource Plan (IRP). In slide 11 (Idaho Power's summer and Winter Peaks) these are actual measured peaks and demand response is not added back in.

Mark Stokes

The IRP takes a 20 year forecast of what loads will be as well as supply and demand side resources. If you look back to the 1980's, there isn't much difference between summer and winter peaks. In the 1990's there was an increase in summer peak due to irrigation and an increase of homes with central air conditioning. Peak hour is the critical time when Idaho Power needs to make sure there are enough resources to meet load. Demand response and energy efficiency are looked at before adding additional supply side resources. On slide 13 (Peak Hour Deficit) the longer bars are July peaks. Without adding any new resources the deficits get worse. This slide shows all existing resources and Demand Response programs.

The 2011 IRP will be filed on Thursday June 30th. Mark informed the members that if anyone wanted a copy to let someone at this meeting know. Slide 15 (Demand Response Costs) shows that programs are modeled at 60 hours. Actual performances are different which means they are more expensive than a simple cycle peaker plantcompared on a per hour basis, but these programs are priced on a capacity basis and are for an extreme load situation.

There was some discussion around the Demand Response Costs. Mark stated that it was hard to compare the Demand Response that has an upfront cost that costs nothing to dispatch against those programs that have a more variable cost. If you paid upfront for all these programs, they probably should be dispatched all the time since it isn't costing anything to do it. During the discussion of slide 16 (IRP Analysis) Celeste asked what attributed to the growth in column C (60th Hour Peak Load). Mark stated that it was due to the increase of customers in our service territory. The PUC approved changes in the Irrigation Peak Rewards program to allow a 75% fixed and 25% variable payment. Idaho Power had proposed a 40% fixed and 60% variable payment structure. One member was in favor of how the Irrigation Peak Rewards program was proposed and not how it was approved by the IPUC.

10:23 Economizer Study—Celeste Becia

An economizer is a system that reduces the amount of mechanical dependence on an air conditioner by utilizing outdoor air for cooling when appropriate. It is well suited to a mountain environment where it cools down significantly at night. These systems do not seem to do as well in hot or humid climates. Three years ago the Office of Energy Resources (OER) installed economizers in three homes in the Treasure Valley but apart from that there isn't a whole lot of research data on residential economizers.

Idaho Power is planning a joint project with NEEA to install economizers in fifty homes in the Treasure Valley in 2011, and monitor these homes to estimate cooling savings. One member asked if these homes could be gas heated. Celeste answered that gas heated homes will be accepted as long as they have air conditioning. Another member asked if damper position is going to be evaluated too. Todd answered that yes, that will be looked at. NEEA's role in the project is to construct a baseline cooling usage amount, and conduct customer satisfaction surveys. They will use the data to determine if economizers might be viable in other hot dry climates in the Pacific Northwest. The Integrated Design Lab will install the monitoring equipment, and two HVAC contractors have been selected to install economizers from two separate manufacturers.

Celeste asked the group for any other feedback or suggestions during the data collection process. One member suggested collecting wet and dry bulb data. It might not be as relevant for this area, but for the extrapolation of data for other areas it could be beneficial. He also commented that he thought this was a great opportunity for research. One member asked for clarification on what the customers out of pocket amount would be. Celeste explained that the customer is only responsible for paying $250 of the total $1200-$1500 total cost of the system.

10:50 Break

11:03 Smart Grid Projects Update-Jan Bryant, Mgr Smart Grid Project

Idaho Power received a 47 million dollar federal grant which matched Idaho Power's 47 million dollar existing investment in smart meters. There are three main categories that all twelve of the Smart Grid projects fall under; AMI or Advanced Metering Infrastructure, Customer Systems and Electric Infrastructure Improvements. The AMI meter exchanges will be completed this December. The Smart Grid projects will provide enhance customer service, improve power reliability, promote energy efficiency, and integrate renewable resources into the system.

The current Customer Information System was replaced 15 years ago. The new system will make interactions with the customer more beneficial for the customer.

The improvements to the Energy Infrastructure are necessary to fully enable the Smart Grid. The projects planned under this category are Outage Management System (OMS) updates, development of renewable integration tools to improve load and wind forecasting, a self-healing network pilot project and implementation of a transmission situational awareness project. The self healing network project was deferred for now.

One member asked for more information regarding the promotion of the Energy Use Advising Tool and what the goal is in making this information available to customers. Theresa Drake addressed this inquiry. She stated that it will be an enhancement of what is currently available to customers right now with the Account Manager tool. The Account Manager tool provides information to customers on how to save more energy. The Energy Use Advising Tool enhancement will help Customer Service Reps provide better service to customers since they will now have the ability to see what the customer sees in Account Manager.

Theresa showed the group the Energy Guide insert that was in the Idaho Statesman distributed on June 26th. One member asked what other alternative energy sources are anticipated coming online. Jan stated that solar is somewhat new and that there are a few geothermal projects online already. She couldn't give any further information on these projects as she is not part of the teams managing those.

11:30 Conservation Voltage Regulation-Bryan Hobson, Engineering Leader

This project was originally a BPA and NEEA initiative called Distribution Efficiency. The goal of the Conservation Voltage Regulation (CVR) program is to modify equipment to enable it to operate in the bottom half of the voltage range between 114-120 volts. Normal voltage levels are maintained in the upper half of this range, but lowering this voltage by 2-4% will reduce energy consumption by 1-3%.

In 2007 a pilot study was conducted where voltage was lowered at a Boise substation for a whole year. This provided a good database of information on energy savings. Typically for every percent voltage drop, you get about a 7% reduction in energy. When loads drop off on the system, voltage can be further reduced.

One member said that reducing the voltage affected the lights in his home. Bryan explained that reducing the voltage by only 2-3% wouldn't affect lumens in light. Most of the savings being realized is from motors, not lights. There wouldn't be this much savings if it was just lighting. If a motor is not being used at 100%, lower voltage will increase efficiency. If it is being used at 100%, it won't increase efficiency. That is why we will never see this used for irrigation pumps. This will not be a program that will be applied to irrigators; it will be for industrial and commercial customers.

Someone asked if a voltage problem was found at the end of a feeder, would a technician go out and fix it. Bryan explained that yes, Idaho Power would send someone out to fix it. There was a customer where this happened. It was a business that had expanded over time and the transformer was heavily loaded, there was a lot of voltage drop on that line. One member asked what was holding up implementation of this program, was it because the benefit cost ratio is too low. Bryan explained that the hurdle is the misconception that Idaho Power is lowering customer voltage and giving subpar service. In the six substations where CVR has been implemented all of the feeders coming off of those were reduced, so the cost benefit ratio was high. No capital upgrades were needed.

12:00 Lunch and Farwell to Ric Gale

Tour of Integrated Design Lab

1:10 Meeting Reconvened

1:10 Regulatory Update-Mike Youngblood

The IPUC issued their final order on March 9th approving a pricing structure change to the Irrigation Peak Rewards Program. This included a 75% fixed and 25% variable payment to irrigators that provides a fixed amount regardless of the number of times the program is dispatched, plus a variable payment that is dependent upon dispatching the program.

On March 15 the company filed its 2010 DSM Annual Report with the commission and requested a prudency determination of the $42.5 million of energy efficiency funds spent in 2010. As of today, the comment period was extended in the DSM prudency filing.

On May 31, the Commission approved Idaho Power's request for $9.3 million for the Fixed Cost Adjustment, which is a mechanism that replaces foregone revenues due to energy efficiency programs that cover the fixed cost portion of residential and small business accounts.

Each customer class got a different Power Cost Adjustment (PCA) for this year. In their comments filed regarding the PCA this year, interveners were concerned that the rider was a percentage of customer base rates and the PCA is a kWh charge and there might be a shift in cost recovery among the different customer classes.

The Idaho Public Utilities Commission (IPUC) said that Idaho Power could start a regulatory asset account as of January 1st 2011. Mike explained that Idaho Power will place the incentive payments for Custom Efficiency into an asset account in order to earn a rate of return on this expense, similar to that earned by supply side assets. . The amortization of those funds will be determined by the IPUC at a later date.

In a clarification on May 17, The IPUC reiterated that it wants the company to pursue all cost effective energy efficiency programs, and included a $10 million recovery of the outstanding Energy Efficiency Rider deferral balance in the PCA. However, the IPUC also stated that the appropriate time for Idaho Power to recover additional rider fund deficit balances should be in a general rate case.

The next open application period for the Oregon Solar PV pilot was postponed until October 2011. Celeste stated that the first open application period was in the fall of 2010, and the allocation was fully subscribed within a few hours of the opening time. . The successful applicants had one year to start working on their project and get their system in place. Not all of the applicants have been able to develop their projects, so their allocations have been put into a second application pool. This pool was originally scheduled to open this summer but has been postponed to adjust the incentive amount downward. Mike stated that there will be a lottery with a random number generator to more fairly award these projects.

The company has had a number of PURPA projects, mostly wind, that have been denied due to when the contracts were signed. December 14th was the effective date and some of the contracts were signed before as well as after that date. The IPUC stated that the contract wasn't fully executed until both parties signed the contract. The BPA Slide (9) shows that the residential credit will be reinstated. The mechanism for distribution of this credit to customers hasn't been determined. The credit should show up either the end of this year or beginning of 2012.

There was some discussion around the General Rate Case slide (10) when one member asked if critical peak pricing relates to only those on a time of day rate. Mike answered yes, but it will also be increased to $.40/kWh during peak periods to encourage customers to use less during those times. Another member asked if Idaho Power has customers on time of day rates. Mike explained that there are about 116 customers in the Emmett area. Now that the AMI meters will be service area wide, the company is looking at expanding that option, but in a controlled way. It was asked if these will just be residential customers. Mike answered yes, but that there is time of day rates for industrial customers. This same member asked if it is strictly voluntary. Mike stated that it was voluntary and the company is looking at ways to market this to a representative group of people at a voluntary level. The same member stated that the IPUC is behind mandatory time of day rates in the future. Theresa Drake stated that typically residential customers like to have choices in how their rates are structured so that they can control who much or how little energy they use. One member suggested making sure that before this is presented to customers that customer education as well as thorough marketing plans be made to ensure customers will have a good understanding of how this will work.

2:00 Evaluation Studies-Pete Pengilly

Pete discussed the 2011 Forecast Summary handout. The first of 2011 there was a 17.6 million dollar deficit in the rider. The $10 million came out of the rider as a credit. The Custom Efficiency line has a footnote that reflects moving the incentives to a regulatory asset account. The middle column of this handout is the forecast numbers. The right hand column is forecasting a 6.6 million dollar deficit at year end.

One member asked if the A/C Cool Credit program and EnerNoc are half of the deficit. Is there any intent to move it into the PCA? Mike stated that as of right now, there isn't any plan to move anything other than the Custom Efficiency incentives to that account. Celeste clarified the earlier question by stating that if Idaho Power took Demand Response out of the rider then the rider would not be as overburdened with Demand Response. The member stated that yes that is what he meant since it looks as if half of the total rider deficit is from the Demand Response programs.

Pete next presented the Research and Evaluation slides. Reports were finalized at the end of January and beginning of February this year. One of the recommendations given was for the commercial programs to have an online application process that seamlessly integrates with the company's current systems. This will take time due to the current projects in place for the IT department to complete. The company PECI will be doing an evaluation for the A/C Cool Credit program. Pete explained the difference between impact and process evaluations. With impact evaluations you get the savings/reduction, while process evaluations look at application processes and customer satisfaction. There will also be an evaluation for the Custom Efficiency program. This will entail file reviews and field verifications. The projects will be split between lighting and non lighting. A Request for Proposal (RFP) is scheduled for the third quarter on four residential programs and with the intent of having the final report in the fourth quarter.

One member asked if there was intent by the company to use AMI meter information to expedite getting billing analysis answers sooner. He stated that using this data might be a quicker way than getting information from the consultants. Most of the consultants are unaware that AMI data is available, so providing that information to them up front could be helpful in the way they construct their analysis.

Two studies are being done on the Ductless Heat Pump program and ENERGY STAR® Homes by NEEA. The company tries not to duplicate these same studies in order to be sensitive to customers being overburdened by surveys. Celeste passed out an insert that was part of the Idaho Statesman June 26th edition and asked that for any feedback from the group after looking it over. Celeste also stated that the next meeting will probably be held in October and thanked the group for their continued participation.

2:30 Meeting Adjourned

Energy Efficiency Advisory Group (EEAG)
Minutes dated October 14th 2011

Present:

Catherine Chertudi–City of Boise, Public Works Dept.
Ken Robinette–South Central Comm. Action Partnership
Stacey Donohue–Idaho Public Utilities Commission
Nancy Hirsh–Northwest Energy Coalition
Mike Youngblood*–Idaho Power
Tom Eckman–Northwest Power & Conservation Council
Don Sturtevant–Simplot
Lynn Young–AARP
Sue Seifert–Office of Energy Resources
Sid Erwin–Idaho Irrigation Pumpers Association
Ben Otto-Idaho Conservation League
Celeste Becia*–Idaho Power

Not Present:

Kent Hanaway–CSHQA

Guests and Presenters*:

Pete Pengilly*–Idaho Power
Lynn Anderson
Shelley Martin–Idaho Power
David Davis–Idaho Power
Randy Thorn–Idaho Power
Shelley Martin–Idaho Power
Dennis Merrick–Idaho Power
Bryan Lanspery-Idaho Public Utilities Commission
Donn English-Idaho Public Utilities Commission
Todd Schultz*–Idaho Power
Becky Arte Howell–Idaho Power
Todd Greenwell–Idaho Power
Denise Humphreys–Idaho Power
Billie McWinn–Idaho Power
Warren Kline–Idaho Power
Ken Miller–Snake River Alliance
Nikki Karpavich-Idaho Public Utilities Commission

Recording Secretary:

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

Meeting Convened at 9:40 am

Introductions of EEAG members and guests were made. General housekeeping items were mentioned and minutes from June 27th 2011 were reviewed.

9:45am—Demand Response, Research & Evaluations-2011-Pete Pengilly

During the discussion of Slide 2 (Demand Response 2011) one member wanted clarification regarding the number of days Flex Peak was dispatched vs. the maximum number of days. Pete informed the group that those numbers were inadvertently switched, it should read: **20 days max = Dispatched 14 days**. Irrigation Peak program did not get dispatched this year due to cooler than normal temperatures along with low summer energy loads. There was much discussion around Slide 3 and how Idaho Power saved 3 million dollars of customer funds by not dispatching the Irrigation Peak program. One member added that it was a savings compared to the former program design. Idaho Power wouldn't have had to call an event either way because of lower summer temperatures, but the company would have incurred the cost prior to program redesign. Slide 6 (Total Demand Response) shows a large divot in the load shape from last year, while Slide 5 shows the load shape of this year. The goal is to flatten out loads rather than create the large divots. One member asked if it is hard on Idaho Power's system to manage that steep of a load reduction. Pete stated that it is hard on the operators and that it is much easier to flatten out the load. Much of Demand Response planning is done for the extreme temperature

days. Idaho Power used Demand Response more this summer partly due to the Idaho Public Utilities Commission's case order no. 32250 that stated Idaho Power should use all available opportunities to reduce its power supply costs. Idaho Power consulted with Freeman Sullivan and Co to discuss Demand Response planning, value and cost effectiveness, load impacts and incentive structure. One member asked how these consultants value Demand Response differently than Idaho Power. Idaho Power's avoided costs for Demand Response is primarily the capacity cost of a simple cycle peaker plant. The company gives these programs the full value of that capacity cost, which isn't always fair because peaks can happen year round. Freeman Sullivan and Co uses the load duration curves and weights the value. Idaho Power is still wrapping its arms around that idea. There was some discussion around the A/C Cool Credit program impact evaluation that is being conducted. One member asked what type of housing stock is being looked at and how participants were selected. Pete stated that it was a random selection and that housing stock was not known when participants were chosen. Snap back is also being looked at in the evaluation. One member asked if snap back is being looked at from the customer perspective where they are actively trying to decrease the temperature in their home after an event has been called. Pete stated that the equipment, not the temperature is what is being evaluated. One member asked when did the evaluation starts. Pete stated that the evaluation started at the beginning of the cycling season. It is one of the company's first opportunities to utilize the AMI data. The process evaluation being done on the Irrigation Peak Rewards program will look at how the program is being operated and not the impact of the program. PECI is doing the process evaluation and the impact evaluation will be done internally. The report for the Flex Peak Management's Impact evaluation will be included in the Demand Side Management annual report. One member asked if a process evaluation will be done for Flex Peak, as it would be interesting to see how it stacks up to other programs. Pete stated that there isn't one scheduled. This program is more difficult to evaluate since it is administered by a third party. Billie McWinn and Todd Schultz attended EnerNOC's annual meeting in Boston and came away from it with confidence that EnerNOC is a reputable company administering the program. A process evaluation is being done on the See ya later refrigerator program. This program is administered by JACO; a third party that does this type of program with 50 other utilities in the country. In Slide 19 (Current Plan for 2012) it was mentioned that some of the programs scheduled for evaluations are subject to change, but that the company is trying to stay on a three year schedule for evaluations. One member asked what percent of the department budget goes towards evaluations. Pete stated that we can get an amount for this year, but we won't know what the amount for next year will be. Another member asked what the price range was for these evaluations. Pete stated that for the potential study the budget is about $250,000 and for impact evaluations it was around $65,000 for three studies. Idaho Power always goes thru a Request for Proposal (RFP) process for these evaluations. One member asked if the RFP is done for individual evaluations or if they are done as a bundle. Pete stated that the residential evaluations are bundled. The company has strict security requirements with regard to customer information and bundling limits the number of companies accessing that. There are also economic advantages to bundling.

10:30am—Economizer Study-Celeste Becia

Celeste updated the group on the progress of the Economizer Pilot that was put before members of EEAG in February of 2011. Idaho Power is in the analysis portion of the pilot so there are no final numbers yet. Economizers save energy by using outside ambient are for cooling instead of air conditioning when outdoor temperatures are lower than indoor. Economizers work well for commercial customers, so the analysis will be helpful in determining if economizers benefit residential customers. This part of Idaho has a short cooling season and is considerably dryer than the southeastern portion of the country, where the majority of the research has been done. The data gathered from this pilot will be beneficial for other areas in the Pacific Northwest.

During this pilot, there have been some lessons learned, including the importance of contractor training, the need for follow-up after installation, and a better understanding of how each manufacturer's economizer operates, which affected the data monitoring results.

Proper installation is essential. To minimize variability in the installation process only two contractors were hired to work with Idaho Power on this pilot but the HVAC contractor community has much to learn when it comes to installation of economizer units.

Due to delays in getting contracts signed, program marketing efforts were delayed which affected customer response and ultimately the number of systems installed. 53 customers responded to the offer to install an economizer system, but only 19 actually qualified and/or completed the installation process. Data monitoring occurred primarily in August and September, which are not the optimal months for collecting information.

After the systems were installed they needed follow-up visits to ensure proper operation and data collection. One type of system had a software error that needed to be corrected.

Idaho Power contracted with NEEA to do third party data analysis, surveys and market transformation report. The Integrated Design Lab partnered with Idaho Power for the data collection and reporting. In order to get baseline energy usage data to apply to the economizer run time during the summer, one week's worth of data on air conditioning usage was obtained before the economizers were installed. Two manufacturers' economizer systems were installed by the contractors, and each operated differently, which has resulted in the likely over-reporting of energy use by one economizer.

One member asked if the surveys being done would ask about customer behavior. Todd answered that there would be some behavior questions on the survey. The contractor interviews are being conducted now and in about 3 weeks the customer interviews will start. One member stated that it appears that more information is needed and encourages Idaho Power to continue this project into next year and to add new sites. The learning curve won't be as drastic as with the first group which will give more robust data. Another member stated that the beauty of these economizer systems is that the savings is cumulative and the full value will be realized over time. One member asked if there were any customers that didn't participate due to installation costs. Todd answered that only one person out of the total number declined participation. Celeste stated that if this becomes a full program, the customer might be paying the majority of the cost. One member suggested looking at doing installs during new construction since it is easier to install these at the ground level rather than doing retrofits.

Celeste suggested that in order to get a better understanding of the impact of this technology, the pilot should be repeated in 2012. The membership agreed with this suggestion and plans are being made to repeat the pilot to overcome the issues identified in 2011 and produce additional data.

11:10am-Break

11:28am-Financial Update-Pete Pengilly

The PDF titled DSM Expenses by Sector/Funding sources was shown to the group. This is a year to date snapshot of expenses so far. This does not include incentives for the Custom Efficiency program in Idaho as those are going into a regulatory asset account. One member suggested that it would be useful to have a "Budget Column" for comparison. Pete stated that the next slide compares last year's expenses, but maybe for next time a column could be added to compare the total to the budget. The Idaho EE Rider Summary PDF was presented and it was stated that this slide has Demand Response included. One member asked if most of Demand Response payments show being paid in this slide. Anne Wadsworth stated that there will be a true up for EnerNOC payments that will show up in November. One member asked if the base rates column will show the Custom Efficiency payments. Pete stated that a new column is needed, just haven't decided how to display it yet. From now until the end of the year, the forecast for the Idaho Rider balance will be around what it is currently. Idaho Power expects to spend what is collected. Overall it looks like the company is on track to spend the same as last year.

11:43-Regulatory Update-Mike Youngblood

On August 18th the Public Utilities Commission approved Idaho Power's request for prudency of Rider funds spent on energy efficiency in 2010. Mike thanked the group for their efforts in providing recommendations for Idaho Power in regards to energy efficiency. Idaho Power filed a contract with the Office of Energy Resources (OER) with the Idaho Public Utilities Commission and on September 29th. The contract was approved as an Energy Efficiency Incentive Agreement effective July 21, 2011. The OER had received ARRA (American Recovery & Reinvestment Act) funding to benefit schools in Idaho. The contract will enable OER to submit these projects through the Easy Upgrades Program so that the incentive payments will be directed to a separate account for use in future funding of energy efficiency projects for the schools. This agreement will enable a greater number of energy efficiency projects than would have been achieved by the OER without the contract. One member stated that this agreement with the OER will enhance potential savings.

12:15 Lunch

1:10 Meeting Reconvened

1:12—Commerical/Industrial/Irrigation Topics-Todd Schultz

All of the information in the slides is preliminary. There are 169 projects for the Custom Efficiency program in the pipeline through the end of the year. Most of these won't be completed by year end, but they are applications that have come in and been approved. Idaho Power has an intern program and the department has applied for a Mechanical Engineer to work with the commercial programs in the summer of 2012. The Building Efficiency program has not processed as many applications this year due to the decline in commercial construction but the projects that have come thru are maximizing their savings potential. The Easy Upgrades program has experienced significant changes in 2011. A new lighting calculator was created. There have been 2 trade ally meetings this year and contractor education is a component of these meetings. Idaho Power is also involved with NEEA in a comprehensive lighting pilot program with the hope of getting 15-25 projects. There have been 9 contractors that were trained on new technologies and techniques. There was some discussion around the upcoming changes in lighting requirements and that education will be a key factor. One member stated that they are in support of continued incentives during this transitional phase since it will be a while before the T12's are completely out of the market. Shelley Martin stated that there will still be some T12's available even after the July date, but the assumption is that they will be expensive. Idaho Power cannot send a message to customers that there won't be any available. One member asked if the customers are being informed of proper disposal of the old lighting ballasts. Shelley Martin stated that information is given to customers and also there is information on Idaho Power's website. One member asked if there was an energy savings cap on the Easy Upgrade Program. Todd stated that Easy Upgrades caps incentives at $100,000. The Custom Efficiency program has a minimum energy savings of 100,000 kWh, but no cap on the incentive. Todd informed the group that Idaho Power has enrolled its building into the Flex Peak program. The company does not get paid an incentive to be involved with the calling of an event. As a company, there were no negative complaints from employees when an event was called to reduce energy usage. One member wanted to know what happens when an event is called at Idaho Power. Billie stated that there were chiller setbacks, a couple of the elevators were shut down, HVAC systems were shut down and lighting. One member asked what kind of facilities have signed up for this program. Billie stated that manufacturing, food processing, pumping projects, grocery chains, and cement plants. The majority of them are in manufacturing and food processing. The Irrigation Peak Reward program conducted a customer survey which asked participants if an additional 3or 4 events were called during the normal scheduled events if they would still participate and 96% would still participate even though they would not get paid for those extra events. One member wanted to stress what a great job Idaho Power is doing with their Demand Response programs. He stated that Idaho Power works with customers in a great way and thanked Todd Schultz and his team in helping his industry keep electricity rates low.

1:55 Residential Topics—Celeste Becia

Celeste discussed some of the ups and downs of the residential programs so far this year. The programs are a little behind goal as of mid September. Currently we are at 68% of total savings. The Weatherization Assistance for Qualified Customers (WAQC) has been lagging due to the CAP Agencies working on their stimulus funded projects first which delayed work on the Idaho Power projects.

Energy Awareness Month is going on this month and Idaho Power had a booth on the Basque Block here in downtown Boise for the First Thursday event. This included numerous booths from various companies featuring Energy Efficiency topics and information. Idaho Power also created a school art competition that highlighted themes around energy savings and efficiency. There were approximately 1500 entries and gift certificates were awarded to the winners.

Energy Education activities have blossomed over time. Idaho Power has improved the way outreach activities are conducted. At the end of events, there are surveys for attendees to fill out so that we can learn more about customers. An example of this is from the Women's Show held earlier in the year. We were hoping to receive about 400 to 450 surveys and over 700 were completed and returned. There is a more streamlined way for customers to contact our department via Idaho Power's website. There is also a way for outside companies to invite Idaho Power to their events, such as a Brown Bag Lunch event where an Idaho Power representative would speak on a specific topic. One member stated that the education agenda is great, "the more the better." She asked how Idaho Power sees this education translating into the residential programs and how this will drive people into accessing programs down the road. Celeste stated that the more people that are educated about the energy efficiency programs, the more aware they will be of the offered programs.

Celeste informed the group of some current paging issues impacting the A/C Cool Credit program. One of the current paging companies that Idaho Power uses, USA Mobility, informed the company two weeks ago that they had reduced paging coverage in the Treasure Valley on May 1st 2011. No prior notification was given. Idaho Power is looking at a number of options to upgrade this paging system. One member commented on the fact that if Idaho Power spends a lot of money boosting this paging company's systems and then their other customers stop using these paging services, then Idaho Power has made a significant investment in upgrading, and they become the only customer using that paging company's service. Celeste will report back to the EEAG on specific steps that will be taken prior to the 2012 cycling season to mitigate the loss of paging services.

Celeste updated the group on the Boise City Home Audit project that took place at the end of 2010. Through surveys we want to find out how many participants acted on the recommendations of the audit. One member asked what kind of audit tool was used. Celeste stated that a customized tool was created in conjunction with a third party. Another member asked if "building type" information was gathered in the original audits. Celeste stated that building characteristic data was available if anyone was interested in seeing it. This same member stated that he would like to see in the follow up survey, how many CFL's were added and retained and also information on why CFL's were either added or taken out in certain areas of the home and what were the reasons.

In 2011 there have been 223 homes certified ENERGY STAR® and those were mostly gas heated homes. There was some discussion among the members in regards to code changes. One member stated that new home construction might be a good opportunity for different utilities to collaborate in offering incentives. Another member stated that the new code requirements help in changing behaviors in building non-ENERGY STAR homes and creates market transformation. He also stated that it might be worthwhile to find out from water companies how much energy is used in waste water treatment, as an additional benefit to include in the cost-effectiveness analysis.

3:00-Meeting Adjourned

NEEA MARKET EFFECTS EVALUATIONS

Table 1. 2011 NEEA Market Effects Evaluations

Report Titl e	Program or Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
NEEA Market Progress Evaluation Report #6: Evaluation of NEEA's Industrial Initiative	Industrial	The Cadmus Group	NEEA	Market Effects
Consumer Electronics Television Initiative Market Progress Evaluation Report	Residential	Energy market Innovations	NEEA	Market Effects
NEEA Market Progress Evaluation Report #3: 80 Plus	Commercial	Navigant Consulting	NEEA	Market Effects
2010 BetterBricks Market Progress Evaluation Report	Commercial	Research Into Action, Inc.	NEEA	Market Effects
Northwest Ductless Heat Pump Initiative 2010	Residential	Research Into Action, Inc.	NEEA	Market Effects
Ductless Heat Pump Impact & Process Evaluation: Lab-Testing Report	Residential	Ecotope, Inc.	NEEA	Market Effects
Northwest Ductless Heat Pump Pilot Project	Residential	Research Into Action, Inc.	NEEA	Market Effects
Northwest Residential Code Savings for Idaho, Montana and Washington	Residential	Ecotope, Inc.	NEEA	Market Effects
Long-Term Northwest Residential Lighting Tracking and Monitoring Study	Residential	KEMA, Inc.	NEEA	Market Effects

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

This page left blank intentionally.

RESEARCH

Table 2. 2011 Research

Report Title	Program or Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
Demand Response Workshop	All	Freeman, Sullivan & Co.	Idaho Power	Research
Idaho Power TRU Study Q1 Report	Commercial	Idaho Power	Idaho Power	Research
Idaho Power Company's SO_2 Emissions Allowance Energy Education Program	Commercial	Idaho Power	Idaho Power	Research
Final Rooftop Unit Working Group Phase 4 Recommendations	Commercial	New Buildings Institute	Idaho Power	Research
Residential Economizer Research	Residential	NEEA	Idaho Power	Research

This page left blank intentionally.

Idaho Power Company Demand Response Workshop

Freeman, Sullivan & Co.

September 14 & 15, 2011

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER®
An IDACORP Company

Workshop Objectives

- Introduction to FSC
- What are some current trends and lessons learned concerning DR?
- How should DR be incorporated in a planning context?
- How should DR be valued?
- How should DR cost-effectiveness be evaluated?
- How should load impacts be estimated?
- What steps are necessary to fully integrate DR into operations?
- How should participant incentives be structured?
- How much DR reduction is optimum for the system?

Our main objective is to discuss if and how these issues have been addressed and what remains to be done to properly integrate DR into planning and operations

Freeman, Sullivan & Co Overview

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER®
An IDACORP Company

FSC's Areas of Expertise Include

- Research design
- Pricing strategy
- Demand response and energy efficiency load impact evaluations
- Process evaluations
- Demand response and energy efficiency program design
- Choice modeling
- Focus groups and other qualitative research
- Survey design and implementation
- Expert testimony

FSC's Clients Include Leading Utilities, Research Institutions and Governments

PG&E
SDGE A Sempra Energy utility
SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company
SOUTHERN COMPANY
SRP
PUGET SOUND ENERGY The Energy To Do Great Things
BC hydro FOR GENERATIONS
ComEd An Exelon Company
conEdison
PECO An Exelon Company
OPA Ontario Power Authority
Central Maine Power
CenterPoint Energy
APS
Duke Energy
TOYOTA
SMUD SACRAMENTO MUNICIPAL UTILITY DISTRICT
U.S. DEPARTMENT OF ENERGY
BERKELEY LAB LAWRENCE BERKELEY NATIONAL LABORATORY
AVISTA
EPRI ELECTRIC POWER RESEARCH INSTITUTE
nationalgrid THE POWER OF ACTION

Our People are Our Strength

- **FSC has a mix of highly experienced senior people and more recent graduates with outstanding training from leading institutions**
- **Many of our staff have advanced degrees in**
  - 5 with Ph.D.s (economics, sociology)
  - 6 with Master's degrees (public policy, economics, business administration, public administration)
  - 4 with Bachelor's degrees (economics, policy, environment)
  - See appendix for more details
- **Core strengths include advanced statistical analysis of load data, sample design, research design and high quality data collection**

Our Expertise Has Been Applied to a Wide Variety of Key Issues

- Demand response and energy efficiency resource planning and evaluation
- Design of experiments and pilots – pricing and behavior change
- Electricity pricing strategy and analysis
- Smart metering business case analysis
- New product and service market assessments – rates, EV, PV
- Customer tracking studies – comfort, convenience, satisfaction
- Retail market design and implementation
- Electricity value of service studies

Research Design

- **FSC Has designed multi-year research plans to estimate load impacts and customer acceptance of time-based pricing and information provision for a variety of utilities:**
  - Central Maine Power
  - Dominion Virginia Energy
  - San Diego Gas & Electric
  - Hawaiian Electric Company
  - CenterPoint
  - Southern California Gas
  - Pacific Gas and Electric
  - PECO
  - KCP&L
  - First Energy
  - Minnesota Power
  - Marblehead Municipal
- **Three FSC staff members sit on the LBNL/DOE technical advisory groups that are helping to design and guide consumer behavior studies being funded through the Federal Smart Grid Grant Awards**
- **FSC recently published protocols for designing behavioral research to measure the impacts of information feedback on customer behavior. The protocols can also be applied to pricing studies.** http://my.epri.com/portal/server.pt?Product_id=000000000001020855

Demand Response Load Impact Estimation

- **We have conducted numerous projects to estimate ex post and ex ante load impacts for DR programs and tariffs, including:**
  - Critical peak pricing
  - Traditional TOU rates for both residential and non-residential customers
  - Interruptible tariffs for large C&I customers and for agricultural pumping
  - Hourly pricing for large C&I customers
  - Air conditioner cycling
  - Capacity bidding
  - Demand bidding
  - Cafeteria style DR programs
- **We developed the protocols and guidelines used by all California electric utilities to estimate load impacts for DR programs and tariffs**
- **We developed the model and key input data used by FERC to develop DR potential estimates for each state and for the nation as a whole**

DR Cost Effectiveness Analysis

- **Cost effectiveness analysis for DR programs and tariffs must take into consideration the unique characteristics of DR**
  - DR load impacts vary significantly by time of day, day of week and month and, in many cases, across weather conditions (e.g., normal versus extreme weather)
  - DR impacts are often greater during times when resources are most needed
  - DR provides value (insurance) even when it is not used
- **FSC developed a cost effectiveness framework and model for the Ontario Power Authority that properly values the unique features of DR resources**
- **FSC recently developed a model to determine the cost effectiveness of air conditioner cycling under various marketing and operational strategies for a large West Coast utility**

Smart Metering and Smart Pricing

- **FSC staff have estimated the load impacts associated with a wide variety of dynamic and traditional TOU rates, often in support of applications for smart meter investments**
  - San Diego Gas & Electric
  - Anaheim Municipal Utility District
  - New York State Electric & Gas
  - Commonwealth Edison (ComEd)
  - Puget Sound Energy
  - Pacific Gas and Electric
  - Rochester Gas & Electric
  - Central Maine Power
  - Xcel Energy (MN and CO)
- **FSC has determined the cost effectiveness of price-based DR in conjunction with smart metering for the Vermont DPS and the government of Victoria, Australia**
- **FSC has estimated the load impacts associated with PG&E's SmartRate tariff every year since the initial offer in 2008**

Understanding Customer Decision Making

- **Market assessments and policy analyses often require understanding/modeling customer decisions - recent projects include**
  - Estimating choice models for a/c cycling, dynamic pricing and dual enrollment iusing revealed and stated preference data and combining models with data on smart meter deployment and program marketing to estimate program enrollment over ten years
  - Conjoint survey and analysis to understand the key drivers of customer decisions associated with plug-in hybrid electric vehicles (PHEVs)
  - Conjoint survey and analysis to understand the impact of program features on residential customer acceptance of photovoltaic systems
  - Enrollment modeling for a portfolio of non-residential DR programs and tariffs
- **We recently used an innovative approach, Business Town Hall Meetings, to develop qualitative and quantitative data on C&I customer perceptions concerning a fundamental shift in pricing strategy**
- **We frequently conduct focus groups to explore customer understanding and perceptions about DR & EE programs & policies**

Population Research Systems

- **FSC's market research group is branded separately as Population Research Systems**
- **In business more than 25 years**
- **Survey laboratory – 30 CATI stations**
- **Focuses on statistical surveying and market research related to**
  - Demand response and energy efficiency program design and evaluation
  - Customer tracking studies – automotive and health care
  - Reactions of consumers to new products and services in utilities, health care, cosmetics and automotive
  - Market assessments
- **Focus groups**
- **Executive and professional interviewing**
- **In-person interviews, street and mall intercepts**
- **Telemarketing to enroll customers in experiments & DR programs**

What Are Some Current Trends and Lessons Learned Concerning DR?

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER
An IDACORP Company

DR resources have evolved dramatically in both magnitude and scope

Yesterday

- Primarily emergency triggered
- Primarily incentive-driven options
- Primarily non-residential customer focus
- Limited interrelationships among resource options
- All customers are good customers

Tomorrow

- Much more economic driven DR
- Much more emphasis on price-based options
- Much more focus on the significant potential in the residential sector
- Recognition of the interrelationship among DR options (e.g., prices, load control, etc.)
- Better targeting to maximize customer lifetime value and improve cost effectiveness

Lessons learned about AC load control

- **The key to a more cost effective AC load control program is targeting**
  - Recruiting from customers that have a high likelihood of owning air conditioning will reduce marketing costs
  - Targeting customers that have AND use air conditioning will further reduce marketing costs and significantly increase average load impacts
- **Another critical factor is efficiency in scheduling and installations**
  - Some programs loose up to a third of recruited customers due to scheduling issues and delays
  - Scheduling problems are much greater with PCTs than with switches because of the need to enter the home when installing PCTs
- **PCTs are more expensive and have much higher communication problems than switches**

AC load control lessons (continued)

- **Cycling/control strategy is also important**
  - People will sign up for very high cycling rates (including 100% cycling) if you pay enough – but make sure that you aren't paying more and getting less – customers in hotter areas are less likely to sign up for higher cycling rates
  - Load impacts from adaptive cycling are greater than from standard cycling
- **High sign up rates are possible using telephone and door-to-door marketing compared with direct mail marketing**

California's IOUs have implemented three distinct AC direct load control programs

Program Feature	PG&E	SCE	SDG&E
Control Device	Switches and thermostats	Switches	Switches
Residential control options	Adaptive 50% cycling for switches, 4 degree setback for tstats (2-1-1)	50%, or 100% traditional cycling	50%, or 100% adaptive cycling
Commercial control options	Adaptive 30% cycling for switches, 4 degree setback for tstats (2-1-1)	30%, 50%, or 100% traditional cycling	30% or 50% adaptive cycling
Sign up incentives	$25 per AC unit	None – annual payments	None – annual payments
Annual Incentives	None – end of year gratitude gift	Up to $200 per year – Based on AC unit size, degree of control, whether events are limited or unlimited	Up to $200 per year – Based on AC unit size, degree of control, and whether events can be called on weekends

All three have been successful in enrolling a substantial number of AC units and load reduction capability

Metric	PG&E		SCE		SDG&E	
	Res*	C&I*	Res*	C&I*	Res*	C&I*
Number of accounts	123,000	1,700	342,000	9,600	24,100	5,400
Number of AC units	135,000	4,400	402,000	54,000	27,600	10,900
1-in-2 annual peak load reduction (MW)	108.7	3.9	582.0	78.4	18.8	6.3
1-in-10 annual peak load reduction (MW)	100.3	3.4	670.5	90.5	20.9	7.3

*2009 Values. Does not reflect 2010 and 2011 additional growth

A substantial share of customers elect more aggressive load control for higher incentives

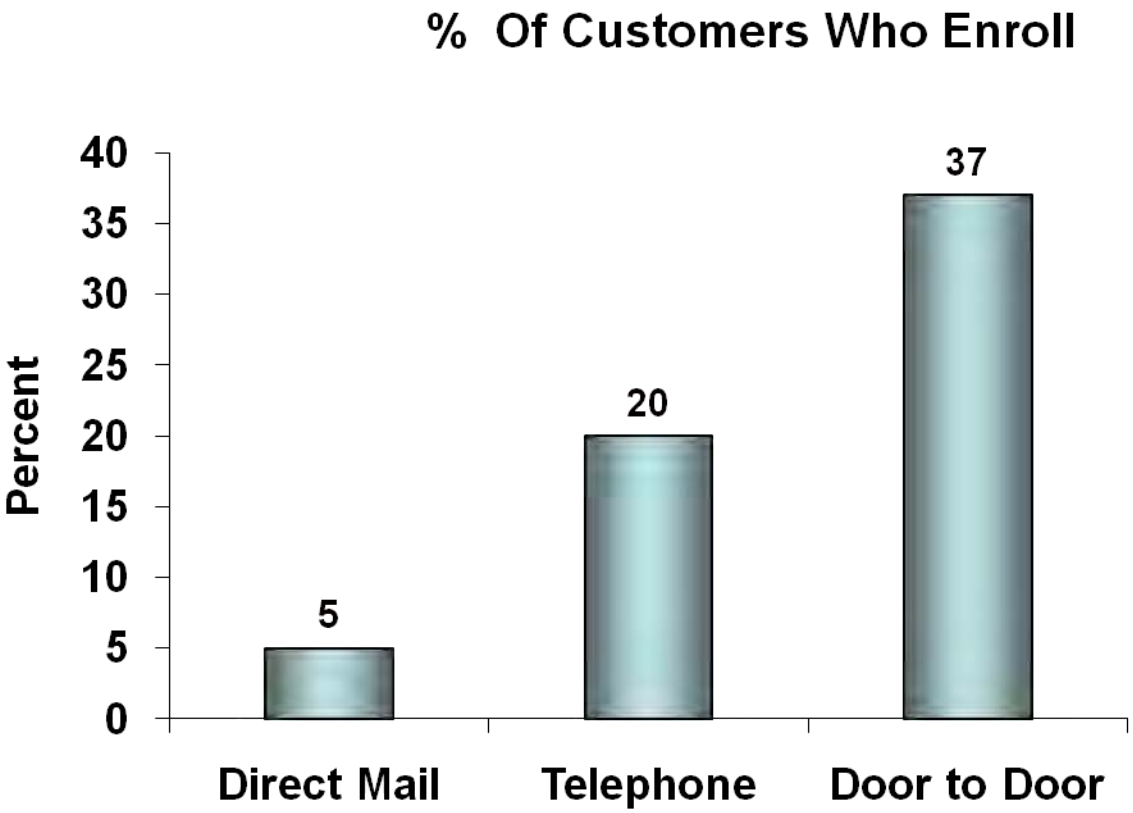
SCE (infrequent events)

- **Almost 90% of residential households chose the 100% cycling option across all climate zones (coastal to desert)**
- **Overall, 80% of households chose to remove limits on the number of events. The share was lower (65%) among customers that elected 50% cycling**
- **Over 60% of non-residential customers chose the 100% cycling option**

SDG&E (more frequent events)

- **46% of residential households chose 100% cycling**
  - 75% of coastal households
  - 43% of inland households
- **27% of residential households elected cycling on both weekdays and weekends. The share was much higher (48%) among customers that elected 100% cycling**
- **60% of commercial customers elected the more aggressive cycling option, 50% cycling**

Marketing mode can also significantly influence enrollment rates



- Not a controlled test but indicative—was for customers located on selected feeders in high air conditioning regions
- 20% represents percent enrolled who were spoken to (not all customers could be reached)
- 37% represents percent of those spoken to—most people answered the door

Thinking About DR in the Context of Planning and Operations

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER
An IDACORP Company

How should DR resources be incorporated into system planning?

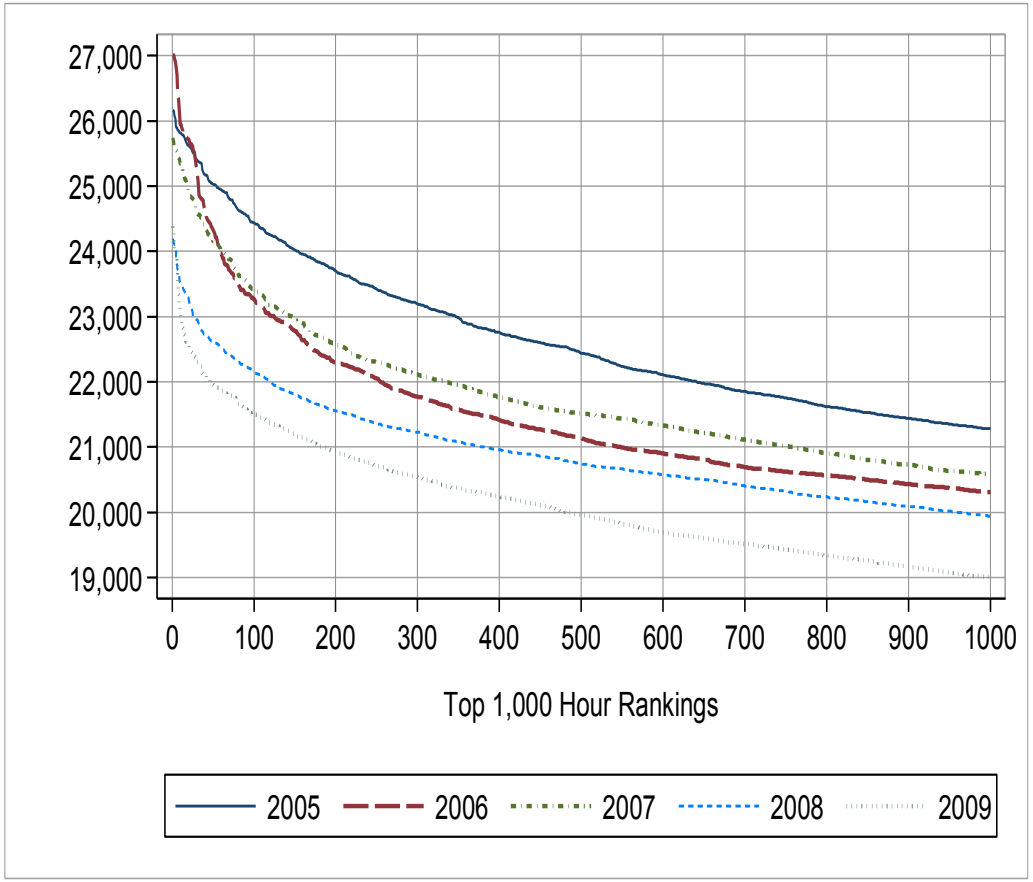
- Can and should DR resources be compared to generation?
- How should program limitations on maximum event length, total annual hours of dispatch and hour and month of availability be incorporated into resource planning?
- How should the variation in DR resources (e.g., AC cycling) across days and system conditions be handled?
- Is there a metric that concisely allows "apples-to-apples" comparisons of DR with other resource options?

There are multiple objectives in system planning…which areas does DR target?

- **Is the supply mix able to meet peak demand levels? Does the plan meet standards that limit the likelihood of supply shortages?**
- **What mix of resources should be used to meet electricity consumption needs at lowest cost?**
- **Is the system able to withstand shocks such as transmission of generation forced outages or unexpected demand levels? (i.e., spinning and non-spinning reserves)**
- **Are there sufficient load following resources to enable the operator to instantaneously balance supply and demand? (i.e., regulation)**

DR resources provide "insurance" against low probability events that may have severe consequences when they occur

DR targets extreme load hours in order to avoid the need for additional installed capacity



- The risk of shortages is concentrated in relatively few hours (<200) and in years with abnormal weather conditions
- At higher demand levels the likelihood of a shortage in installed capacity is higher
- If multiple unforeseen outages occur, the system may have insufficient resources to meet supply
- For hydro intensive systems droughts can substantially increase the likelihood of shortages

Shortage conditions happen very infrequently by design

- **The system is designed with enough capacity to meet 1-in-20 year demand levels with 1-in-10 low hydro levels**
- **In many years, the insurance provided by additional installed capacity does not need to be exercised**
- **Most DR value arises from capacity – insurance – and not from frequent use**
- **But there are reasons to operating DR programs more frequently**
  - To test them for operational effectiveness and to identify improvements
  - To understand the load reductions that can be delivered under different conditions (and to support DR impact evaluations)
  - To create incentives necessary to keep customers engaged
  - To minimize lost revenue (primarily for price driven DR)
  - To help reduce market price volatility

How should DR resources be incorporated into system planning?

- It is necessary to take into account when, where, how often, how much and for how long DR resources are available
- How much demand reduction capability is available when resources are needed most? (i.e., How do the resources align with the extreme conditions the electricity system is designed to meet?)
- How quickly can DR resources respond and ramp up to full capacity?
- Can we control and predict the increment of load reduction?

Evaluation outputs must align with planning and cost effectiveness

For DR benefits to be realized, load impacts must be tailored to system planning requirements

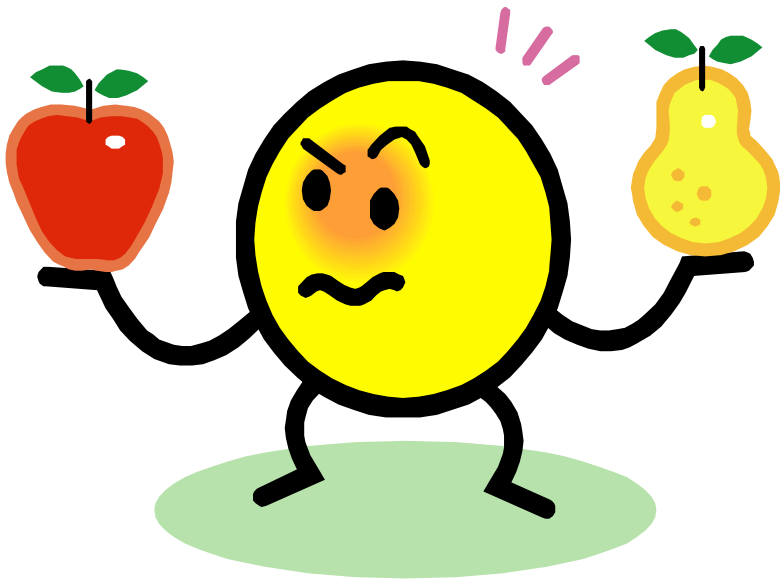
- **Generation capacity costs are not avoided if DR is not incorporated into planning**
- **Integrating DR resources into the system is a challenge because these resources have different characteristics than typical thermal generators**
- **They often also follow different dispatch because they are designed as a capacity resource while the dispatch supply curve usually focuses on the marginal cost of production**
- **To properly link DR resources to avoided capacity costs both need to be time-differentiated**
- **Evaluation results need to be useful for system planning**
  - Explain why there are differences between the expected and delivered demand reductions
  - Report the load reduction capability and if it varies under different conditions
  - Provide information that aligns with system planning conditions
  - Produce results that allow comparison with other resources

How Should DR be Valued?

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER®
An IDACORP Company

Comparing DR to generation is like comparing car insurance quotes



- **When the car policy characteristics differ, the insurance quotes are not directly comparable – the details matter**
- **DR and generation are insurance policies with slightly different characteristics**
  - Hours and months when they can operate may be different
  - DR impacts can vary by hour or month
  - DR can have limitations on the duration of demand reduction – e.g., 4 hours per event day
  - DR can have caps on the total hours it can be dispatched annually – i.e., 100 hours
- **We need a translator for comparing different types of "insurance"**

We propose using a common metric – simplified Effective Load Carrying Capacity (ELCC) – to facilitate comparisons across programs and supply resources

What about uncertainty in DR resources?

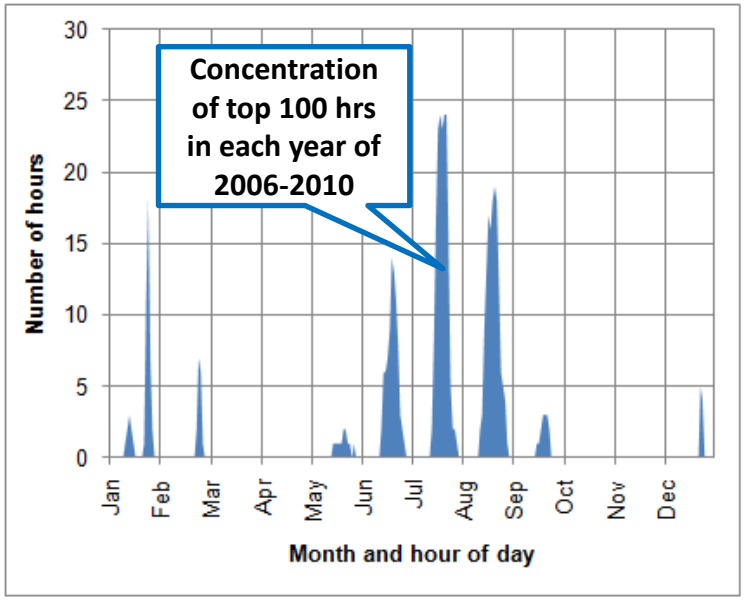
DR resources

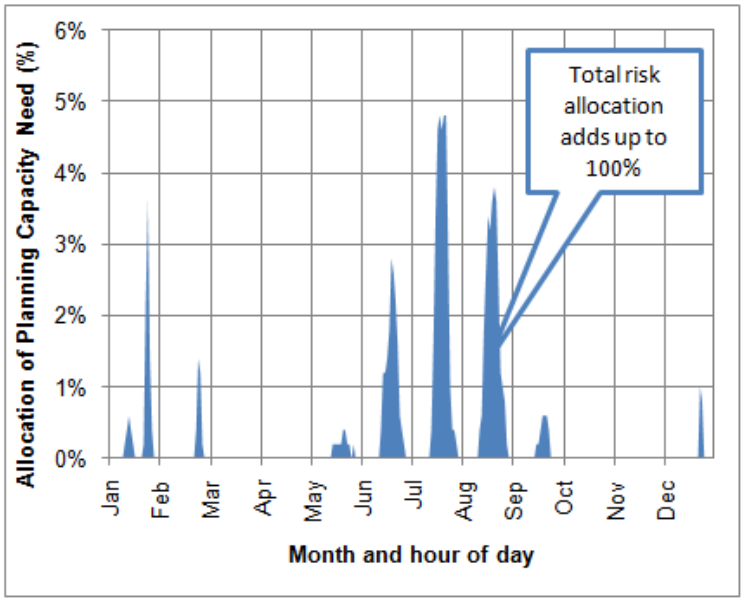
- Existing resources are highly predictable, less so for intermittent resources (AC load)
- Large sources of uncertainty are often future enrollment and regulatory direction – Will a program be approved? How many customers will enroll?
- Capped by customer acceptance and enrollment – even very successful programs can have limits
- Highly modular – DR resources can be ramped up and down in small increments

Generation

- Existing resources are highly predictable, less so for intermittent resources (wind) and for individual plants
- Main sources of uncertainty are plant siting constraints and construction timelines – you can plan it, but can you really build it?
- Transmission constraints also matter – can you deliver the power to where it is needed?
- Step like growth in resources. Resource is not available until plant is fully built and connected. Once built, it is there for decades.

To compare resources, we need to time-differentiate capacity value





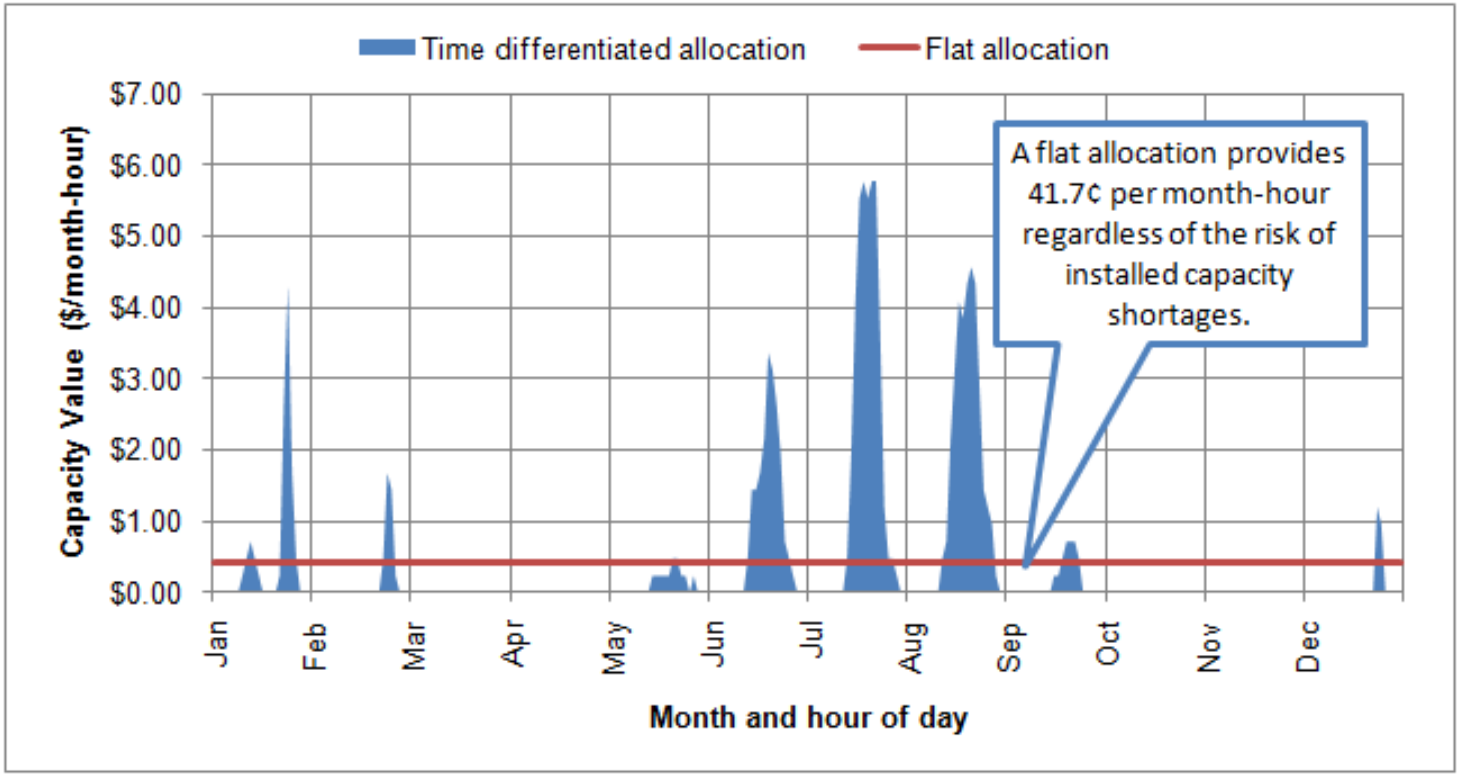
- **Ideally, this is done using outputs on the risk of supply shortages from planning models – LOLP, LOLE, EUE – but:**
  - Many of the models don't produce sufficiently granular output
  - The results are often confidential
- **The concentration of the top 100 system load hours or when demand thresholds are exceeded can also be used to allocate risk & capacity value**

How to produce a simplified risk allocation

- **Decide how many years of system load data to use**
  - A single year reflects the weather patterns for that year
  - Multiple years better reflect the likelihood of heat waves in June, July, August, etc.
  - Too many years can confound fundamental shifts in the customer mix and end-uses with weather
- **Identify the top 100 hours in each year**
  - 100 hours are used because the risk of shortages is usually concentrated in 100 hours or less
  - With five years of data, this produces 500 observations
- **To assign more weight to the highest system load hours:**
  - Use the bottom hour demand as the base threshold
  - Calculate the difference between each hours' system load and the base threshold
  - This assigns more weight to higher system load hours
- **Sum the hours or MWhs above the threshold for each hour and month**
- **Divide by the total hours or MWhs above the threshold**

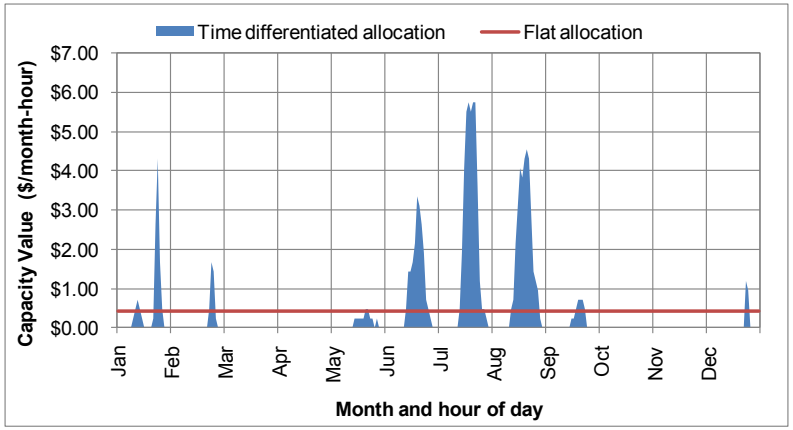
Sensitivity analysis is recommended to ensure the risk allocation is not the artifact of judgmental calls

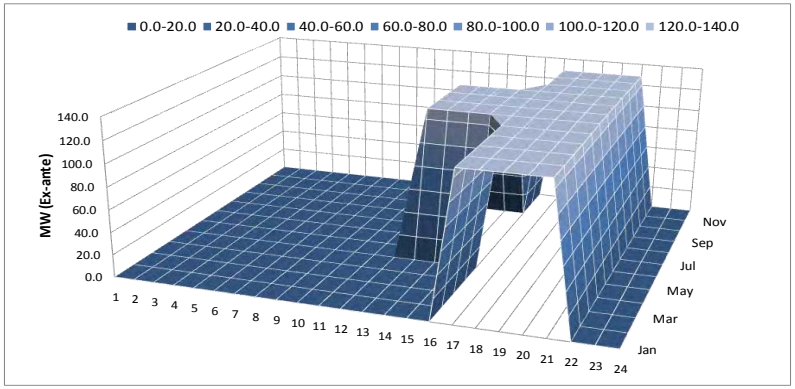
Multiplying the risk allocation with the annual capacity value time differentiates it



- **For this example, we assume a capacity value of $120 per kW-year**
- **A flat allocation overpays for hours when there is little or no need for capacity and underpays for hours when resources are needed most**

Having a capacity value for each month and hour allows us to factor in limitations on availability



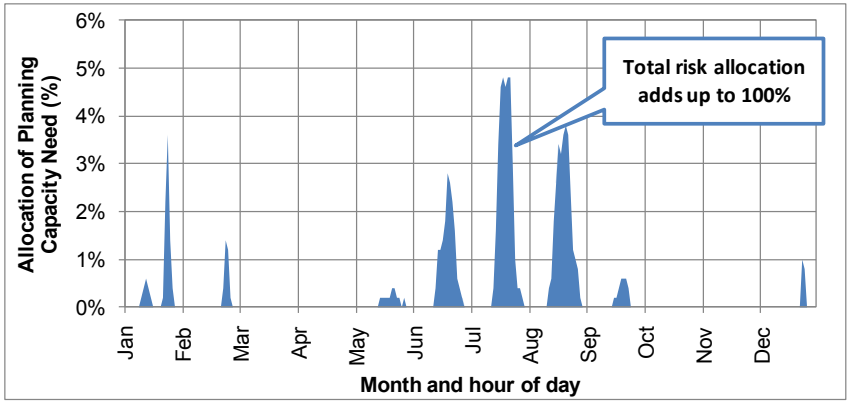


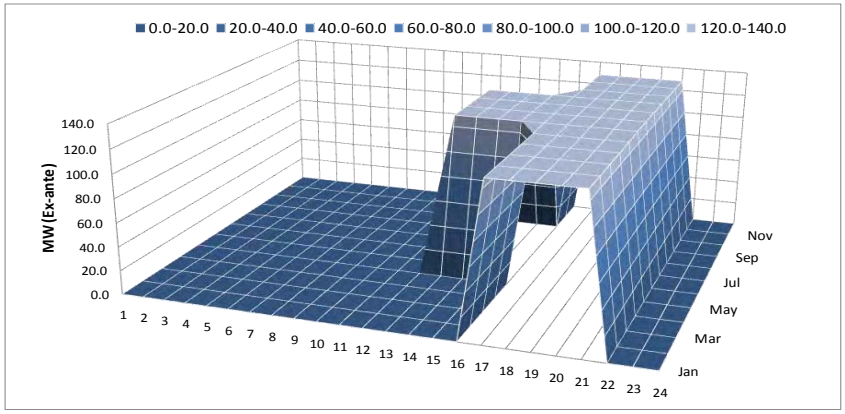
Capacity value allocated to each month-hour

Net demand reduction capability for each month-hour

- Both graphs show results by month and hour
- For simplicity, we assume a program:
  - With no variation in demand reduction capability
  - That is only available from 12 PM to 9 PM in the summer and from 4 PM to 9 PM in the winter
  - That can call events for up to 9 hours
- The program captures 82.6% of the capacity value
  - It targets most of the right hours
  - The example utility's peaks are not as highly concentrated as in other areas

An alternative is to multiply the risk allocation and demand reduction capability by hour and month and add it up





Capacity allocation (adds up to 100%)

Net demand reduction capability

- **This metric is a simplified version of the ELCC)**
- **It conveys the extent to which the resource helps meet capacity needs and accounts for:**
  - Hours and months of availability
  - Caps on dispatch event duration
  - Variability in resource availability

Comparing DR and generation capacity – a simplified example

DR Program

- 167 MW of contracted DR
- Delivers 77% of the nameplate after factoring in non-performance (129 MW)
- After adjusting up for avoided line losses (6.7%), the program delivers the equivalent of 137.7 MW of supply
- However, it is only available for a maximum of 4 hours per day within the hours of availability – the hours cover 59% of the risk allocation
- It effectively can support 81.2 MW (59% times 137.7 MW) of peak system load without altering the likelihood of shortages in supply – ELLC of 48.6% (81.2/167.0)

Generator

- 167 MW of rated capacity
- With a 10% forced outage rate, the generator can be counted on to deliver 150.3 MW
- Available 24/7 (though not necessarily operated) except for 6 weeks of scheduled non-performance in May and October – these hours cover 97.6% of the risk allocation
- Effectively can support 146.7 MW of load - ELLC of 87.8%

The two main characteristics that affect value are availability and maximum event duration

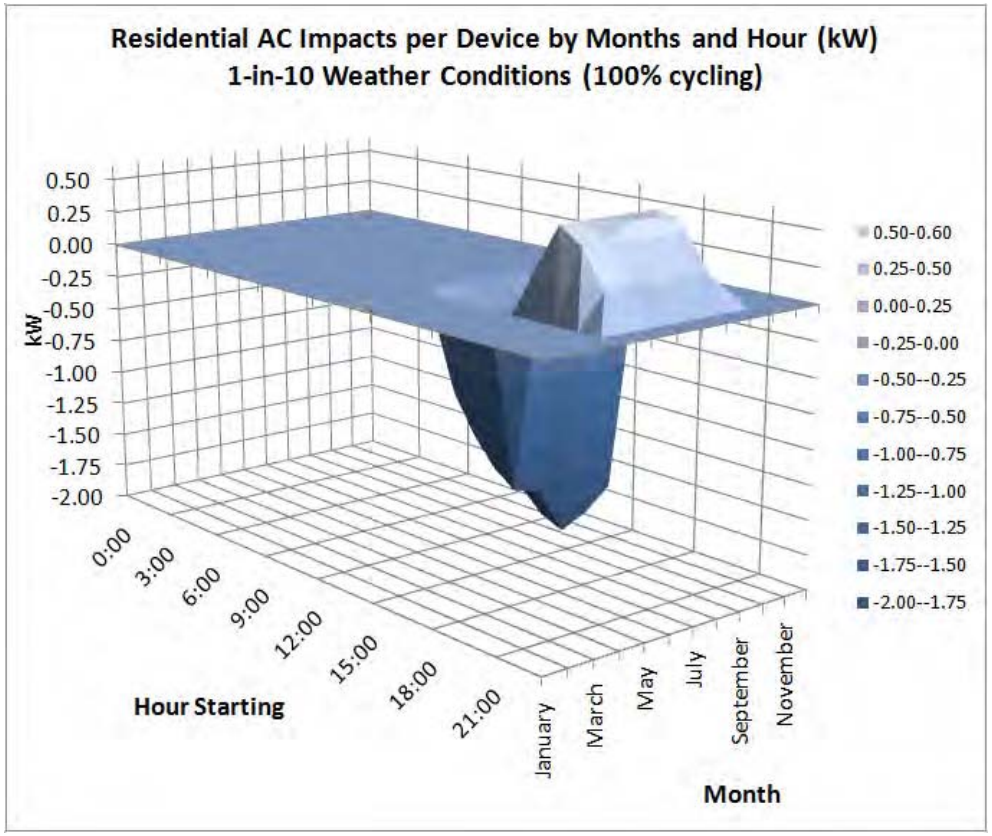
Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
7	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
8	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.2%**
9	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	**0.8%**
10	0.6%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%	0.6%	0.0%	0.0%	0.0%	0.0%	**2.0%**
11	0.4%	0.0%	0.0%	0.0%	0.2%	1.2%	1.6%	1.8%	0.0%	0.0%	0.0%	0.0%	**5.2%**
12	0.2%	0.0%	0.0%	0.0%	0.2%	1.2%	3.4%	2.6%	0.2%	0.0%	0.0%	0.0%	**7.8%**
13	0.0%	0.0%	0.0%	0.0%	0.2%	1.4%	4.6%	3.4%	0.2%	0.0%	0.0%	0.0%	**9.8%**
14	0.0%	0.0%	0.0%	0.0%	0.2%	1.8%	4.8%	3.2%	0.4%	0.0%	0.0%	0.0%	**10.4%**
15	0.0%	0.0%	0.0%	0.0%	0.2%	2.8%	4.6%	3.6%	0.6%	0.0%	0.0%	0.0%	**11.8%**
16	0.0%	0.0%	0.0%	0.0%	0.4%	2.6%	4.8%	3.8%	0.6%	0.0%	0.0%	0.0%	**12.2%**
17	0.2%	0.0%	0.0%	0.0%	0.4%	2.2%	4.8%	3.6%	0.6%	0.0%	0.0%	0.0%	**11.8%**
18	2.2%	0.4%	0.0%	0.0%	0.2%	1.6%	3.0%	2.4%	0.4%	0.0%	0.0%	1.0%	**11.2%**
19	3.6%	1.4%	0.0%	0.0%	0.2%	0.6%	1.0%	1.2%	0.0%	0.0%	0.0%	0.8%	**8.8%**
20	1.4%	1.2%	0.0%	0.0%	0.0%	0.4%	0.4%	1.0%	0.0%	0.0%	0.0%	0.0%	**4.4%**
21	0.4%	0.2%	0.0%	0.0%	0.2%	0.2%	0.4%	0.8%	0.0%	0.0%	0.0%	0.0%	**2.2%**
22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	**0.4%**
23	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**9.6%**	**3.2%**	**0.0%**	**0.0%**	**2.4%**	**16.4%**	**34.0%**	**28.6%**	**3.0%**	**0.0%**	**0.0%**	**1.8%**	**100.0%**

- **The table shows the risk allocation by hour and month**
- **Not all risk is covered with the hours available for the DR resource (83%)**
- **Even less of the risk is covered when we factor in maximum event duration (59.1%)**
- **Still need/want insurance for high risk hours that are not covered**

Expanding the maximum event duration from 4 to 6 hours increases risk coverage from 59% to 77%

The other big factor is how well DR resources align with system peaking conditions

- Some DR resources can deliver larger load reductions when they are needed most
- AC is the driver of system peak loads and, not surprisingly, can deliver larger reductions during peaking conditions
- It is critical to factor in both the benefits of load reductions and the costs of snapback



Less influential are the amount of advance notice and the maximum number of dispatch hours

- Extremely high demand levels can usually be foreseen a few days in advance
- Shortages in installed capacity are different than the ability to recover from short term system shocks due to forced outages – these are addressed by having the right amount of reserves online
- More advanced notice increases the number of false positives and increases the chance a resource is exhausted
- Most programs have more than enough hours to address the frequency of emergency needs due to insufficient installed capacity
- True shortage events are rare as can be seen by the total hours of expected load for 1-in-20 year conditions (LOLE)
- Enough cushion must be built in to allow DR dispatchers to err on the safe side

How can Idaho Power apply these concepts?

- **Allocate the risk of installed capacity shortages across hours and months of the year**
- **Ensure that DR evaluations produce results that align with system planning:**
  - Impacts for each hour and month of the year under a standard set of conditions that match planning
  - Produce net load reduction capability. Many DR programs such as Irrigation Peak Rewards and A/C Cool Credit do not have a nameplate capacity and vary based on weather conditions and/or seasonality. Actual events do not always reflect full capability
- **Factor in limits on availability and maximum event duration**
- **Assess if LOLE model outputs can be used to conduct a quantitative assessment of day-of versus day-ahead dispatch and on the likelihood of exhausting DR resources**

How Should DR Cost Effectiveness be Evaluated?

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER®
An IDACORP Company

Cost-effectiveness analysis is the link between impacts, program design, operations & planning

- **Cost-effectiveness tests are designed to allow "apples to apples" comparisons of DR resources with conservation, renewables, and generation**
- **CE analysis must accurately take into account when, where, how often and for how long DR resources are available and how these characteristics affect the value of the DR resource**
- **CE analysis is also extremely useful as a program design tool. It can help assess the extent to which program changes such as better targeting, event timing and duration and notification lead time impact cost-effectiveness**
- **Rule of thumb – if a resource is cost-effective, it is usually worthwhile to acquire or retain the resource – but this is not always true**

It answers several relevant questions…

Question	Analysis
Should the program be continued at current levels?	Do future benefits of running the program without expanding it exceed operating costs? Ignores sunk costs and does not add any new customers.
Should the program be expanded using existing marketing and operation strategies?	Do benefits associated with ***new*** customers exceed the cost of acquiring and servicing these customers? Ignores sunk costs and focuses on the marginal benefits of adding new customers
How can the program be adjusted to make it more cost-effective?	Sensitivity analysis helps identify the key levers and how adjusting them affects cost-effectiveness

There is not full agreement concerning DR benefit streams and costs

	Societal or Total Resource Cost Perspective	Program Administrator Perspective
Benefits	▪ Avoided generation capacity costs ▪ Wholesale market energy cost savings ▪ Avoided transmission and distribution costs*** ▪ Effect on wholesale market prices***	▪ Avoided generation capacity costs ▪ Wholesale market energy cost savings ▪ Avoided transmission and distribution costs*** ▪ Effect on wholesale market prices***
Costs	▪ Device and installation costs (if applicable) ▪ Administrative costs ▪ Participant costs (cost of providing the load reductions)***	▪ Device and installation costs (if applicable) ▪ Administrative costs ▪ Participant payments

*****There is significant disagreement across jurisdictions about:**

- Whether the impact of DR on market prices is a societal benefit or income transfer
- If and when T&D benefits should be included
- If participant costs associated with providing DR should be considered

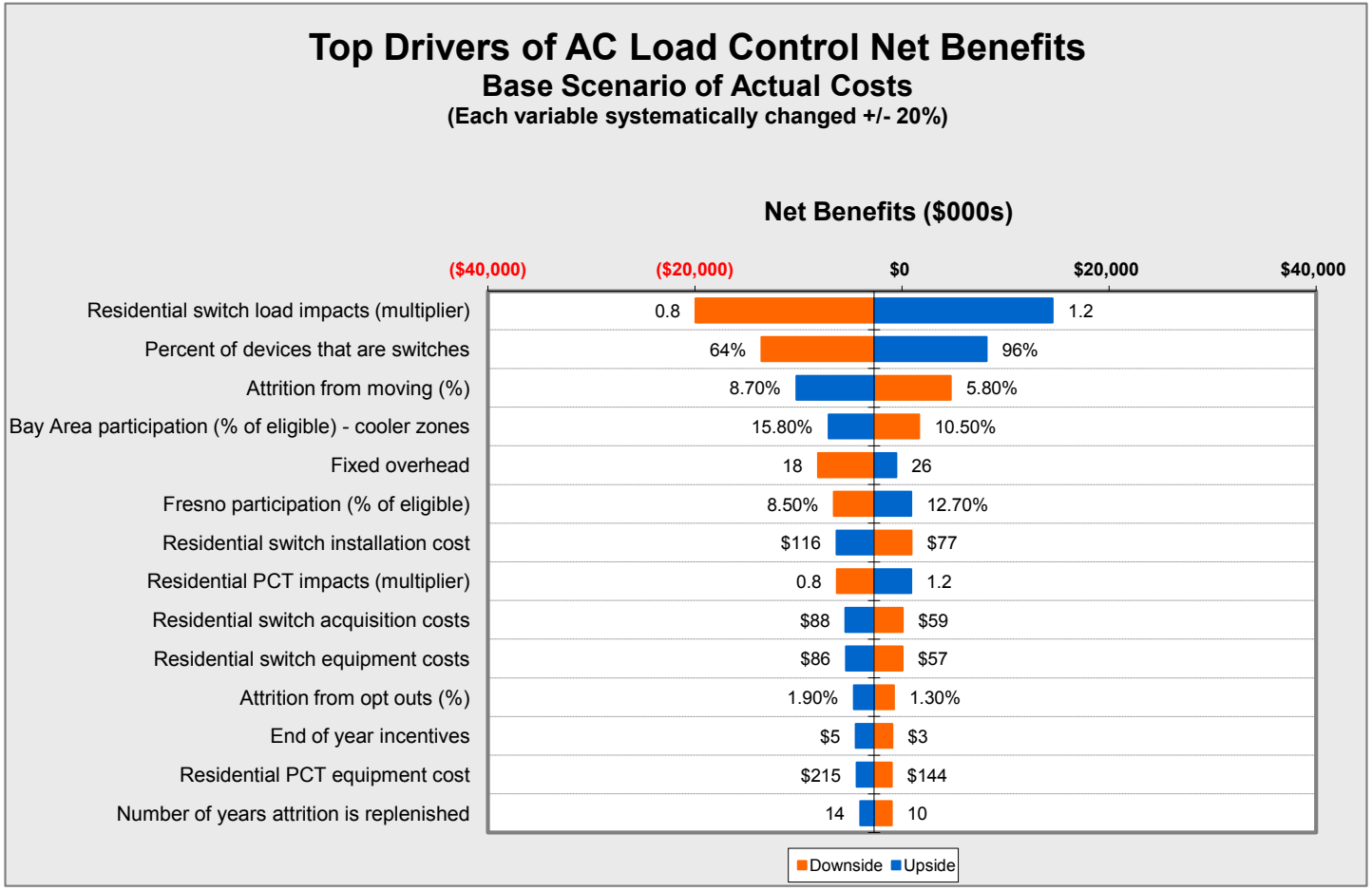
Example of cost-effectiveness results

Cost-effectiveness Metric	Continuing Program w/o Expansions	New 2010 Enrollment
Participants	186,749	43,530
Annual Peak Reduction (MW)	103.6	24.1
Effective Load Carrying Capacity (MW)	50.7	11.8
Benefits	$76,932,494	$17,860,975
Costs	$86,301,133	$18,251,788
Net Benefits	($9,368,638)	($390,813)
Benefit Cost Ratio	0.89	0.98
Levelized Cost per Per Peak kW ($/kW-year)	$95.45	$86.86
Levelized Costs per ELCC kW ($/kW-year)	$195.17	$177.76

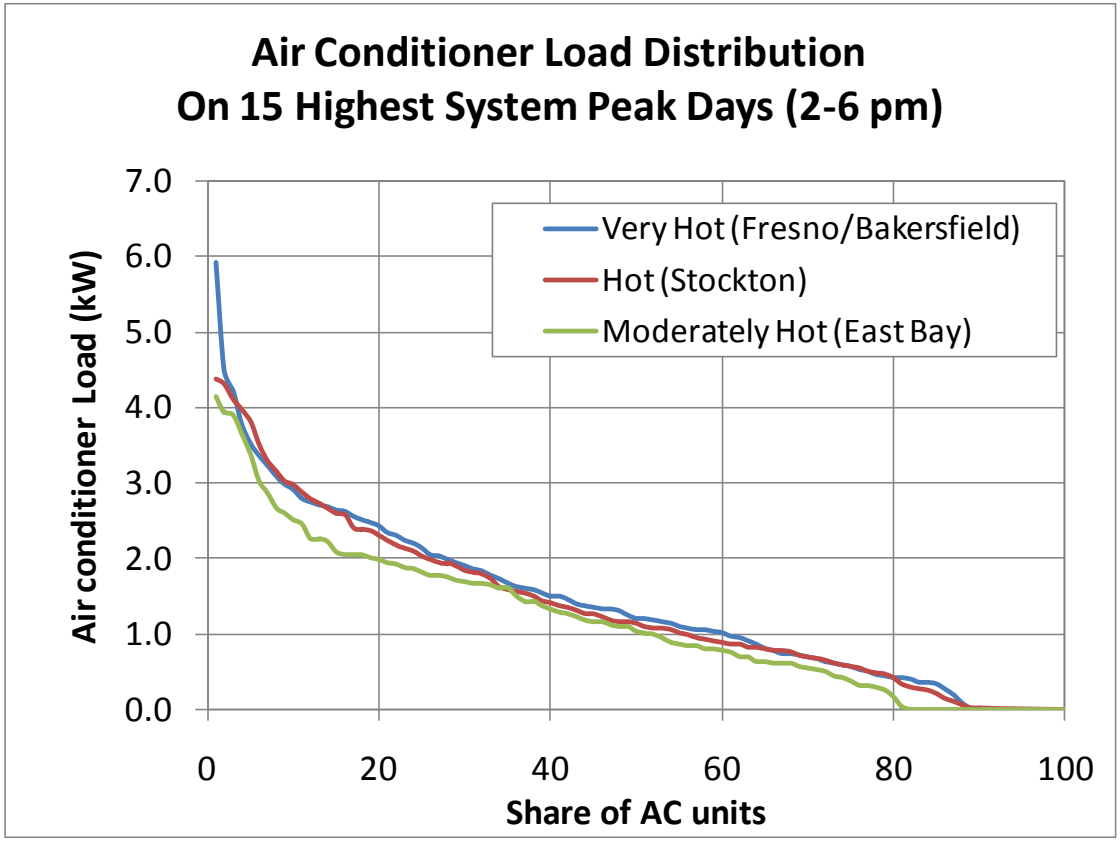
*Program overhead costs do not apply to new enrollees

- **In some cases, using ELCCC makes a big difference**
- **Due to the limitations on dispatch hours and how impacts coincide with peak hours, the full capacity value is not captured**
- **It is also key to distinguish if it is cost-effective to maintain the program and if it is cost-effective to expand it**

Sensitivity analysis is very important for identifying what affects cost-effectiveness and for improving it

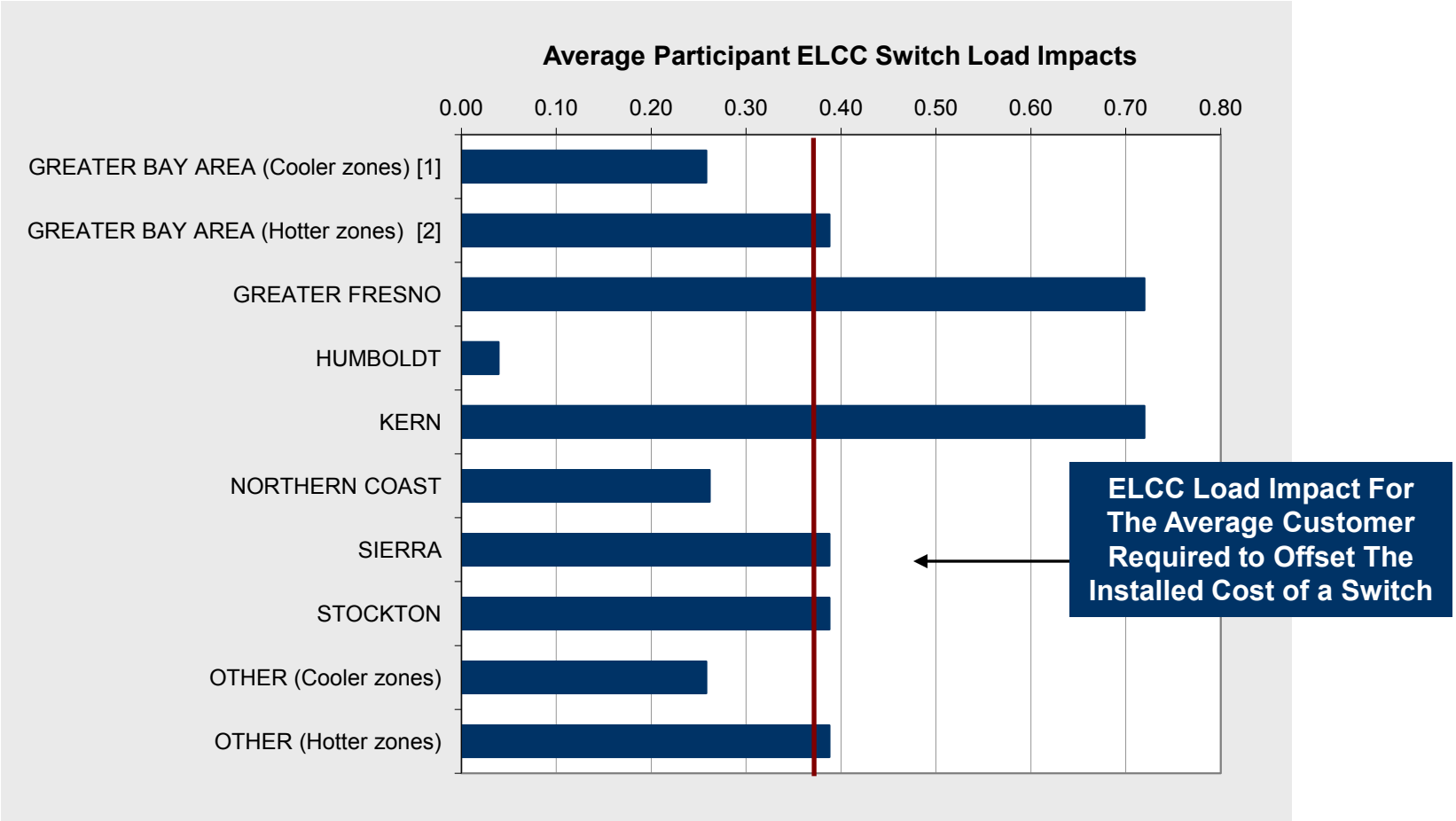


Targeting has a large effect on cost-effectiveness of programs such as AC load control



- Not all customers are cost-effective to enroll
- There can be significant variation in usage even within hot regions
- Findings were similar across all 3 California utilities for both residential and non-residential sectors
- Customers that do not use much A/C during peak hours are usually not cost effective

The ELCC load reduction provides a useful metric for break-even analysis



How Should DR Load Impacts be Estimated?

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER
An IDACORP Company

There are two issues to be addressed when estimating DR impacts

- **How do you accurately measure demand reductions?**
- **What evaluation outputs are needed to incorporate DR programs into planning?**

How do you estimate what you cannot directly observe?

- **To calculate the resource delivered, participant's load patterns in the absence of the DR program – the counterfactual or reference load – must be estimated**
  - It is not possible to directly observe what customers would have used in the absence of the DR incentive during event day peak hours
- **Accurate estimation of DR impacts requires systematically eliminating or controlling for alternative explanations for changes in hourly demand besides the DR program (the intervention)**
- **Developing accurate counterfactuals that are not confounded with factors unrelated to the intervention is at the core of program evaluation**

Conceptually, there are two primary methods for estimating reference loads

Within-subject Estimates

- Use customer's electricity use patterns during days when they are not dispatched to estimate the counterfactual
- They work when DR is introduced on some days and not on others, making it possible to observe behavior with and without DR
- Examples: Day-matching baselines, individual customer regressions
- This approach is weaker when event days are systematically different than non-event days

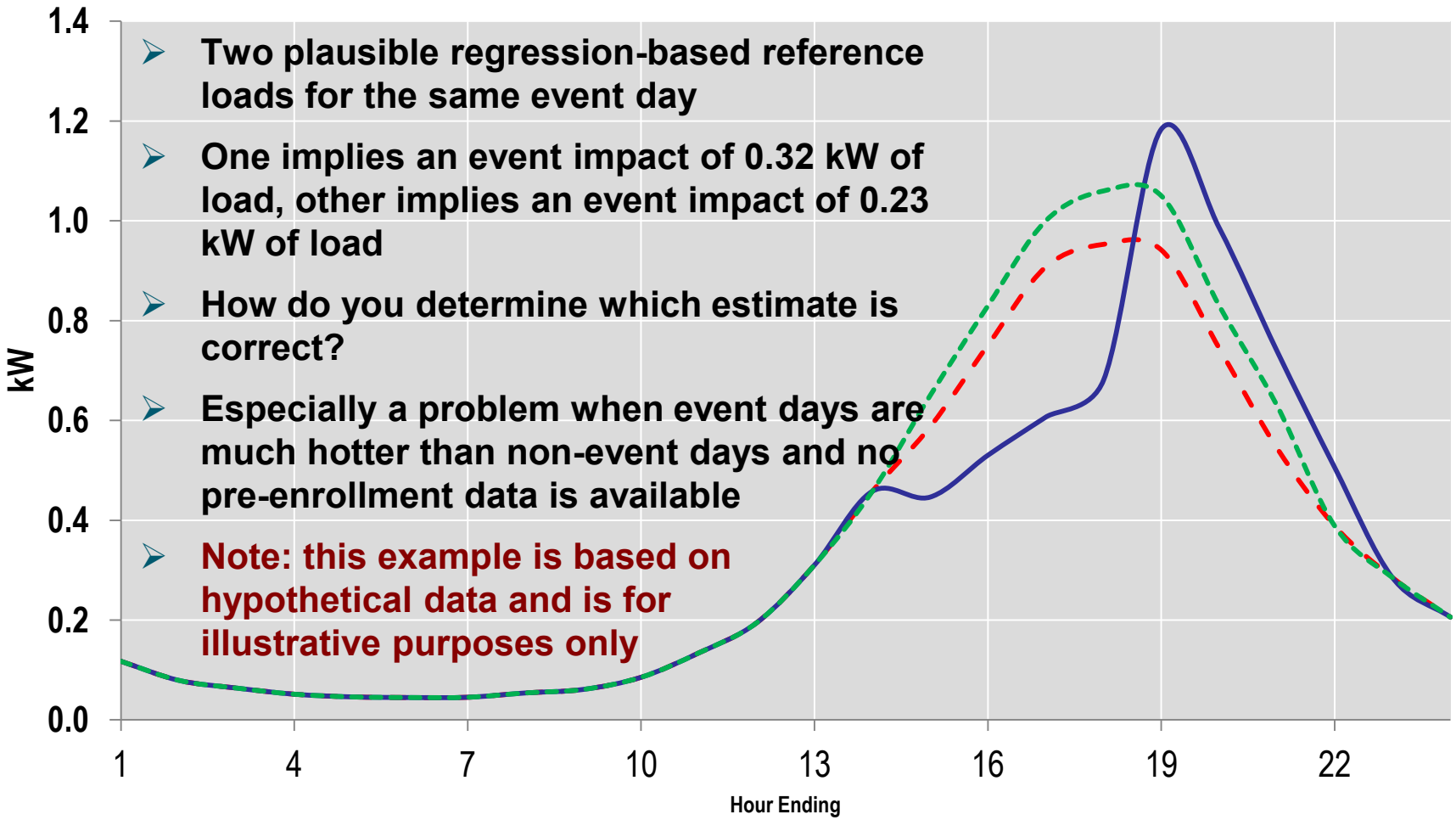
External Control Groups

- A set of customers not exposed to DR provides information about how participants would have used electricity in the absence of the DR influence
- Using a control group does not guarantee more accurate results – poorly matched controls will produce biased estimates
- A good control group has customers that, on average, look like and behave identically to participants except for the exposure to the DR signal.

In practice, there is a wide spectrum of design alternatives and statistical methods that can be used to estimate reference loads & load impacts

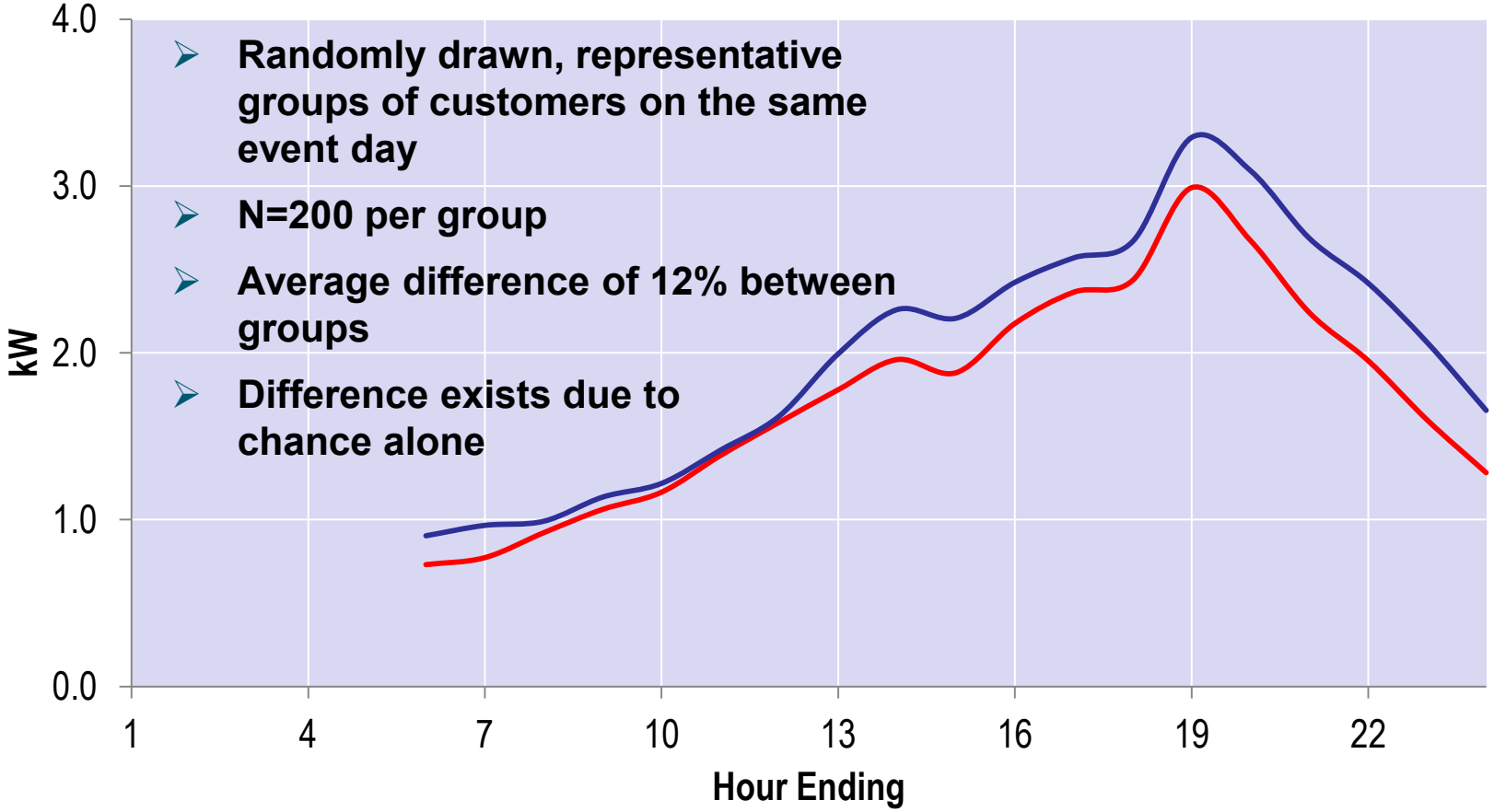
Randomized Assignment Strategies	Methods that rely on random assignment to recruitment blocks	Methods that use pre-enrollment data and control groups	Methods that use pre-enrollment data or control groups only	Other
• Recruit and deny • Random assignment to start times • Random assignment of dosage • Random assignment to alternating treatment groups	• Intention to treat analysis • Randomized encouragement design (RED) • Selection of control group via propensity score matching combined with random assignment to recruitment blocks	• Difference-in-differences with a matched control group • Differences-in-differences with an unmatched control group • Panel regression with a matched control group • Panel regressions with an unmatched control group	• Panel regressions with either a control groups or pre-treatment data (but not both) • Regression discontinuity designs (assignment based on cut-off threshold) • Propensity score matching without pre-treatment data • Analysis of repeated treatments with time series data • Interrupted time series analysis	• Regressions with a heckman selection correction • Panel regressions without a control group or pre-treatment data • ANCOVA

A key challenge is determining which impact estimate method is more accurate



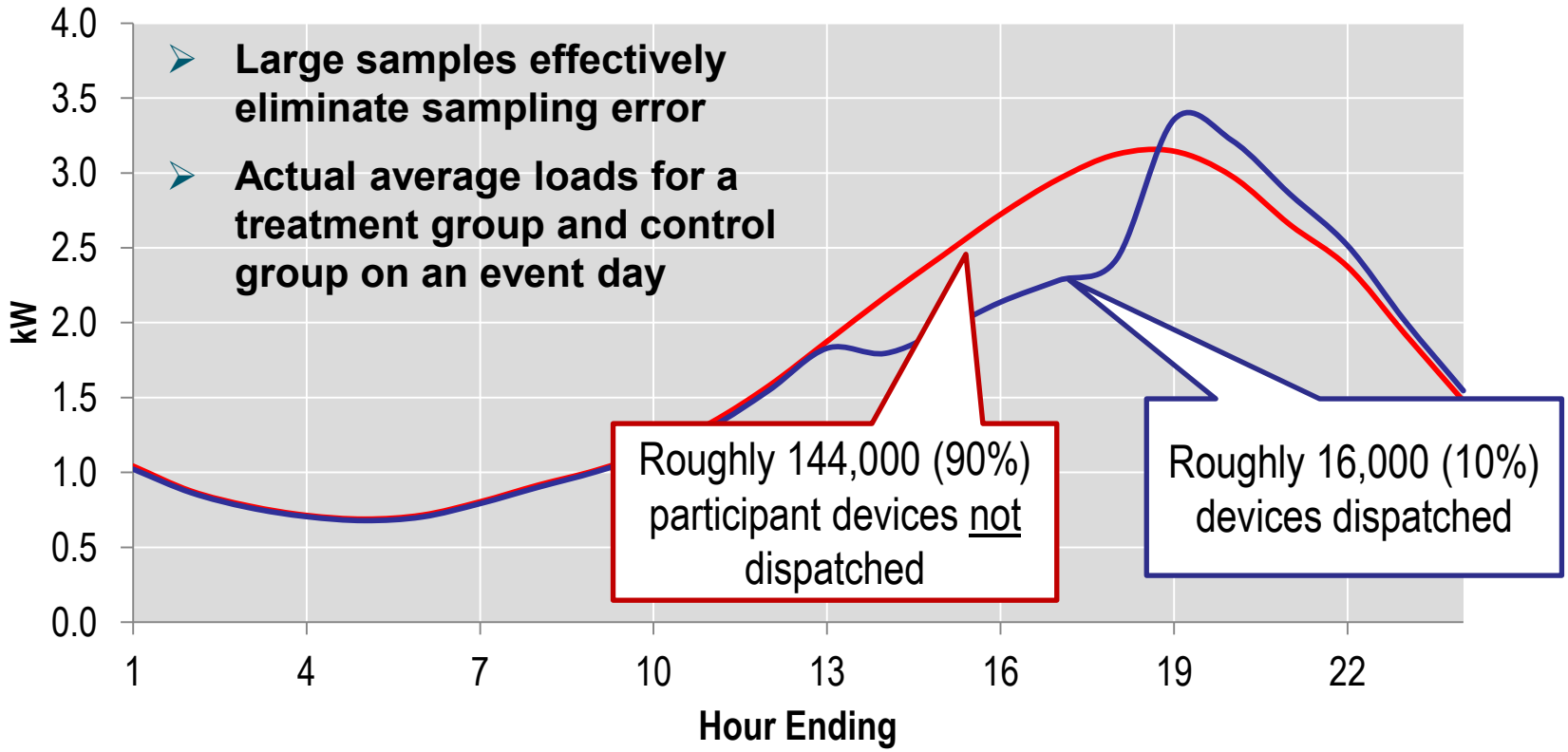
- Two plausible regression-based reference loads for the same event day
- One implies an event impact of 0.32 kW of load, other implies an event impact of 0.23 kW of load
- How do you determine which estimate is correct?
- Especially a problem when event days are much hotter than non-event days and no pre-enrollment data is available
- Note: this example is based on hypothetical data and is for illustrative purposes only

With smaller sample sizes, load impacts can also be inaccurate due to random variation



- Randomly drawn, representative groups of customers on the same event day
- N=200 per group
- Average difference of 12% between groups
- Difference exists due to chance alone

Option #1: Use random assignment with large sample sizes

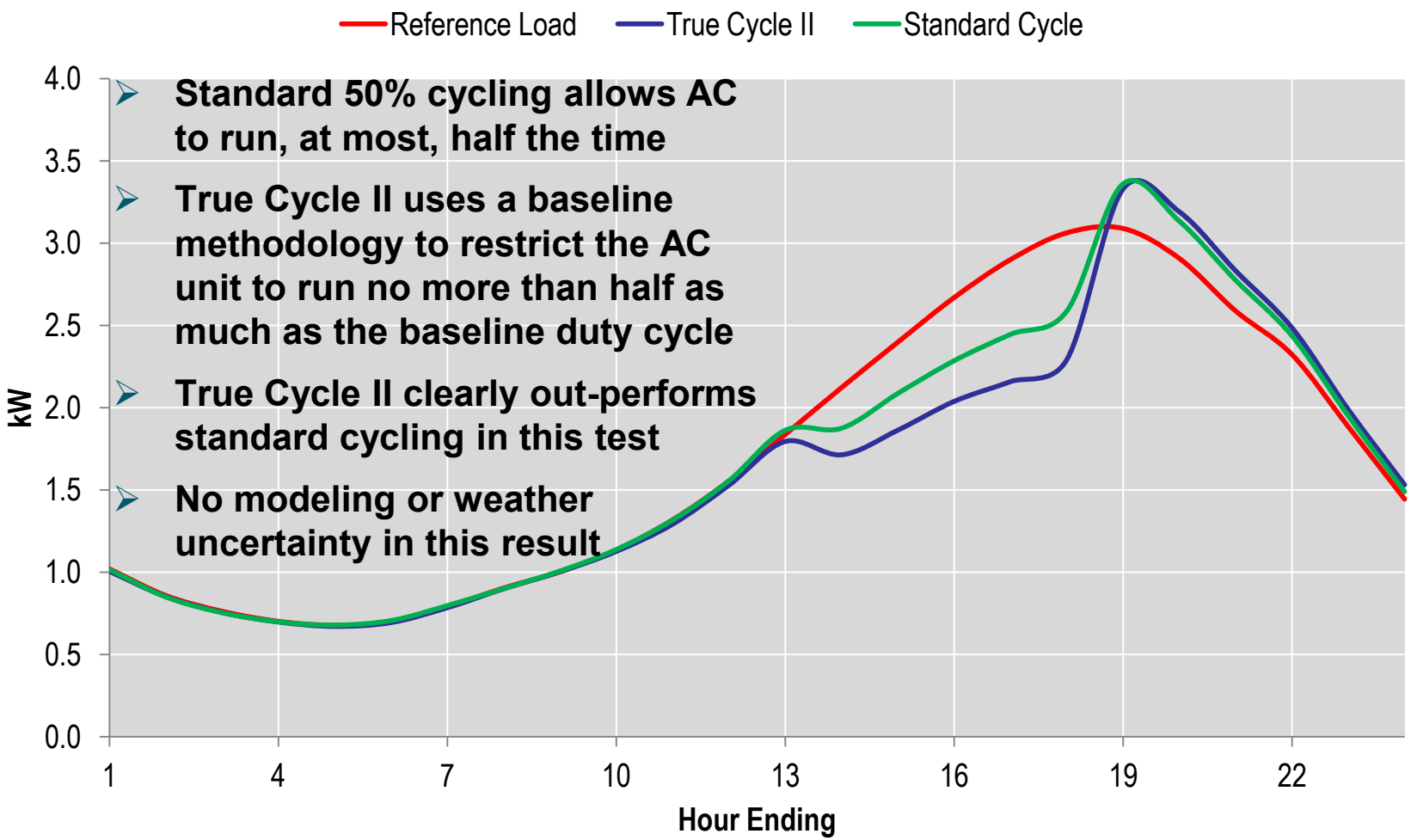


Randomized assignment is cheaper with smart meters and feasible when load control devices can be individually addressed

Side-by-side testing with treatment & control customers can also assess the relative effectiveness of different operational strategies

- **Important questions that can be explored in this way include**
  - Does algorithmic cycling produce higher impacts than simple cycling?
  - Are impacts smaller at 5 PM if the event started at 1 PM than if it started at 4 PM?
- **In the absence of smart meter data, these issues could be explored by calling different strategies on different days, but weather and other factors could confound the comparison**
- **With side-by-side comparisons of randomly selected customers, there is virtually no uncertainty in the comparison**
- **Call two groups with different treatments on the same day**
- **This allows for optimizing program operations**

Simple versus algorithmic cycling



- Standard 50% cycling allows AC to run, at most, half the time
- True Cycle II uses a baseline methodology to restrict the AC unit to run no more than half as much as the baseline duty cycle
- True Cycle II clearly out-performs standard cycling in this test
- No modeling or weather uncertainty in this result

Option #2: When random assignment is not feasible, use systematic checks for accuracy

- **Need to ensure that the results are accurate and not artifacts of the baseline method or regression model selected**
- **This is particularly important when the percent load reductions are relatively small and difficult to distinguish from background noise**
- **Three approaches for assessing accuracy are:**
  - out-of-sample testing
  - use of false experiments
  - crosschecking results with methods that rely on control groups
- **In the first two cases, the "true" answers are known and are designed to assess whether the evaluation method produces accurate results**

Example of false experimental results

Date	Event Temp	Daily Max Temp (°F)	True Impact (Simulated)	Predicted Impacts							
				Day Matching			Weather Matching	Regression			
				1	2	3		1	2	3	4
07/13/09	90.0	94.3	0.09	0.09	0.02	0.00	0.04	0.13	0.14	0.14	0.09
07/15/09	96.4	97.0	0.27	-0.14	0.52	0.46	0.31	0.26	0.26	0.31	0.28
07/16/09	98.1	98.2	0.25	-0.04	0.33	0.26	0.30	0.34	0.39	0.38	0.29
07/27/09	81.9	97.6	0.23	-0.06	0.26	0.31	0.23	0.17	0.18	0.21	0.16
7 OTHER PROXY EVENT DAYS OMITTED FOR SPACE											
09/11/09	80.8	96.4	0.20	-0.02	0.16	0.16	0.17	0.24	0.23	0.26	0.20
09/17/09	87.5	90.2	0.14	0.01	0.12	0.16	0.16	0.13	0.13	0.13	0.10
09/18/09	79.4	96.6	0.19	-0.02	0.17	0.17	0.18	0.21	0.21	0.22	0.20
09/23/09	88.0	94.0	0.14	-0.24	0.22	0.23	0.30	0.14	0.13	0.14	0.06
Average	**88.1**	**95.5**	**0.20**	**-0.01**	**0.23**	**0.22**	**0.19**	**0.20**	**0.21**	**0.23**	**0.19**
Mean percent error				**-105%**	**14%**	**9%**	**-3%**	**3%**	**5%**	**15%**	**-2%**
Mean absolute error				**0.22**	**0.06**	**0.06**	**0.05**	**0.04**	**0.04**	**0.05**	**0.04**
Weighted mean absolute percent error				**112%**	**30%**	**30%**	**27%**	**20%**	**20%**	**24%**	**19%**
R-squared (Goodness-of-fit)				**-9.53**	**-0.15**	**-0.02**	**0.18**	**0.60**	**0.54**	**0.45**	**0.65**

How load impacts are used drives the analysis

- What will DR deliver tomorrow or right now?—an ex ante exercise
- Prediction accuracy matters significantly
- Need to incorporate planned non-performance , if known
- Estimate performance given operating conditions and committed resources
- Approaches range from decision tables to predictive models

- How much DR did we get last month?—an ex post exercise
- Need customer buy-in
- Participants want payment quickly
- Estimates at the individual participant level
- Prediction accuracy affects costs (overpayments /penalties)
- Usually based on baseline or day matching methods

- What is the load reduction capability?
- Ability to compare DR with other resources is critical for cost-effectiveness and planning
- Need to estimate resource availability under a standard set of conditions that align with system planning
- The focus is on impacts for the program and for key segments
- More detailed, robust, and/or complex analyses are possible

How do historical impacts fit into planning?

- **They do not necessarily reflect the full load reduction capability:**
  - Impacts are tied to conditions – e.g., weather and market prices
  - Programs are not always dispatched in full
  - Do not reflect potential for more enrollment
- **But they are critical for assessing how impacts vary:**
  - Across the hours in a day
  - Across temperature conditions
  - By season
  - By program design characteristics (e.g. 100% versus 50% cycling)
  - By type of customer

Elements of a comprehensive evaluation framework

- Report the load impacts using transparent, robust, and precise methods, but do not dictate methodology
- Report what load impacts were and why they were what they were – ex post results
- Provide standard tests to validate that estimated impacts are accurate
- Estimate load reduction capability for planning
- When possible and practical, base ex-ante estimates on historical performance
- Standardize load impacts for planning conditions (e.g., 1-in-10 weather year conditions)
- Deliver impacts in a consistent format that can be used to compare results, incorporate DR into planning, and assess cost-effectiveness

What Steps are Necessary to Fully Integrate DR into Operations?

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER®
An IDACORP Company

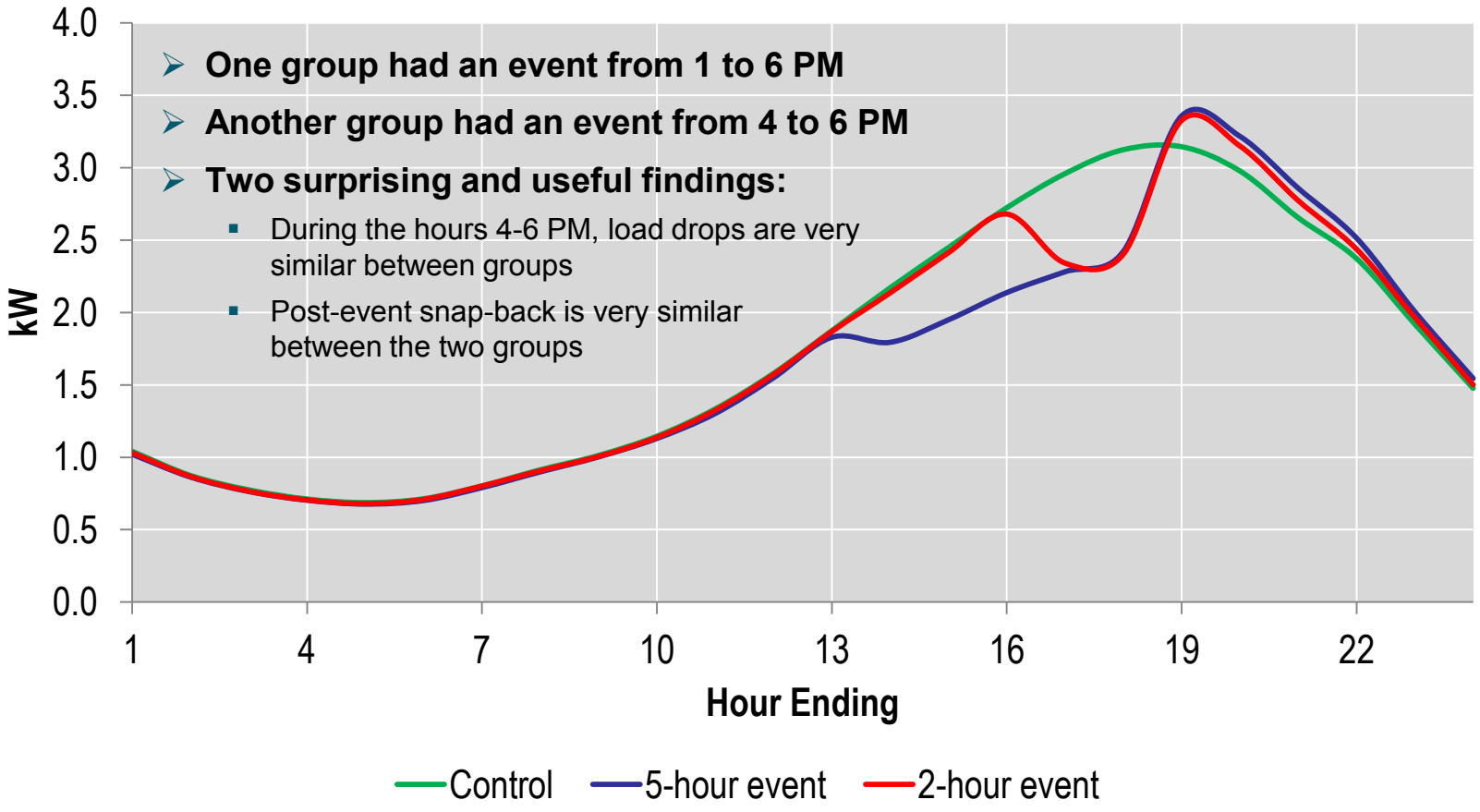
Integrating DR into operations is critical and requires several steps

- Conduct experimental or test operations to better define how different factors such as weather, event length and cycling strategy affect load impacts
- Develop accurate same-day and day-ahead hourly forecasts of DR load reduction capability
- Automate processes that produce optimal dispatch strategy for delivering discrete amounts of DR
- Develop operator confidence in the demand reduction forecasts and the ability to confirm that DR was activated
- Develop clearly defined dispatch rules that balance extracting value from DR against exhausting it prematurely
- Improve real-time visibility of demand reductions

The better DR is integrated into operations, the easier it is to explain its value

- **System operators are used to dispatching resources with known output**
  - DR "output" can vary significantly with temperature, hour of day and season
  - Many types of DR are highly predictable, but trust needs to be developed between operators and short-term demand reduction estimates
- **System operators are NOT used to dealing with the limited use provisions of some DR resources**
  - That is, deciding whether use the constrained resource now or hold out for more extreme conditions that might occur later
- **System operators are used to having real time information on the magnitude of a resource they are dispatching**
- **System operators are not used to resources that do not fit easily into the marginal cost supply curve**

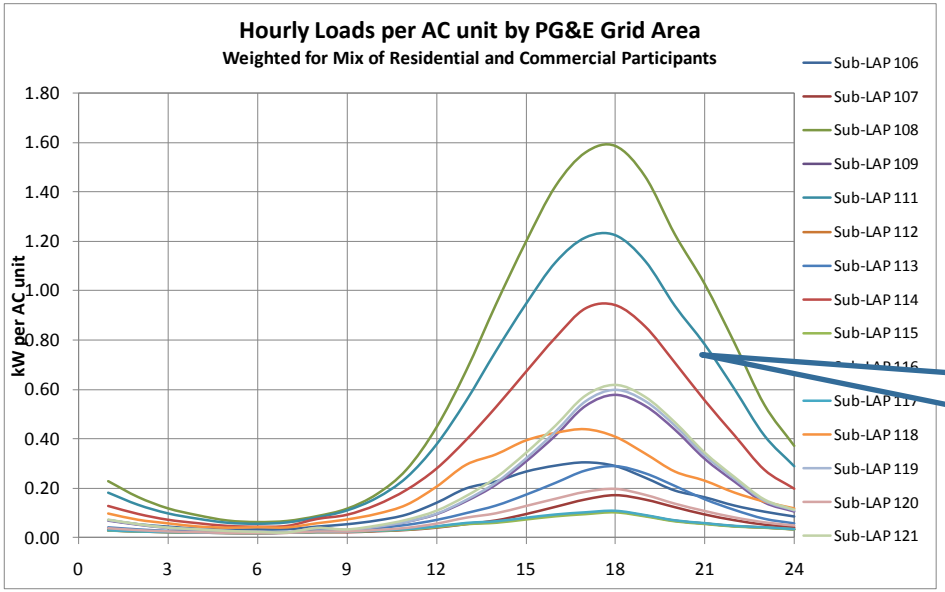
Understanding how load impacts vary is critical for operations



- **One group had an event from 1 to 6 PM**
- **Another group had an event from 4 to 6 PM**
- **Two surprising and useful findings:**
  - During the hours 4-6 PM, load drops are very similar between groups
  - Post-event snap-back is very similar between the two groups

Accurate forecasts of demand reductions also matter substantially for operations

- **AC is a substantial but highly variable resource - accurate forecasts of its load reduction capability are needed for operations**



- **FSC's SmartAC Forecasting Model is an Excel-based model that allows the user to:**
  - Specify event length and start time
  - View impacts across population segments such as T&D planning areas
  - Automatically update weather with the most recent PG&E forecast
  - Upload population counts and incorporate growth projections

Same day, different climates and different residential/commercial mix

The ability to schedule and deliver discrete amounts of DR affects how it is utilized

- **The traditional approach has been to forecast the demand reduction if the program is dispatched in full**
- **It is possible to instead specify the desired demand reduction for specific hours and locations and optimize the dispatch strategy to attain those reductions**
- **The goal is to schedule DR much like a supply side resource**

- **To do so, you need:**
  - The ability to break up the program dispatch into blocks (e.g. SCE's BIP tariff or PG&E's SmartAC)
  - The ability to dispatch specific customers and/or address specific devices
  - Accurate forecasts of per participant or per device hourly demand reduction capability
  - A small optimization engine that recognizes program limitations and constraints

The technology for real time visibility of DR is available but when is it worth it?

- **Near real-time visibility of participant loads is available with a one minute lag – it was used in 2009 pilot testing the ability of A/C to provide ancillary services**
- **A total of 70 fifteen minute notch tests were called on 4 feeders with high program penetration**
- **The top graph shows the effect on the feeder load, the bottom the effect on AC loads**
- **What is the goal of real time visibility? — to confirm activation or to provide live measurement of the reduction?**
- **Is it worth the cost when the load drops are clearly observable on the system load?**

In dispatching DR, there is a need to balance extracting DR value against exhausting it prematurely

- **DR is a capacity product, not an energy product**
- **In practice it is designed for extreme and unlikely 1-in-20 year events**
- **Because the costs are often sunk, there is a temptation to use it to lower market prices**
- **If you use it too little, you don't capture the full value**
- **If you use it too much, you can exhaust it so it is unavailable when actual resource shortages occur**

- **DR often does not fit nicely into the supply stack:**
  - It uses no fuel
  - It has limitations on the number of dispatches
  - It is designed to meet capacity shortages
- **There is still value in utilizing it:**
  - It helps better understand how different factors affect program performance
  - It bolsters operator confidence
  - It bolsters regulatory confidence
  - It does help lower market prices when it is used

Quick response DR programs such A/C Cool and Irrigation Peak Rewards are often well suited for ancillary services operations

- **Spinning and non-spinning reserves are essentially fast response back-up for system shocks such as generator or transmission forced outages**
- **In most markets, they are paid for availability but rarely used**
- **However, there is a substantial amount of hydro in the Idaho Power territory**
- **Load control has been shown to respond quickly. Based on 70 controlled test operations:**
  - A noticeable drop in load is observed in 60 seconds, on average
  - The resource ramps up to full capacity in less than 6 minutes
- **Load control does not use fuel and has minimal start-up costs**

A wide array of dispatch triggers have been used for DR

- **Market strike prices**
  - OPA set a fixed strike price for its demand bidding program, DR-1 and then market prices dropped. In 2008, it was dispatched for 2,000 hours. In 2009, it was dispatched for 1,000 hours
- **Day-Ahead Supply Cushion**
  - This is the percent difference between the forecasted demand and the generation capacity scheduled to be online
  - A thin supply cushion often indicates a lack of resources, but it is also a function of the slack in the generators that are scheduled.
- **Weather based triggers**
  - They are transparent, related to system load and forecasts are often already public
  - The system peak is more often than not affected by overnight heat build-than by the actual daily maximum temperature
- **Peaking unit heat rates**
  - Heat rates reflect the degree to which the system is taxed, but do not reflect volatility in fuel prices

Dynamic triggers tend to work better

- **Set a temperature threshold and a target number of events for the summer**
- **Based on historical data, the temperature threshold is expected to yield the target number of events**
- **As the summer progresses, the trigger is adjusted up or down based on:**
  - The number of events to date
  - The target number of events
  - The number of days remaining in the summer
  - The probability of exhausting the target

How Should Incentives be Structured?

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER®
An IDACORP Company

There are a variety of ways to structure incentives

Type	How it works	Positives and Negatives	Examples
Sign-up incentives	Participants are offered a one-time payment for joining the program	✓ It is highly effective ✓ Avoids recurring costs – Less of an ongoing relationship with participants	▪ PG&E's SmartRate (test) ▪ Toronto Hydro's load control program ▪ PG&E's SmartAC
Annual Fixed incentives	Participants are paid a fixed amount per summer – often tied to AC tons, cycling strategy and degree of availability	✓ Customer satisfaction ✓ Higher recruitment rates ✓ Customer get paid regardless of whether resource is used – Customer get paid regardless of whether resource is used – Not tied to actual loads available for dispatch – Creates recurring costs	▪ SCE AC load control program ▪ SDG&E's load control program ▪ BG&E's load control program

Even more ways to structure incentives

Type	How it works	Positives and Negatives	Examples
Capacity or option payments	Participants are paid for availability over the summer – some utilities vary payments by month and day-of versus day-ahead activation	✓ Often tied to a contractual obligation to provide a pre-specified load reduction ✓ Reflects that participants are paid for capacity – It is sometimes hard to justify option payments for insurance	▪ Almost all aggregator contracts ▪ Capacity Bidding Program ▪ PeakChoice ▪ DR-3
Performance payments with baselines	Participants are paid based on number of events and estimated reductions	✓ If events are not called, there are no payments ✓ Tied to performance – Higher administrative costs – If events are called infrequently, there is little incentive for customers to continue – Baselines are generally not very accurate for individual customers on individual event days – Due to baseline error, some customers can comply with their baseline though in reality they under-deliver	▪ Demand Bidding ▪ ISO NE Real-Time DR ▪ A component of aggregator incentives

If payments need to be tied to performance, it is usually better to do so using directly metered electricity usage

Example #1: BIP

- Payment for the month is tied to the participant's average demand over peak hour s (Same as SCE's AP-I)
- A firm service level is pre-specified
- During an event, any usage above the pre-specified level is subject to penalties
- Customer can choose to buy-through but has a monetary incentive to perform

Example #2: BIP and CPP

- Rate reductions are offered in exchange for higher prices during event days
- A capacity reservation level (CRL) is selected, customer pays for the capacity on a monthly basis
- During an event, any usage above the (CRL) is subject to penalty prices
- Customer can choose to buy-through but has a monetary incentive to perform

The goal of incentives is to obtain the highest enrollment and impacts at the lowest costs

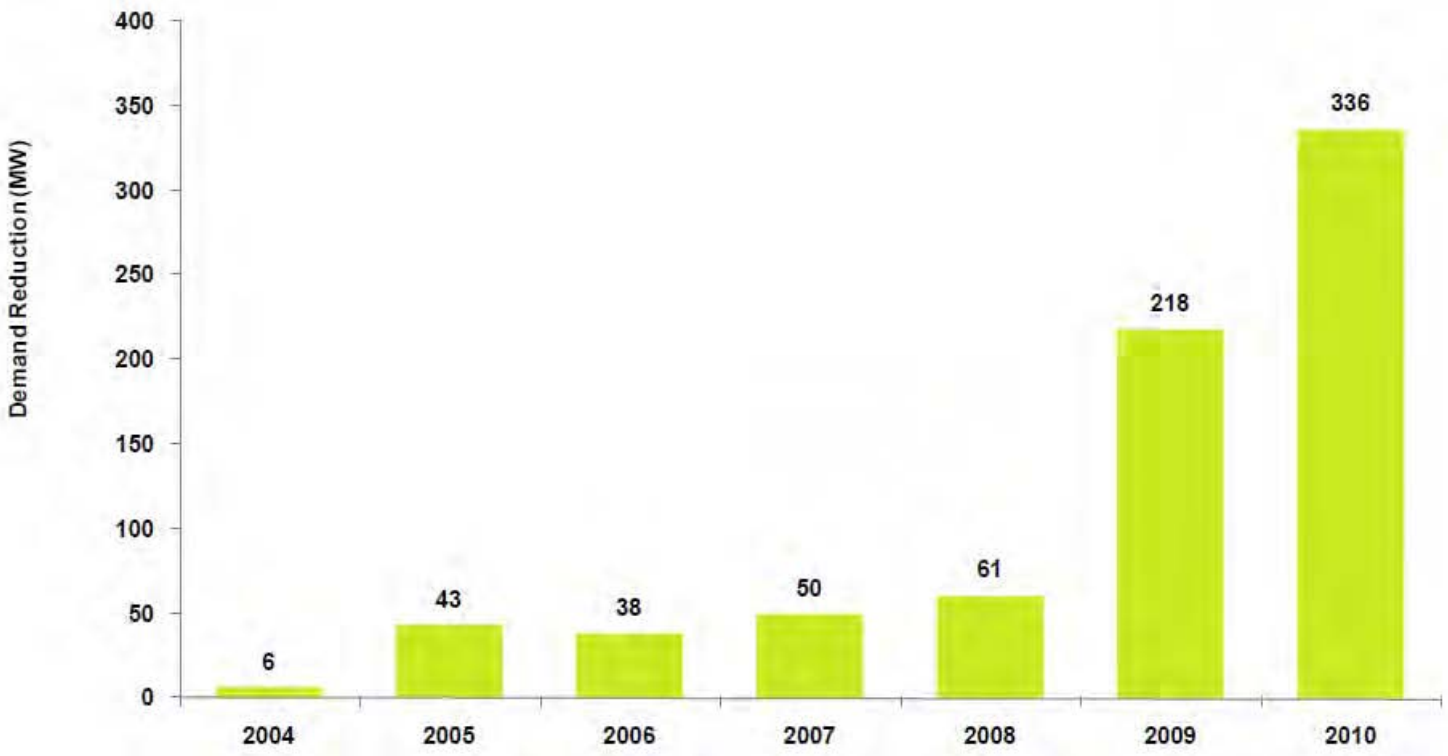
- Incentive structures do not have to be related to market prices
- They need to be clear for customers and cost-effective
- Usually, they are designed to capture a percentage of avoided capacity costs
- In many instances, the initial estimates are incorrect and overpay for DR

What is the Optimum Amount of DR?

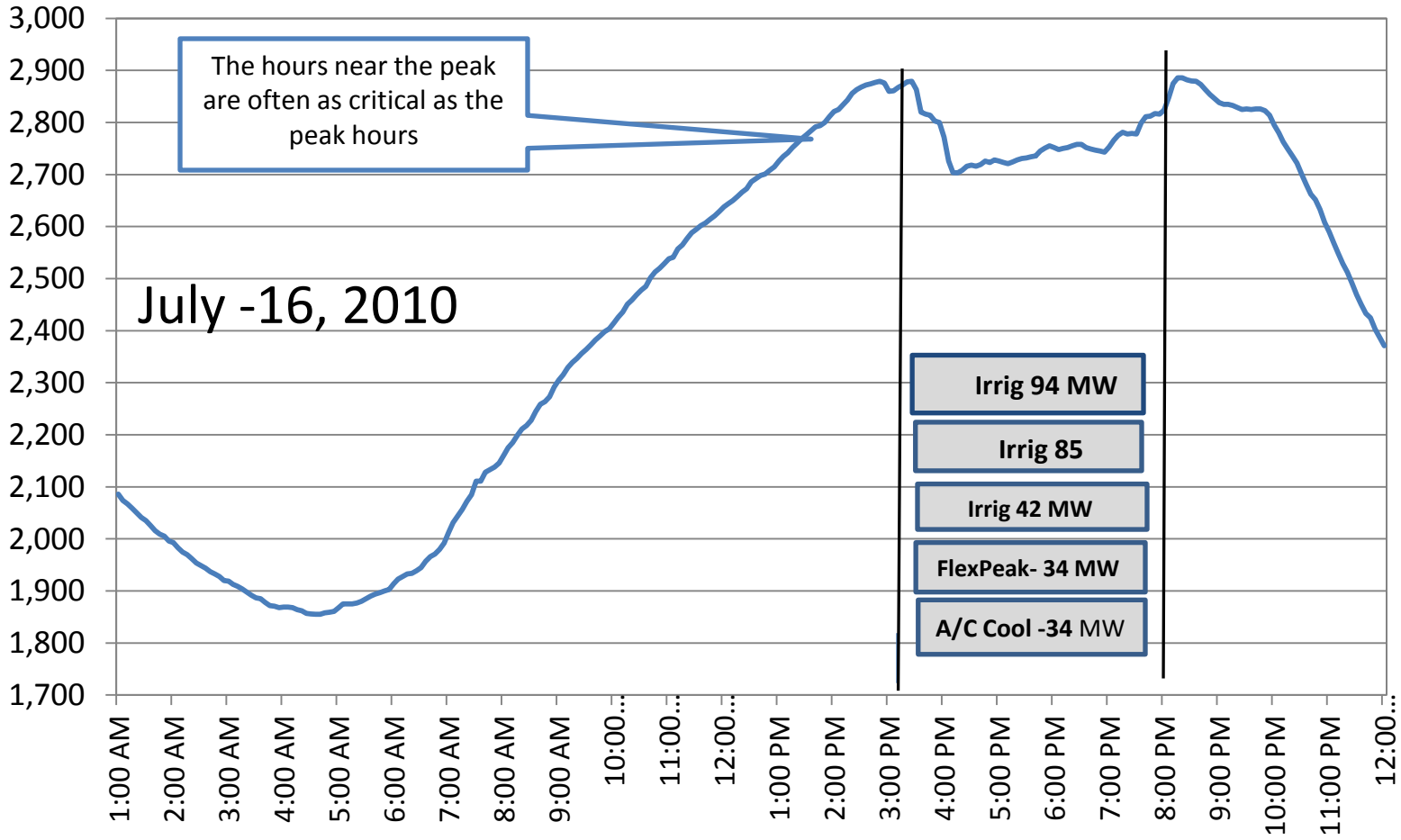
FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER
An IDACORP Company

Idaho Power's DR programs have expanded very quickly



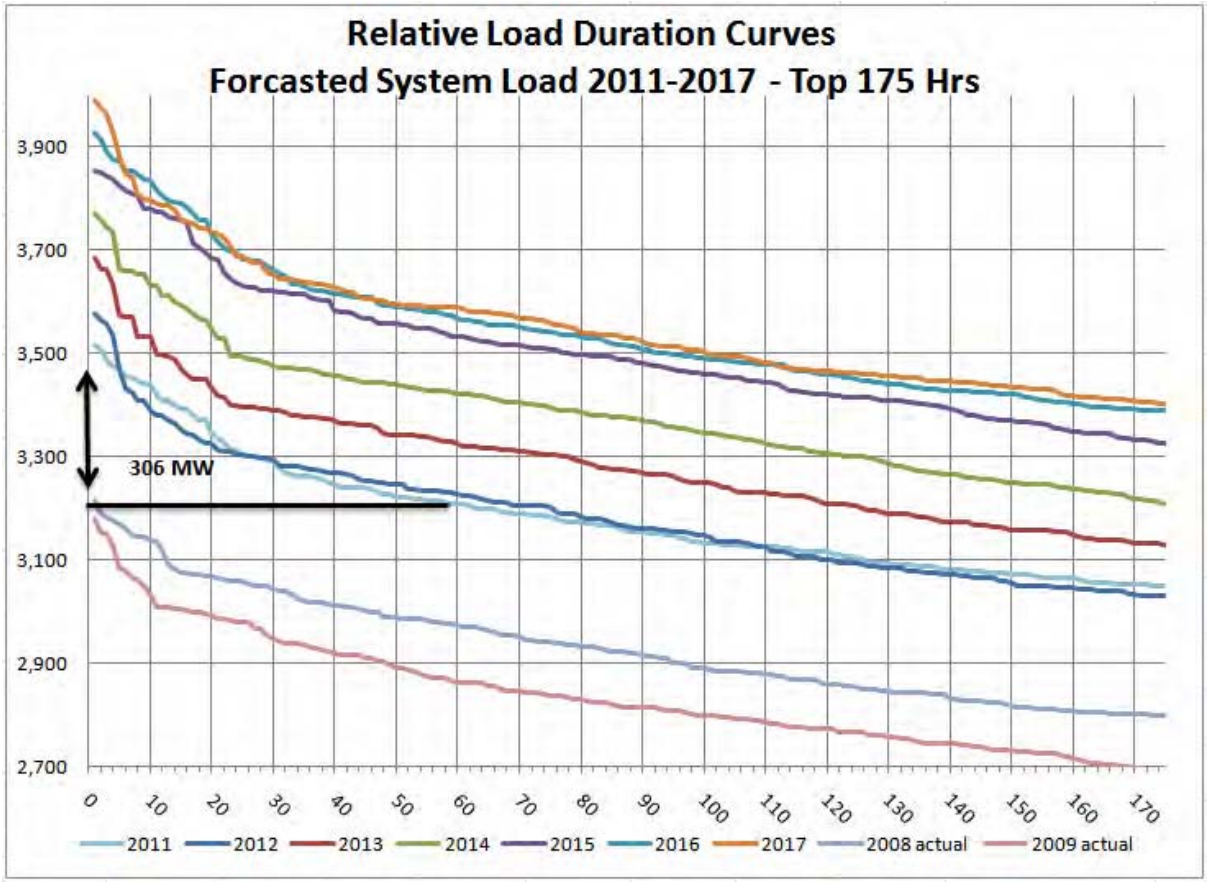
Combined, IPC's programs have a very noticeable impact on system load



Several key operational issues affect the DR optimum

- **The 4-hour maximum duration limits the ability to target all the right DR hours**
- **In practice, DR is often dispatched outside of the marginal cost supply curve because it targets capacity, not energy costs:**
  - Need room to call events for close calls – although they may not be true emergencies (False positives)
  - Need to minimize the chance of missing the key hours
  - Need to avoid exhausting the resource prematurely
  - Key hours are not necessarily the highest load hours
- **The maximum number of hours a program can be called and how well the dispatch mechanism targets the "right" hours affect the optimum**

The optimum amount of DR depends on how much load is associated with the targeted peak hours and the quality of the targeting



- Conceptually, we agree with the Idaho Power approach
- It may also be necessary to incorporate the quality of the targeting
- Another consideration is the need for DR to mitigate market manipulation, though it is less of an issue in a vertically integrated utility

Appendix
Our People

FSC FREEMAN, SULLIVAN & CO.
A MEMBER OF THE FSC GROUP

IDAHO POWER®
An IDACORP Company

Principal and Senior Consultants

- **Dr. Stephen George – 35 years of utility industry experience; leading expert on electricity pricing, advanced metering, DR and EE program design and evaluation, retail market design; (Ph.D. in Economics)**
- **Dr. Michael Sullivan – expert statistician specializing in research design and market research and a leading expert on value of service studies; (Ph.D. in Sociology with focus on Quantitative Research & Methods)**
- **Dr. Michael Perry – an economist with several years of consulting experience and recent work on time-based pricing, direct load control impact analysis and sampling strategy(Ph.D. in Economics)**
- **Mr. Josh Bode – public policy expert with extensive experience in modeling, demand response load impact analysis, cost-effectiveness analysis and value of service studies (M.P.P.)**
- **Mr. Dan Engel – 25 years of experience in demand-side management program design, implementation and process evaluation; skilled focus group facilitator (M.P.A.)**

Consultants and Project Managers

- **Mr. Josh Schellenberg – recent work on load impact estimation for numerous C&I DR programs, PHEV qualitative and quantitative research and value of service outage cost modeling (M.A. in Economics)**
- **Dr. Peter Malaspina – has worked primarily on evaluation of air conditioning load control programs and C&I DR programs since joining FSC in November 2010 (Ph.D. in Economics)**
- **Dr. Matt Mercurio -- an expert econometrician with 10 years of consulting experience and recent work on DR load impact estimation, value of service analysis and PHEV and DR program choice modeling (Ph.D. in Economics)**
- **Ms. Caren Leong – leads our survey laboratory and is an expert in survey design and management research experience (MBA)**
- **Mr. Kenric Erickson – an expert in database design, data management and web-based interfaces. Manages FSC 's work for Toyota, which involves the largest new car buyer survey in America (BA)**

Senior Analysts and Analysts

- Elizabeth Hartmann – has worked on numerous projects including impact evaluations of dynamic pricing and data analysis in support of research design for pricing and information feedback experiments (BS in Policy Analysis & Management)
- Samuel Holmberg – has worked on impact evaluations for non-residential CPP and agricultural interruptible tariffs (BA in Business Economics and Environmental Economics and Policy)
- Sarah Woehleke – has worked on impact analysis for information feedback, including pricing tier alerts & web portal presentment of hourly usage (BA in Mathematical Economic Analysis)
- Mr. Dries Berghman – joined FSC in August 2011 and has experience working on energy issues for City of Santa Fe and for former CPUC Commissioner Grueneich . Since joining FSC, has worked on developing billing calculators for time varying pricing (M.P.P. from UC Berkeley)
- Mr. Jason Burwen – joined FSC in August 2011 and has previous experience working on renewable resources at the CPUC. (M.P.P. and MA in Energy and Resources at UC Berkeley)

For any questions, feel free to contact

Josh Bode, M.P.P.
Sr. Consultant

Stephen S. George, Ph.D.
Principal Consultant and Director, Energy Practice
StephenGeorge@fscgroup.com

Freeman, Sullivan & Co.
101 Montgomery Street 15th Floor, San Francisco, CA 94104
joshbode@fscgroup.com
415.777.0707

Idaho Power RTU Study Q1 Report

The Idaho Power RTU Study instrumented and repaired 9 Rtus with an aggregate capacity of 60 tons and an estimate annual electric energy consumption of 108,000 kWh/yr. A unit by unit summary of this work is presented in Table 1. The results of this activity show an aggregate savings of -4,732 kWh/yr, -4.4 %. Table 1 summarizes the results of the more detailed analytical work on each unit which includes an energy signature and energy model for each unit that has been derived from the monitored data. The analytical rationale and the general methods are described in Ref 1. A narrative summary of performance at each unit along with its energy signature is given in Appendix A.

Table 1

site ID	RTU ID	Size tons	weather Data	compressor stages	Savings kWh/yr	Pre kWh/yr	Post kWh/yr	Econo?	As found 24 hr fan
Bigelow	#1	5	BOISE	1	-2,145	8,193	10,339	Yes	Yes
Bigelow	#2	7	BOISE	2	0	6,236	6,236	Yes	No
Bigelow	#3	10	BOISE	2	6,479	38,710	32,231	Yes	Yes
Cesco	#1	7	BOISE	1	86	14,351	14,265	yes	Yes
Cesco	#2	7	BOISE	1	0	12,072	12,072	no	Yes
Cesco	#3	6	BOISE	1	-7,905	7,827	15,733	yes	No
Nampa	#1	5.5	BOISE	1	-180	7,162	7,342	yes	Yes
Nampa	#2	7	BOISE	1	-7,227	2,853	10,080	yes	No
Nampa	#3	5.5	BOISE	1	6,161	10,652	4,490	yes	Yes
Total		60			-4,732	108,058			

This unexpected negative performance included examples of very high savings counteracted by examples of high negative savings. This project is intended to be a “measurement guided retrofit”, and prior to the retrofit monitored data for each unit was reviewed and an informal punch list was developed for each unit. But the repairs were extended over a longer period than expected waiting for parts and the work was interspersed with other pressing repair work. As a result the units are currently all in good repair, but the intended savings are not evident, and the total energy use for the group as a whole is essentially unchanged.

The HVAC contractor is one of the largest and most competent in the area and has full knowledge of the equipment and of the general aims of the program, and of the particular customers. But it appears that this first iteration of repairs reverted to the repair business as usual and focused on the repairs of economizers, electrical glitches, fan belts and etc, and not so much on tuning the whole process for maximum savings.

Fortunately the units were monitored for the whole time and they will remain monitored until next summer. The monitored data and the energy models were then reviewed to explain the observed summary performance. It was quickly apparent that most units in this sample had 24 hour fan schedules and that these would dominate the estimated

annual RTU energy. It was also apparent in the monitored data that the economizers which were now all functional were not maximizing their potential and needed further work to refine the set points and in one case the damper opening. The energy models for each unit were then used to estimate the revised savings that follow from a second iteration of repairs directed at optimizing fan schedules and economizer operation. The revised savings projections are presented in Table 2 along with the current as observed savings.

Table 2 Observed and Achievable Savings

site ID	RTU ID	Size tons	observed savings	achievable savings
Bigelow	#1	5	-2,145	4,300
Bigelow	#2	7	0	2,200
Bigelow	#3	10	6,479	11,200
Cesco	#1	7	86	6,800
Cesco	#2	7	0	4,900
Cesco	#3	6	-7,906	3,100
Nampa	#1	5.5	-180	3,100
Nampa	#2	7	-7,227	800
Nampa	#3	5.5	6,162	7,100
Total			-4,732	43,500
% of annual usage			-4.4%	40.3%

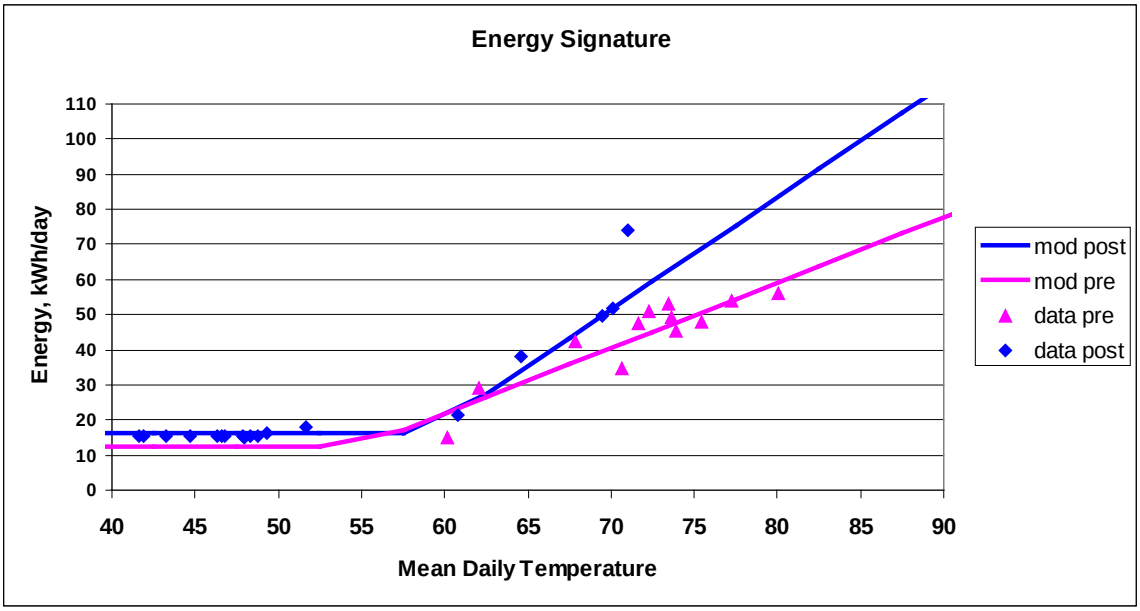
It is quite evident in this table that the achievable savings vastly exceed the observed savings. In Table 2 the achievable savings are not based on “rule of thumb” but are based on measureable evidence and current engineering practice. Fortunately the units are all monitored and the claims for achievable savings will be subject to verification in the subsequent monitoring. It should be noted that the principal cause for the achievable savings is the reduction of the 24 hour fan schedule. In the energy models for each unit the as found fan schedule is assumed to persist for the entire year, and that differing seasonal fan schedules are not used. This assumption also will be verified or modified by the subsequent monitoring.

The cause of the large difference between the achievable and the observed savings is partly opportunistic in the sense that this sample has a high percentage of 24 hour fans, which are very rich savings targets. And it probably lies partly in the difference in perspective of the HVAC mechanic and the energy conservation manager. The HVAC mechanic is charged with making the equipment functional, not necessarily optimizing it.

Thus far this experience has showed that the savings did not spontaneously arise from attention and repair of the units. And it appears that the achievement of savings may require a more intentional performance review, which the planned future work on this project will test.

APPENDIX A Individual Site Summaries

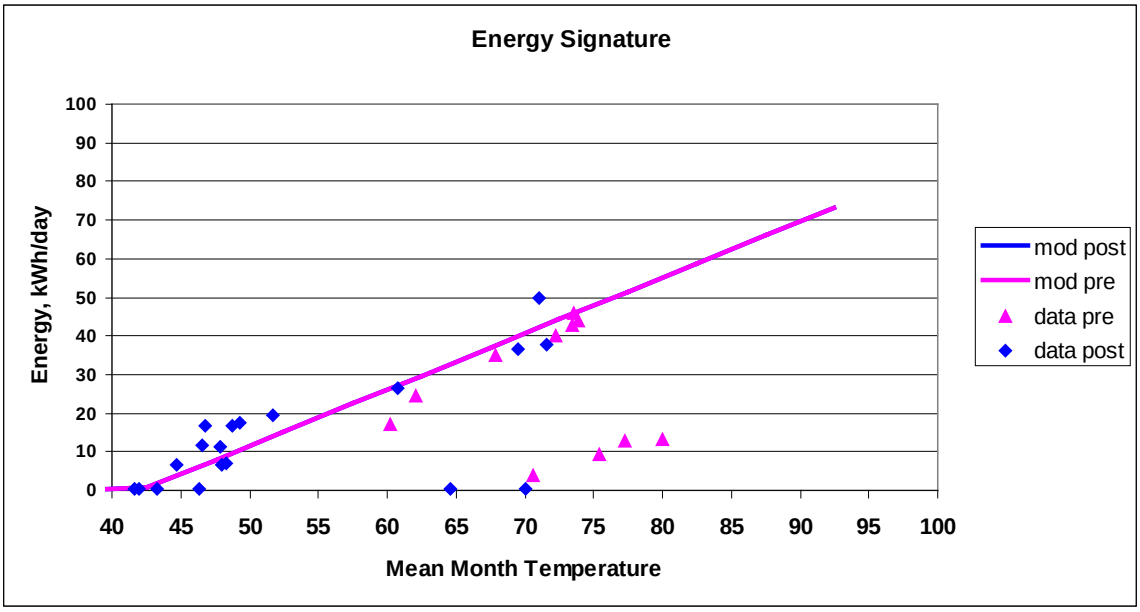
Bigelow #1



Summary:
This site has -2,145 kWh/yr energy savings. The energy use increased because a very dirty filter was replaced, leading to higher supply air flow and higher all-year fan energy. The higher air flow appears to have increased the capacity of the unit. Normally the higher capacity would satisfy the thermostat more quickly and no extra cooling would be applied. However in this case the cooled space was near an entry vestibule and other cooled spaces and the extra cooling went to these places.

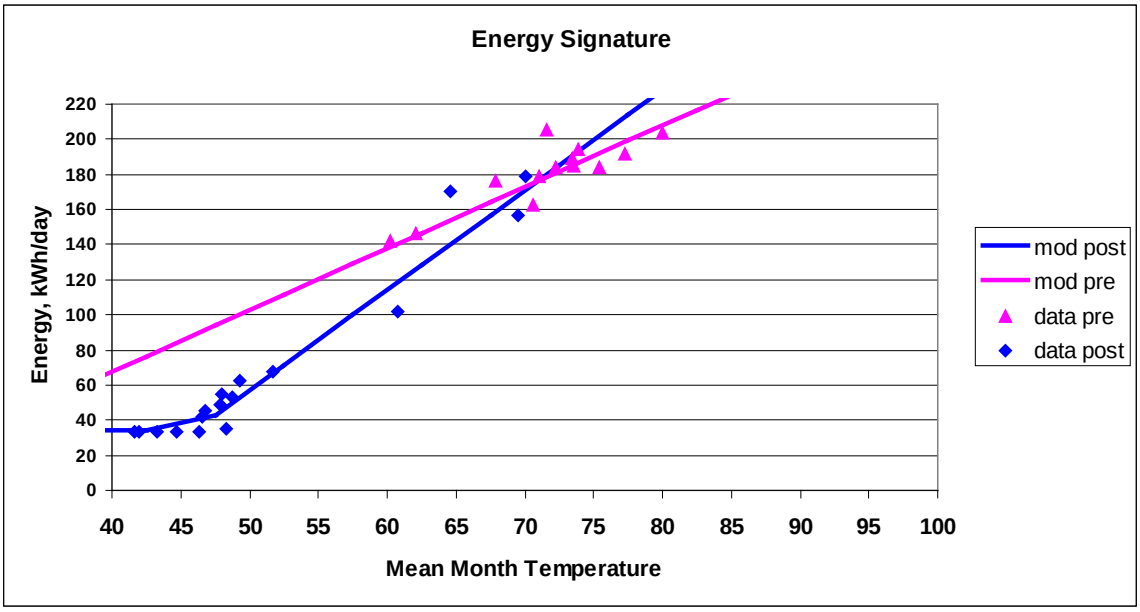
Significant savings are still achievable for this unit by eliminating the 24 hr fan schedule, setting up the economizer temperature, and a weekend temperature set back. Achievable savings for this unit are estimated to be 4,300 kWh/yr.

Bigelow #2



Summary:
This site shows 0 energy savings. The site has a properly functioning economizer, and the fan operation is coincident with the applied cooling (auto mode). The site also appears to show a weekend temperature set back. In spite of the general good operation of this unit, it appears that the economizer could be set up several degrees as there is evidence of mechanical cooling operating at temperatures as low as 60 deg F. Achievable savings for this unit are estimated to be 2,200 kWh/yr.

Bigelow #3

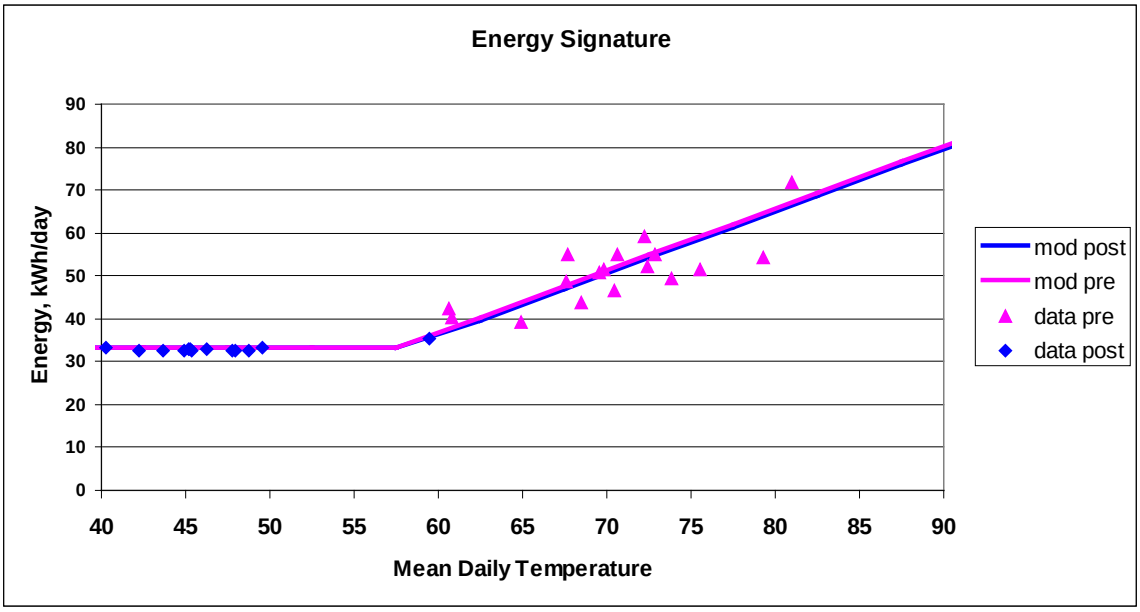


Summary: **TEA DUST FROM OUTLET CLOGGING UNITS**
This unit shows 6,479 kWh/yr, principally due to restoring the operation of the economizer. This is a very heavily used unit serving a tea sorting room, and it appears to have an unusually low set point. This unit has a 24 hour operation than may be necessary ventilation for this type of product storage. As such this is essentially an industrial operation.

This site also had a filter dirty with tea dust that was replaced, leading to higher fan flows and higher cooling capacity. It is apparent also that the operating power (and presumably cooling output) increased significantly (by 2 kW) after the repairs. Part of this increased output is due to the filter replacement, but an adjustment may have been applied to the compressor system, that we were not able to confirm. Prior to the retrofit the unit was not meeting its set point during the hot portion of the day, and after the retrofit the unit was still not meeting the set point during the hot part of the day so that the increased cooling was all used without reducing cooling operating hours.

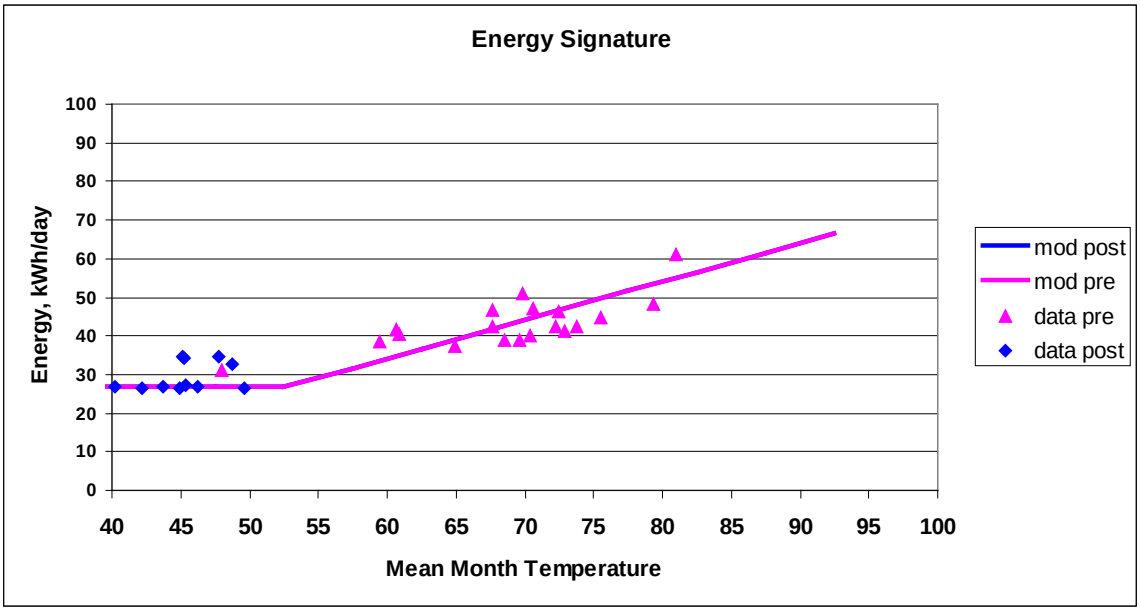
Although this site currently shows strong savings, there is evidence of mechanical cooling at outside air temperatures as low as 50-55 deg F, suggesting that further use of the economizer may be possible. Also the heavy operation at this site makes the energy use particularly sensitive to the interior set temperature. If it is possible to increase the interior set point by only a few deg and the economizer set point by a few deg and remain within the operating requirements of this industrial operation, then further savings are possible. Assuming that these slight temperature adjustments are possible, the achievable savings for this site could increase to 11,200 kWh/yr.

Cesco #1



Summary:
This unit shows almost no savings, about 100 kWh/yr. The principal repair at this site was the restoration of economizer operation, but the repair was achieved too late in the season to confirm the operation fully. However, there is evidence that the economizer was not opening fully in response to its control signal. The most conspicuous aspect of this unit is the 24 hour fan operation, which is unnecessary. Significant further savings for this unit can be achieved by reducing the fan operating schedule, and by further work on the economizer. The achievable savings for this site are 6,800 kWh/yr.

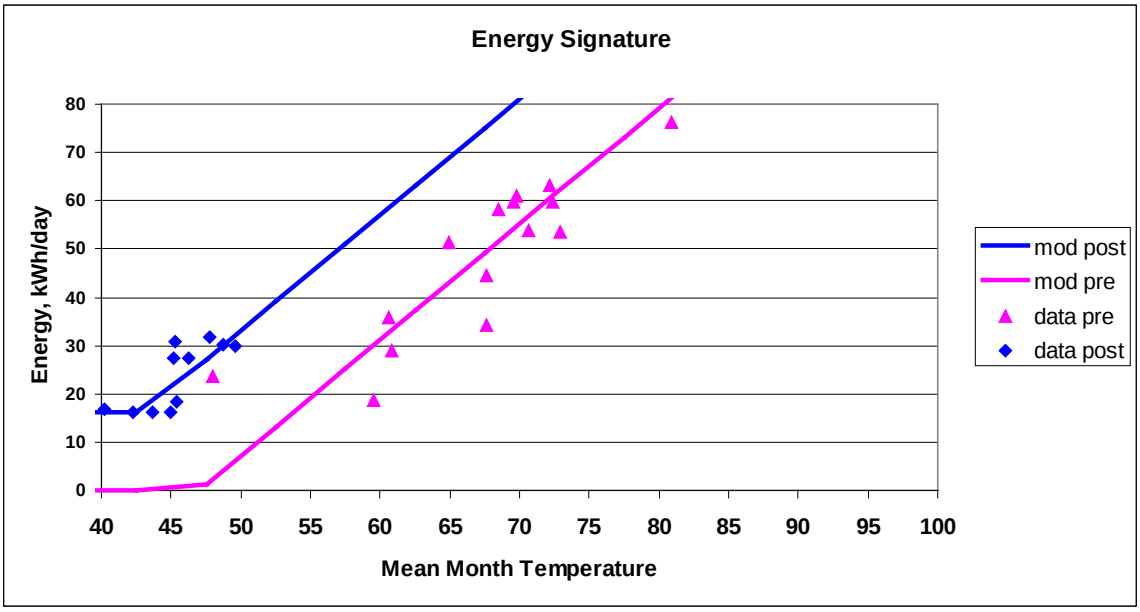
Cesco #2



Summary:

This unit shows essentially no savings. The unit has no economizer and a 24 hour fan schedule that is unnecessary. Significant savings can be achieved by reducing the fan schedule. The achievable savings for this site are 4,900 kWh/yr.

Cesco #3

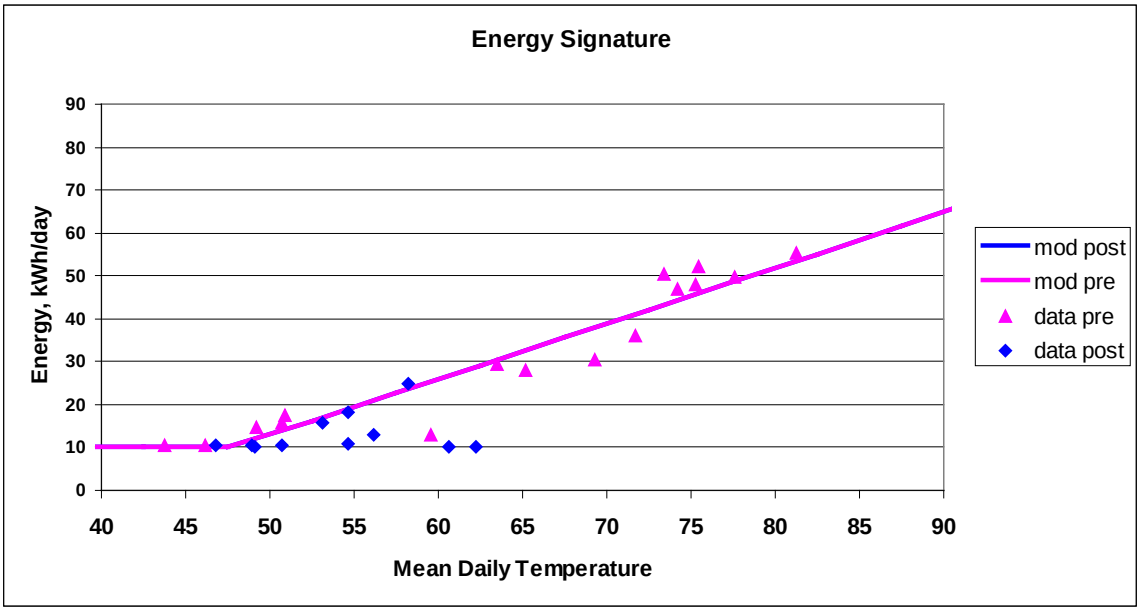


Summary:

This unit shows savings of -7,905 kWh/yr. Most of the increased energy use is due to increasing the fan schedule from automatic to 24 hours, and some of the increased energy use is due to the use of mechanical cooling at low outdoor temperatures. It appears possible that the changeover temperature of the new economizer temperature sensor may have been incorrectly set to an unusually low changeover temperature.

This is the only unit at this site with a fan schedule change, and this change may have been unnecessary. The achievable savings for this unit are 3,100 kWh.

Nampa #1

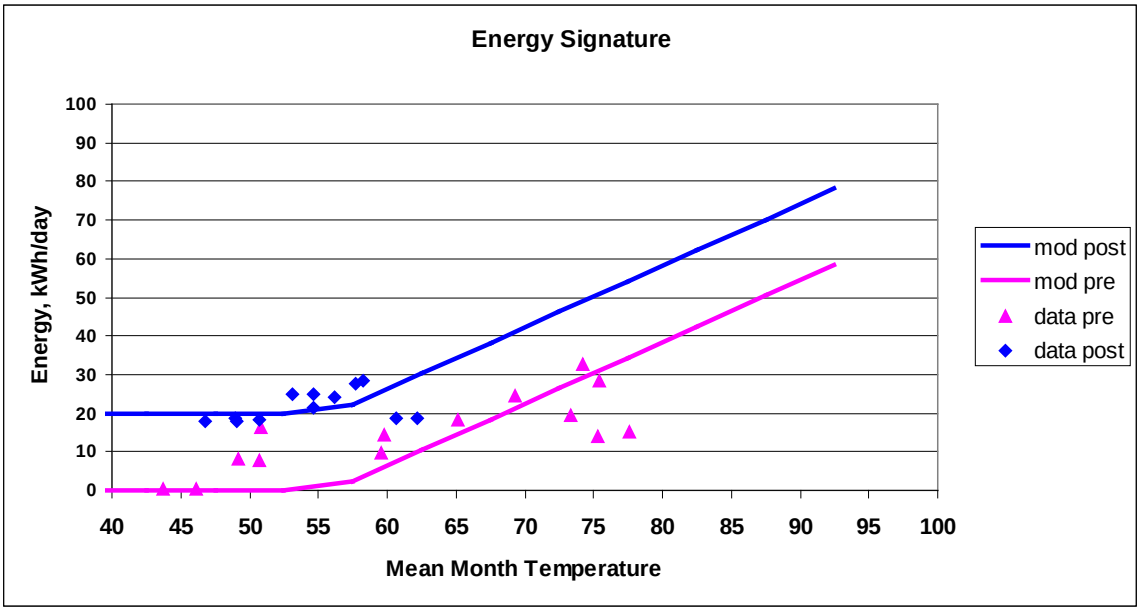


Summary:

This unit showed essentially no savings. The economizer repair was accomplished too late in the year to verify the intended savings from the restored economizer operation, though there is some indication of improved economizer operation. In the pre retrofit period there was no economizer operation and a 24 hour fan schedule.

Assuming that the economizer fix is fully operable, and that a 12 hour fan schedule is adopted, the achievable savings for this unit are 3,100 kWh/yr.

Nampa #2

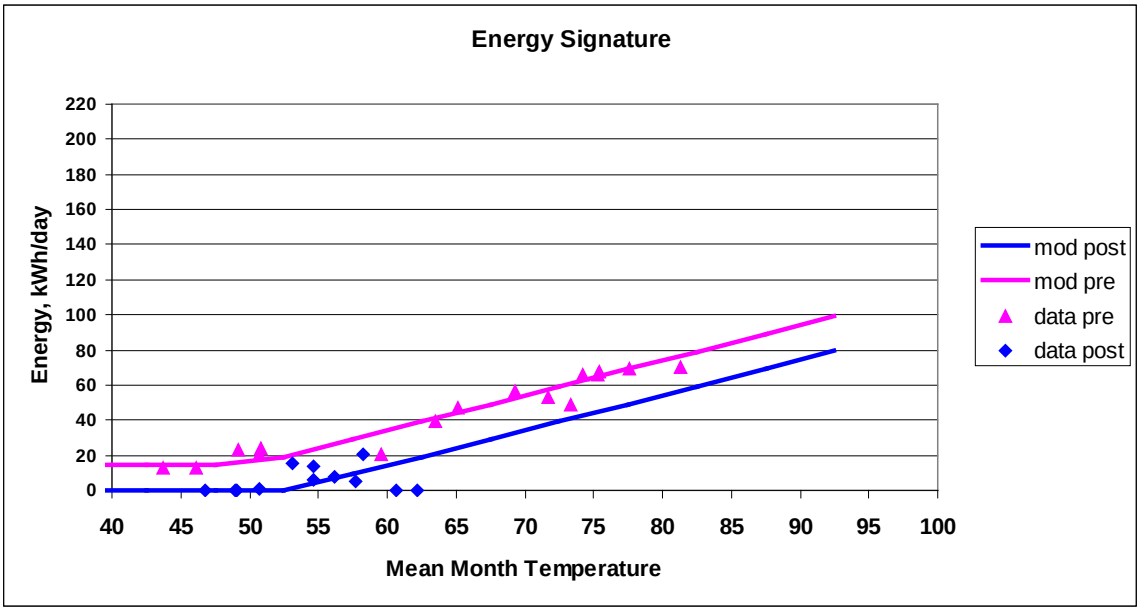


Summary:

This unit showed savings of -7,227 kWh/yr. These negative savings were principally due to an increase in the fan schedule from auto to 24 hour. There is an economizer on this unit but it appears that mechanical cooling is used at temperatures below 60 deg F. The interior location of this unit suggests that a 24 hour fan schedule is unnecessary and that the original automatic fan schedule is the proper setting.

The performance of this unit could be improved slightly from the original state by increasing the economizer set point slightly. The achievable savings for this unit is 800 kWh/yr.

Nampa #3



Summary:
This unit shows savings of 6,162 kWh/yr, principally from reducing a 24 hour fan schedule to automatic fan schedule. In the post retrofit period it is evident that mechanical cooling is starting at temperatures below 60 deg F, which leaves room for an upward adjustment of the economizer changeover temperature of about 5 deg F. Even though this unit currently shows strong savings, the fully achievable savings are 7,100 kWh/yr

Idaho Power Company's SO_2 Emissions Allowance Energy Education Program

Developed and Administered by
Idaho Power Customer Relations &
Energy Efficiency

An Energy Efficiency Education Program
Targeting Elementary and Secondary Students

August 2011

© 2011 Idaho Power

TABLE OF CONTENTS

Table of Contents i
Executive Summary 1
Energy Wise Program—Elementary Students 1
Students for Energy Efficiency Program—Junior and Senior High Students 1
Summary 2
Energy Wise Program 2
Students for Energy Efficiency Program 2
History 3
IPC's Energy Education Program 3
Community Advisory Group 3
Community Advisory Group Meetings 4
First Year of Program Implementation 2009–2010 School Year 5
Energy Wise Program 5
Program Description 5
Elementary School Program Survey 7
Students For Energy Efficiency Program 8
Marketing 8
First Year: 2009–2010 School Year 9
Second Year of Program Implementation 2010–2011 School Year 15
Energy Wise Program 15
Program Description 15
Elementary School Program Survey 15
Students for Energy Efficiency Program 16
2010–2011 Curriculum 16
Marketing 17
Second Year: 2010–2011 School Year 17

Program Budget Details 23

Recommendations for Future Use of Remaining Equipment and Funds, and Program Continuation……...23

Conclusion 24

EXECUTIVE SUMMARY

Idaho Power Company (IPC) has a long history of educating elementary, junior high and senior high students in the topics of energy and energy efficiency. As a neighbor and community partner, and in response to a directive from the Idaho Public Utilities Commission, IPC developed an elementary and secondary program to educate and promote energy efficiency for Idaho students in the IPC service area. The program allows the students to use their skills in science and math to evaluate where energy consumption improvements can and should be made. The program, consisting of an elementary component and high school component, was developed and implemented for two consecutive academic school years.

Energy Wise Program—Elementary Students

The program targeting elementary school students is a fully implemented, multi-resource efficiency/education program designed to facilitate installation of efficiency measures in homes and build knowledge of energy issues. The pre-packaged program, known as "Energy Wise," yields a variety of measurable energy savings results using the best messengers—students. The program delivered a proven blend of teacher-designed classroom activities with hands-on home projects to install energy efficiency devices and introduce resource-conscious behavior to students and their families.

Students for Energy Efficiency Program—Junior and Senior High Students

This secondary program targeting junior and senior high students is a hands-on learning lab that provides the following opportunities for secondary-school students:

- Awareness of energy flow/use in a building
- Competency in the use of specific energy efficiency equipment
- Processes to collect data and assess energy usage in a building
- Individual report gathering and team collaboration on findings and recommendations
- Preparation of a written report detailing the assessment findings and recommendations
- Presentation of the report to school boards, principals, administrators, faculty, staff, business owners, and other interested groups

SUMMARY

Energy Wise Program

	Total	2009–2010	2010–2011
Students	7,192	1,008	6,184
Teachers	247	37	210
Schools	99	32	67

Projected Annual Savings (Combined for Both Years)

Electricity Savings 1,749,884 kilowatt-hours (kWh)

Natural Gas Savings 39,124 therms

Projected Average Annual Savings per Home (Combined for Both Years)

Electricity Savings 475 kWh

Natural Gas Savings 9 therms

Students for Energy Efficiency Program

	Total	2009–2010	2010–2011
Students	423	155	268
Teachers	33	17	16
Schools	30	16	14

Potential Electricity Savings (Combined for Both Years)

Electricity Savings 2,200,137 kWh

*Potential Savings differs from Projected Savings as follows: Potential Savings are savings identified and recommended by students but not yet implemented; Projected Savings is based upon actual replacement of incandescent bulbs, use of LED night lights, etc.

HISTORY

On November 9, 2007, IPC filed a report disclosing that it sold 35,000 sulfur dioxide (SO_2) emission allowances in 2007. The after-tax proceeds approximated $10 million.

The Idaho Public Utilities Commission (IPUC) issued Order 30478 convening a public workshop to decide proper disposition of the funds. An initial public workshop was held in January 2008; because workshop participants were unable to reach a consensus, public comment was sought. Several participants and groups proposed suggested uses of the funds, including development of an energy education program submitted by the Idaho Energy Education Project. On March 27, 2009, the IPUC ordered $500,000 in SO_2 proceeds, plus accrued interest, be used to develop and implement an energy education project proposed by IPC (IPC-E-08-11 Order 30760).

IPC's Energy Education Program

In 2009, David Thornton of IPC began development of IPC's Energy Education Program with assistance from Bill Chisholm of the Idaho Energy Education Project (Buhl, Idaho) and Dave Beck from Sawtooth Technical Services (Meridian, Idaho).

It was decided to offer two, grade-specific programs:

1. Energy Wise program
   Providing at-home energy conservation activities targeting students in elementary grades

2. Students for Energy Efficiency (SEE) program
   Promoting the use of specialized equipment to gather energy usage data and education on energy reduction strategies targeting secondary school students

Students for Energy Efficiency Community Advisory Group

As directed by the IPUC, Idaho Power established the Students for Energy Efficiency Community Advisory Group (SEECAG) to facilitate the disbursement of funds for the development and implementation of an energy education project. SEECAG members were invited to participate by IPC, with input from the IPUC, Office of Energy Resources (OER), and the Idaho Department of Education.

Member	Affiliation	City
Tracy Blenker	Horizon Elementary	Boise
Bill Block	JUB Engineering	Twin Falls
Bill Chisholm	ID Energy Education Project	Buhl
Sheryl Howe	Capital High School	Boise
Kristen Jensen	William Thomas Middle School	American Falls
Billie Johnson	ON Semiconductor	Pocatello

Member	Affiliation	City
Alla Langston	Community Member	Boise
Bryan Lanspery	IPUC	Boise
Dan Richards	Meadows Valley School	New Meadows
Hannah Sanger	ID Environmental Education Association	Pocatello
Sue Seifert	OER	Boise
Scott Smith	ID Department of Education	Boise
Russ Weedon	IPC	Boise
Mike Youngblood	IPC	Boise

SEECAG Meetings

The IPUC IPC-E-08-11 Order 30760 directed IPC to ensure expenses related to conducting SEECAG meetings were not to exceed the interest earned on the original $500,000. The total amount of interest earned at the time of this writing is $32,553, and total expenses spent on conducting SEECAG meetings came in under $7,000.

FIRST YEAR OF PROGRAM IMPLEMENTATION 2009–2010 SCHOOL YEAR

Energy Wise Program

The first SEECAG meeting was held on July 21, 2009. Because time was limited for developing separate curricula, and due to the intensity of developing and implementing the SEE program for high school students, IPC staff recommended to the SEECAG the use of an existing, proven classroom kit for the elementary portion of the program. During spring 2010, 34 elementary schools were approached and received Student Energy Wise Home Savings Kits developed and distributed by the Resource Action Program. The program is a fully implemented, multi-resource efficiency/education program designed to facilitate installation of efficiency measures in homes and build knowledge of environmental issues. The program delivers a proven blend of teacher-designed classroom activities with hands-on home projects to install high-efficiency devices and introduce resource-conscious behavior to students and their families.

Program Description

The school-based Energy Wise program is fully implemented and designed to generate immediate and long-term savings by bringing interactive, ―real-world" education home with motivated students. The Resource Action Program staff identified and enrolled students and teachers within IPC's Idaho service area. Enrolled participants received educational materials designed to build knowledge and demonstrate simple ways to save by not only changing habits, but also changing devices. Materials support state and national educational standards, which allow the program to easily fit into teachers' existing schedules and requirements.

Each participant received classroom materials and an Energy Wise Activity Kit containing efficiency measures for their homes to perform the hands-on activities. Modifications were made to select materials that incorporated IPC's logo and brand guidelines.

Materials Each Student Received

Student Guide

Student Workbook

Parent introduction letter*

Home Audit Form

Pre & Post Surveys

Certificate of Achievement

Energy Wise Activity Kit containing:

- 13-Watt (W) Compact Fluorescent Lamp (CFL)
- 18-W CFL
- 23-W CFL

- FilterTone® alarm*
- LimeLite® night light
- Natural Resources Fact Chart
- Air temperature ruler
- Reminder stickers and magnet pack*
- Parent comment card
- "GetWise" wristbands

Additional Resources

Interactive program website

Toll-free telephone support

Supplemental activities*

***Materials/installation instructions provided in English and Spanish**

Materials Each Teacher/Classroom Received

Teacher Book

Step-by-step program checklist

Lesson plans

Teacher program evaluation

Supplemental activities*

ID State Education Standards Correlation Chart

Pre & post survey answer keys

Classroom electricity poster

Self-addressed postage paid envelope

Teacher gift card

***Materials/installation instructions provided in English and Spanish**

Total Outreach to Elementary Schools in the IPC Service Area

Schools	32
Teachers	37
Students/Homes	1,008

Elementary School Program Survey

Surveys conducted by Resource Action Program revealed the following:

- One-hundred (100) percent of participating teachers indicated that parents supported the program.
- One-hundred (100) percent of participating teachers indicated they would recommend this program to other colleagues.
- Eighty-one (81) percent of participating students gave the program a rating of good or great.

Knowledge Gained

Identical surveys (tests) were taken by students prior to the program and again upon program completion to measure knowledge gained. Scores and subject knowledge improved from 77 percent to 86 percent.

Energy Savings Results

In addition to educating students and their parents, the primary program goal for utility sponsors is to generate cost-effective energy savings. Student reporting activities not only provided the data used in savings projections, but also reinforced the learning benefits.

The following projections are based on the actions taken by students in their homes:

Projected Annual Savings:

Electricity Savings	251,989 kWh
Natural Gas Savings	4,524 therms

Projected Average Annual Savings per Home:

Electricity Savings	241 kWh
Natural Gas Savings	4 therms

See the IPC Energy Wise Program Summary Report 2009–2010 for a complete program description.

Students for Energy Efficiency Program

Marketing

The SEE program was marketed to high school teachers as follows:

- Development of IPC website: http://www.idahopower.com/EnergyEfficiency/educationalResources/default.cfm
- Dissemination of a tri-fold, color brochure
- Email distribution via the State Department of Education, Association of School Superintendents, and the OER
- Outreach by IPC Community Education representatives
- Outreach by members of the SEECAG

Dave Beck of Sawtooth Technical Services (Meridian, Idaho) was contracted to assist in development and implementation of the SEE program curriculum. John Bernardo, a part-time project manager with a masters degree in education, was hired in September 2009 to continue development and manage implementation of the SEE program.

High school teams and their sponsoring teacher were identified, registered, and contacted to arrange a training date in October and November 2009. When possible, multiple schools were trained at a single school site. For example, students from Leadore High School traveled to Salmon to receive training with students from Salmon High School.

Frequent follow-up conversations were conducted via telephone and email to monitor assessment progress and address questions or concerns from teachers and their students. In several cases, IPC employees performed additional site visits to provide continued assistance.

Upon completion of the school assessments, students developed a report that provided their findings and recommendations for energy improvements. In many cases, the report included the IPC Easy Upgrades Lighting Calculator spreadsheet, accessible on the IPC website, which detailed recommended changes in lighting and installation of lighting controls. (Easy Upgrades is a prescriptive energy efficiency program offered by Idaho Power.) Additionally, the calculator spreadsheet detailed kWh savings, projected cost savings, return on investment (ROI) for project implementation, and payments of IPC incentives. School report formats took the form of Word documents, PowerPoint presentations, and, in one case, a high school website.

IPC employees reviewed and revised the draft reports and returned them to the students for development of a final report. Their report was presented a minimum of two times by the student groups, often to the school board and principals, classmates, teachers, janitors, or local service organizations. The presentations to school boards included a formal request for funding of the recommended projects. All reports were submitted to the OER for funding consideration using federal American Recovery and Reinvestment Act (ARRA) monies.

Participating teachers whose students completed the program requirements received a stipend of $250 and one continuing education credit from Boise State University.

First Year: 2009–2010 School Year

Program Details

For the 2009–2010 school year, a total of 155 students (78 males and 77 females) participated in the training sessions.

A total of 16 schools completed the program:

American Falls High School
Buhl High School
Capital High School (Boise)
Dennis Professional Technical Center (Boise)
Emmett High School
Hansen Junior–Senior High School
Horseshoe Bend High School
Jerome High School
Kuna High School
Leadore High School
Magic Valley Christian School (Jerome)
Meadows Valley School (New Meadows)
Mountain View High School (Meridian)
Pocatello High School
Salmon High School
Timberline High School (Boise)

Four schools did not complete the program:

Centennial High School (Boise)
Riverstone International School (Boise)
Treasure Valley Math & Science School (Boise)
Twin Falls High School

Note: Schools may not have been able to complete the SEE program due to the difficulty in incorporating an extracurricular activity into the classroom regimen.

Training Sessions

Training sessions were performed at the schools with multiple school teams participating. The sessions usually lasted three hours. An example training session is as follows:

1:00—3:00 Presentation of the PowerPoint slide deck

Review of the SEE program curriculum

Introduction of the Energy Scene Investigation (ESI) equipment kit

Kit contents:

- Electronic/magnetic ballast discriminator
- Kill-A-Watt meter
- Lumen light meter
- Tapeless measuring device
- Switchable power outlet strip
- HoBo Light Sensor Data Logger
- HoBo Temperature Sensor Data Logger

3:00–4:00 Hands-on training in use of ESI equipment

Walk-through assessment of school to determine and familiarize students with lighting, use of sensors, exit sign lighting, opportunities for installation of occupancy sensors and Vendingmisers, etc.

Schools Assessed for Energy Efficiency Opportunities

A total of 21 schools were assessed by the student teams:

School	Sponsoring Teacher	Student Team
American Falls High School	Todd Winters	American Falls HS
Buhl Middle School[1]	Susie Jones	Buhl HS
Buhl High School	Susie Jones	Buhl HS
Popplewell Elementary School[1]	Susie Jones	Buhl HS
Capital High School	Sheryl Howe	Capital HS
Fairmont Junior High	Sheryl Howe	Capital HS
Valley View Elementary School	Sheryl Howe	Capital HS

School	Sponsoring Teacher	Student Team
Mountain View Elementary School	Sheryl Howe	Capital HS
Dennis Professional Technical Center	James Cupps	Dennis Prof TC
Emmett High School	Sandy Powell	Emmett HS
Hansen Junior–Senior High School	Shirley Mikota	Hansen Jr–Sr HS
Horseshoe Bend High School[1]	Chris Ball	Horseshoe Bend HS
Jerome High School	Steve Bruns	Jerome HS
Kuna High School	DaNel Huggins	Kuna HS
Leadore High School	Shane Matson	Leadore HS
Magic Valley Christian School	Dale Quesnell	Magic Valley CS
Meadows Valley School	Loretta McConnor	Meadows Valley School
Mountain View High School	Gina Lockwood	Mountain View HS
Pocatello High School	Sharie Ellis	Pocatello HS
Salmon High School[2]	Arlene Wolf	Salmon HS
Timberline High School	Dick Jordan	Timberline HS

[1]These schools are scheduled for a full lighting upgrade replacing all T-12 lamps with T-8 lamps through the OER. This lighting upgrade was one of the recommendations made by SEE program participating students.

[2]This school participated in the SEE program. Participating student teams made recommendations that mirrored improvements implemented by their respective school districts through IPC's Easy Upgrades program.

Total Potential kWh Savings from Student Recommendations

As a result of the total energy assessments performed by students, the estimated potential energy savings for all projects exceeds 1,480,000 kWh. At an average cost of $0.06/kWh, the estimated potential savings exceeds $88,000.

Known Energy Efficiency Implementation Projects

As a result of the SEE program report and presentations, several schools implemented lighting retrofits and installation of lighting controls. While the retrofits and installations may have been previously considered by the respective school districts, there is no doubt that the student recommendations either echoed the recommendations from energy professionals or, in some cases, exceeded the professional recommendations, providing school boards and facility maintenance managers with additional opportunities for energy reductions and cost savings.

It was evident to IPC employees and sponsoring teachers that the education imparted on the students through this program had an impact beyond the classroom. Many students discussed taking the information home to inform (in some cases prod) their families to practice energy conservation measures, such as unplugging cell phone chargers when not in use, turning off computers and monitors, and unplugging or using switchable power strips to eliminate phantom (continual electrical draw) load from major appliances.

The following are descriptions of some of the findings and impacts from the student assessments.

Dennis Professional Technical Center

Boise School District Facilities & Operations Administrator Chris Wendrowski began implementing projects in May 2010. According to Wendrowski, the projects were scheduled to be performed prior to the development and presentation of the SEE program report to the school board. However, he did confirm that the students identified many of the energy efficiency opportunities previously identified by a school district audit conducted by energy efficiency professionals. The overlap included the following:

- Recommissioning of occupancy sensors and installation of new occupancy sensors throughout the facility
- Delamping of overlit areas
- Resetting of thermostats, especially in summer months

Emmett High School

The school board was very interested in the findings and recommendations presented in the SEE program report; however, funding was not available. Mike Fisher, head of maintenance for the high school, is pursuing bids for the purchase and installation of motion sensors as recommended in the SEE program report. He is particularly interested in this recommendation because of the potentially attractive ROI using the IPC Easy Upgrades incentive money.

Horseshoe Bend High School

In June 2010, the Horseshoe Bend school district submitted a pre-application for an IPC Easy Upgrades incentive payment. The project entailed lighting retrofits, including installation of T-8 fluorescent fixtures, T-5 high output (HO) fixtures and CFLs, and delamping of 92 lamps. All of these upgrades reflected recommendations described in the SEE program report developed by Horseshoe Bend High School students.

Salmon High School

The Salmon school board had previously approved money to perform energy efficiency upgrades at the high school. The improvements were previously identified in an energy efficiency audit performed by the McKinstry Engineering Company. Many of the improvements recommended by the SEE program report mimicked the McKinstry audit findings. It is important to note that the students did not have access to the McKinstry report while conducting their assessment of the high school or preparing their SEE program report.

Arlene Wolf, the SEE program sponsoring teacher, indicated that one of the findings in the SEE program report, purchase and installation of power outlet strips to reduce plug and phantom loads, was not part of the McKinstry recommendations. Arlene indicated plans to identify funding and source the strips during the 2010–2011 school year.

Student Reports

The following is a link to the IPC website containing the student reports:
www.idahopower.com/EnergyEfficiency/educationalResources/studentsForEE/keyFindings.cfm

Survey Summaries

During the 2009–2010 school year, IPC employees worked with teachers and other school officials in 16 schools across IPC's Idaho service area to implement the SEE program. IPC employees provided all the schools with training and education about the program as well as an ESI kit for every four to five students participating in the program. Upon completion of the program, sponsoring educators were asked via an email message to participate in an online survey. The survey, developed and administered by Becky Andersohn, Customer Relations Research Coordinator for IPC, consisted of 23 questions. Fourteen of the 16 educators completed the survey for an 87.5 percent response rate. The following summarizes the response:

- In general, educators involved with the SEE program were satisfied with the program.
- All of the educators involved with the program indicated that the program "exceeded" (71 percent) or "met" (29 percent) their expectations.
- Most of the educators involved with the program in the 2009–2010 school year heard about the program through a brochure or another teacher.
- The majority (86 percent) of the educators said that IPC communicated with them excellently regarding the program.
- The Kill-A-Watt meter and the lumen light level meter were the two pieces of equipment judged most useful to the students in completing their evaluations.
- Approximately 50 percent of the teachers felt the students would have benefited from at least one more of each of the tools included in the ESI kit.
- A majority of the educators indicated that an infrared heat detector, computer software to interact with the HoBo devices, and a regular tape measure would be beneficial tools for the ESI kit.
- Most of the educators (93 percent) said they thought their school is likely to implement recommendations from the student evaluations.
- Of these recommendations to be implemented, the most commonly cited were motion/occupancy sensors and delamping light fixtures.
- Over 50 percent of the respondents indicated they did not think their school would have implemented any of the energy efficiency improvements if their students had not participated in the SEE program.

- All of the sponsoring educators from the 2009–2010 school year said they "definitely would" (86 percent) or "probably would" (14 percent) recommend the SEE program to a fellow teacher.

- Half of the participants in the 2009–2010 SEE program said they "definitely will" participate in the program again next year, and 43 percent said they "probably will."

- All the educators felt their student participants gained an awareness and understanding of how lighting, building design, and plug-in devices impact energy usage and costs. They also felt the experience in conducting an assessment, writing a report with recommendations, and making oral presentations was of benefit to the student participants.

- Most of the teachers felt their student participants would use the skills they learned participating in the SEE program outside the classroom.

SECOND YEAR OF PROGRAM IMPLEMENTATION 2010–2011 SCHOOL YEAR

Energy Wise Program

Based on the success and interest in participation of the program during the initial year, IPC solicited interest and participation from area-wide elementary school classrooms.

Program Description

The program was revised during the summer of 2010 as follows:

- Specific graphic changes were incorporated into the educational materials provided by Resource Partners to emphasize IPC's involvement.
- Instructions regarding the replacement of incandescent lamps (light bulbs) with the three CFLs in each kit were enhanced to promote replacement of appropriate incandescent lamps with the proper wattage CFL. For instance, instructions targeted replacement of a standard 75-W incandescent lamp with the kit's 18-W CFL, which provides similar lumen output with a vast reduction in power usage.

Otherwise the kit contents and materials provided to each student and classroom teacher remained the same.

Total Outreach to Elementary Schools in the IPC Service Area

Schools	67
Teachers	210
Students/Homes	6,184

Elementary School Program Survey

Surveys conducted by Resource Action Program revealed the following:

- Ninety-nine (99) percent of participating teachers indicated that parents supported the program.
- Ninety-eight (98) percent of participating teachers indicated they would recommend this program to other colleagues.

- Ninety-eight (98) percent of participating teachers indicated they would conduct the program again.

Knowledge Gained

Identical surveys (tests) were taken by students prior to the program and again upon program completion to measure knowledge gained. Scores and subject knowledge improved from 71 percent to 82 percent.

Energy Savings Results

In addition to educating students and their parents, the primary program goal for utility sponsors is to generate cost-effective energy savings. Student reporting activities not only provided the data used in savings projections, but also reinforced the learning benefits.

The following projections are based on the actions taken by students in their homes:

Projected Annual Savings:

Electricity Savings	1,497,895 kWh
Natural Gas Savings	34,600 therms

Projected Average Annual Savings per Home:

Electricity Savings	234 kWh
Natural Gas Savings	5 therms

See IPC's Energy Wise Program Summary Report 2010–2011 for a complete program description.

Students for Energy Efficiency Program

2010–2011 Curriculum

Based on the comments received from participating teachers, students, and the SEECAG, IPC revised the SEE program curriculum for the 2010–2011 program year. The revised curriculum contained significant additional information and reference tabs, modified graphics, and a link to the 21 reports produced by the students from the 2009–2010 program year. Copies of both versions of the curriculum are included for reference.

Additionally the HoBo data loggers were coupled with software donated by the manufacturer and distributed to each teacher so students could immediately download and graph lighting and temperature data.

Marketing

The SEE program was once again marketed to high school teachers as follows:

- Expansion of IPC website: http://www.idahopower.com/EnergyEfficiency/educationalResources/default.cfm
- Dissemination of a tri-fold, color brochure
- Email distribution via the State Department of Education, Association of School Superintendents, and the OER
- Outreach by teacher participants from first year
- Outreach by IPC Community Education representatives
- Outreach by members of the SEECAG
- Outreach by IPC employees

Additional marketing efforts included the following participation in Chartwell's Webinar on Children as Social Change Agents: Educating Kids about Energy Efficiency. October, 2010. www.chartwellinc.com.

Second Year: 2010–2011 School Year

Program Details

A total of 268 students (108 males and 160 females) participated in the training sessions.

A total of 15 schools participated in the trainings.

A total of 14 schools completed the program:

American Falls High School
Buhl High School
Capital High School (Boise)
Emmett High School
Homedale Middle School
Homedale High School
Kimberly High School
Kuna High School
Lewis & Clark Middle School (Meridian)
Meadows Valley School (New Meadows)
Pocatello Community Charter School
Salmon High School
Timberline High School (Boise)
Twin Falls High School

One school, Wings Charter Middle School, did not complete the program.

Note: Schools may not have been able to complete the SEE program due to the difficulty in incorporating an extracurricular activity into the classroom regimen.

Participating teachers whose students completed the program requirements received a stipend of $250 and one continuing education credit from Boise State University.

Training Sessions

Part of the revisions made to the SEE program was splitting the training sessions into two separate sessions. As was the case during the first year, training sessions were presented to multiple school team audiences. The first training lasted two hours, and the second lasted one hour.

First Training

Presentation of the PowerPoint slide deck (reduced in size and scope with more reference to the hard-copy curriculum and materials provided on a CD to each teacher)

Review of the SEE program curriculum

Introduction of the ESI equipment kit

Kit contents:

- Electronic/magnetic ballast discriminator
- Kill-A-Watt meter
- Lumen light meter
- Flexible tape measuring reel
- Switchable power outlet strip
- HoBo Light Sensor Data Logger
- HoBo Temperature Sensor Data Logger

Hands-on training in use of ESI equipment

Walk-through assessment of school to determine and familiarize students with lighting, use of sensors, exit sign lighting, opportunities for installation of occupancy sensors and Vendingmisers, etc.

Second Training

Review of energy assessments, graphic presentation of IPC Easy Upgrades Lighting Calculator, discussion of report format, Q&A.

Note: When necessary and as requested, additional visits to the schools were made or questions were addressed via email and telephone calls with students and teachers.

Schools Assessed for Energy Efficiency Opportunities

A total of 14 school buildings were assessed by the student teams:

School	Sponsoring Teacher	Student Team
William Thomas Middle School	Pat Patterson	American Falls HS
Emmett Middle School[1]	John Bernardo, IPC (mentor to senior student)	Emmett HS
Homedale Middle School	Jennifer Martin	Homedale MS
Homedale High School	Mark Thatcher	Homedale HS
Kimberly High School[3]	Mike Huttanus	Kimberly HS
Kuna Middle School[1,2]	DaNel Huggins	Kuna HS
Pocatello Community Charter School	Cara Sonnemann	PCCS
Salmon Alternative School[3]	Arlene Wolf	Salmon HS
Salmon Elementary School[3]	Arlene Wolf	Salmon HS
Salmon Middle School[3]	Arlene Wolf	Salmon HS
Salmon High School[3]	Arlene Wolf	Salmon HS
Salmon School District Office[3]	Arlene Wolf	Salmon HS
Timberline High School	Dick Jordan	Timberline HS
Twin Falls High School	Jo Dodds	Twin Falls HS

[1]These schools are scheduled for a full lighting upgrade replacing all T-12 lamps with T-8 lamps through the OER. This lighting upgrade was one of the recommendations made by SEE program participating students.

[2]This school participated in the SEE program. Participating student teams made recommendations that mirrored improvements implemented by their respective school districts through IPC's Easy Upgrades program.

[3]Student assessment reports detailing potential kWh savings are pending.

Businesses Assessed for Energy Efficiency Opportunities

Since several of the schools and sponsoring teachers returned for a second round, it was decided to assist the students in identifying area businesses for performance of the energy assessment. In many cases, the businesses provided this service have established ties of financial or other support to the school. A total of seven businesses were assessed by the student teams:

Business	Sponsoring Teacher	School
Don's Market in Buhl[1]	Susie Jones	Buhl HS
El Cazador Restaurant[1]	Susie Jones	Buhl HS
Garden City Boys & Girls Club	Sheryl Howe	Capital HS
Paul's Market	DaNel Huggins	Kuna HS
US Forest Service Office[1]	Loretta McConnor/Dan Richards	Meadows Valley School
C&M Lumber Company[1]	Loretta McConnor/Dan Richards	Meadows Valley School
Meadows Valley Market	Loretta McConnor/Dan Richards	Meadows Valley School

[1]Reports containing potential kWh savings are still pending.

Municipal Building Assessed for Energy Efficiency Opportunities

During summer 2010, Leah Resinkin of Emmett High School received a request from the mayor of Emmett to use the ESI equipment and assist Emmett Public Library staff in assessing the library for energy efficiency opportunities. Leah went on to assess Emmett Middle School for her senior project.

Student Reports

The following is a link to the IPC website containing the student reports:
www.idahopower.com/EnergyEfficiency/educationalResources/studentsForEE/keyFindings.cfm

SEE Benefits

1. In the 2010–2011 program year, the SEE program had 268 students and 16 teachers participate. Each student and teacher received one, 19-W CFL, which replaces a 75-W incandescent, according to the product description.

   Estimated energy savings were derived from ~~"d~~eemed" savings estimates provided by the Regional Technical Forum (RTF). The RTF is a part of the Northwest Power Council and serves as an advisory committee to develop standards to verify and evaluate conservation savings. Utilities across the Northwest, including IPC, use the RTF format to estimate energy savings for many of their energy efficiency measures. Deemed values from the RTF take into consideration many factors, including calculated energy savings, operating hours, measure persistence, and direct install realization rates.

   The deemed value for replacement of a 75-W incandescent lamp with a19-W ENERGY STAR® CFL is 34 kWh per lamp per year. The total estimated savings of the direct install of 283 CFLs by students and teachers is 9,622 kWh per year. The calculation methodology is as follows:

   283 x 34 kWh/year = 9,622 kWh/year

2. The estimated total savings for schools whose student teams made recommendations that mirrored improvements implemented by their respective school districts through IPC's Easy Upgrades program equaled 662,834 kWh.

Survey Summaries

At the completion of the 2010–2011 SEE program, IPC employees engaged 16 teachers and other school officials to encourage the student participants to complete a survey about their experience with the SEE program. Once again, Becky Andersohn, Customers Relations Research coordinator for IPC, provided the instructors with an email and survey link to be forwarded to student participants. Eighty-seven students completed the survey for a 37-percent response rate.

The findings are as follows:

- Almost one-half of the student respondents said that they put more than 15 hours into their project for the SEE program.
- Only 10 percent of the respondents indicated they spent less than 5 hours on their project.
- Almost 60 percent of the respondents said they liked participating in the program ―a lot".
- Only 2.3 percent (2 respondents) said they didn't like participating in the program at all.
- Most students (59.3 percent) said the program met their expectations; 22 percent said the program exceeded their expectations; and 18.6 percent said it met some of their expectations.
- The majority (52.9 percent) of the respondents said they are ―very likely" to recommend the SEE program to other students. Another 37.9 percent said they are ―somewhat likely" to recommend the program, and 9.2 percent said they would be ―somewhat unlikely" to recommend the program to other students.
- Almost half (48.3 percent) of the students ―strongly agree" they will be able to apply what they learned about energy efficiency after high school. Forty-six percent of the students ―somewhat agree" they will be able to use what they learned about energy efficiency.
- When asked what tools and techniques they learned as part of the program they will use after high school, most students mentioned an overall awareness of energy usage and the costs associated with energy usage. Other students noted they are much more informed about phantom load and how leaving various electrical equipment plugged in still uses electricity. Other students mentioned the training they received on the various equipment used in the program for validating usage and savings.
- Those students who indicated they didn't think they would use what they learned in the program after high school said that it didn't match their interest or career choice or they anticipate they will forget much of what they learned if not used on a regular basis.
- Students were asked how confident they would feel using the equipment and procedures they learned in the program to conduct an energy audit in their home or business. The majority (57.1 percent) said they would be ―very confident," and another 45.1 percent said they would be ―somewhat confident" conducting an energy audit.
- Almost half (49.4 percent) of the students feel ―very confident" their recommendations will be implemented at their school or the business where they conducted the audit, and 47 percent feel ―somewhat confident" their recommendations will be implemented.

- For those students who were ―not very confident" their recommendations would be implemented, the primary reasons were the building is already energy efficient, budget constraints, and inconclusive results of the audit.

- When asked what the students liked best about participating in the SEE program, responses included the following:

  - Learning about the tools and equipment

  - Understanding how their school (or the business they worked with) used energy and how the audit could help them know how to save energy

  - Working together as a team on a project

  - Collecting and analyzing data

  - Being given the responsibility for conducting the audit

- When asked what students like least about participating in the SEE program, responses included the following:

  - The volume of data and detail that needed to be recorded

  - Having to depend on other team members to complete their portion of the work and the fact that some students didn't seem to take the project seriously

  - Learning how to use the HoBo devices

  - The length of time it took to complete the entire project

  - The lecture portion of the program

- Students were asked to make suggestions of ways to enhance the SEE program for future participants. Some of the suggestions included the following:

  - Providing more information up front so participants have a better understanding of what the project will entail (i.e., how much time, activities they will be involved in, measurements and tools they will use)

  - Providing better explanation of how to use the tools and equipment

  - Making the program more youth oriented

- Over half the respondents (54.2 percent) were 7th graders; 21.7 percent were 8th graders; and the rest were distributed across grades 9–12 with smallest representation from both 9th and 12th graders.

Program Budget Details

	2009	2010	2011
Beginning Fund Balance	500,000	479,101	371,210
Labor	(17,973)	(46,063)	(30,350)
Other Expenses	(30,119)	(66,228)	(239,197)
Total Expenditures	(48,092)	(112,291)	(269,546)
Total Interest Earned	27,193	4,400	959
Ending Fund Balance	**479,101**	**371,210**	**102,622**

Recommendations for Future Use of Remaining Equipment and Funds, and Program Continuation

At the time of this writing, approximately $100,000 remains from the original $500,000 plus interest. At the final SEECAG meeting held June 28, 2011, it was recommended to use the remaining funds as follows:

- Purchase additional equipment to provide ESI kits to two Idaho Science, Technology, Engineering, and Mathematics (*i*STEM) lending libraries (in Meridian and Twin Falls) for use by teachers.
- Use the majority of funds to purchase additional Energy Wise kits for use during the 2011–2012 school year. IPC employees will coordinate with IPC Customer Education representatives for elementary classroom teacher participation throughout the IPC Idaho service area.
- Cover additional program expenses, including outstanding travel and labor costs.
- Encourage the Center for Advanced Energy Studies, Energy Efficiency Research Institute (CAES EERI), Idaho Science, Technology, Engineering, and Mathematics consortium (*i*STEM) or other entity to adopt the SEE Program for dissemination throughout the state of Idaho.

IPC concurs with the recommendations of the SEECAG and will use the remaining equipment and disburse the remaining funds as described above. IPC will also pursue adoption and dissemination of the program by CAES EERI, *i*STEM or other entity or investigate continuing the program along with the many other educational programs currently offered by the company.

CONCLUSION

While implementing the two-year program, IPC staff witnessed firsthand the enthusiasm and opportunity the SEE program provided to students. Most memorable is the ―a-ha" moment when students used the equipment to investigate their school and discovered the phantom load and over-lit energy usage occurring around them. Many teachers reported their schools and students were highlighted in local newspaper articles and television reports. Several students used the SEE program as their senior project. In fact, one teacher described the SEE program as the catalyst which turned an at-risk student into an engaged student who graduated on schedule with his classmates.

Here are some observations and takeaways, presented in an abridged manner:

- Paraphrasing a student from the Dennis Professional Technical Center upon seeing school district personnel changing lights and activating occupancy sensors: ―I never thought adults listened to me. I can't say that anymore."

- Learning that empowered students can politely but directly question teachers about the plug and phantom loads of the appliances and circulating fan in their offices/classrooms.

- ―I enjoyed the program and learned which of my classmates are workers and which are slackers."

- ―I just wanted to thank you and Idaho Power for the stipend and credit. This was the most fun and greatest continuing credit I have ever received."

- Witnessing the interaction between a school board member and a high school student as they discussed energy and cost savings opportunities in district buildings. This from a student who, 15 minutes earlier, was anxious about presenting in the first place.

- Being amazed at the involvement, over two years, of students at Buhl High School whose sponsoring teacher, the librarian, mentored the school's ecology club. These students spent hours on their projects without the incentive of earning a grade.

- Seeing heads nod in approval when IPC staff stated that some graduates return to their schools to view the winning team plaque on display in the trophy case, and some graduates walk the halls and see improved lighting, motion sensors, and programmable thermostats. Both important contributions that can have an effect on their futures.

- Feeling a sense of pride upon learning that, in multiple cases, the recommendations presented by participating students mirrored and even exceeded the recommendations made by professional companies contracted by the OER under ARRA funding.

- Initiating the SEE program training for a group of 80 seventh and eighth graders at the Pocatello Community Charter School (PCCS). This was by far the largest student contingent participating in the SEE program, to which IPC staff agreed only after meeting

with their teacher and determining her commitment to the program and its relevance to their Expeditionary Learning track on energy. Staff remained anxious yet confident this would work, all in the interest of energy efficiency education. And work it did. The students did a thorough assessment of their school building, which included consistent data from multiple student collections (which supports the scientific method), and confirmed findings and recommendations.

This page left blank intentionally.

`

Final Rooftop Unit Working Group Phase 4 Recommendations

September 8, 2011

Submitted by New Buildings Institute

Prepared for:

Charlie Grist, Senior Analyst
Northwest Power and Conservation Council
851 S.W. Sixth Avenue, Suite 1100 Portland, Oregon 97204

Vancouver Office (mailing address) | **White Salmon Office**
1601 Broadway Street, Vancouver, WA 98663-3435 | PHONE (360) 567-0950 | FAX (360) 213-1065 | PHONE (509) 493-4468 | FAX (509) 493-4078

This report summarizes the outcomes of work that was completed for Phase 4 of the Rooftop Unit Working Group (RTUG) for the Northwest Power and Conservation Council. A key objective of the work was to "Lead the RTUG through a process to scope technical and related elements of a regional RTU strategic plan, something the region does not currently have."

There are a number significant issues to explore related to continued ratepayer funds being committed to RTU efficiency for both existing and new systems. At the highest level, they include: cost-effective options for maintaining and retrofitting existing older, but serviceable RTUs, early replacement and consideration of emerging RTU technologies. Of necessity, the scope for a strategic plan to address a myriad of technical and market challenges to addressing the performance of conventional, RTU HVAC systems is broad and deep. The RTUG focused its efforts in Phase 4 on issues related to developing a protocol for the measurement and verification of energy savings impacts from RTU service measures that are appropriately implemented.

The basic elements of an RTU Strategic Plan include:

- Goal setting
- Review of market barriers
- Selecting priorities
- Establishment of action plans
- Identifying resources to support the action plan activities

There are multiple and distinct audiences for elements of a Strategic Plan: PNW regional and local, public and investor-owned energy utility planners, utility energy efficiency program designers/implementers, public benefits energy efficiency organizations, the HVAC industry including contractors and equipment OEM's, workforce education and training organizations in including vocational programs offered publicly, privately, and through union organizations. Last, but not least, are the end users of HVAC systems in their buildings. The everyday choices that commercial building owners, managers and tenants make on how they operate their HVAC system, ultimately determines the success of technical and programmatic energy efficiency initiatives aimed at achieving maximum design performance from RTUs.

The RTUG did not finalize a specific strategic plan goal statement. Based on lessons learned and analysis of RTU performance data, it is expected that the RTUG would support one major goal: continue efforts to establish cost-effective solutions for keeping commercial RTUs performing at their engineered efficiency.

There are existing criteria for assessing and determining priorities for pursuing the variety of technical and market questions that need attention. These criteria include:

- Consistency with regional power and conservation plan goals including resource acquisition and cost effectiveness
- Regional efficiency potential in kWh/kW/therms
- Technology advancement
- Research/development/demonstration/deployment status
- Operating performance management
- System and equipment operation/maintenance/replacement costs
- Greenhouse gas management benefits
- Market response
- Market transformation opportunity

- Integrated design/performance optimization opportunity
- Evaluation, monitoring and verification requirements

Strategic Plan Activities

Three priority issues that emerged from RTUG deliberations that would benefit from near term RTF consideration include:

- Establishing and measuring appropriate air flow as required by best practice standards, customer comfort and the building energy code:
    - Technical: how to improve effectiveness of field measurement and service protocols?
    - Utility program field protocol: what savings can be realized through program design?
    - Utility program benefit-cost issue: how to treat negative savings from upgrade to minimum ventilation or ASHRAE 62.1?
    - Building code requirement: how to ensure compliance; program responsibility related to code compliance?
- Measure life: Sixth Northwest Conservation and Electric Power Plan assumes 18 years for compressor life, and 5 years for operation and maintenance measures. Currently, there is little or no substantiating data for these assumptions.
- Uncertainty around operating persistence of entire systems as well as major system components (*e.g.* sensors, economizer damper motors), maintenance and operation-based efficiency measures, and occupant control settings for fans, schedules, temperatures. Currently, there is insufficient substantiating data to make assumptions with a high level of confidence.

In addition to these topics, a list of other priority areas was developed for consideration along with the successful development of a measurement and evaluation protocol for projecting annualized savings from RTU maintenance measures using monitored operating data. Although the recommendations were not formally prioritized by the RTUG, they include:

- Maintaining and enhancing as appropriate, the Regional RTU Research Results Database that is up and running at the NPPC/RTF website. This is a functional data repository with open access. Appropriate new data sets and analytical results as available from projects inside the region and perhaps as relevant, outside the region should be added.
- Developing a research scope/budget for establishing and extending a low cost monitoring protocol on a set of RTUs for up to 60 months to begin to look at persistence of maintenance measures and also track maintenance costs.
- Substantially document whole building conditions and operating changes in buildings where RTU service work has been performed.
- Active customer and HVAC contractor contact with enhanced education and training for both groups especially covering control strategies and economizers.
- Ongoing reconciliation between modeling and inputs to modeling from metered results
- Economizer research program including DCV interaction (currently underway through the Premium Ventilation project).

- Test of web-based RTU control and performance monitoring to determine impact on building operator schedule management using the monitoring information (being completed through a Bonneville-sponsored web-enabled thermostat monitoring project).
- Improve DOE2/eQUEST RTU-related calculations (this is fundamental to improving forecasting for RTU savings potential).
- Regional assessment of deeper RTU savings through retrofit including: variable-speed motor/fan controls, advanced motor retrofits, 5-bladed fans, automated performance monitoring/fault detection and diagnostics with remote communications gateways.
- Assessment of the regional benefits of early retirement of conventional package RTUs with one-to-one replacement or substitution of a different RTU technology.

In addition to the technical and technology related activities, there are broader market transformation opportunities to be explored collaboratively in the region among BPA, NPPC, NEEA, ETO and other appropriate organizations. They include:

- Customer education
- Enhanced HVAC contractor/distributor workforce education and training
- Quality installation/quality maintenance (QI/QM) standards review, adoption and implementation (such standards have been developed nationally)

Western Regional and National Developments

In addition to in region PNW organizational collaboration, developments in California have opened the door to increased opportunities for cooperation in the West. The establishment of the Western Cooling Efficiency Center at the University of California/Davis, has led the way to a new generation of advanced evaporative cooling technologies including evaporative-direct expansion (Dx) hybrid products through its Western Cooling Challenge program. The Cooling Challenge is the gateway for hybrid RTUs, one of which (Coolerado H80) was tested as a prototype in the PNW through a NEEA-sponsored research project. NEEA is implementing a research project to evaluate the performance of a second hybrid RTU product (Speakman Quattro) that has met the Cooling Challenge specification and may show an 80% reduction in energy and a 60% reduction in peak demand, as did the Coolerado product in tests at the National Renewable Energy Laboratory. The Cooling Center is also planning an evaluation of retrofit evaporative pre-cooling products for peak demand reduction in existing Dx RTUs.

In addition, the Western HVAC Performance Alliance[1] has been formed to address four key strategic energy efficiency goals of the statewide HVAC Action Plan[2]: code compliance, QI/QM, integrated building design and advanced technology. The HVAC Action Plan was informed in part by PNW RTU experience and recognizes the important benefits of active communication and where possible, direct collaboration with energy efficiency organizations in the PNW and the southwest. California HVAC and emerging technology personnel have participated in RTUG meetings. Results from the PNW RTU research work have been shared with the California utilities, California Energy Commission and the California Public Utilities Commission. In addition, California has embarked on a Zero Net Energy Action Plan for

[1] Western HVAC Performance Alliance
http://www.performancealliance.org/

[2] ibid.

commercial buildings. Significant funding has been allocated to initiate a range of design, research, case studies, promotion and training activities that the PNW can potentially leverage for deeper savings around HVAC.

At the national level, US DOE and the Commercial Building Energy Alliances (CBEA) issued the High Performance Rooftop Unit Challenge specification to HVAC manufacturers. Given the unit's efficiency potential (50-60% energy reduction projected from ASHRAE 90.1-2010 HVAC standards), a full set of performance and diagnostic monitoring functions, along with the capacity to be integrated with evaporative systems, the Challenge spec represents the most advanced Dx package RTU unit ever designed, at least conceptually. Assuming the spec can be met at a price that CBEA members will pay, this unit should become the priority product for utility financial incentives for high efficiency RTUs in new construction or replacement of 10 ton RTUs in the PNW and nationally.[3]

DOE has also instituted a national HVAC Roadmap development process with Oakridge National Laboratory in the lead. The Roadmap will be used by DOE to prioritize HVAC-related funding resources. Since this Roadmap is likely to influence Bonneville's RTU-related efficiency activities, the region needs to be aware of and involved in the DOE process. A separate national roadmap on refrigerants is also under development. DOE is expected to issue a rulemaking in June 2011 on two residential air conditioner climate optimized cooling standards (hot/dry, hot/humid) that exceed federally pre-empted standards and that may be adopted in specified states in building energy codes. The RTF along with California and southwest states should consider joining forces to determine the level of a climate optimized standard for commercial RTU equipment in the hotter drier areas in the west that could be formalized in state building energy codes.

Recommendation for a Western RTU Forum

In reality, the market and technical scope of a PNW HVAC strategic plan includes the PNW, California, the other western states and ultimately, national considerations. It is recommended that the RTF reach out to the WHPA to discuss opportunities for active collaboration and the potential benefits of organizing a western regional „RTU Forum' to address the many market and technical challenges with RTU performance. The Forum would bring together HVAC stakeholders, including contractors, customers, manufacturers, consultants, public benefits organizations, utility HVAC staff, regulators, code officials, researchers, and others. The forum could have three major tracks: 1) QI/QM standards, 2) advanced technology and 3) whole building integration. Workforce education and training, and code compliance could be covered as sub-tracks under QI/QM. Given the existing heavy workloads across the entire energy efficiency sector, the Forum could be viewed as one time event rather than an ongoing process, with specific follow up activities resulting from the natural shared interests and priorities of the participants.

q:\cg\main\rtf\rooftop\rtug\phase4\nbi rtug phase 4 final report.docx

[3] High Performance RTU Challenge Specification

RESIDENTIAL ECONOMIZERS
ENERGY IMPACTS

TECHNICAL REPORT

General Service Agreement
SOW #2
4/15/2011 to 12/31/2011

Prepared For:
Idaho Power Company

Authors:
B. Acker
C.Duarte
K. Van Den Wymelenberg

INTEGRATED idl DESIGN LAB
University of Idaho

University of Idaho
COLLEGE of ART and ARCHITECTURE
Department of Architecture & Interior Design

January 31, 2012
Date

20110311-01
Report No.

Prepared By:
University of Idaho, Integrated Design Lab-Boise
306 S. 6th St. Boise, ID 83702 USA
www.uidaho.edu/idl

Kevin Van Den Wymelenberg
Director

Brad Acker
Project Manager

1- Brad Acker
2- Carlos Duarte
3- Kevin Van Den Wymelenberg
Authors

General Services Agreement SOW #2

Prepared For:
Idaho Power Company

Todd Greenwell
Project Manager

DISCLAIMER

This report was prepared as the result of work sponsored by Idaho Power Company. It does not necessarily represent the views of Idaho Power Company or its employees. Idaho Power Company, its employees, contractors and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by Idaho Power Company nor has Idaho Power Company passed upon the accuracy or adequacy of the information in this report.

Please cite this report as follows: Acker, B., Duarte, C., Van Den Wymelenberg, K. 2012. *Residential Economizer – Energy Impacts*, Technical Report, 20110311-01, Integrated Design Lab, University of Idaho, Boise, ID.

This page left intentionally blank.

Table of Contents

TABLE OF CONTENTS **4**

1 BACKGROUND **5**

1.1 RESIDENTIAL ECONOMIZER EQUIPMENT AND CONTROLS **5**

1.1.1 ECONOMIZER EQUIPMENT 8

2 METHODS **8**

2.1 SITE SELECTION **8**

2.2 METERING METHODOLOGY **9**

2.3 ANALYSIS METHODOLOGY **9**

2.4 STUDY PERIOD RESULTS **10**

2.4.1 AGGREGATED ENERGY USE BY MODEL 12

2.5 ANNUAL ESTIMATED ENERGY SAVINGS **16**

2.5.1 DISCUSSION 18

3 DETAILED RESULTS BY SITE **21**

3.1 MODEL 1 SITE DATA **22**

3.2 MODEL 2 SITE DATA **34**

4 REFERENCES **41**

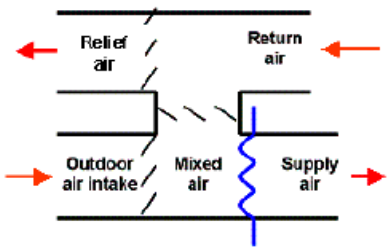
5 APPENDIX **41**

5.1 APPENDIX A- SOLICITATION LETTER **42**

1 Background

A HVAC economizer system is designed to save cooling energy by using outdoor air (OA) instead of return air in order to avoid compressor operation. Hence, cooling in economizer mode is often referred to as 'free cooling'. The economizer system operates when there is a call for cooling in the space and OA conditions are favorable to provide cooling to the space. Figure 1 below shows a schematic of the different air steams and dampers in a typical economizer system. The blue line represents the cooling coil. In full economizer mode, the OA damper is open to the maximum position and the mixed air damper is closed. Some control systems can also throttle the mixed air damper to provide the desired supply air temperature. These systems can also be used to supply fresh air to a space when the damper would otherwise be closed due to outdoor air conditions.

Figure 1 Airflow paths with economizer system



Air-side economizers are used and are required by codes in commercial buildings. Economizers in commercial buildings are cost effective because many commercial structures are interior load dominated. This means buildings can often have cooling load requirements when the outdoor air temperature (OAT) is quite low, in the range of 40-50° F. Industrial style economizers and residential style economizers share basic similarities but also have differences. This report discusses residential economizer design, installation, controls, and energy impacts. The specifics of residential economizers are addressed below.

1.1 Residential Economizer Equipment and Controls

This study focused on economizers installed as part of a "split" HVAC system. Split systems have mechanical components that are not physically collocated. The air-conditioning compressor and condensing unit are located outside of the house while the furnace is located on the interior of the structure (crawl space, garage, attic or mechanical room). The furnace comprises a heating device (gas or electric), evaporator coil for cooling, fan (blower) and the supply/return ductwork. Figure 2 shows the major components of a typical split system.

Figure 2- Typical Split System

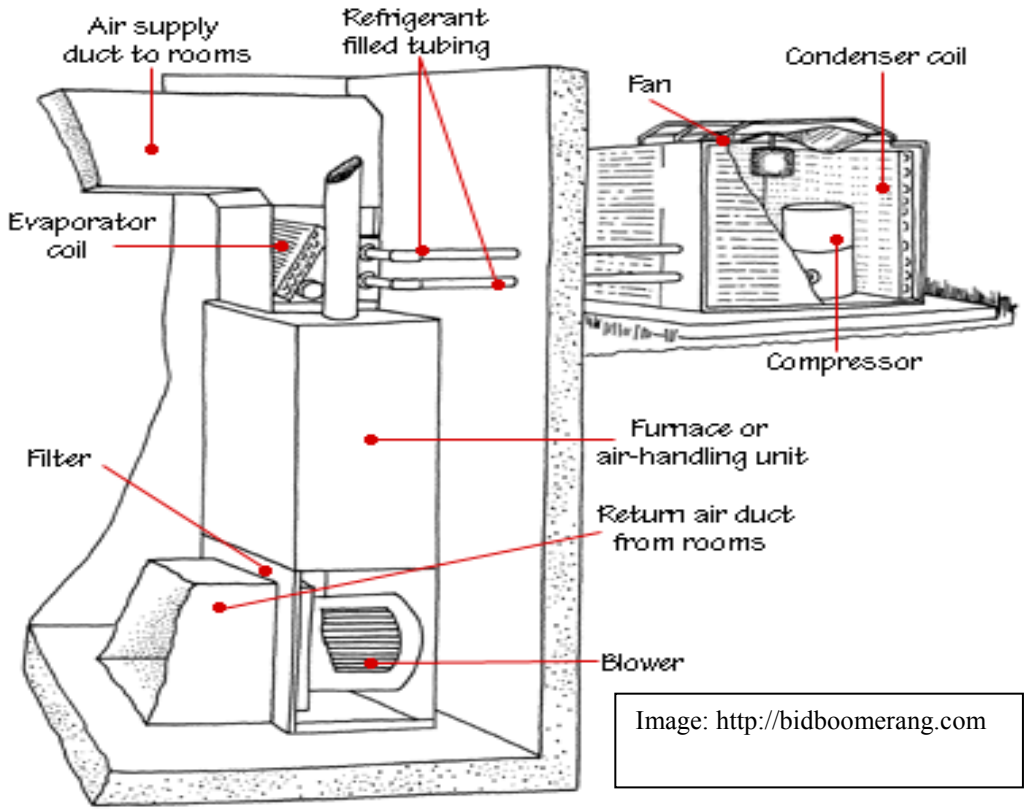


Image: http://bidboomerang.com

Figure 3 and Figure 4 illustrate a schematic of the ductwork and dampers necessary to operate an economizer system. Figure 3 shows the system in economizer mode. Air is drawn from the outside, through the furnace/blower assembly and distributed to the conditioned space. The addition of outside air pressurizes the conditioned space, and the return air duct system allows the air to be exhausted to the attic space, providing an additional benefit of cooling the attic and allowing for less heat transfer from the attic to the conditioned space. Note the position of the dampers, which allow outside air into the furnace and isolate the return system forcing return air to the attic. Figure 4 shows the system in normal or non-economizer mode. Again, note the position of the dampers, which direct recirculation air from the conditioned space through the furnace and back to the conditioned space.

Figure 3 Residential Economizer in Economizer Mode

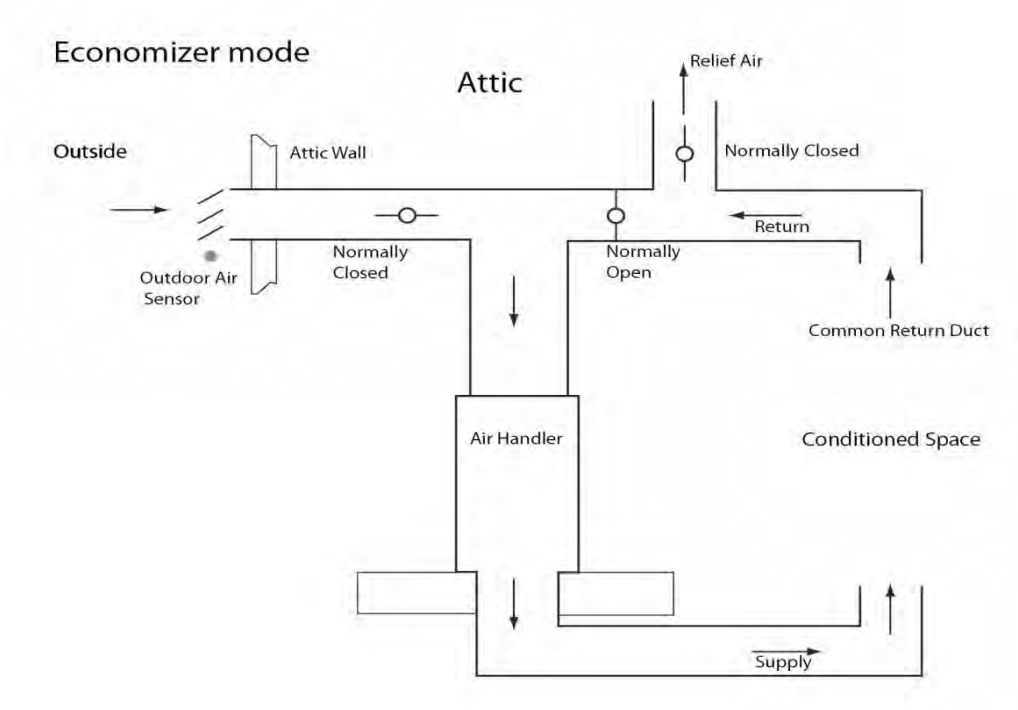
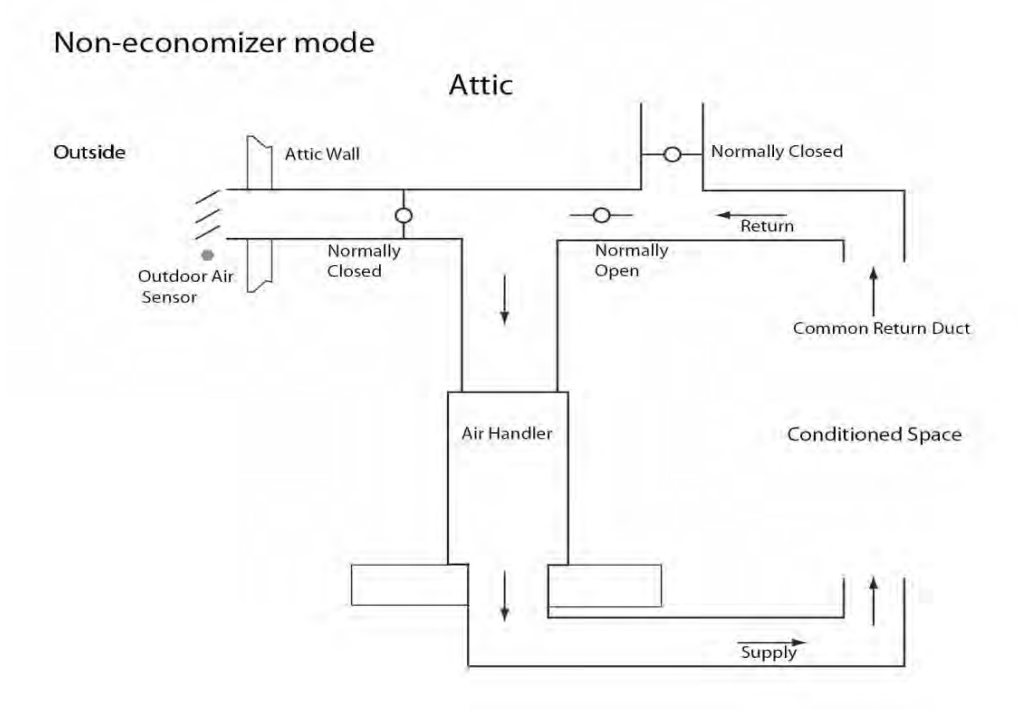


Figure 4 Residential Economizer in Normal or Non-Economizer Mode



1.1.1 Economizer Equipment

Two models of equipment from different manufactures were used in this study, and herein will be referred to as Model 1 and Model 2. Both models provide an economizer function and have the same ductwork requirements. The installation of an economizer requires the installation of an outside air intake, three dampers (outside air, exhaust air and return air) along with the associated ductwork to link the various components together. Another requirement is that the existing system must physically have space to install these dampers between a point of a common return duct and the furnace. Control wiring and boxes are also installed. Model 1 is marketed as a fresh air machine and provides many options above and beyond a basic economizer and operates independent of the home thermostat. An additional control box with display and user interface is mounted in the same thermal zone as the thermostat. Model 1 utilizes a dry bulb temperature sensor, which is acceptable in the Northwestern United States but may be a disadvantage in other, more humid climates. Model 2 also offers additional features beyond a traditional economizer but is not a standalone control device. This means Model 2 is wired in line with the thermostat, and if a call for cooling is placed, the control logic decides to turn on the compressor or open the outside air damper based on outside conditions. Model 2 uses a more sophisticated outdoor temperature and humidity sensor, which would be beneficial in humid climates. Both manufactures recommend that outside air intakes be located in a shaded area, such as North facing roofs or gable ends.

2 Methods

2.1 Site Selection

Idaho Power Company (IPC) staff was responsible for home owner participation in this project. A letter was mailed to 1,000 IPC customers to explain the project objectives, and any associated costs and responsibilities. Homeowners were selected by IPC staff based on home size and HVAC system type. Site selection started in early spring of 2011 and was completed in mid June. The original solicitation letter is listed in Appendix A. A list of desirable qualification are as follows:

- Current homeowner planed to still live in same home throughout the analysis period
- Had a ducted air-conditioning system without a heat pump for heating
- Had a single-level home from 1,400–1,800 ft^2 or two-story between 1,800–2,500 ft^2
- Allowed window air-conditioners and whole-house fans to remain off with windows closed during the evening/early morning hours
- Allowed the installation of additional HVAC equipment, such as a wall-mounted control, external wall or roof vent, flex duct and dampers to their existing system

- Allowed IPC and a third parties to analyze energy-usage data and other data collected

The original goal was to randomly select 50 homes for the study out of the first 200 qualifying respondents. The sample of 50 homes was agreed upon as acceptable based on meeting with IPC and Northwest Energy Efficiency Alliance staff. A total of 52 replies were received from the mailing, of this only 43 met the criteria.

Contractors were given the final discretion regarding accepting or denying homes to participate in the study. IPC staff provided contractors and investigators a list of 43 possible study homes. While equipment was installed and data were collected for 30 homes, several circumstances existed that led to home rejection. After screening and review of homes by the installation contractors, 19 homes were able to participate in the study and have economizers installed. Of the homes which were installed 12 homes could not be used for reasons outlined below, 7 sites were used in the final analysis.

A post-study interview of the contractors revealed some of the reasons for rejection including the following. Sixteen homes had return ducts that were not accessible due to being in a wall or ceiling cavities. This includes lack of physical space between a common return duct and the furnace. This did not allow space for the dampers to be installed. Three home owners did not return calls or show up for appointments. Four homes were not able to be installed due to workload of the contractors. One homeowner took issue with the location or appearance of an outside air intake, expressing neighborhood association concerns, and was therefore excluded.

2.2 Metering Methodology

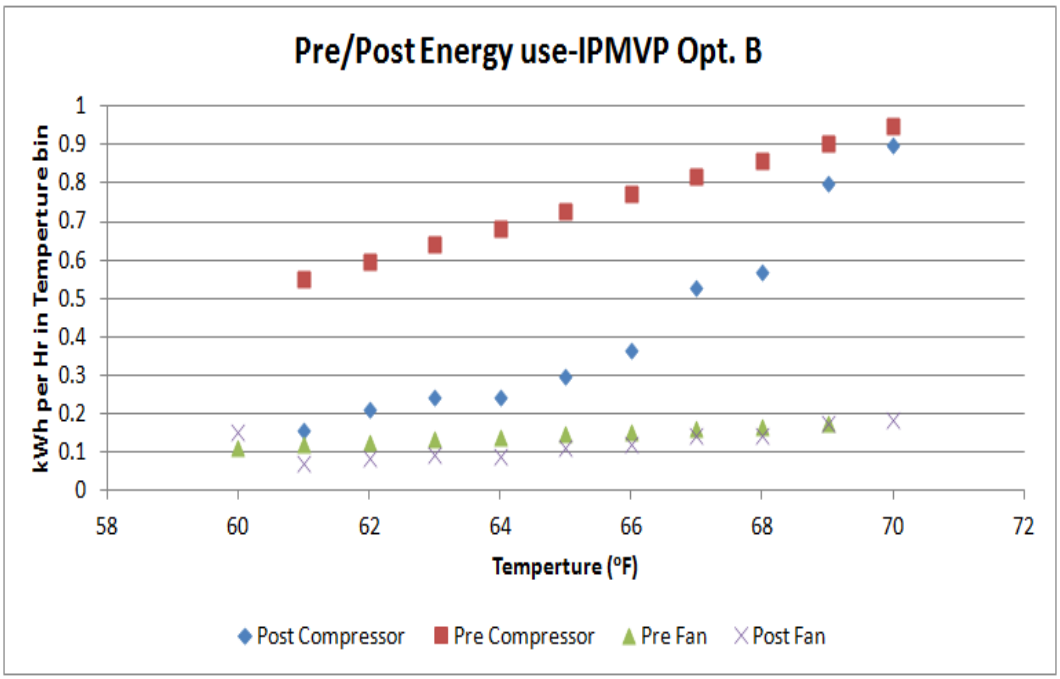
Compressor power, fan power and outdoor air temperature were logged as the primary data sources. Indoor air temperature and humidity, outdoor humidity and damper position data were also collected to aid in trouble shooting and system verification if needed. Data were collected on a 15-minute interval. Compressor and fan power data were integrated over the 15-minute period and temperature data were taken instantaneously at 15-minute intervals.

2.3 Analysis Methodology

Relationships between outdoor air temperature (OAT) and compressor/fan power were compared pre and post-economizer installation. OAT was categorized in one degree Fahrenheit bins and the amount of hours in each bin was determined. A metric of kWh per hour in a temperature bin was developed and compared pre/post to determine the energy savings as a result of economizer use. Normalization of the kWh metric (kWh per hr in a bin) removed the time dependence of the data collection period spanning the pre and post conditions. In accordance with the International Performance Measurement and Verification Protocol (IPMVP, 2010), a regression curve was developed based on the pre data, and this same regression curve was applied to the post-install

data. The difference in the two values is an IPMVP compliant savings number for the monitoring period. IPMVP Option B compliant data can only be reported for periods of monitored energy use. Due to this, data are reported for the monitoring period and an extrapolation of these data were applied to TMY3 weather data to arrive at an estimate of annual savings. Figure 5 shows an example of an IPMVP compliant analysis graph.

Figure 5 IPMVP Compliant Energy Savings-Single Site



2.4 Study Period Results

Results of this study are reported in several formats. Compressor energy and fan energy are reported for the pre and post period. The two economizer models are substantially different, therefore results are reported based on each model. Aggregated results for each model are reported, followed by an annual energy saving estimate based on Typical Meteorological Year version 3 (TMY3) data. Detailed individual home results are reported last with the identification of the model of economizer used. An attempt was made to report all savings values in a form compliant with IPMVP standards. However, due to poor regression line curve fits, only one site qualified to be reported in this fashion. This site was also evaluated on an annual basis using the pre and post data curve fits.

Of the homes listed as 'not installed per contractor discretion' a post-study interview of the contractors revealed some of the reasons for rejection including the following. Sixteen homes had return ducts that were not accessible due to being in a wall or ceiling cavities. This includes lack of physical space between a common return duct and the furnace. This did not allow space

for the dampers to be installed. Three home owners did not return calls or show up for appointments. Four homes were not able to be installed due to workload of the contractors. One homeowner took issue with the location or appearance of an outside air intake, expressing neighborhood association concerns, and was therefore excluded. No information was provided as to which house was rejected for a particular reason.

Table 1 shows the total number of sites originally in the study, sites that were not installed, sites with data that could not be used, and sites used in the final analysis. Of the homes listed as 'not installed per contractor discretion' a post-study interview of the contractors revealed some of the reasons for rejection including the following. Sixteen homes had return ducts that were not accessible due to being in a wall or ceiling cavities. This includes lack of physical space between a common return duct and the furnace. This did not allow space for the dampers to be installed. Three home owners did not return calls or show up for appointments. Four homes were not able to be installed due to workload of the contractors. One homeowner took issue with the location or appearance of an outside air intake, expressing neighborhood association concerns, and was therefore excluded. No information was provided as to which house was rejected for a particular reason.

Table 1 Participant Sites

Count	Comment	Site #
43	Respondents to mailing request – 1,000 sent out	1-43
24 (56%)	Not installed per contractor discretion	7,9,10,12,14-16,18,20,21-25,27,29,31-33,35,39,41-43
12 (28%)	Model 1-Data not used in analysis	28,30,36,37,38,40
	Model 2-Data not used in analysis	1,2,4,8,11,13
8 (16%)	Model 1-Final data analyzed	17,19,26,34
	Model 2-Final data analyzed	3,5,6

Table 2 details the sites that were installed and logged, but ultimately had data that could not be used in the final analysis for the reasons listed below. Some of these sites have subsequently been fixed, however, the end of the cooling season limited the use of further data collection.

Table 2 Sites with Unusable Data

Site #	Model	Reason
28	1	A/C equipment issues- low refrigerant levels
30, 37		No compressor use in pre period-possible window cooling by homeowner
38		Blower fan compatibility issues
4	2	Damper control tubing hooked to wrong port
8		Unknown system problem, possible bad circuit board. Zero economizer hours
13		System problem- pump failure, unknown date
2		No compressor use in pre period-possible window cooling by homeowner
1, 11		Logger problems, lost or corrupted data

2.4.1 Aggregated Energy Use by Model

Model 1 is a standalone control system, and as a result, is able to control the blower fan independently of the thermostats' call for cooling. The advantage of this type of system is the ability to perform night flush ventilation of the home, which can result in a delay of compressor powered cooling during the day. This cooling strategy is optimum for structures with high thermal mass. Due to this additional functionality, the results between the two economizer models are reported separately.

Compressor power and blower power are shown independently, and the aggregate of the two is shown last. Savings appear to be sensitive to fan usage and total fan power. Figure 6 below shows compressor power savings from the economizer. Figure 7 indicates very high fan power from pre to post periods. Figure 8 shows the interactions of the compressor and fan energy. This system was effective in reducing compressor power consumption; however this resulted in an overall energy penalty. One possibility is that the independent control of the fan caused longer run times while the system was trying to cool the house to a level which was not obtainable. The manufacturer has since suggested that the control logic would be modified to address this issue.

Figure 6- Model 1 Compressor Power

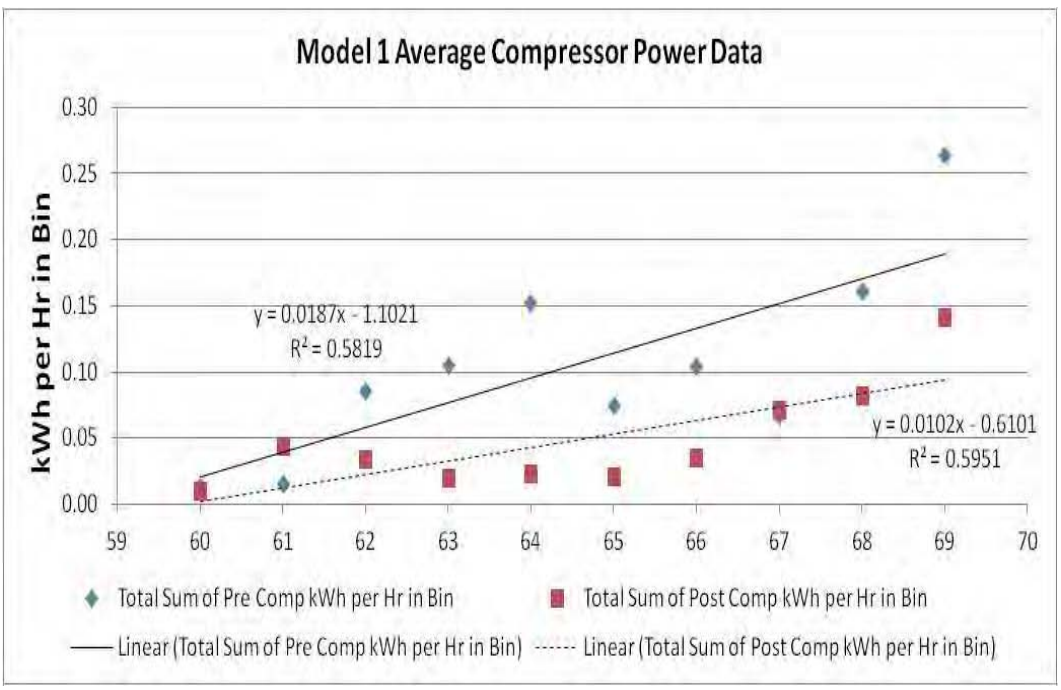


Figure 7- Model 1 Fan Power

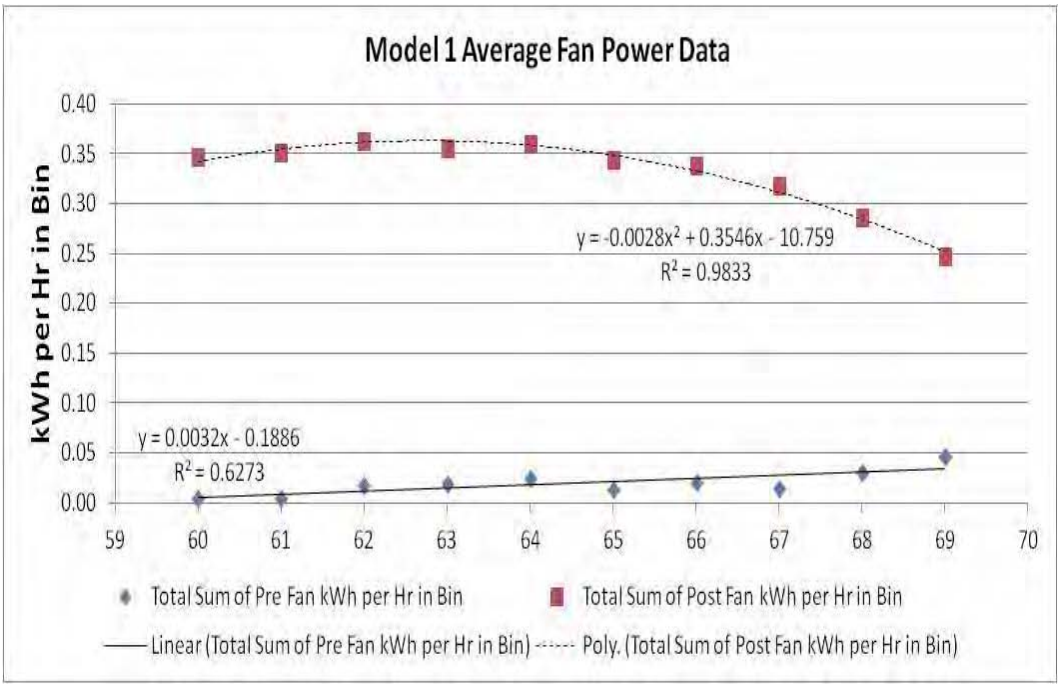
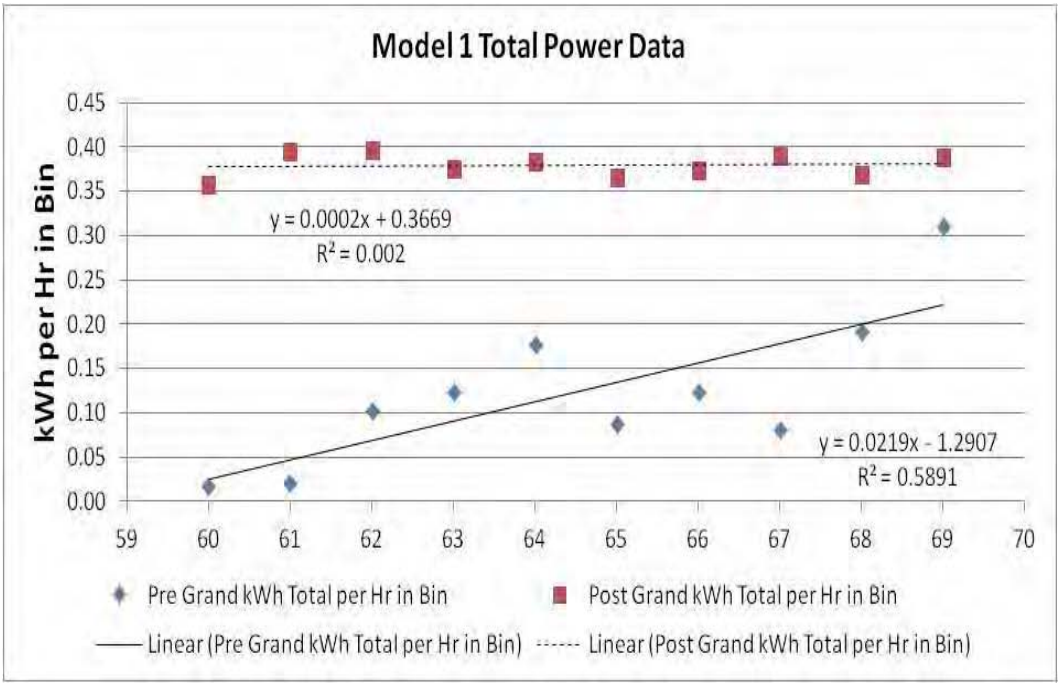


Figure 8- Model 1 Total Power



Model 2 data are presented in the next three figures. Figure 9 below shows a reduction in compressor power from the pre to post periods. The fan power used is larger in the post period, as seen in Figure 10. Note that the fan power in the post period increases as the outside temperature increased. It appears as though this is due to the longer fan runtimes needed to cool the house as the outside air temperature supplied increases. Figure 11 shows the interaction of the compressor and fan power. The regression lines agree well with the average economizer shut off temperature of 68° F. This can be seen as the regression lines intersect with each other.

Figure 9- Model 2 Compressor Power

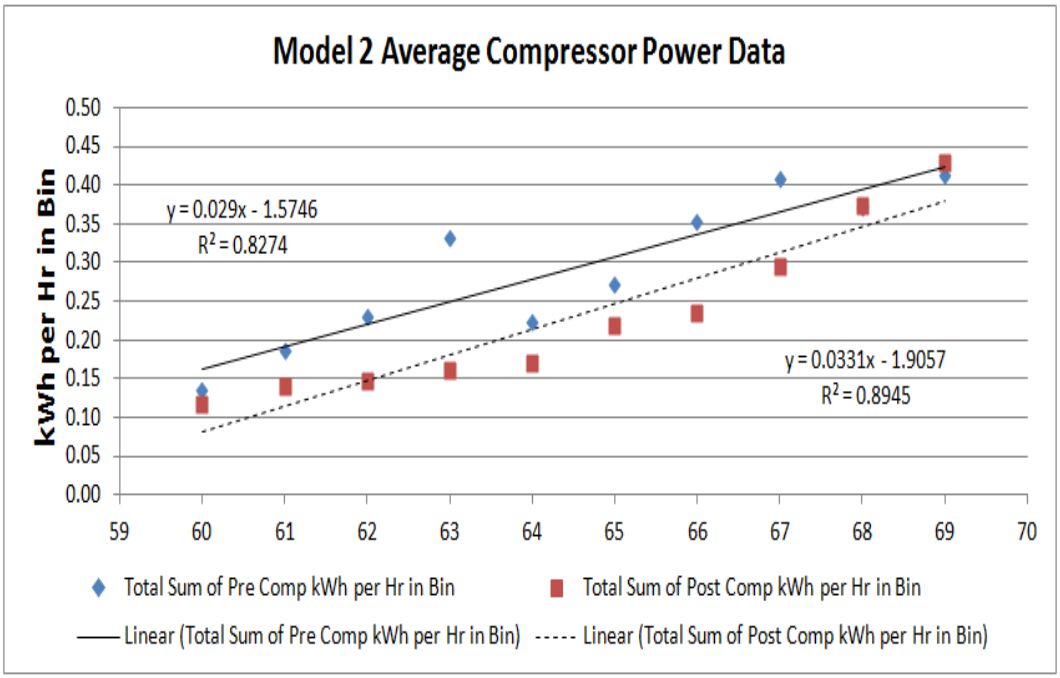


Figure 10- Model 2 Fan Power

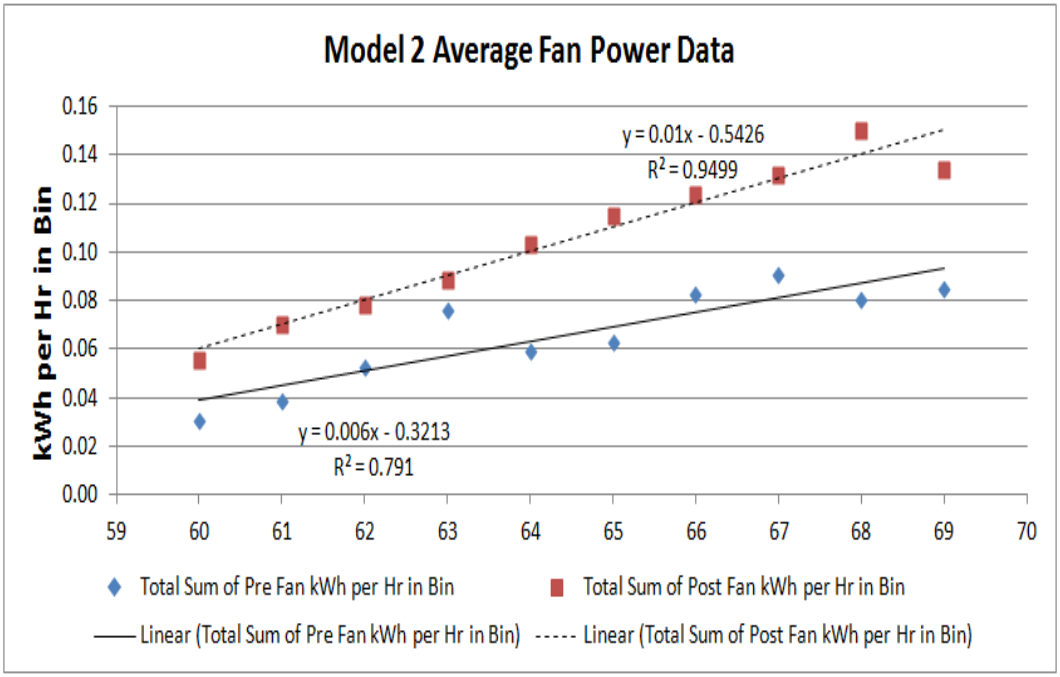
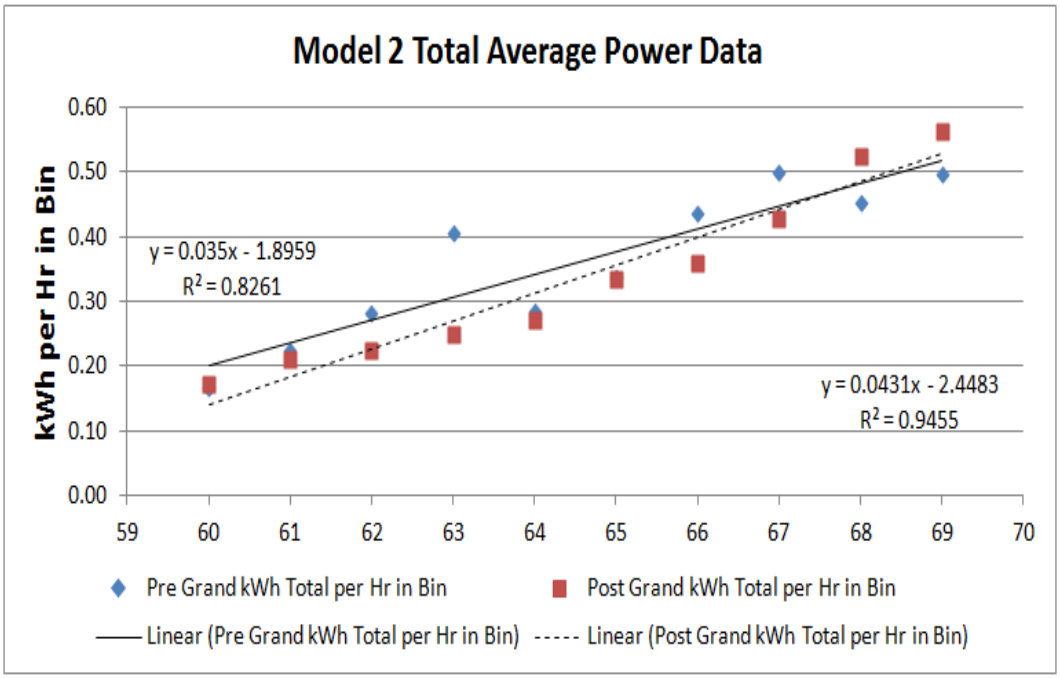


Figure 11- Model 2 Total Power



2.5 Annual Estimated Energy Savings

The annual estimate of energy saving was found by using TMY3 data and pre/post regression lines. TMY3 data were sorted to determine the number of hours in each temperature bin between 60° F and 69° F. The hours are show in Table 3. The regressions from Figure 6 through Figure 8 for Model 1, and Figure 9 through Figure 11 for Model 2, were applied to each temperature bin and multiplied by the number of hours in that bin. The results can be seen in Figure 12 and Figure 13, it should be noted that each bar in the graphs below are generated from individual regression curve fits. One effect of a small sample size has been poor cure fits. This can be seen in Figure 12, note that the compressor and fan savings do not match the total savings. The three regressions used to generate Figure 13 is better and the individual fan and compressor savings agree with the total savings.

Table 3 TYM3 Hours in Temperature Bins

TMY3 hours	Temp
172	60
288	61
3	62
269	63
1	64
270	65
0	66
239	67
4	68
127	69

Figure 12- Model 1 Regression Generated Estimated Savings

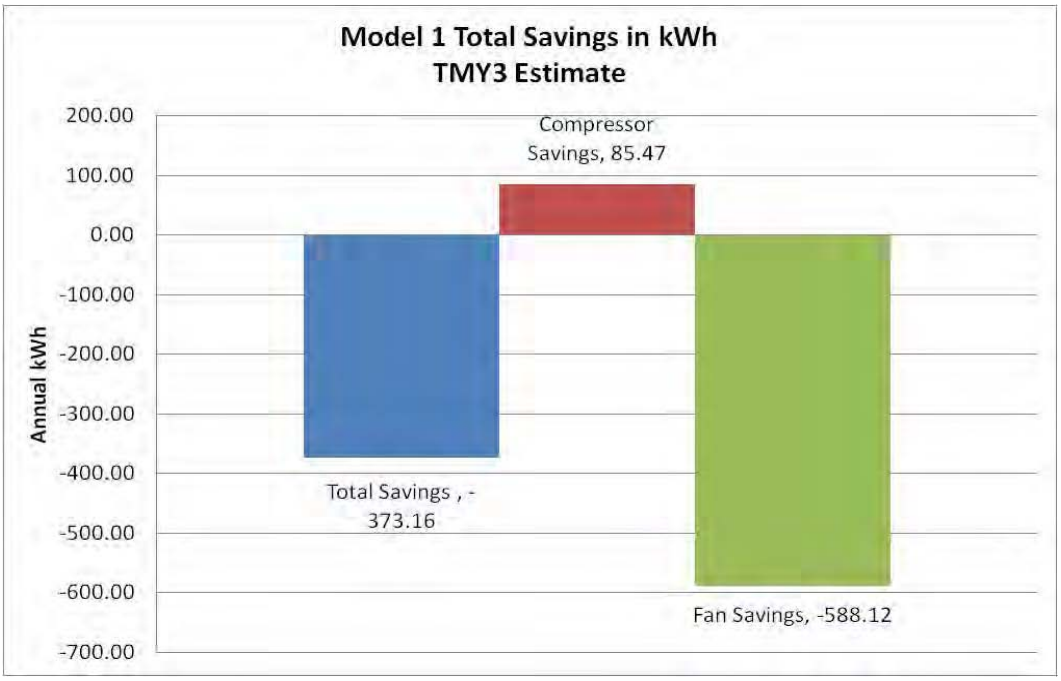
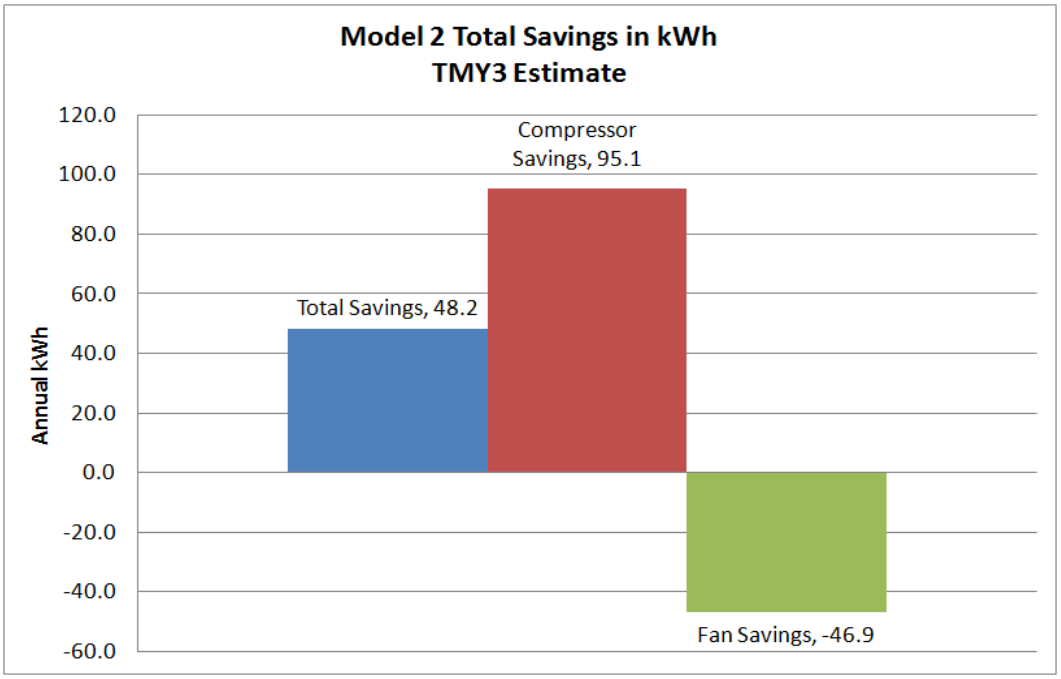
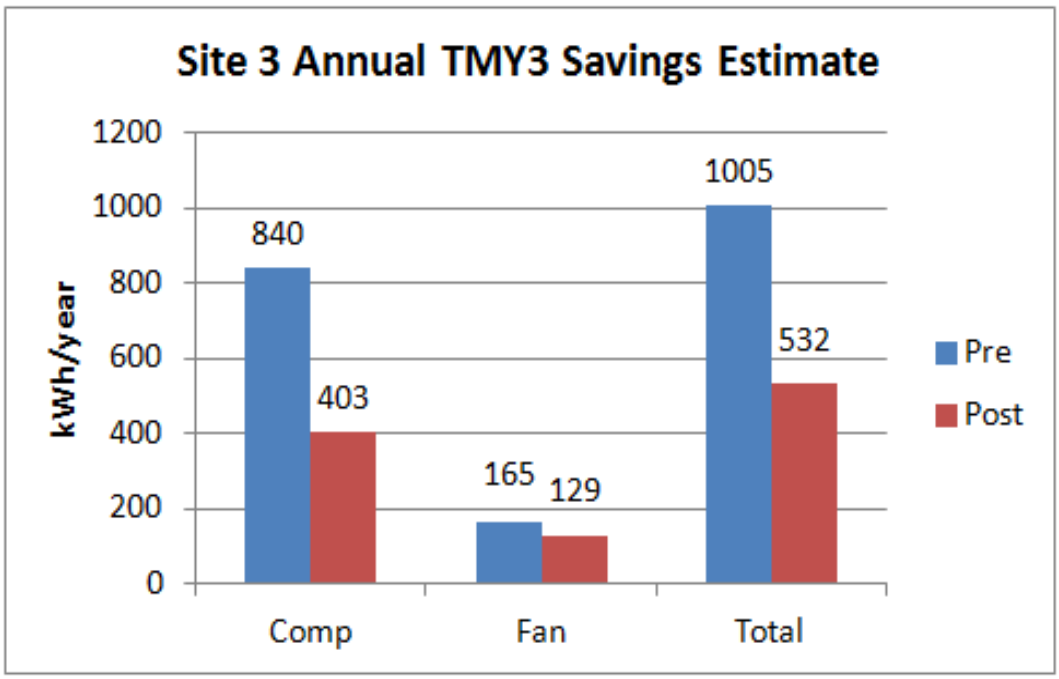


Figure 13- Model 2 Regression Generated Estimated Savings



While it is best to look at average energy saving over a significant number of houses, due to several issues outlined above the sample size for this study is low. In order to demonstrate the potential of this technology, Figure 14 shows the annual estimate for one of the homes that performed well. Compressor and fan energy savings were realized and a total of 473 kWh per year saved.

Figure 14 Site 3 Annual TMY3 Savings Estimate



2.5.1 Discussion

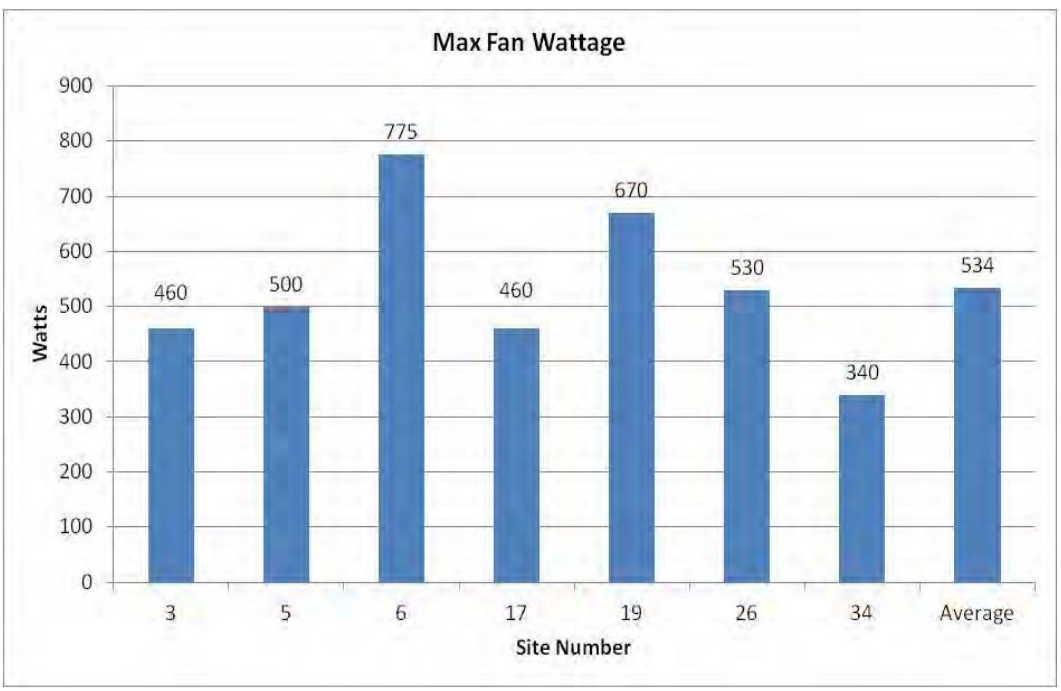
Energy savings from this type of device are highly dependent on installation and use patterns. Both models of economizers state in the installation instructions that air intake located on the north side of the house is preferred. In some cases, this is not possible; however, in many cases this guideline was simply ignored. The methods used were not established to capture this limit to economizer run time, however future work will examine temperatures at various intake locations.

The ability of Model 1 to act as an independent control unit, separate from the thermostat, caused it to use an excessive amount of fan energy when compared to Model 2. However, Model 1 showed substantial compressor savings. Readers should be cautioned that the savings reported between Model 1 to Model 2 cannot be directly compared because the installed cooling capacities of the two sets of homes are not equivalent. This study was not intended to compare and contrast the two models, rather it was meant to evaluate the technology as a whole. The excess fan energy from Model 1 is believed to be a result of the ability of Model 1 to over cool a space, often referred to as "night flush ventilation." This feature can result in a delayed compressor start time, but its success is highly dependent on the amount of thermal mass within

the home, and does not appear to be desirable in most "stick built" homes. Homes were not selected based on the capacity of the thermal mass, and the experimental design was not set up to explicitly record a delayed start time of a compressor. However, a delayed start does save energy overall, and energy savings were reflected in the overall compressor data.

Fan energy use was found to be a substantial factor regarding overall energy savings. Measures could be developed to lower fan energy use through the use of more efficient A/C induction motors or the use of newer more efficient D/C Electronically Commutated Motor (ECM). Permanently Split Capacitor (PSC) motors are the standard motor being used today in furnaces (Gusdrof, 2002). ECM motors offer higher efficiency and the controls needed to run variable speed is less expensive for D/C motors. Figure 15 shows the wattage of the blower fan at the homes analyzed. A Canadian study (Gusdrof, 2002) showed a 74% electrical energy savings between ECM motors and PSC motors. This study was performed in the heating season and also tracked the motor heat added to the airstream. ECM motor added less heat to the airstream which would lower overall cooling requirements. Based on these findings the wattage range below of 775 - 350 W could be reduced to 200 - 88 W. In addition the ECM motors ran more efficiency at lower speeds, which could be utilized for long hours of nighttime economizing.

Figure 15- Maximum Fan Wattage



One shortcoming of this experiment was that the night flush feature of Model 1 was not locked out. The basic control logic of the two units were not the same, and as a result, the data could not be combined, leading to smaller sample sizes for data analysis. Going forward, more pre-

installation qualification and post-installation commissioning must occur. Commissioning of the systems as well as verification of the data loggers to ensure quality pre data are collected will reduce the number of rejected sites.

3 Detailed Results by Site

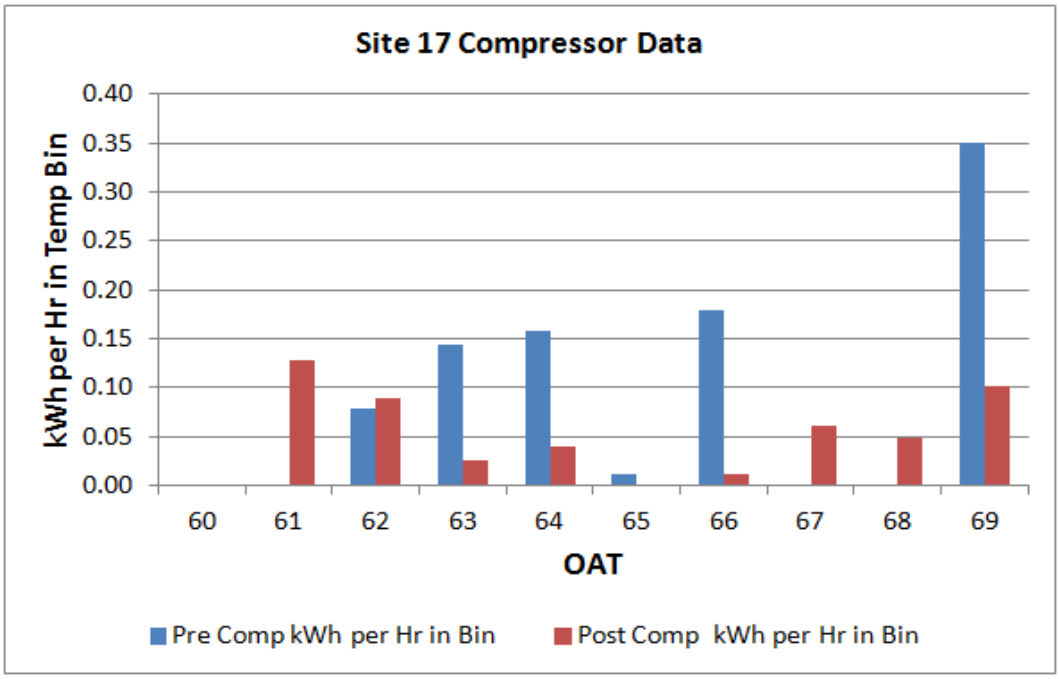
The table below shows all the installed sites and relative descriptions of the home and equipment.

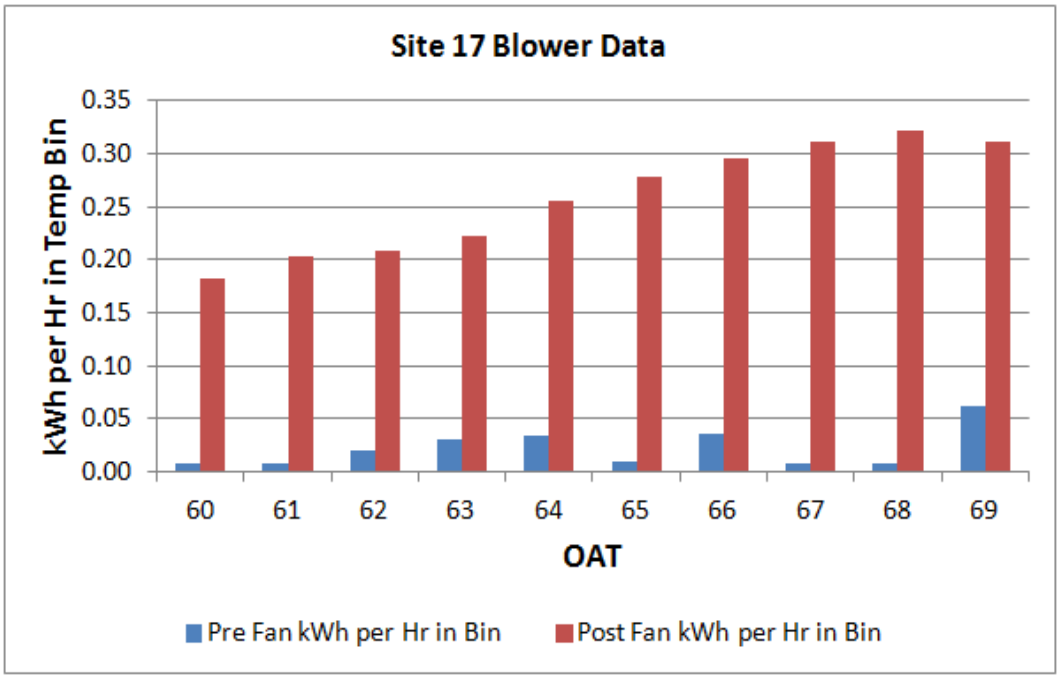
Site #	Model #	Intake location	Home Description	Square Footage	A/C Model	Furnace Model
1	2	Roof, East Face	1978, 1 Story, 3 bed, crawlspace and attic	1788	HS29-030-1P	58RAV070-16112
2	2	Roof, South Face	2002, 2 story, 3 bed,	2032	561CJ036-F	376CAV036096
3	2	Roof, West Face	1994, 1 Story, 3 bed, attic, slab on grade	1540	373LAV036055	1593A11168
4	2	Roof, North Face	1996, 1 Story, 3 bed, attic, slab on grade	1850	380K036340	GCIC070CX30
5	2	Roof, West Face	1975, 1 story, 3 bed, attic	1350	9403128089	GCS90703BXA
6	2	Gable, East Face	1975, 1 story, 4 bed, crawlspace and attic	1938	N/A	T0C100B948A0
8	2	Roof, East Face	1972, remodel 2006, 1 story, 3 bed, attic, slab on grade	1812	N/A	N/A
11	2	Roof, East Face	1998, 1 story, 3 bed,	1194	N/A	N/A
13	2	Roof, Northeast Face	2001, 1 story, 3 bed	1500	N/A	80MGF3-75A-12
17	1	Gable, West Face	1982, 1 Story, 3 bed, attic, slab on grade	1284	561CJX030000ACAA	BL0080E936B1
19	1	Gable, South Face	2004, 2 story, 4 bed, attic	2592	KGA031001121	N/A
26	1	Gable, East Face	1975, 1 story, 3 bed, attic	1314	UACB-024JAS	GCI70A30
28	1	Gable, North Face	1996, 1 story, 3 bed with bonus, crawlspace, no attic	1304	EAEM016877	GCI045X25A

Site #	Model #	Intake location	Home Description	Square Footage	A/C Model	Furnace Model
30	1	Gable, West Face	1977, remodel 1982, 2 story, 4 bed, crawlspace, attic	2232	RAMB-048JB2	RGTJ07EYBGS
34	1	Gable, West Face	1980, 1 story, 3 bed, attic, slab on grade	1320	CRMH-24-45-S	376CAV036055ABJA
36	1	Gable, South Face Shaded	1977, 2 story, 4 bed, crawlspace, attic	1740	38EE002300	376CAV036075AAJA
37	1	Gable, North Face	2007, 2 story, 5 bed, slab on grade	2771	PA13NR060000ACAA	PG8MAA066135A0JA
38	1	Gable, West Face	1988, 2 story, 4 bed, crawlspace, attic	2536	N/A	2036-911
40	1	Gable	1972, 1 story, 3 bed	3888	N/A	N/A

3.1 Model 1 Site Data

Data are presented for each site below. Compressor and blower power pre/post data are graphed, and tables with temperature bins are shown. The tables list the total amount of power used in each bin along with the normalizing factors used, kWh per hour in each temperature bin.

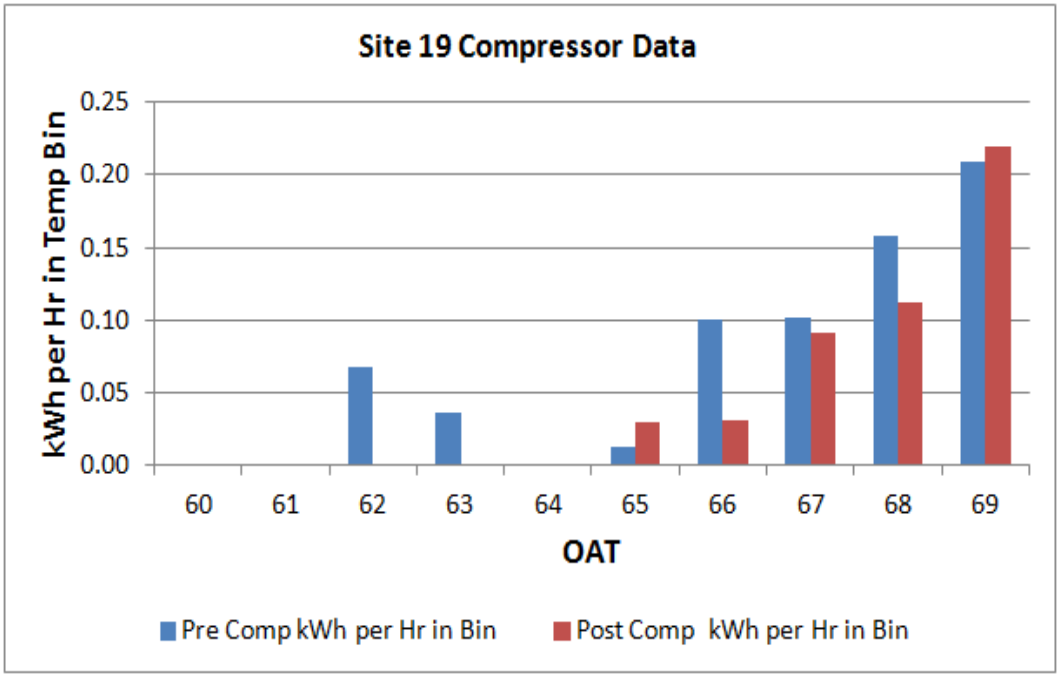


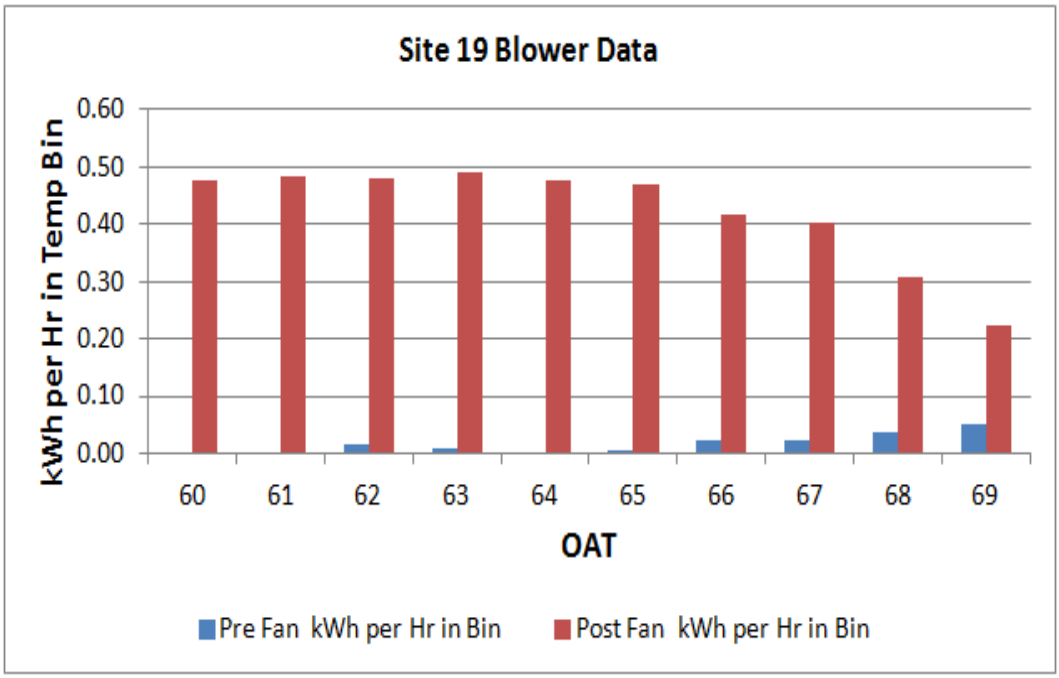


Row Labels	Sum of Pre Comp kWh	Sum of Pre Fan kWh	Sum of Time	Sum of Pre Comp kWh per Hr in Bin	Sum of Pre Fan kWh per Hr in Bin
60	0	0.03425	4.5	0.000	0.008
61	0	0.03925	5.25	0.000	0.007
62	0.5315	0.1405	6.75	0.079	0.021
63	1.26175	0.274	8.75	0.144	0.031
64	1.2975	0.2745	8.25	0.157	0.033
65	0.0925	0.0715	7.75	0.012	0.009
66	1.11975	0.22525	6.25	0.179	0.036
67	0	0.047	6.5	0.000	0.007
68	0	0.04675	6.5	0.000	0.007
69	2.454	0.437	7	0.351	0.062
Grand Total	**6.757**	**1.59**	**67.5**	**0.100**	**0.024**

Row Labels	Sum of Post Comp kWh	Sum of Post Fan kWh	Sum of Time	Sum of Post Comp kWh per Hr in Bin	Sum of Post Fan kWh per Hr in Bin
60	0	8.04875	44	0.000	0.183
61	5.334	8.4285	41.5	0.129	0.203
62	4.2655	9.8645	47.5	0.090	0.208
63	1.3815	11.754	53	0.026	0.222
64	2.4365	15.294	60	0.041	0.255
65	0	16.72725	60	0.000	0.279
66	0.77975	18.5825	63	0.012	0.295
67	3.9405	20.3625	65.5	0.060	0.311
68	3.43525	22.429	69.75	0.049	0.322
69	6.697	20.54825	66	0.101	0.311
Grand Total	**28.27**	**152.03925**	**570.25**	**0.050**	**0.267**

Site 19

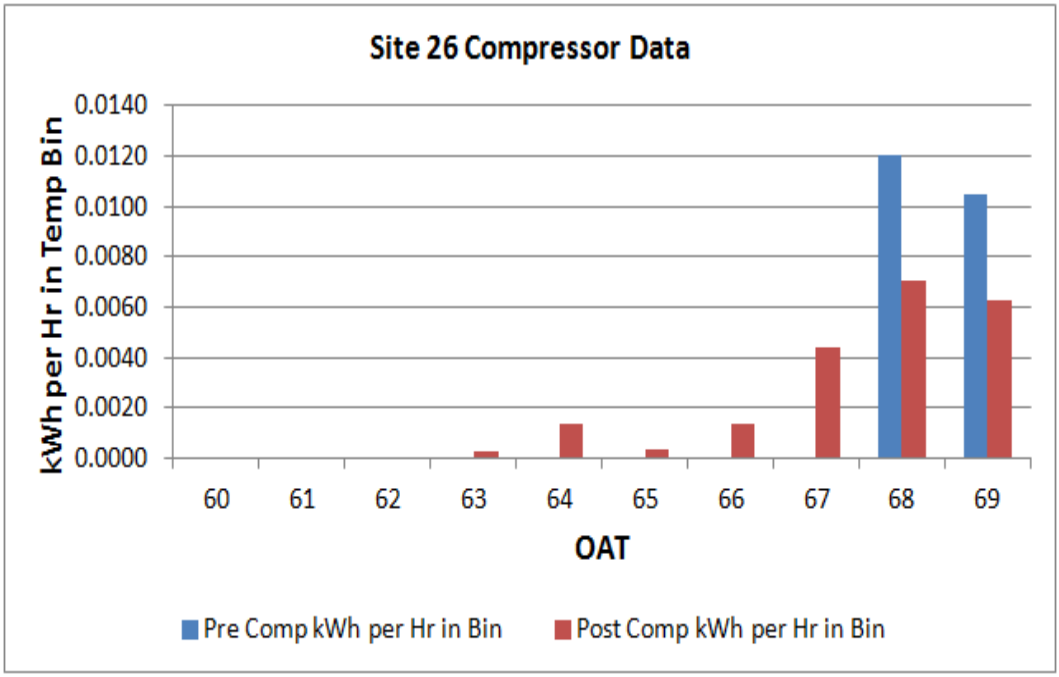

Site 19 Compressor Data
kWh per Hr in Temp Bin
0.25
0.20
0.15
0.10
0.05
0.00
60
61
62
63
64
65
66
67
68
69
OAT
Pre Comp kWh per Hr in Bin
Post Comp kWh per Hr in Bin

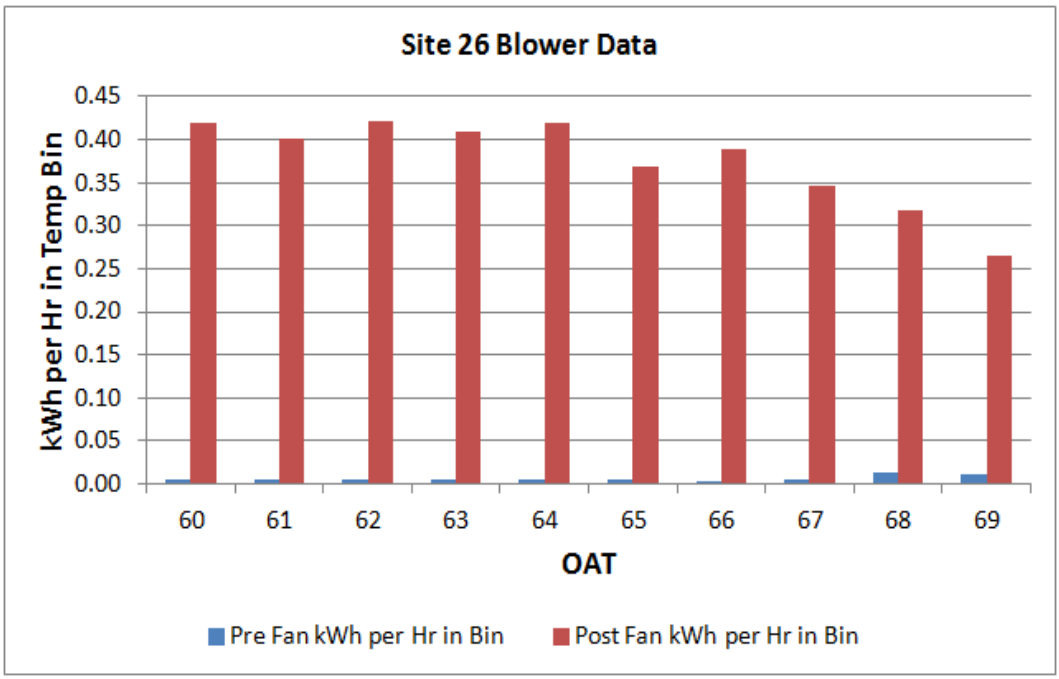

Site 19 Blower Data
kWh per Hr in Temp Bin
0.60
0.50
0.40
0.30
0.20
0.10
0.00
60
61
62
63
64
65
66
67
68
69
OAT
Pre Fan kWh per Hr in Bin
Post Fan kWh per Hr in Bin

Row Labels	Sum of Comp kWh	Sum of Fan kWh	Sum of Hours	Sum of Pre Comp kWh per Hr in Bin	Sum of Pre Fan kWh per Hr in Bin
60	0	0.001	19.5	0.00	0.00
61	0	0.001	17.75	0.00	0.00
62	1.4865	0.37825	22	0.07	0.02
63	0.8185	0.2005	22.5	0.04	0.01
64	0	0.0015	22.5	0.00	0.00
65	0.22825	0.067	18.5	0.01	0.00
66	2.2715	0.54125	22.75	0.10	0.02
67	2.097	0.50825	20.75	0.10	0.02
68	3.371	0.82	21.25	0.16	0.04
69	4.40425	1.046	21	0.21	0.05
Grand Total	**14.677**	**3.56475**	**208.5**	**0.07**	**0.02**

Row Labels	Sum of Comp kWh	Sum of Fan kWh	Sum of Hours	Sum of Post Comp kWh per Hr in Bin	Sum of Post Fan kWh per Hr in Bin
60	0	19.06075	40	0.00	0.48
61	0	17.71525	36.75	0.00	0.48
62	0	17.33475	36	0.00	0.48
63	0	16.358	33.25	0.00	0.49
64	0	16.13375	33.75	0.00	0.48
65	0.7995	12.48175	26.5	0.03	0.47
66	0.69225	9.3405	22.5	0.03	0.42
67	2.465	10.90675	27	0.09	0.40
68	2.59275	7.15225	23.25	0.11	0.31
69	2.10275	3.54375	13.25	0.16	0.27
Grand Total	**8.65225**	**130.0275**	**292.25**	**0.03**	**0.44**

Site 26


Site 26 Compressor Data
kWh per Hr in Temp Bin
0.0140
0.0120
0.0100
0.0080
0.0060
0.0040
0.0020
0.0000
60
61
62
63
64
65
66
67
68
69
OAT
Pre Comp kWh per Hr in Bin
Post Comp kWh per Hr in Bin


Site 26 Blower Data
kWh per Hr in Temp Bin
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
60
61
62
63
64
65
66
67
68
69
OAT
Pre Fan kWh per Hr in Bin
Post Fan kWh per Hr in Bin

Row Labels	Sum of Pre Comp kWh	Sum of Pre Fan kWh	Sum of Time	Sum of Pre Comp kWh per Hr in Bin	Sum of Pre Fan kWh per Hr in
60	0	0.11875	23.5	0.000	0.005
61	0	0.108	22	0.000	0.005
62	0	0.1115	23.25	0.000	0.005
63	0	0.128	26	0.000	0.005
64	0	0.11625	23.75	0.000	0.005
65	0	0.1255	26.5	0.000	0.005
66	0	0.104	26.25	0.000	0.004
67	0	0.08925	21.25	0.000	0.004
68	0.2345	0.249	19.5	0.012	0.013
69	0.24025	0.2615	23	0.010	0.011
Grand Total	**0.47475**	**1.41175**	**235**	**0.002**	**0.006**

Row Labels	Sum of Post Comp kWh	Sum of Post Fan kWh	Sum of Time	Sum of Post Comp kWh per Hr in Bin	Sum of Post Fan kWh per Hr in Bin
60	0	17.5705	42	0.000	0.418
61	0	16.01025	40	0.000	0.400
62	0	15.9725	38	0.000	0.420
63	0.01175	18.7895	46	0.000	0.408
64	0.0475	14.87225	35.5	0.001	0.419
65	0.012	13.2635	36	0.000	0.368
66	0.048	13.61475	35	0.001	0.389
67	0.12125	9.5975	27.75	0.004	0.346
68	0.21425	9.68775	30.5	0.007	0.318
69	0.181	7.644	28.75	0.006	0.266
Grand Total	**0.63575**	**137.0225**	**359.5**	**0.002**	**0.381**

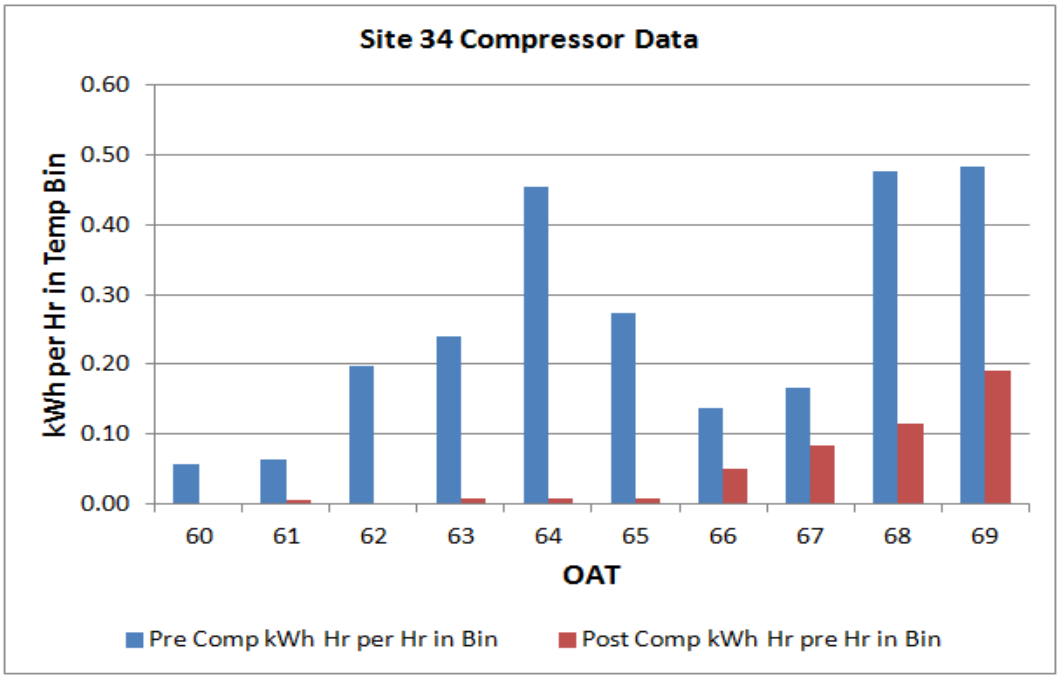
Site 28

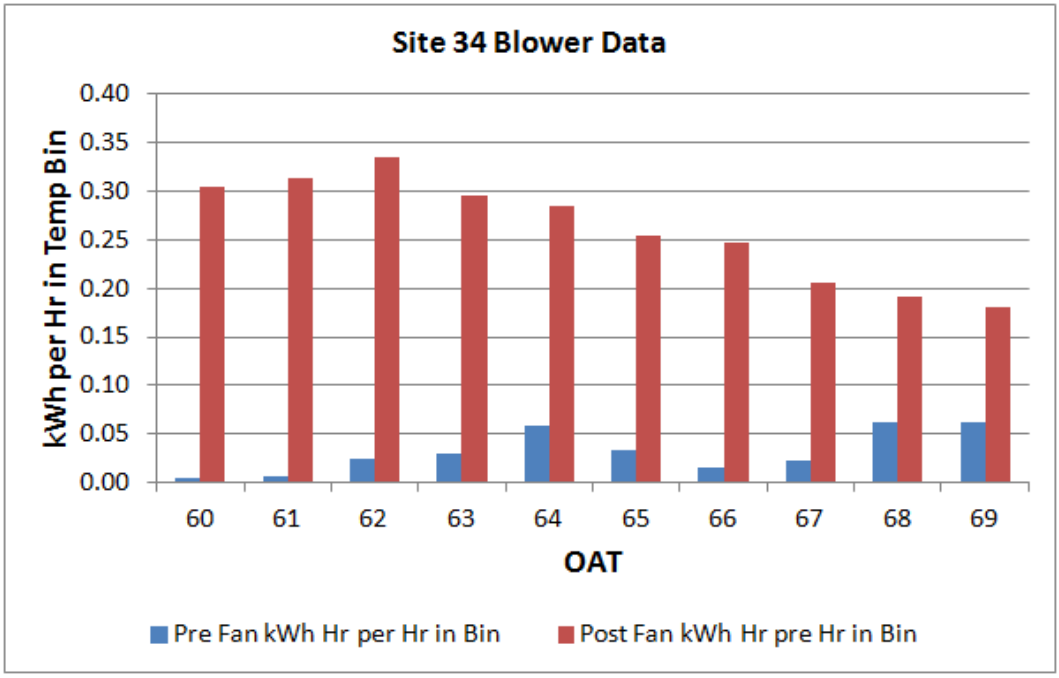
Site 28 had air conditioning equipment problems. The air conditioning system was losing refrigerant charge. The system was charged up at the beginning of the study by the contractor. The system could not hold charge during the study, which affected compressor run times. No meaningful data were collected from this site.

Site 30

Site 30 had no pre data for compressor run times. It appears that the homeowner was using window cooling during the study period.

Site 34

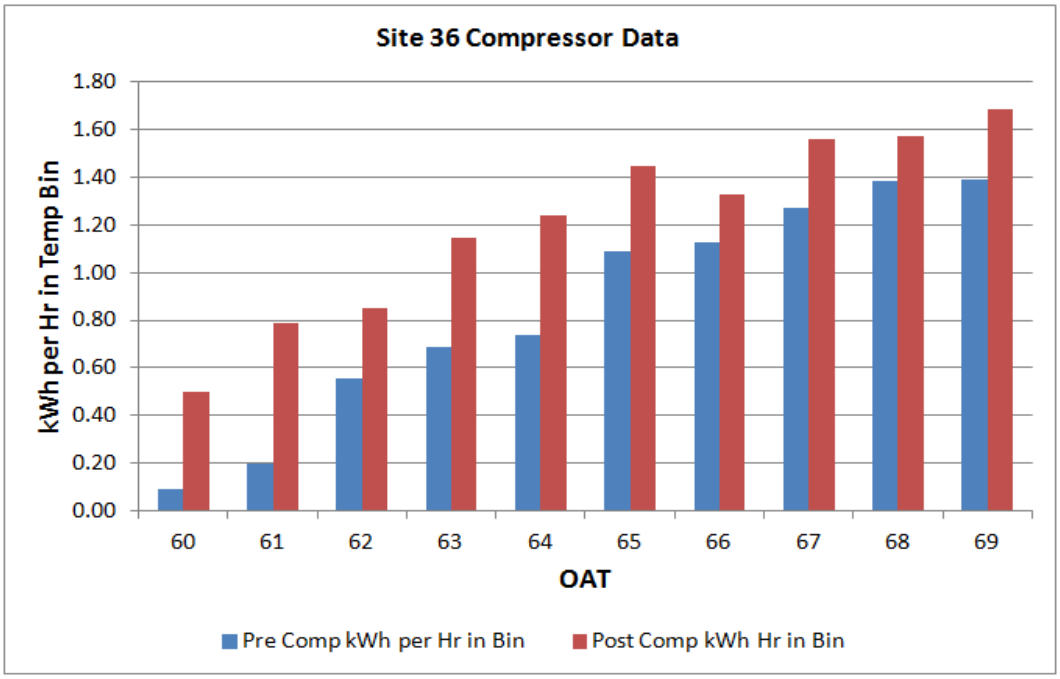

Site 34 Compressor Data
kWh per Hr in Temp Bin
0.60
0.50
0.40
0.30
0.20
0.10
0.00
60
61
62
63
64
65
66
67
68
69
OAT
Pre Comp kWh Hr per Hr in Bin
Post Comp kWh Hr pre Hr in Bin

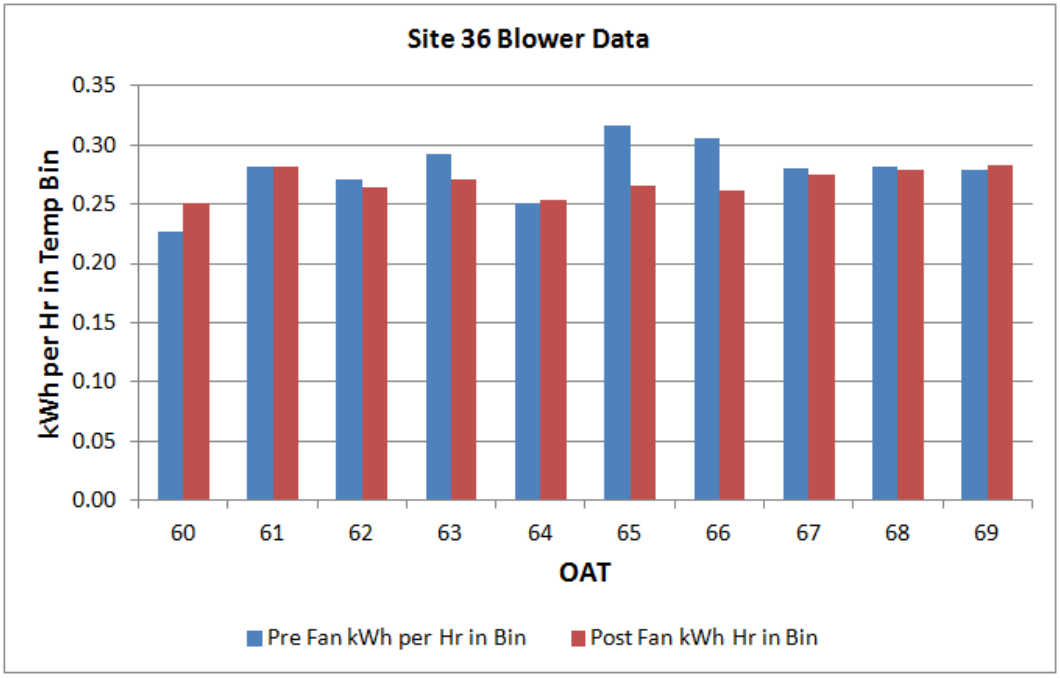

Site 34 Blower Data
kWh per Hr in Temp Bin
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
60
61
62
63
64
65
66
67
68
69
OAT
Pre Fan kWh Hr per Hr in Bin
Post Fan kWh Hr pre Hr in Bin

Row Labels	Sum of Pre Comp kWh	Sum of Pre Fan kWh	Sum of Time	Sum of Pre Comp kWh per Hr in Bin	Sum of Pre Fan kWh per Hr in Bin
60	1.19225	0.10675	21.25	0.056	0.005
61	1.31775	0.137	20.5	0.064	0.007
62	3.75125	0.46925	19	0.197	0.025
63	5.484	0.68675	22.75	0.241	0.030
64	7.4915	0.9775	16.5	0.454	0.059
65	4.303	0.536	15.75	0.273	0.034
66	2.1215	0.24325	15.5	0.137	0.016
67	2.94125	0.38975	17.75	0.166	0.022
68	9.7585	1.2545	20.5	0.476	0.061
69	11.2465	1.42525	23.25	0.484	0.061
Grand Total	**49.6075**	**6.226**	**192.75**	**0.257**	**0.032**

Row Labels	Sum of Post Comp kWh	Sum of Post Fan kWh	Sum of Time	Sum of Post Comp kWh per Hr in Bin	Sum of Post Fan kWh per Hr in
60	0.04775	12.364	40.5	0.001	0.305
61	0.20975	13.30975	42.5	0.005	0.313
62	0.07225	14.6715	43.75	0.002	0.335
63	0.362	13.80525	46.75	0.008	0.295
64	0.3755	14.267	50.25	0.007	0.284
65	0.38575	12.6585	49.75	0.008	0.254
66	2.16625	10.778	43.5	0.050	0.248
67	3.483	8.601	41.75	0.083	0.206
68	4.82125	8.0125	41.75	0.115	0.192
69	6.756	6.377	35.25	0.192	0.181
Grand Total	**18.6795**	**114.8445**	**435.75**	**0.043**	**0.264**

Site 36


Site 36 Compressor Data
kWh per Hr in Temp Bin
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
60
61
62
63
64
65
66
67
68
69
OAT
Pre Comp kWh per Hr in Bin
Post Comp kWh Hr in Bin

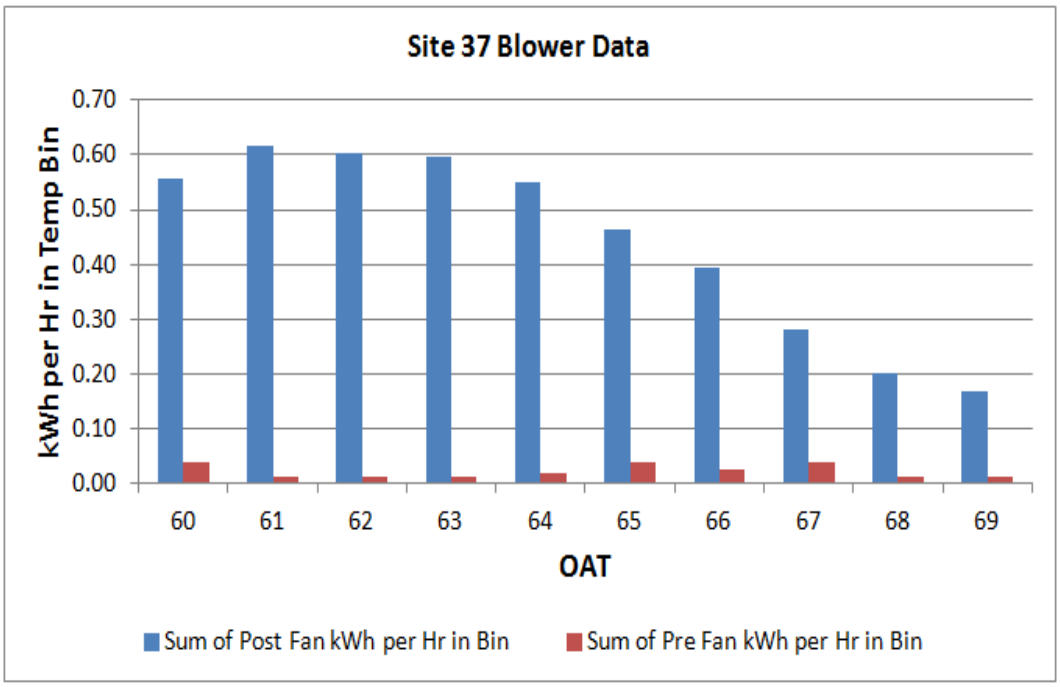

Site 36 Blower Data
kWh per Hr in Temp Bin
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
60
61
62
63
64
65
66
67
68
69
OAT
Pre Fan kWh per Hr in Bin
Post Fan kWh Hr in Bin

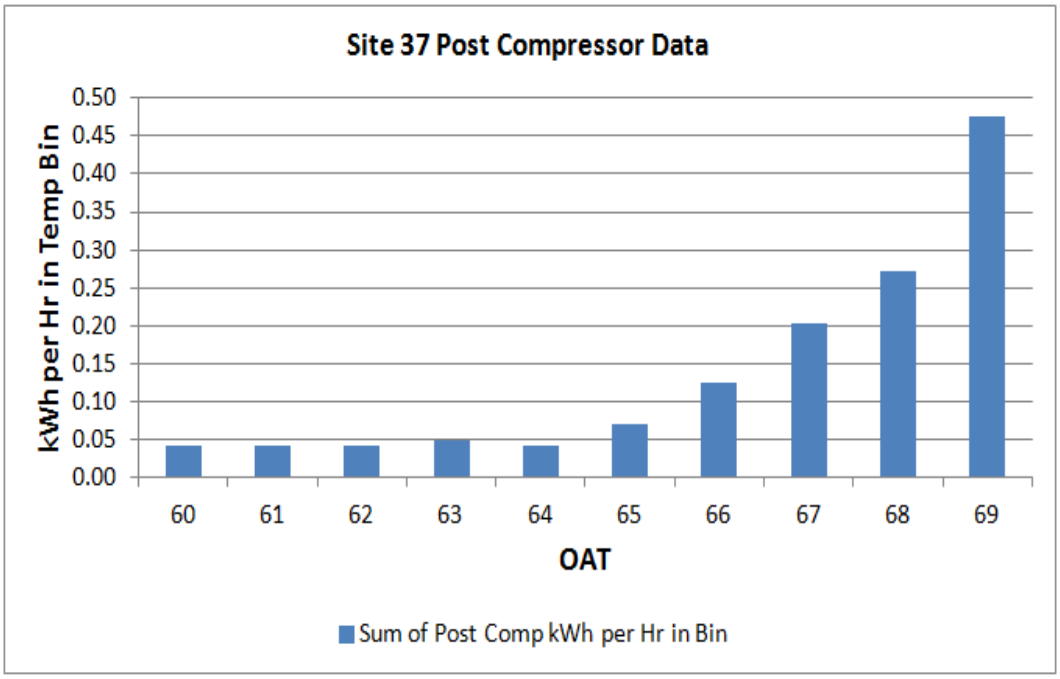
Row Labels	Sum of Pre Comp kWh	Sum of Pre Fan kWh	Sum of Time	Sum of Pre Comp kWh per hr in Bin	Sum of Pre Fan kWh per hr in Bin
60	1.73675	4.427	19.5	0.089	0.227
61	3.87975	5.5645	19.75	0.196	0.282
62	10.393	5.085	18.75	0.554	0.271
63	13.743	5.85375	20	0.687	0.293
64	15.311	5.21575	20.75	0.738	0.251
65	19.3455	5.6175	17.75	1.090	0.316
66	22.035	5.9725	19.5	1.130	0.306
67	19.05175	4.1985	15	1.270	0.280
68	24.572	4.992	17.75	1.384	0.281
69	24.04575	4.823	17.25	1.394	0.280
Grand Total	**154.1135**	**51.7495**	**186**	**0.829**	**0.278**

Row Labels	Sum of Post Comp kWh	Sum of Post Fan kWh	Sum of Time	Sum of Post Comp kWh per Hr in Bin	Sum of Post Fan kWh per Hr in Bin
60	22.90275	11.516	46	0.498	0.250
61	37.34375	13.2925	47.25	0.790	0.281
62	47.60575	14.72	55.75	0.854	0.264
63	62.49325	14.731	54.5	1.147	0.270
64	57.3045	11.721	46.25	1.239	0.253
65	68.14675	12.4605	47	1.450	0.265
66	65.4555	12.8815	49.25	1.329	0.262
67	61.537	10.88125	39.5	1.558	0.275
68	79.47925	14.06025	50.5	1.574	0.278
69	86.72325	14.56125	51.5	1.684	0.283
Grand Total	**588.99175**	**130.82525**	**487.5**	**1.208**	**0.268**

Site 37

At Site 37, during the pre period no compressor run time was shown in the data. This was due to a combination of factors: mild temperatures, late equipment install, and possible window cooling by the homeowner. Although no pre data exists, the post data show low compressor usage starting to ramp up at 66° F, and similar fan energy issues as seen with other sites.





Site 38

Site 38 had compatibility problems with the economizer equipment and the blower motor in the furnace unit. This problem was not corrected until late in the cooling season and no data were recorded.

Site 40

Site 40 had installation issues, which were not resolved prior to the end of the cooling season. Therefore, it was not possible to compare pre/post data. The installation issues revolved around an undersized intake louver and a non-representative location for the indoor controller. For this site, the homeowner requested that the contractors utilize an existing intake louver. After the installation, it was determined that the louver was undersized. Contractors were not able to return to the home to modify the system.

3.2 Model 2 Site Data

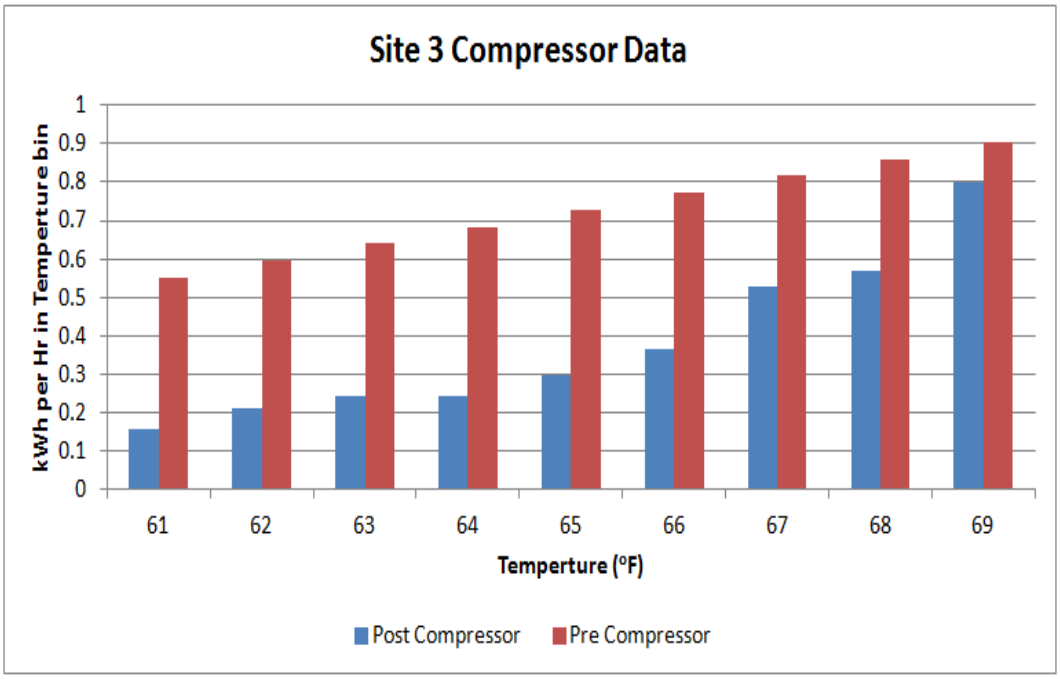
Site 1

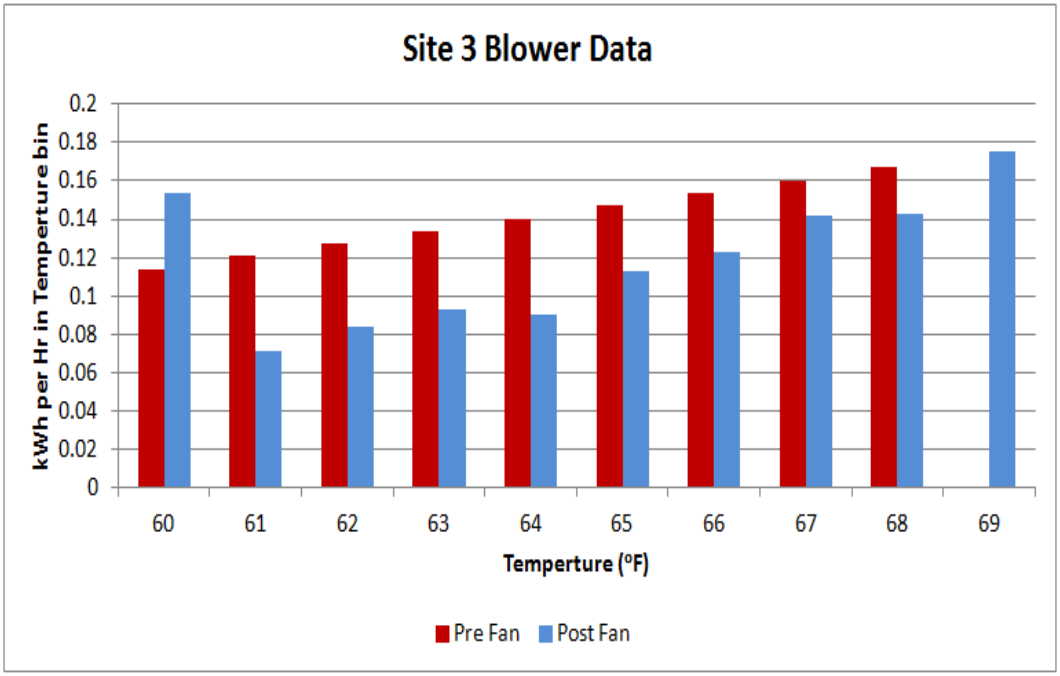
Due to data logger problems, the pre data for this site was lost. No pre/post comparison was possible for this site.

Site 2

This site had no available pre compressor run time hours. It appears that the homeowner used window cooling during the study period.

Site 3

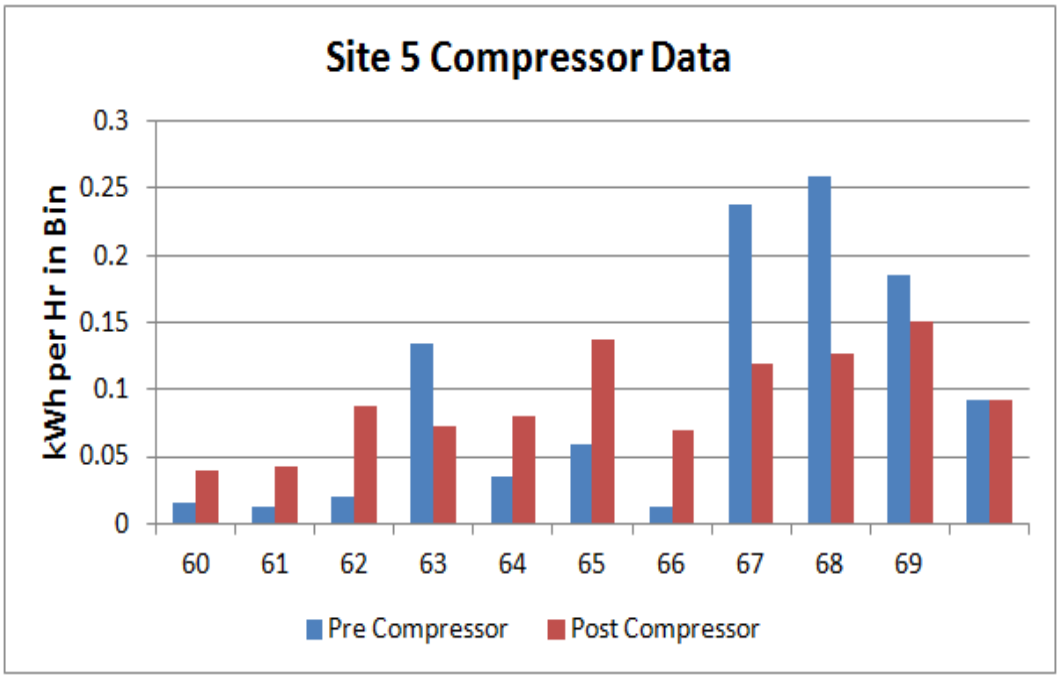


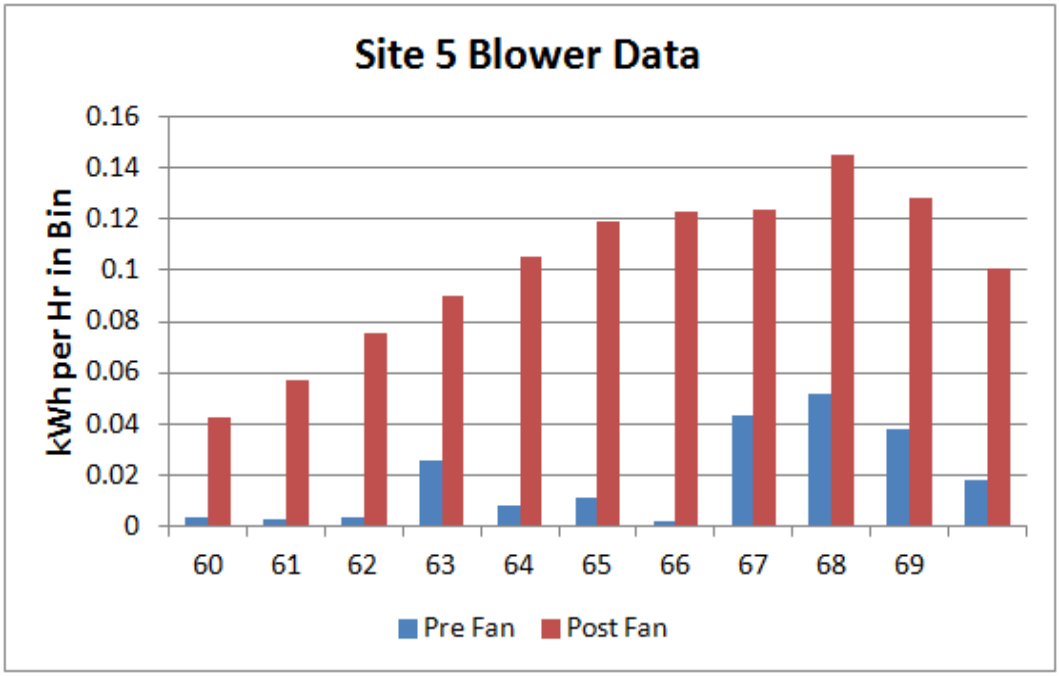


Site 4

Site 4 had the control tubing for the dampers hooked to the fresh air port of the control box and not the economizer port. This was not noticed until after the cooling season ended. These data were not used in the study.

Site 5

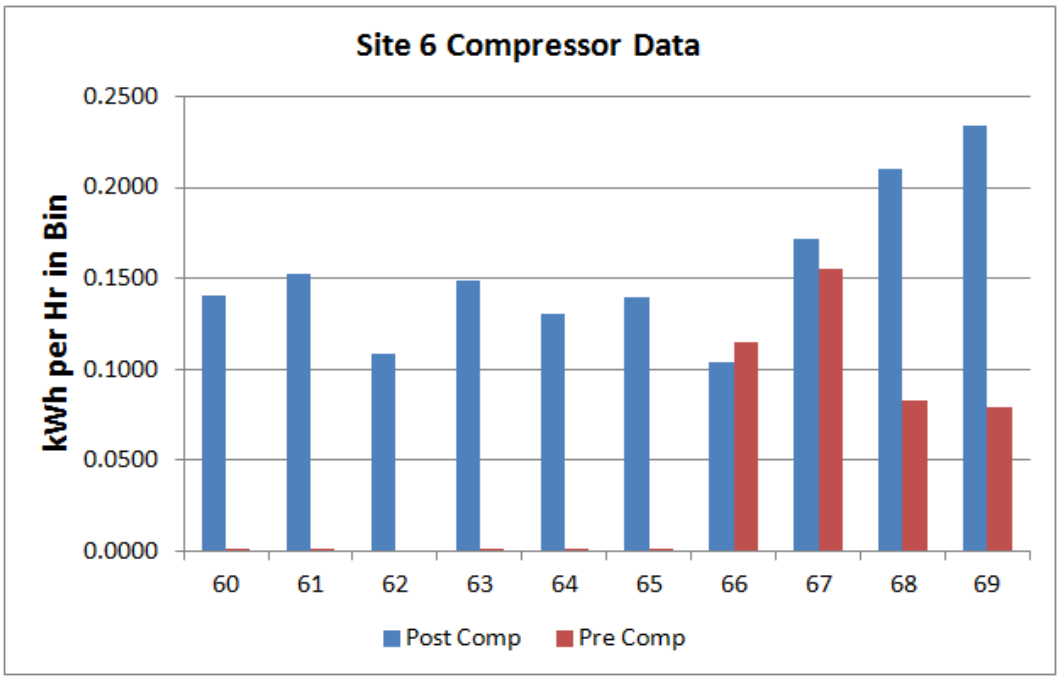


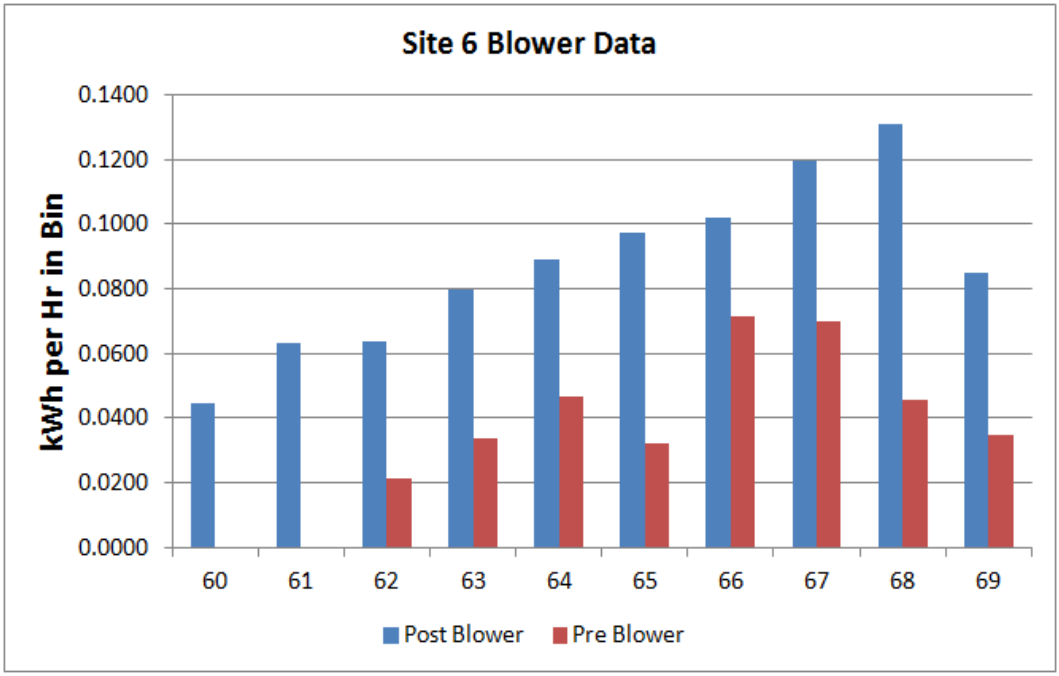


Row Labels	Sum of Post Comp kWh	Sum of Post Fan kWh	Sum of Time	Sum of Post Comp kWh per Hr in Bin	Sum of PostFan kWh per Hr in Bin
60	2.512	2.68075	63.5	0.0396	0.0422
61	2.12675	2.86475	50.5	0.0421	0.0567
62	4.3135	3.727	49.25	0.0876	0.0757
63	3.53325	4.42625	49	0.0721	0.0903
64	4.476	5.84	55.5	0.0806	0.1052
65	7.75325	6.68525	56.25	0.1378	0.1188
66	3.95425	7.00375	57	0.0694	0.1229
67	7.453	7.735	62.5	0.1192	0.1238
68	6.1205	7.029	48.5	0.1262	0.1449
69	7.805	6.6905	52	0.1501	0.1287
Grand Total	**50.0475**	**54.68225**	**544**	**0.0920**	**0.1005**

Row Labels	Sum of Comp kW	Sum of Fan Avg.	Sum of Fan kWh	Sum of Comp kWh	Sum of Time	Baseline Comp kWh per Hr in bin	BaselineFan kWh per Hr in bin
60	0.643	0.155	0.03875	0.16075	10.75	0.0150	0.0036
61	0.492	0.09	0.0225	0.123	9.75	0.0126	0.0023
62	0.828	0.149	0.03725	0.207	10.5	0.0197	0.0035
63	4.036	0.765	0.19125	1.009	7.5	0.1345	0.0255
64	1.597	0.366	0.0915	0.39925	11.5	0.0347	0.0080
65	2.761	0.517	0.12925	0.69025	11.75	0.0587	0.0110
66	0.461	0.063	0.01575	0.11525	9.75	0.0118	0.0016
67	9.495	1.734	0.4335	2.37375	10	0.2374	0.0434
68	9.828	1.959	0.48975	2.457	9.5	0.2586	0.0516
69	7.047	1.437	0.35925	1.76175	9.5	0.1854	0.0378
Grand Total	37.188	7.235	1.80875	9.297	100.5	0.0925	0.0180

Site 6

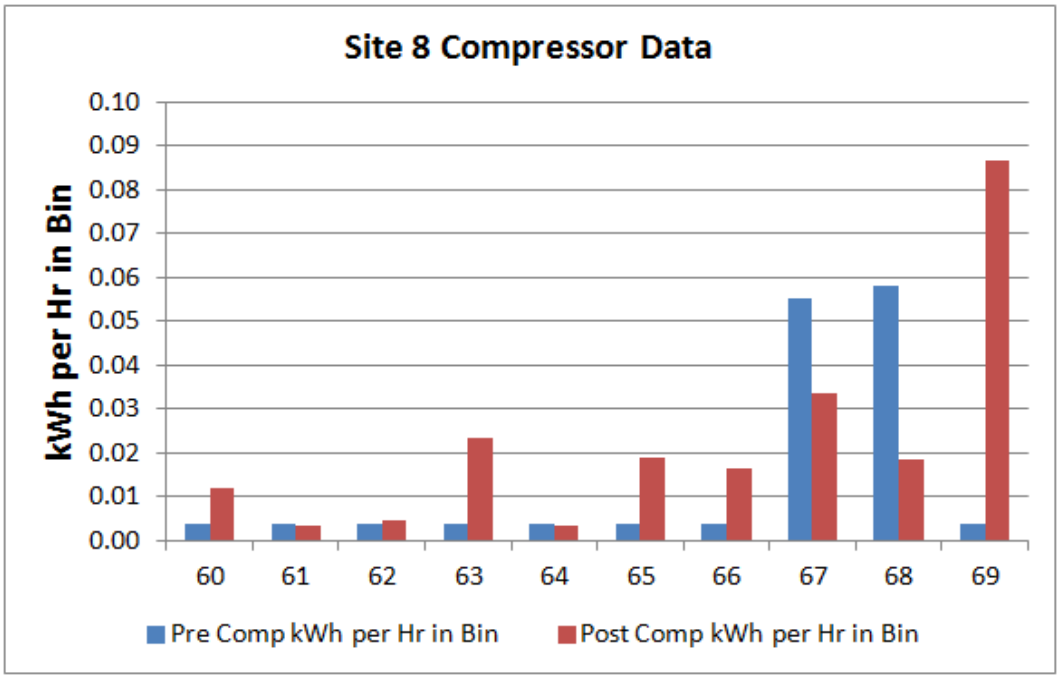


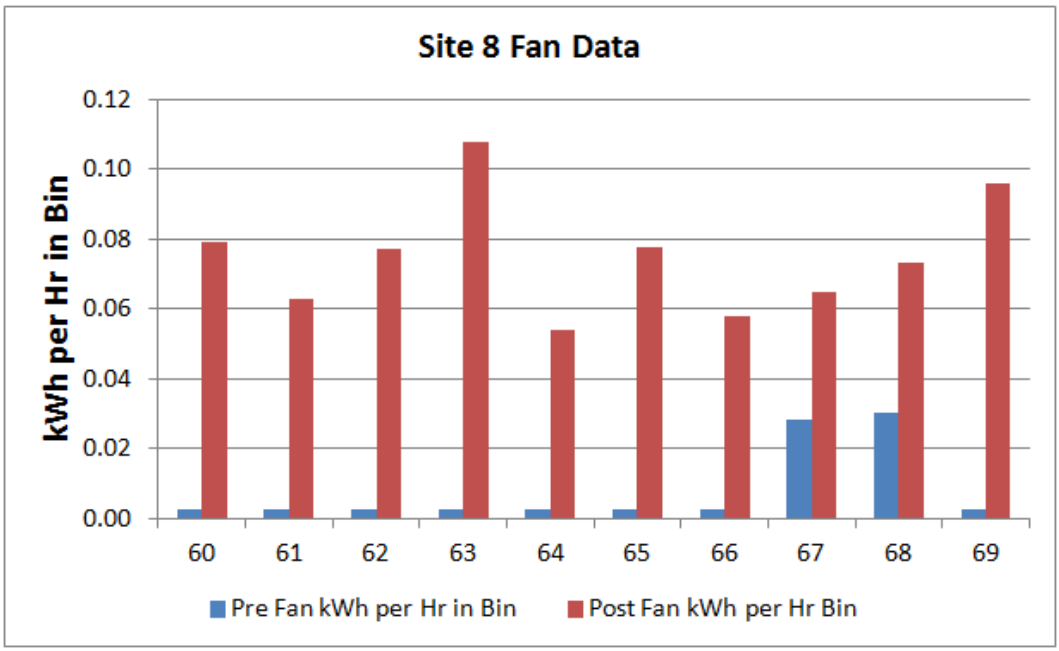


Row Labels	Sum of Post Comp kWh	Sum of Post Fan kWh	Sum of Hours	Sum of Post Comp kWh per Hr in Bin	Sum of Post Fan kWh per Hr in Bin
60	6.93975	2.20225	49.25	0.1409	0.0447
61	8.19725	3.40725	53.75	0.1525	0.0634
62	6.8305	4.0235	63	0.1084	0.0639
63	7.45775	3.978	50	0.1492	0.0796
64	6.6145	4.5255	50.75	0.1303	0.0892
65	6.465	4.5085	46.25	0.1398	0.0975
66	4.9135	4.8475	47.5	0.1034	0.1021
67	7.7325	5.3865	45	0.1718	0.1197
68	8.704	5.44425	41.5	0.2097	0.1312
69	13.33075	4.85025	57	0.2339	0.0851
Grand To	**77.1855**	**43.1735**	**504**	**0.1531**	**0.0857**

Row Labels	Sum of Post Comp kWh	Sum of Post Fan kWh	Sum of Hours	Sum of Post Comp kWh per Hr in Bin	Sum of Post Fan kWh per Hr in Bin
60	6.93975	2.20225	49.25	0.1409	0.0447
61	8.19725	3.40725	53.75	0.1525	0.0634
62	6.8305	4.0235	63	0.1084	0.0639
63	7.45775	3.978	50	0.1492	0.0796
64	6.6145	4.5255	50.75	0.1303	0.0892
65	6.465	4.5085	46.25	0.1398	0.0975
66	4.9135	4.8475	47.5	0.1034	0.1021
67	7.7325	5.3865	45	0.1718	0.1197
68	8.704	5.44425	41.5	0.2097	0.1312
69	13.33075	4.85025	57	0.2339	0.0851
Grand To	**77.1855**	**43.1735**	**504**	**0.1531**	**0.0857**

Site 8





Row Labels	Sum of Post Comp kWh	Sum of Post Fan kWh	Sum of Time	Sum of Post Comp kWh per Hr in Bin	Sum of Post Fan kWh per Hr in Bin
60	0.641802	4.1665736	52.75	0.0122	0.0790
61	0.156646	2.7930588	44.5	0.0035	0.0628
62	0.2594872	4.3047032	55.75	0.0047	0.0772
63	1.2057388	5.5936776	51.75	0.0233	0.1081
64	0.202216	3.0555196	56.75	0.0036	0.0538
65	1.0169068	4.1868092	53.75	0.0189	0.0779
66	0.9506784	3.3466412	57.75	0.0165	0.0580
67	1.6083256	3.098508	47.75	0.0337	0.0649
68	0.8859648	3.507056	47.75	0.0186	0.0734
69	4.3355872	4.8128416	50	0.0867	0.0963
Grand Total	**11.2633528**	**38.8653888**	**518.5**	**0.0217**	**0.0750**

Row Labels	Sum of Pre Comp kWh	Sum of Pre Fan kWh	Sum of Time	Sum of Pre Comp kWh per Hr in Bin	Sum of Pre Fan kWh per Hr in Bin
60	0.05838	0.0378	15	0.0039	0.0025
61	0.040194	0.025704	10.25	0.0039	0.0025
62	0.043134	0.030114	11.5	0.0038	0.0026
63	0.039942	0.027342	10.75	0.0037	0.0025
64	0.049728	0.032508	13	0.0038	0.0025
65	0.038514	0.025704	10.25	0.0038	0.0025
66	0.046158	0.030198	11.75	0.0039	0.0026
67	0.510636	0.26082	9.25	0.0552	0.0282
68	0.507738	0.263886	8.75	0.0580	0.0302
69	0.03906	0.02667	10	0.0039	0.0027
Grand Total	**1.373484**	**0.760746**	**110.5**	**0.0124**	**0.0069**

Site 11

Site 11 had data logger problems and data were lost.

Site 13

Site 13 had a vacuum pump malfunction at an unknown date. No data were used from this site.

4 References

Gusdorf, John., Swinton, Mike., Entchev, Evgueniy., Simpson, Craig., Castellan, Bill. (2002). The Impact of ECM Furnace Motors on Natural Gas Use and Overall Energy Use Durring the Heating Season at CCHT Research Facility. NRCC-38443, Canadian Center for Housing Technology.

International Performance Measurement and Verification Protocol (2010), Volume 1-Concepts and Options for Determining Energy and Water Savings. Efficiency Valuation Organization, Washington, D.C. www.evo-world.org

5 Appendix

5.1 Appendix A- Solicitation Letter

<<Date>>

«AddressBlock»

RE: New summer cooling program from Idaho Power

«GreetingLine»

You have been randomly selected to receive an opportunity to apply for a research project conducted by Idaho Power in the Treasure Valley. If you own a home with central air conditioning, you could reduce your energy use while keeping your home cool this summer. Fifty participants will be selected from those expressing interest.

If you're one of the 50 participants chosen, you will receive:

- An $1,100 economizer system for $250
- Potential:
  - Reduction in summer cooling costs
  - Increased home comfort
  - Better air quality

The Residential Economizer Pilot Project involves fitting 50 houses with a residential economizer that draws cool outside nighttime air into your home with the goal of reducing summer cooling costs. The objective of the pilot is to evaluate the energy savings and comfort provided by these economizers.

Installation will be performed by a local heating and cooling contractor. Selected participants will pay $250 to the contractor prior to the installation; the value of the work is estimated at up to $1,100, and the economizer will remain the property of the homeowner after the pilot is complete.

You might qualify to participate if you:

- Are the homeowner and plan to be home this June and July
- Have a ducted air conditioning system without a heat pump for heating
- Have a single-level home from 1,400–1,800 sq. ft. or two-story between 1,800–2,500 sq. ft.
- Allow window air conditioners and whole-house fans to remain off with windows closed during the evening/early morning hours

- Allow the installation of additional HVAC equipment, such as a wall-mounted control, external wall or roof vent, flex duct and dampers to your existing system
- Allow Idaho Power and a third party to analyze energy-usage data and data collected
- Other requirements may apply

How to participate:

E-mail your name, address, and a daytime phone number to **economizer@idahopower.com** within 5 days of receiving this letter. Fifty homeowners will be contacted from among all e-mail respondents to verify eligibility and interest in participating. These 50 will be asked to sign and return the enclosed agreement. You will have the opportunity to decline this offer at that time if you wish. Neither this letter nor your e-mail response is a guarantee of your participation, nor is your e-mail a commitment to participate. If you are chosen to participate, the enclosed agreement must be completed and returned per the instructions.

If you have further questions about this offer, please give me a call or send an e-mail to the address above. We look forward to hearing from you.

Sincerely,

Todd Greenwell
Program Specialist
Idaho Power Company
1221 W. Idaho St.
Boise, ID 83702
Ph: 208-388-6484

P.S. This offer is limited to 50 homes in the Treasure Valley. If you're interested, respond today to **economizer@idahopower.com**

Frequently Asked Questions

1. What is an economizer?

An economizer is a device made up of a control box, dampers and an outside vent. These components are installed into an existing forced-air cooling system along with a vent placed on the roof. A flexible duct connects the vent to the existing ductwork of the house. When your thermostat calls for cooling, the vent will open, the existing air handler will come on, and air will be drawn in from the outside. This air is circulated throughout the house using your existing air handler. At the same time, the air conditioner compressor will remain off. Keeping the compressor off is where the energy savings come from. The vent opens only when the outside air temperature drops to a set level, 68 degrees for example. If

it was not at that level at that moment, the vent would not open, and the air conditioner would come on instead to cool the house.

2. Why is Idaho Power doing this project?

The Idaho Power service area enjoys cool air in the summer generally between 10 p.m. and 10 a.m. Cool air drawn into the house can take the place of running the air conditioner in the evening, overnight and early morning hours. The project goal is to determine how much energy can be saved by cooling a house with a residential economizer.

3. What is the time frame?

Installations will be performed May and June. The operating period is from July through the end of September.

4. Can I confirm my enrollment now?

No. Residents who confirm interest via e-mail as described in this letter will be contacted on a random basis until 50 houses are selected.

5. What will it cost?

Selected participants will pay $250 to the contractor prior to the installation; the value of the work is estimated at up to $1,100, and the economizer will remain the property of the homeowner after the pilot is complete.

6. What information will be shared with the installing contractor?

Only information necessary to establish appointments for installation, follow-up calls, and data equipment removal will be provided.

7. How will I identify the installing contractor?

The contractor will possess identification to confirm he or she is a contractor representing Idaho Power. You will be contacted prior to the appointment so we may provide an introduction as to who will be present at your house.

8. What type of data will be collected during the project?

The types of data that will be collected include house temperature, compressor run times, and energy consumption of the compressor.

EVALUATIONS

Table 3. 2011 Evaluations

Report Title	Program or Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
A/C Cool Credit Program	Residential	PECI	Idaho Power	Impact
Energy House Calls Program	Residential	ADM Associates, Inc.	Idaho Power	Impact
Rebate Advantage Program	Residential	ADM Associates, Inc.	Idaho Power	Impact
Home Products Program	Residential	ADM Associates, Inc.	Idaho Power	Impact
Home Improvement Program	Residential	ADM Associates, Inc.	Idaho Power	Impact
Custom Efficiency Program	Commercial/Industrial	ADM Associates, Inc.	Idaho Power	Impact
Irrigation Peak Rewards Program	Irrigation	PECI	Idaho Power	Process
Irrigation Peak Rewards Program	Irrigation	Idaho Power	Idaho Power	Impact
Flex Peak Management	Commercial/Industrial	Idaho Power	Idaho Power	Impact
See ya later, refrigerator®	Residential	ADM Associates, Inc.	Idaho Power	Process

This page left blank intentionally.

A/C Cool Credit Program

Impact Evaluation

Idaho Power Company | February 2012

Demand Response

peci

Page intentionally left blank

Table of Contents

List of Tables 4
List of Figures 6
Executive Summary....8
Methodology....8
Participant Sample....8
Results 9
Conclusions....9
Key Findings....9
Recommendations 11
Introduction 13
Program Background 13
Methodology.... 13
kW Measurements 13
Adjusting Compressor kW for Outside Air Temperature 13
Baseline Data 14
Offset Factor.... 14
Outdoor Temperature Data 14
Indoor Air Temperature Measurements 14
Evaluation Participants 15
Sample Stratification 15
Participant Recruitment 16
Load Control Technology 16
Quality Control Analysis 18
Analysis Results 22
Curtailment Events.... 22
Demand Reduction Analysis Results.... 22
Boise Metro Results 22
Pocatello and Twin Falls Results 31
Mountain Home Air Force Base Results 37
Aggregate Results.... 42
Indoor Temperature Analysis Results.... 47
Conclusions 50
Key Findings.... 50
Key Findings.... 50
Recommendations .... **Error! Bookmark not defined.**
Appendix.... 54
Boise Demand Results – Individual Events 54
Pocatello/Twin Falls Demand Results – Individual Events 63

MHAFB Demand Results – Individual Events 70
Boise Indoor Air Temperature Analysis Results – Individual Events 78

List of Tables

Table 1 Sample Stratification 9
Table 2: Results Summary 9
Table 3: Sample Stratification 15
Table 4: Summary of Load Control Device Types by Population 18
Table 5: Summary Statistics for Civilian Sample 19
Table 6: Detailed Test Signal Data for Civilian Sample 20
Table 7: Summary Statistics for MHAFB Sample 21
Table 8: Detailed Test Signal Data for MHAFB Sample 21
Table 9: Curtailment Event Schedule 22
Table 10: Boise Participant Sample 23
Table 11: Boise Load Control Device Types 23
Table 12. Boise Demand Results - per Unit 25
Table 13: Comparison of Total kW Just Before the Curtailment Event 26
Table 14. Boise July 31st Curtailment Event Results 27
Table 15. July 5th Boise Run-time Analysis – 50% Cycling Target 28
Table 16. July 11th Boise Run-time Analysis – 50% Cycling Target 28
Table 17. Boise Non-Contributing Participant Analysis 29
Table 18: Natural Duty Cycle of Boise A/C Units 29
Table 19. Boise Snapback and Net Energy Impact Results 31
Table 20. Pocatello/Twin Falls Participant Sample 31
Table 21. Pocatello/Twin Falls Load Control Device Types 32
Table 22. Pocatello/Twin Falls Demand Results - per Unit 34
Table 23. July 5th Pocatello/Twin Falls Run-time Analysis – 60% Cycling Target 34
Table 24. July 11th Pocatello/Twin Falls Run-time Analysis – 60% Cycling Target 35
Table 25. Pocatello/Twin Falls Non-contributing Participant Analysis 35
Table 26. Natural Duty Cycle for Pocatello Units 36
Table 27. MHAFB load Control Device Types 37
Table 28. MHAFB Demand Results - per Unit 39
Table 29. MHAFB July 31st Curtailment Event Results 40
Table 30. July 5th MHAFB Run-time Analysis – 50% Cycling Target 40
Table 31. MHAFB Non-contributing Participant Analysis 41
Table 32. MHAFB Snapback and Net Energy Impact Results 42
Table 33. Program Population by Region 42
Table 34. Boise Demand Results - Total Program Population 43
Table 35. Pocatello/Twin Falls Demand Results - Total Program Population 43
Table 36. MHAFB Demand Results - Total Program Population 44
Table 37. All Regions Demand Savings - per Unit 44
Table 38. Overall Program Demand Reduction Results 45
Table 39. Boise Snapback and Net Energy Impact Results - Total Program Population 46
Table 40. MHAFB Snapback and Net Energy Impact Results - Total Program Population 47
Table 41. Boise IAT Analysis Results 48
Table 42: IAT Analysis Comparison 49
Table 43. MHAFB IAT Analysis Results 49
Table 44. Boise July 5th Curtailment Event Results 54
Table 45. Boise July 6th Curtailment Event Results 55
Table 46. Boise July 11th Curtailment Event Results 55
Table 47. Boise July 12th Curtailment Event Results 56
Table 48. Boise July 18th Curtailment Event Results 56
Table 49. Boise July 25th Curtailment Event Results 57
Table 50. Boise July 29th Curtailment Event Results 57
Table 51. Boise July 31st Curtailment Event Results 58
Table 52. Boise August 10th Curtailment Event Results 59
Table 53. Boise August 17th Curtailment Event Results 59
Table 54. Boise August 18th Curtailment Event Results 60

Table 55. Boise August 22nd Curtailment Event Results 60
Table 56. Boise August 24th Curtailment Event Results 61
Table 57. Boise August 26th Curtailment Event Results 61
Table 58. Pocatello/Twin Falls July 5th Curtailment Event Results 63
Table 59. Pocatello/Twin Falls July 6th Curtailment Event Results 63
Table 60. Pocatello/Twin Falls July 11th Curtailment Event Results 64
Table 61. Pocatello/Twin Falls July 12th Curtailment Event Results 64
Table 62. Pocatello/Twin Falls July 18th Curtailment Event Results 65
Table 63. Pocatello/Twin Falls July 25th Curtailment Event Results 65
Table 64. Pocatello/Twin Falls July 29th Curtailment Event Results 66
Table 65. Pocatello/Twin Falls August 10th Curtailment Event Results 66
Table 66. Pocatello/Twin Falls August 17th Curtailment Event Results 67
Table 67. Pocatello/Twin Falls August 18th Curtailment Event Results 67
Table 68. Pocatello/Twin Falls August 22nd Curtailment Event Results 68
Table 69. Pocatello/Twin Falls August 24th Curtailment Event Results 68
Table 70. Pocatello/Twin Falls August 26th Curtailment Event Results 69
Table 71. MHAFB July 5th Curtailment Event Results 70
Table 72. MHAFB July 6th Curtailment Event Results 70
Table 73. MHAFB July 11th Curtailment Event Results 71
Table 74. MHAFB July 12th Curtailment Event Results 71
Table 75. MHAFB July 18th Curtailment Event Results 72
Table 76. MHAFB July 25th Curtailment Event Results 72
Table 77. MHAFB July 29th Curtailment Event Results 73
Table 78. MHAFB July 31st Curtailment Event Results 73
Table 79. MHAFB August 10th Curtailment Event Results 74
Table 80. MHAFB August 17th Curtailment Event Results 74
Table 81. MHAFB August 18th Curtailment Event Results 75
Table 82. MHAFB August 22nd Curtailment Event Results 75
Table 83. MHAFB August 24th Curtailment Event Results 76
Table 84. MHAFB August 26th Curtailment Event Results 76
Table 85. Boise July 5th curtailment event IAT Impact Results 78
Table 86. Boise July 6th Curtailment Event IAT Impact Results 78
Table 87. Boise July 11th Curtailment Event IAT Impact Results 79
Table 88. Boise July 12th Curtailment Event IAT Impact Results 79
Table 89. Boise July 18th Curtailment Event IAT Impact Results 80
Table 90. Boise July 25th Curtailment Event IAT Impact Results 80
Table 91. Boise July 29th Curtailment Event IAT Impact Results 81
Table 92. Boise August 10th Curtailment Event IAT Impact Results 81
Table 93. Boise August 17th Curtailment Event IAT Impact Results 82
Table 94. Boise August 18th Curtailment Event IAT Impact Results 82
Table 95. Boise August 22nd Curtailment Event IAT Impact Results 83
Table 96. Boise August 24th Curtailment Event IAT Impact results 83
Table 97. Boise August 26th Curtailment Event IAT Impact Results 84

List of Figures

Figure 1. Aclara Demand Response Unit (DRU) ... 16
Figure 2. Aclara Load Control Transponder (LCT) ... 17
Figure 3. Cooper Power Systems Load Control Relay (LCR) 5000 ... 17
Figure 4. Cooper Power Systems Load Control Relay (LCR) 5200 ... 17
Figure 5: Test Signal Data for the Civilian Sample ... 19
Figure 6: Test Signal Data for MHAFB Sample ... 21
Figure 7. Boise July 5th Curtailment Event Load Impact ... 23
Figure 8. Boise August 22nd Curtailment Event Load Impact ... 24
Figure 9. Boise Demand Results – Average kW per Unit ... 25
Figure 10. Boise August 18th Curtailment Event Load Impact ... 26
Figure 11. Boise July 31st Curtailment Event Load Impact ... 27
Figure 12: Boise July 6th Curtailment Event Load Impact ... 30
Figure 13. Pocatello/Twin Falls July 5th Curtailment Event Load Impact ... 32
Figure 14. Pocatello/Twin Falls July 12th Curtailment Event Load Impact ... 33
Figure 15. Pocatello/Twin Falls Demand Results – Average kW per Unit ... 33
Figure 16. MHAFB August 10th Curtailment Event Load Impact ... 37
Figure 17. MHAFB August 22nd Curtailment Event Load Impact ... 38
Figure 18. MHAFB Demand Results – Average kW per Unit ... 38
Figure 19. MHAFB July 31st Curtailment Event Load Impact ... 39
Figure 20. Overall Program Demand Reduction per Event ... 45
Figure 21. Boise Average IAT Increase ... 48
Figure 22: MHAFB Average IAT Increase ... 49
Figure 23. Boise July 5th Curtailment Event Load Impact ... 54
Figure 24. Boise July 6th Curtailment Event Load Impact ... 55
Figure 25. Boise July 11th Curtailment Event Load Impact ... 55
Figure 26. Boise July 12th Curtailment Event Load Impact ... 56
Figure 27. Boise July 18th Curtailment Event Load Impact ... 56
Figure 28. Boise July 25th Curtailment Event Load Impact ... 57
Figure 29. Boise July 29th Curtailment Event Load Impact ... 57
Figure 30. Boise July 31st Curtailment Event Load Impact ... 58
Figure 31. Boise August 10th Curtailment Event Load Impact ... 59
Figure 32. Boise August 17th Curtailment Event Load Impact ... 59
Figure 33. Boise August 18th Curtailment Event Load Impact ... 60
Figure 34. Boise August 22nd Curtailment Event Load Impact ... 60
Figure 35. Boise August 24th Curtailment Event Load Impact ... 61
Figure 36. Boise August 26th Curtailment Event Load Impact ... 61
Figure 37. Pocatello/Twin Falls July 5th Curtailment Event Load Impact ... 63
Figure 38. Pocatello/Twin Falls July 6th Curtailment Event Load Impact ... 63
Figure 39. Pocatello/Twin Falls July 11th Curtailment Event Load Impact ... 64
Figure 40. Pocatello/Twin Falls July 12th Curtailment Event Load Impact ... 64
Figure 41. Pocatello/Twin Falls July 18th Curtailment Event Load Impact ... 65
Figure 42. Pocatello/Twin Falls July 25th Curtailment Event Load Impact ... 65
Figure 43. Pocatello/Twin Falls July 29th Curtailment Event Load Impact ... 66
Figure 44. Pocatello/Twin Falls August 10th Curtailment Event Load Impact ... 66
Figure 45. Pocatello/Twin Falls August 17th Curtailment Event Load Impact ... 67
Figure 46. Pocatello/Twin Falls August 18th Curtailment Event Load Impact ... 67
Figure 47. Pocatello/Twin Falls August 22nd Curtailment Event Load Impact ... 68
Figure 48. Pocatello/Twin Falls August 24th Curtailment Event Load Impact ... 68
Figure 49. Pocatello/Twin Falls August 26th Curtailment Event Load Impact ... 69
Figure 50. MHAFB July 5th Curtailment Event Load Impact ... 70
Figure 51. MHAFB July 6th Curtailment Event Load Impact ... 70
Figure 52. MHAFB July 11th Curtailment Event Load Impact ... 71
Figure 53. MHAFB July 12th Curtailment Event Load Impact ... 71
Figure 54. MHAFB July 18th Curtailment Event Load Impact ... 72

Figure 55. MHAFB July 25th Curtailment Event Load Impact 72
Figure 56. MHAFB July 29th Curtailment Event Load Impact 73
Figure 57. MHAFB July 31st Curtailment Event Load Impact 73
Figure 58. MHAFB August 10th Curtailment Event Load Impact 74
Figure 59. MHAFB August 17th Curtailment Event Load Impact 74
Figure 60. MHAFB August 18th Curtailment Event Load Impact 75
Figure 61. MHAFB August 22nd Curtailment Event Load Impact 75
Figure 62. MHAFB August 24th Curtailment Event Load Impact 76
Figure 63. MHAFB August 26th Curtailment Event Load Impact 76
Figure 64. Boise July 5th Curtailment Event IAT Impact 78
Figure 65. Boise July 6th Curtailment Event IAT Impact 78
Figure 66. Boise July 11th Curtailment Event IAT Impact 79
Figure 67. Boise July 12th Curtailment Event IAT Impact 79
Figure 68. Boise July 18th Curtailment Event IAT Impact 80
Figure 69. Boise July 25th Curtailment Event IAT Impact 80
Figure 70. Boise July 29th Curtailment Event IAT Impact 81
Figure 71. Boise August 10th Curtailment Event IAT Impact 81
Figure 72. Boise August 17th Curtailment Event IAT Impact 82
Figure 73. Boise August 18th Curtailment Event IAT Impact 82
Figure 74. Boise August 22nd Curtailment Event IAT Impact 83
Figure 75. Boise August 24th Curtailment Event IAT Impact 83
Figure 76. Boise August 26th Curtailment Event IAT Impact 84

Executive Summary

Summer use of air conditioning (A/C) systems places a burden on Idaho Power Company's (IPC) power supply, power contracts, and transmission and distribution departments. Demand reduction programs in which customers agree to curtail A/C use in times of demand stress have proven to successfully deliver significant and dispatchable demand (kW) savings and possibly energy (kWh) savings.

Idaho Power's A/C Cool Credit program addresses this growing residential A/C demand. The program operates from June 1st through August 31st, offering a $7 credit to the approximately 35,895 participants' IPC bills during those three months. The program's function is to curtail some HVAC demand during the peak hours by implementing load reduction strategies which limit the time each HVAC unit may operate within the specified curtailment period. A/C Cool Credit program curtailment events are limited to non-holiday weekdays and total 40 hours or less per month (with the exception of a system emergency). Idaho Power determines the desired cycling strategy to implement. For the 2011 summer curtailment season, Boise metro and Mountain Home Air Force Base (MHAFB) participants were cycled at 50 percent, while Pocatello and Twin Falls participants were cycled at 60 percent. All A/C Cool Credit curtailment events during the 2011 curtailment season began at 4:00pm and had a duration of three hours.

Methodology

The demand reduction analysis used a baseline day methodology which compared the demand during the event day to the demand of similar baseline days. In order to collect demand data, DENT Instrument's SMARTlogger™ series CTlogger™ were used to record the on/off state of the HVAC compressor in each home selected for the Measurement and Verification (M&V) sample. The loggers continually monitored the signal of a split core current transformer (CT) clamped around the electrical supply wire to the HVAC compressor unit. The compressor run-time data was converted to power demand values by applying kW values taken from instantaneous power readings during the installation of the loggers for each A/C compressor included in the study sample. The kW values were adjusted to account for the difference between the outside air (OSA) temperatures at the time of the reading compared to the OSA temperature during the events.

The load reduction achieved during load curtailments was calculated by comparing the average load from each event 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.

Participant Sample

The A/C Cool Credit population is divided between two climate zones, as well as between civilian and military sectors. The Boise metro area and Mountain Home Air Force Base (MHAFB) populations are in climate zone three (CZ3), and Twin Falls and Pocatello are in climate zone two (CZ2). Idaho Power had two cycling strategies: 50 percent for the Boise metro and MHAFB populations and 60 percent for the Pocatello and Twin Falls population. Table 1 shows the population size of each participant along with the final sample size. The aggregate sampling plan achieves 90 percent confidence level with 10 percent precision for the population at the expected Coefficient of Variation (CV) of 0.7. The sample is equally distributed between the two climate zones for the civilian population. Analysis for each civilian population independently achieves a 90 percent confidence level at 15 percent precision assuming the same CV of 0.7. This allows results to be examined independently for each of the two climate zones. The 90/15 confidence/precision levels were chosen to balance accuracy and cost of the evaluation. Analysis for the MHAFB population achieves an 80 percent confidence level at 20 percent precision assuming a CV of 0.5.

Table 1 Sample Stratification

Population	Distribution of Population	Target Sample Size	Final Sample Size	Confidence/Precision Level of Target Sample Size (CV=0.7)
Boise Metro	29,271	68	71	90/15
Pocatello/Twin Falls	5,821	68	69	90/15
MHAFB	803	11	12	80/20
Total	35,895	147	152	90/10

Results

Results were analyzed for each of the three participant samples. The average demand reduction for the Boise metro population was 0.43 kW per unit. When extrapolated to the entire Boise metro participant population an average demand reduction of 12,614 kW was achieved. There was no demand reduction achieved for the Pocatello population. The participants in the Pocatello region all have power line carrier load control devices while participants in the Boise metro and MHAFB populations have a combination of power line carrier and pager type devices. The lack of demand response in the Pocatello population is due to a software integration error associated with the dispatch system for the PLC control units installed on the participants' air conditioners. The average demand reduction for the MHAFB population was 0.39 kW per unit. When extrapolated to the entire MHAFB participant population, this results in an average demand reduction of 312 kW.

Table 2: Results Summary

Population	Avg Demand Reduction per Participant kW)	Avg Demand Reduction (kW) Total
Boise Metro	0.43	12,614
Pocatello/Twin Falls	(0.01)	(41)
MHAFB	0.39	312
Combined Total	0.36	12,885

Conclusions

The evaluation successfully measured the net impacts of Idaho Power's AC Cool Credit program during the 2011 curtailment season. It is important to note that the results presented in this report reflect the specific characteristics of the events executed during the 2011 curtailment season and do not reflect an absolute savings value that the program can achieve. Factors such as weather and the cycling strategy can have a significant impact on the achieved demand savings. The total average demand reduction for the program was 0.36 kW per unit. This result was impacted by the fact that the Pocatello and Twin Falls participants' AC units were not being curtailed during events due to a software integration error related to the signal dispatch system for the PLC load control devices. The average impact excluding the Pocatello/Twin Falls and MHAFB regions was a reduction of 0.43 kW per unit. Key findings and recommendations are described below.

Key Findings

- Idaho Power's system peak occurred on July 6th. The average demand reduction for the entire program during this event was 0.59 kW per unit. The average and maximum reductions by region for this event are listed below. Since the results from the Pocatello/Twin Falls and MHAFB were impacted by signal problems, the Boise metro result of 0.69 kW per unit is the best approximation of the achievable demand savings for all units during the July 6th peak if the signal issues were resolved.
    - Bose metro:
        - Average demand reduction was 0.69 kW per unit
        - Maximum demand savings for any five minute interval was 1.03 kW per unit

        - Maximum demand reduction for any 15 minute interval was 0.86 kW per unit
        - Maximum demand reduction for any one hour interval was 0.77 kW per unit
    - MHAFB
        - Average demand savings of 0.55 kW per unit
        - Maximum demand savings for any five minute interval was 1.42 kW per unit
        - Maximum demand savings for any 15 minute interval was 1.00 kW per unit
        - Maximum demand savings for any one hour interval was 0.78 kW per unit
    - Pocatello/Twin Falls
        - Average demand savings of 0.08 kW per unit

- The average overall demand reduction for the entire program for the 2011 curtailment season was 0.36 kW per unit. The negative value for Pocatello, which is a result of noise in the baseline demand profile, should be considered zero demand reduction. By region, the average reductions were:
    - 0.43 kW per unit for Boise metro,
    - 0.39 kW per unit for MHAFB, and
    - -0.01 kW per unit for Pocatello.

- The rate of non-contributing participants, defined as those participants whose AC units did not turn on for the entire duration of an event, for the civilian population was approximately 19 percent. This effectively means that 19 percent of the civilian participants are not contributing to any demand reduction when events are called, resulting in a lower average demand per unit and, therefore, a lower total kW reduction for the program.

- The duty cycle analysis results showed that 90 percent of the units in Boise metro had a duty of 55 percent or greater, which is the cut-off used to determine if an A/C unit responded to the curtailment signal. This indicates that approximately 10 percent of the units were not responding to the curtailment signal.

- Accounting for the non-contributing participants and the units that are not responding to the signal, it is estimated that 71 percent of the total participating units in Boise metro are contributing to the demand reduction in that area.

- An analysis was conducted on the July 6th event for the Boise metro region that excluded all non-responders, but still included all non-contributing participants. It is very unlikely that any program will have a zero percent non-responder rate, so the intent of this analysis was to show the maximum achievable savings for this event had there been no non-responders. This analysis had the following results:
    - Average demand reduction was 0.74 kW per unit.
    - Maximum demand reduction for any five minute interval was 1.08 kW per unit.
    - Maximum demand reduction for any 15 minute interval was 0.91 kW per unit.
    - Maximum demand reduction for any one hour interval was 0.84 kW per unit.

- The natural duty cycle (the percent of time the unit runs) for A/C units in the Boise metro population is approximately 43 percent on days with an average temperature of 95 degrees. An analysis of eight baseline days with high temperatures within two degrees of the average high temperature during curtailment days was conducted. The average temperature of the eight days was 95 degrees, which was the same average high of the Boise metro curtailment event days. The analyses results showed that the natural duty cycle was 43 percent and 58 percent of the units had a natural duty cycle less than 50 percent. This is significant because the lower natural duty cycle means that there is less available demand to curtail. In addition, the devices in Boise metro area that do not have adaptive controls will not make a significant contribution to demand savings if the natural duty cycle is at or less than the program's cycling target.

- For the Pocatello / Twin Falls population, approximately a quarter of the units had a natural duty cycle of 50 percent or lower (meaning that the units were running 50 percent of the time) and 13.5 percent of the units had a natural duty cycle 40 percent or lower. The low natural duty cycle reduces the available demand to that can be curtailed.

- Pocatello and Twin Falls participants' A/C units were not responding to the curtailment signals dispatched from the program. Pocatello and Twin Falls participants had power line carrier type devices installed on their AC units. The results showed that there was no demand reduction in the Pocatello and Twin Falls particpant population, indicating a fault in the dispatch system used for the power line carrier devices. This lowered the overall impacts of the A/C Cool Credit program.

- The non-contributing participant rate was very low (4 percent) for the MHAFB population. This is expected since residents living at the MHAFB do not pay utility bills, and therefore have no incentive to reduce their AC usage.

- The run-time analysis for the MHAFB sample showed that approximately 60 percent of the units were meeting the cycling requirement and that 40 percent of the units were not responding to the paging signal. The pager signal problems at the MHAFB resulted in a lower average kW per unit for this population.

- The three events that resulted in the lowest demand reduction (August 10th, 17th, and 18th) had on average 31 percent lower total demand during the 5- minute interval proceeding the start of the curtailment event than the other event days. This indicates that the program achieves significantly better demand reduction results during higher demand days compared to lower demand days.

- The average demand reduction for the single weekend event was significantly higher than the reduction for the weekday events. The weekend event resulted in a demand reduction of 0.97 kW per unit compared to an average weekday reduction of 0.43 kW per unit.

- The indoor air temperature analysis results, based on loggers installed in a sample of participant homes, showed that the curtailment events had minimal impact on indoor air temperature in participant homes. The average increase in indoor air temperature during events was de minimis (0.19 degrees) in the Boise metro population and the maximum increase for a single event never exceeded 1.0 degrees.

Recommendations

- To maximize the program's potential, IPC should experiment with increasing the cycling rate as a way to increase average demand savings. As discussed in the key findings above, analysis of Pocatello events showed that a significant portion of the population had AC units with a natural duty cycle in the 40 to 50 percent range. In order to ensure that the vast majority of participants do contribute to demand reduction, the program could increase the cycling rates, especially for older control devices that are not programmed with adaptive algorithms. The indoor air temperature analysis findings also support the recommendation that the program could increase the cycling rates. The results from the indoor air temperature analysis showed that the 50 percent cycling rate implemented on the Boise metro population had a minimal impact on the indoor temperature of the participating homes. This indicates that that there is room for the program to increase the cycling rates without making a substantial impact to the comfort of program participants.

- To maximize the program's potential, IPC should investigate ways to target users likely to contribute to demand reduction. For example, data from IPC's existing AMI system could be used to target high energy users which could lower the non-contributing participant rate.

- The program should account for non-contributing participants when developing demand reduction estimates for program planning. Since no other data is available for the Boise metro and Pocatello area, we suggest that the program assume a 19 percent non-contributing participant rate, which can be updated with future evaluation results.

- During the next process evaluation, Idaho Power should evaluate the program design to identify ways to minimize the number of non-contributing participants.

- The program should work to increase the average kW per unit reductions by identifying and addressing issues affecting the pager signal reception in both the Boise metro and MHAFB populations.

- If processes are not already in place, the program should verify communication systems are operating correctly, sending correct signals to devices, and that the devices, both pager type and power line carrier type, are receiving signals prior to curtailment season.

- It is recommended that IPC conduct research to ensure that the devices with adaptive control capabilities are programmed correctly so that they are reducing the duty cycle relative to the natural duty cycle, not relative to clock-time. This evaluation did not investigate whether or not the devices with adaptive controls were behaving as cycling based on the adaptive algorithyms or clock-time, though a 2010 evaluation of PG&E's Smart AC program found that devices with adaptive controls were cycling based on clock-time, therefore, reducing the potential savings from the units.

- The AC Cool Credit program should consider both temperature and demand when deciding when to excecute an event. The events that took place on August 10th, 17th, and 18th demonstrate that days with an overall demand that is lower than a typical peak day, even with relatively hot temperatures, result in lower achieved demand savings.

Introduction

Program Background

Summer use of air conditioning (A/C) systems places a burden on Idaho Power Company's (IPC) power supply, power contracts, and transmission and distribution departments. Demand reduction programs in which customers agree to curtail A/C use in times of demand stress have proven to successfully deliver significant and dispatchable demand (kW) savings and possibly energy (kWh) savings.

Idaho Power's A/C Cool Credit program addresses this growing residential A/C demand. The program operates from June 1st through August 31st, offering a $7 credit to the approximately 35,895 participants' IPC bills during those three months. The program's function is to curtail some HVAC demand during the peak hours by implementing load reduction strategies which limit the time each HVAC unit may operate within the specified curtailment period. A/C Cool Credit program curtailment events are limited to non-holiday weekdays and total 40 hours or less per month (with the exception of a system emergency). Idaho Power determines the desired cycling strategy to implement. For the 2011 summer curtailment season, Boise metro and Mountain Home Air Force Base (MHAFB) participants were cycled at 50%, while Pocatello and Twin Falls participants were cycled at 60%. All A/C Cool Credit curtailment events during the 2011 curtailment season began at 4:00pm and had a duration of three hours.

The goals of this impact evaluation were to:

- Identify the program impacts, including electrical demand reduction and electric energy impacts.
- Determine effects of various curtailment strategies on indoor temperature of participant homes.
- Identify optimum curtailment strategies that balance load reduction and customer comfort.

Methodology

kW Measurements

The demand reduction analysis used a baseline day methodology, comparing the demand during the event day against the demand of similar baseline days. In order to collect demand reduction data, DENT Instrument's SMARTlogger™ series CTlogger™ were used to record the on/off state of the A/C compressor in each home selected for the M&V sample. The loggers continually monitored the signal of a split core current transformer (CT) clamped around the electrical supply wire to the A/C compressor unit. At the time of the logger installation, spot measurements of the demand (kW) of the A/C compressor were taken at unit start-up and after the unit had been operating for 10 minutes. Following the end of the curtailment season, the data loggers were retrieved and the A/C compressor run-time data was combined with measured AC kW data to determine 5-minute average kW loads for each A/C unit. The compressor run-time data was converted to a percentage run time for 5-minute intervals. Multiplying the percentage run-time for each five minute interval by the kW value measured at the time of logger installation gave 5-minute average demand values for each compressor. These 5-minute average loads were used to determine kW load reduction during curtailment events as compared to baseline kW load.

Adjusting Compressor kW for Outside Air Temperature

Outside air (OSA) temperature was also recorded at the same time as the compressor kW measurements. OSA temperature measurements were used to adjust the kW values to account for increases in the compressor kW demand during the hotter temperatures during curtailment events. The adjustment factor used to account for changes in compressor demand is based on a study that Paragon Consulting conducted on the relationship

between OSA and compressor demand[1]. Paragon analyzed 130 AC units, recording demand data over a range of temperature values for each unit. This data was used to regress the relationship between compressor kW and OSA. The study found that for every degree increase in OSA the compressor demand increased by 0.0164 kW. The kW of each compressor was calculated by the following equation:

$$kW_t = kW_i + 0.0164(T_t - T_i)$$

Where:
Tt = OSA temperature at time (t)
Ti = OSA temperature at the time of the onsite spot measurement
kWt is the kW of the compressor at time (t)
kWi is the kW of the compressor at the time of the onsite spot measurement

Baseline Data

The load reduction achieved during load curtailments was calculated by comparing the average load from each event day against the average load developed from non-curtailment days selected for the baseline. The "previous days" approach was used, which utilizes the average load data from the previous 10 non-weekend, non-curtailment days. Baseline kW was calculated as the average of the three days with the greatest demand from these previous ten non-curtailment days, as ranked by the highest hourly demand occurring during the curtailment timeframe. Curtailment days normally occur on hot, high demand days, thus selecting high demand days for the baseline ensures a similar load profile is used for the baseline days as the curtailment days.

Offset Factor

In order to effectively compare baseline and curtailment day loads, the baseline load was adjusted using an offset factor, calculated as the difference in kW between the baseline and curtailment event day load during the hour prior to the start of the curtailment. The offset factor was applied to the baseline day to "normalize" the baseline kW to the curtailment day kW. The offset factor mitigates underlying differences in load due to slight differences in outdoor temperature or other external factors.

Outdoor Temperature Data

Weather data, sourced from the National Oceanic and Atmospheric Administration (NOAA), for both the baseline and curtailment days was incorporated into the load profile charts of the Load Management Model. The temperature patterns on the curtailment event and baseline days provide an indication of the effect of ambient temperature on the load of the air conditioners, and in most cases, demonstrate a high level of similarity of temperatures between curtailment event and baseline days.

Indoor Air Temperature Measurements

In order to analyze the effects of curtailment events on indoor air temperature in participating homes, indoor air temperature during curtailment days was compared to the indoor air temperature in homes during a selected baseline day. Singular baseline days for the indoor air temperature analysis were selected by taking the day with the closest average outdoor air temperature to the curtailment event day during the curtailment event window. The baseline day was selected from the 10 previous non-weekend, non-curtailment days. Indoor air temperature data was collected using the U-series HOBO loggers. A total of 81 HOBO loggers were installed in sample participants' home near the indoor thermostat. The HOBO loggers recorded the indoor temperature in 5-minute intervals throughout the summer curtailment season.

[1] Paragon Consulting (2006), "Residential Air Conditioning Load Management Program M&V Report: Nevada Power Company."

Evaluation Participants

Sample Stratification

The A/C Cool Credit population is divided between two climate zones, as well as between civilian (Boise metro and Pocatello/Twin Falls) and military sectors (MHAFB). The Boise metro area and Mountain Home Air Force Base (MHAFB) populations are in climate zone three (CZ3), and Twin Falls and Pocatello are in climate zone two (CZ2). Idaho Power had two cycling strategies: 50 percent for the Boise metro and MHAFB populations and 60 percent for the Pocatello and Twin Falls population.

While the cycling strategy was the same for the populations of the MHAFB and Boise metro, for sampling purposes the populations were treated separately. Military populations typically represent a homogeneous housing sector, with houses that are often of similar size and footprint. Additionally, occupants who live at MHAFB do not pay their own utility bills; therefore, their behaviors and energy consumption are likely different than the civilian population. For example, the population of the MHAFB is more likely to operate air conditioners on a consistent basis during the summer cooling season. The curtailment event results from the MHAFB were, therefore, unlikely to represent civilian populations. Because the MHAFB is expected to be a homogeneous sample and to achieve relatively constant load reduction across control events, a smaller coefficient of variation is expected, and a smaller sample size at a lesser confidence and precision level is supported.

The aggregate sampling plan achieves a 90 percent confidence level with 10 percent precision for the population at the expected CV of 0.7. The sample is equally distributed between the two climate zones for the civilian population. Analysis for each civilian population independently achieves a 90 percent confidence level at 15 percent precision, assuming the same expected CV of 0.7. Analysis for the MHAFB population achieves an 80 percent confidence level at 20 percent precision assuming a CV of 0.5.

DENT CT loggers were installed on 166 AC units distributed between all three populations. The sample size was oversampled by approximately 10 percent to account for data loss or errors. Of the 166 loggers installed, a total of 14 were not included in the final analysis for various reasons such as the participant moving or an HVAC contractor removing the logger during a service call.

The sample sizes for the three regions were determined using the following formula.

$$n_h = \frac{(Z)^2 \times (CV_h)^2}{(P)^2}$$

Where:

n_h equals the sample size of the project

Z is the Z-statistic value (1.645 for 90 percent confidence level; 1.282 for 80 percent level)

CV_h is the coefficient of variation (engineering judgment of 0.7)

P is the desired precision level (0.10 for ±10 percent precision; 0.20 for ±20 percent precision)

Table 3: Sample Stratification

Population	Distribution of Population	Target Sample Size	Actual Sample Size	Confidence/Precision Level of Target Sample Size
Boise Metro	29,271	68	71	90/15
Pocatello/Twin Falls	5,821	68	69	90/15
MHAFB	803	11	12	80/20
Total Population	35,895	147	152	90/10

Participant Recruitment

PECI, with cooperation from Idaho Power staff, obtained a random sample from the entire installed population of A/C Cool Credit program participants. These lists were used to identify the final list of participants for the M&V sample. This same sample was utilized for quality control checks. The initial random selection delivered in May contained the contact information for 250 participants in each climate zone.

Idaho Power sent a letter to potential participants notifying them they may be requested to be included in an evaluation of the A/C Cool Credit program. From this random sample, PECI called potential participants and asked if they were willing to participate. To protect the integrity of the sample, participants were not allowed to participate in the study unless they were called by PECI. Participants agreed to allow PECI to install a small data collection device on their A/C unit, along with a temperature sensor near the indoor thermostat. PECI successfully recruited all 75 participants from the Boise metro area with a single list. An additional list of 100 random customers in the Pocatello/Twin Falls region was pulled in order to recruit the required 75 study participants for that region. At the time of installation, participants received a small thank you gift from Idaho Power: Equipment installers left an Idaho Power branded canvas bag containing energy efficiency program information, as well as some CFL light bulbs.

For the sample at Mountain Home Air Force Base (MHAFB), PECI relied on MHAFB base staff to assist with the recruitment of test sites. The base is master metered and Idaho Power does not have individual customer contact information for homes on the base participating in the program.

Load Control Technology

Idaho Power currently utilizes four load control switches. Two of the devices operate with a power line carrier (PLC) signal and two operate utilizing a paging signal. The two PLC devices are manufactured by Aclara (formerly TWACS and DCSI). The two devices are the Load Control Transponder (LCT) and the Demand Response Unit (DRU). The LCT is an older load control technology and while it continues to work, it is no longer manufactured. The DRU is a newer technology which includes built-in programming employing an adaptive control algorithm to look at the duty cycle of the appliance to provide adaptive control. PECI performed only a visual diagnostic on these devices.

Figure 1. Aclara Demand Response Unit (DRU)

Figure 2. Aclara Load Control Transponder (LCT)

The two devices that utilize paging signals are both from Cooper Power Systems. The Cooper Power Systems Load Control Relay (LCR) 5000 and 5200 are installed primarily in the Boise metro area (including the MHAFB). While the LCR 5000 is an older model, the LCR 5200 is a second-generation model that includes an adaptive control algorithm.

PECI performed a visual inspection on the LCR 5000 devices. PECI used software developed by Cooper to quickly download the full memory of the LCR 5200 devices.

Figure 3. Cooper Power Systems Load Control Relay (LCR) 5000

Figure 4. Cooper Power Systems Load Control Relay (LCR) 5200

Quality Control Analysis

A quality control analysis was conducted at the beginning of the summer curtailment season to determine if the load control devices were receiving signals. A more in-depth analysis of the reliability of the load control devices was conducted with the logger data that was retrieved after the curtailment season concluded and is discussed in the Analysis Results section of this report. PECI was only able to collect data from the Cooper LCR 5200 series receivers that allow data to be accessed via infra-red hand- held devices enabled with software called Quick Read. PECI did not have the capability to access data from either of the two PLC devices or the older pager model.

Logger installations in the Boise metro area ran behind schedule and the full data downloads were not delivered to PECI until the beginning of July. Additionally, IPC updated the unique addresses for devices that were part of the evaluation sample. After the re-addressing was complete, PECI revisited 12 devices (spread among Boise, Meridian and Caldwell) to check the success of the re-addressing. All but one of the 12 switches successfully received an address update. Idaho Power sent another signal to the switch that did not have an updated address. The data collected from the re-addressed devices was received on July 11th. The analysis of the signals was started in mid-July and finished at the end of July. PECI met with IPC in early August to discuss the early findings.

Table 4 summarizes the total number of each switch type included in each sample population. It should be noted that the total counts in Table 4 are not the same as the final sample sizes in the demand reduction analysis due to data quality issue resulting from loggers being removed by owners and faulty loggers.

Table 4: Summary of Load Control Device Types by Population

Population	LCR Pager with Quick Read	LCR Page Type w/o Quick Read	DRU PLC	LCT PLC
Boise Metro	47	17	5	10
Pocatello/Twin Falls	0	1	74	0
MHAFB	13	0	0	0
Total	60	18	79	10

To test signal verification, Idaho Power sent a signal that re-set the “EEPropcounter” on the switches to zero in May, 2011. The EEPropCounter counts the number of signals received by the pager. Idaho Power then sent a series of 105 test signals to the switches over several days. After the test signals were sent, PECI representatives conducted on-site visits to download the data from the 45 quick read-enabled devices from the Boise metro sample and 13 devices from the MHAFB sample.

Eleven of the 58 devices examined had an EEPropCounter reading of zero, indicating that these switches did not receive any of the test signals. Eight of these 11 switches that received zero test signals were located in the MHAFB territory (the MHAFB results are discussed further below). It is undetermined whether this meant that these devices were non-operating. The zero count of the EEPropCounter could have meant that the switches received a re-set signal, but not the subsequent test signals. These results were communicated to Idaho Power during the evaluation period so that further investigation could be conducted.

Figure 5 shows a summary of the EEPropCounter data from the 45 switches in the civilian sample that were examined. The data was grouped into bins based on the percentage of test signals received. The majority (87 percent) received over 80 percent of the test signal sent. Of the 45 switches, 7 percent (3 switches) had an EEPropCounter reading of zero.

Figure 5: Test Signal Data for the Civilian Sample

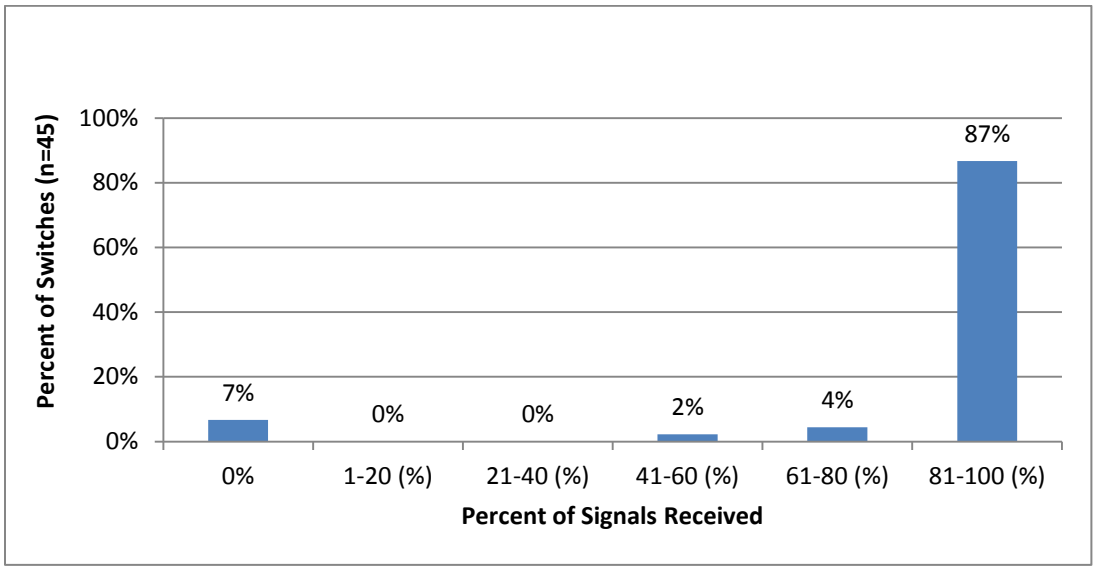


Table 5 shows a summary of the average number of signals received by the switches in the civilian sample. The averages were calculated including both the switches that received zero signals and excluding those switches.

Table 5: Summary Statistics for Civilian Sample

Statistic	Number	Percent
Average number of signals received including switches with zero counts	88	84%
Average number of signals received excluding switches with zero counts	95	90%

Table 6 shows a detailed list of number of test signals received by each switch in the civilian sample.

Table 6: Detailed Test Signal Data for Civilian Sample

Count of Signals Received (n=105)	Count of Switches (n=45)	% of Signals Received	% of Total Switches
0	3	0%	7%
57	1	54%	2%
73	1	70%	2%
83	1	79%	2%
88	3	84%	7%
91	2	87%	4%
92	1	88%	2%
93	1	89%	2%
94	2	90%	4%
95	4	90%	9%
96	1	91%	2%
97	5	92%	11%
98	15	93%	33%
101	1	96%	2%
102	1	97%	2%
104	1	99%	2%
105	2	100%	4%

Figure 6 shows a summary of the EEPropCounter data from the 13 switches in the MHAFB sample that were examined. The data was grouped into bins based on the percentage of test signals received. Overall, the switches in the MHAFB sample exhibited a low rate of signal reception. The majority (62 percent or 8 switches) did not receive any test signals. The remaining 5 switches all received less than 27 percent of the test signals. Further analysis of the reliability of the devices was conducted using the logger data collected after the curtailment season was completed. Analysis of the logger data collected after the curtailment season found that although there were issues with signal reception in the MHAFB population, the reception was not as poor as indicated by the results of the quality control analysis. The logger results are discussed in detail in the “Results Analysis” section of this report.

Figure 6: Test Signal Data for MHAFB Sample

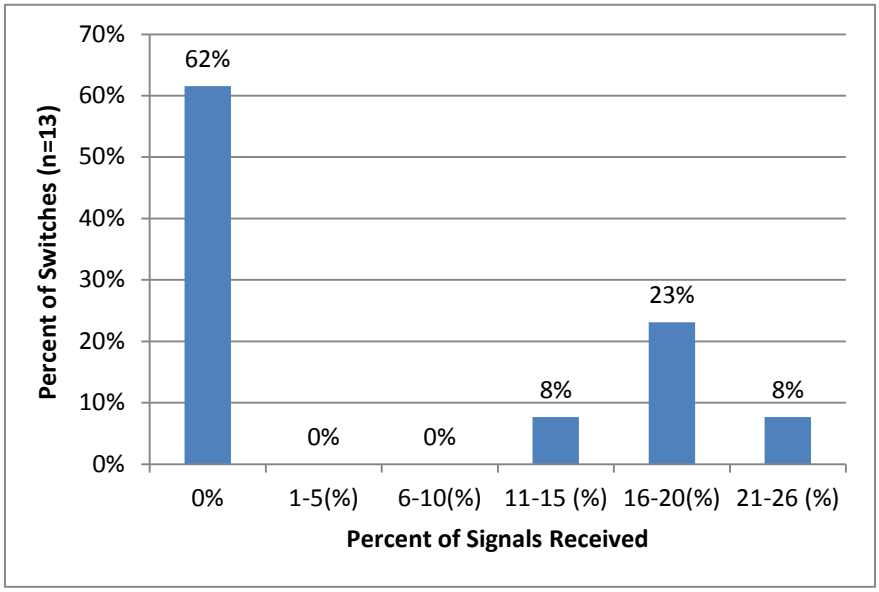


Table 7 shows a summary of the average number of signals received by the switches in the MHAFB sample. The averages were calculated including the switches that received zero signals and excluding those switches.

Table 7: Summary Statistics for MHAFB Sample

Statistic	Count	Percent
Average number of signals received including switches with zero counts	7	7%
Average number of signals received excluding switches with zero counts	16	15%

Table 8 shows a detailed list of number of test signals received by each switch in the MHAFB sample.

Table 8: Detailed Test Signal Data for MHAFB Sample

# of Signals Received (n=105)	# of Switches (n=13)	% of Signals Received	% of Total Switches
0	8	0%	61%
12	1	11%	8%
17	1	16%	8%
21	2	20%	15%
26	1	25%	8%

Analysis Results

Curtailment Events

The AC Cool Credit program implemented fourteen curtailment events throughout the summer curtailment season: from June 1st through August 31st. Table 9 details the curtailment event schedule and includes the cycling targets for each region. The July 31st curtailment event was only for Boise metro participants (including MHAFB). This event was called on a Sunday and because the AC Cool Credit program is not designed for weekend curtailment events, its results will be excluded from aggregate summary tables.

All AC Cool Credit participants were included in each event that Idaho Power called with the exception of the Sunday event called on July 31st. Idaho Power did implement different cycling rates between the Boise metro and the Pocatello and Twin Falls region, with a 50 percent cycling rate in the Boise metro region and a 60 percent cycling rate for Pocatello and Twin Falls region participants. The maximum temperature in Boise during event days ranged from 91 degrees on August 18th to 98 degrees on July 31st, August 22nd, 24th, and 26th. The maximum temperature in Pocatello during event days ranged from 91 degrees on July 5th and 11th to 97 degrees on August 24th and 26th.

Table 9: Curtailment Event Schedule

Date	Start Time	End Time	Cycle % Boise (inc. MHAFB)	Cycle % Pocatello/Twin Falls	Max Temp (Boise)	Max Temp (Pocatello)
July 5, 2011	4:00 PM	7:00 PM	50%	60%	93	91
July 6, 2011	4:00 PM	7:00 PM	50%	60%	96	94
July 11, 2011	4:00 PM	7:00 PM	50%	60%	95	91
July 12, 2011	4:00 PM	7:00 PM	50%	60%	95	89
July 18, 2011	4:00 PM	7:00 PM	50%	60%	96	96
July 25, 2011	4:00 PM	7:00 PM	50%	60%	96	91
July 29, 2011	4:00 PM	7:00 PM	50%	60%	97	94
July 31, 2011	4:00 PM	7:00 PM	50%	N/A	98	N/A
August 10, 2011	4:00 PM	7:00 PM	50%	60%	91	92
August 17, 2011	4:00 PM	7:00 PM	50%	60%	94	92
August 18, 2011	4:00 PM	7:00 PM	50%	60%	91	90
August 22, 2011	4:00 PM	7:00 PM	50%	60%	98	96
August 24, 2011	4:00 PM	7:00 PM	50%	60%	98	97
August 26, 2011	4:00 PM	7:00 PM	50%	60%	98	97

Demand Reduction Analysis Results

Boise Metro Results

Demand Results

The Boise sample consisted of 71 AC units spread across the greater Boise metro area. Table 10 shows the number of units located within different cities in the Boise metro area. The “all others” category contains units located in Caldwell, Eagle, Fruitland, Kuna, Star, and Wilder.

Table 10: Boise Participant Sample

City	Total Units
Boise	29
Meridian	15
Nampa	14
All others	13
Total	71

The AC Cool Credit program uses a variety of load control devices in the Boise metro area, including both pager type devices and power line carrier (PLC) type devices. Table 11 shows the number of each load control device type included in the Boise metro participant sample.

Table 11: Boise Load Control Device Types

Device Model	Device Type	Total Units
LCR	Pager	57
DRU	PLC	5
LCT	PLC	9
Total		71

Figure 7 below shows the demand profile for the Boise metro sample during the July 5th curtailment event which represents the typical load profile for Boise metro participants during curtailment events. It is characterized by an immediate drop in demand relative to the baseline day, then a slow increase in event day demand throughout the three-hour curtailment window, followed by a "snapback period" of increased demand relative to the baseline day immediately after the end of the curtailment event. The maximum demand reduction for a 5-minute interval during the event was 0.93 kW per unit and the average demand reduction was 0.63 kW per unit.

Figure 7. Boise July 5th Curtailment Event Load Impact

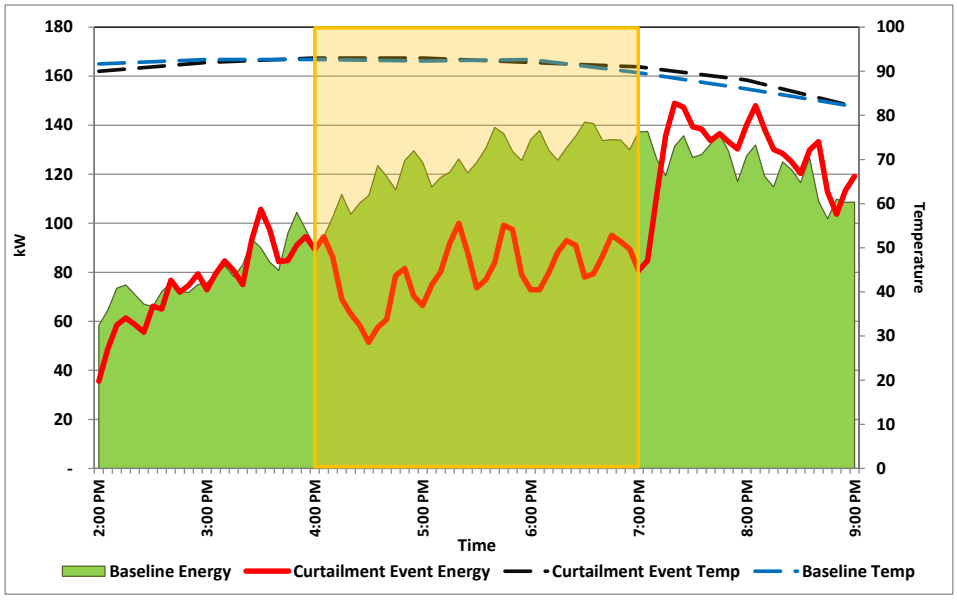


Figure 8 shows another event that took place on August 22nd. As with the July 5th event, the load profile is consistent to what is typically expected during a curtailment event, with a sudden drop in demand followed by a snapback period when the event terminates. The maximum demand drop for a 5-minute interval during the event was 0.79 kW per unit and the average was 0.52 kW per unit.

Figure 8. Boise August 22nd Curtailment Event Load Impact

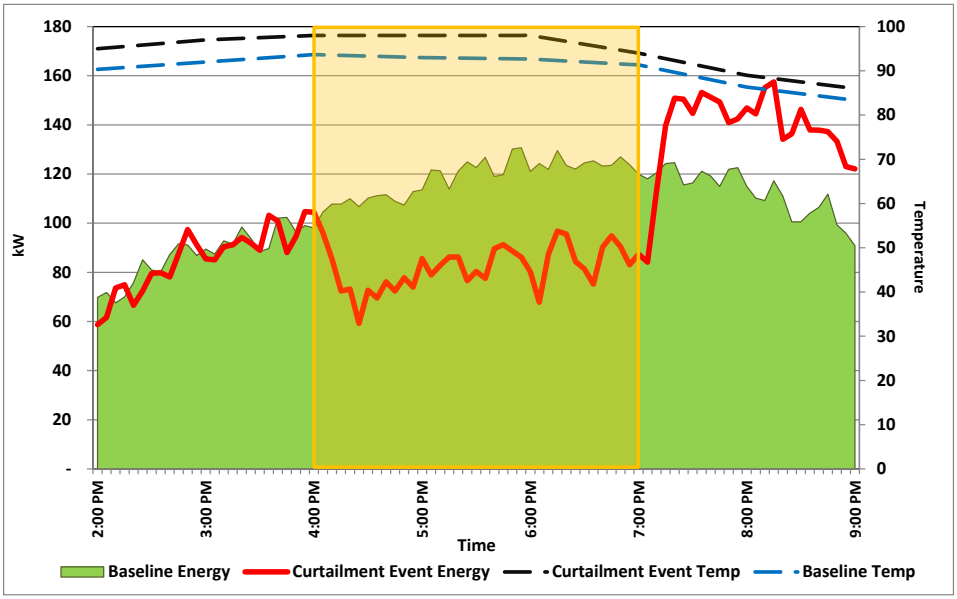


Figure 9 below shows the average demand reduction per unit for each of the Boise metro curtailment events. The daily high temperature is included in parentheses in the x-axis titles. The majority of the events have an average demand drop between 0.4 and 0.7 kW per unit. However, three events that stand out with smaller demand drops compared to the other events occurred on August 10th, 17th, and 18th. We examine these three events further in the analysis below.

Figure 9. Boise Demand Results – Average kW per Unit

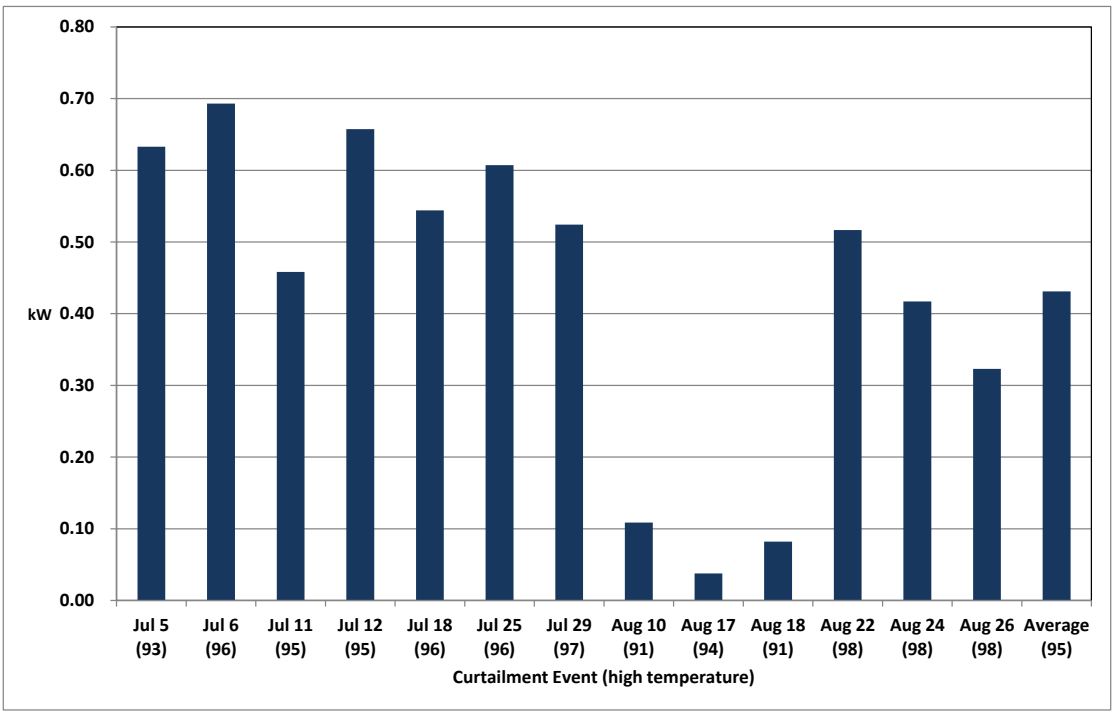


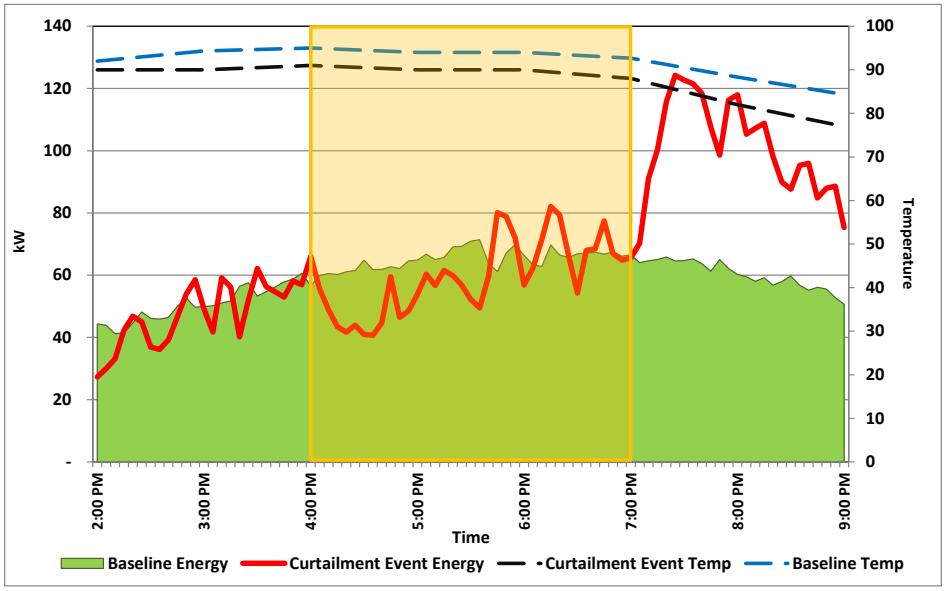
Table 12 below presents demand savings results on a per unit basis for all Boise metro curtailment events. The average kW per unit for the events ranged from a high of 0.69 kW (July 6th) to a low of 0.04 (August 17th). The average demand reduction per unit for all of the events combined was 0.43 kW.

Table 12. Boise Demand Results - per Unit

Event Date	High Temperature (Boise)	Max Demand Reduction per Unit (kW)	Min Demand Reduction per Unit (kW)	Avg Demand Reduction per Unit (kW)
5-Jul	93	0.93	(0.00)	0.63
6-Jul	96	1.03	(0.08)	0.69
11-Jul	95	0.87	0.04	0.46
12-Jul	95	1.04	(0.21)	0.66
18-Jul	96	0.85	0.08	0.54
25-Jul	96	1.05	(0.20)	0.61
29-Jul	97	0.74	(0.05)	0.52
10-Aug	91	0.37	(0.20)	0.11
17-Aug	94	0.32	(0.15)	0.04
18-Aug	91	0.34	(0.27)	0.08
22-Aug	98	0.79	0.12	0.52
24-Aug	98	0.68	0.01	0.42
26-Aug	98	0.75	(0.09)	0.32
Average	95	0.75	(0.08)	0.43

The Boise metro curtailment results for the events on August 10th, 17th, and 18th, showed load shape impacts that were not consistent with the rest of the events, exhibiting less demand drop during the curtailment event while still exhibiting a snapback period. Figure 10 below shows the load shape impact of the August 18th curtailment event, which is representative of all three events. There is a slight demand reduction at the onset of the event, followed by a slight increase of demand and then a snapback period.

Figure 10. Boise August 18th Curtailment Event Load Impact



A likely explanation for the lower demand reduction from these three events is that the overall demand for each of these three event days was significantly lower than the other event days. The average total demand of all events at 3:55pm, the time period just before the start of the curtailment event, excluding the three isolated events with the lowest demand reduction, was 99 kW. The average total demand at 3:55pm for the three events with low reduction values was 68 kW, only 69 percent of the average of the other 10 weekday events. These results indicate that the program is not able to deliver significant demand reduction on days when total demand is significantly less than peak demand days.

PECI investigated a number of factors that could have impacted the loads during these event days. For example, to check if abnormally low temperatures proceeding the event day reduced the A/C load on the event day, PECI examined the average temperature, high temperature, and low temperature for the days preceding each of the these three event days. The data did not indicate that anything was unusual about the weather proceeding these event days. In addition, PECI conducted research to determine if there were any major events that took place during the days in question that would cause participants to alter their normal behavior; no major events were found.

Table 13: Comparison of Total kW Just Before the Curtailment Event

Event Date	Total kW at 3:55 pm	% of Average kW of all Events Excluding 3 Lowest (99 kW)
August 10th	73	74%
August 17th	65	66%
August 18th	66	67%

Average	**68**	**69%**

The AC Cool Credit program is designed to call curtailment events on weekday and non-holidays only. However, a curtailment event was called on Sunday, July 31st for the Boise metro region. The results of this curtailment event are shown in Figure 11 and Table 14 below. The July 31st event took place on a relatively hot day with high demand compared to the weekday events. The average demand reduction for the July 31st event was 0.97 kW per unit. This result is 125 percent higher than the average demand reduction of 0.43 achieved during the 13 weekday events.

Figure 11. Boise July 31st Curtailment Event Load Impact

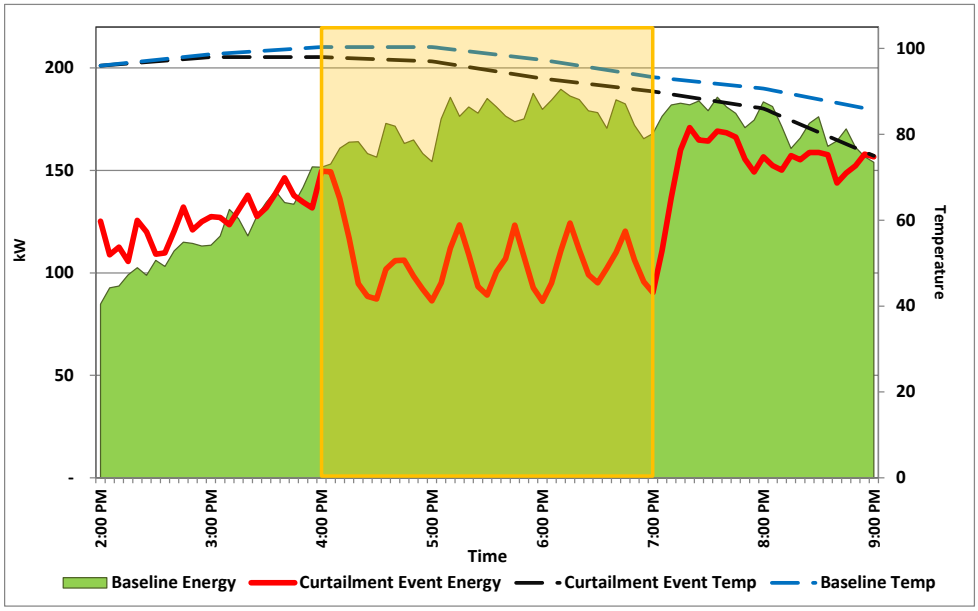


Table 14. Boise July 31st Curtailment Event Results

Event Date	High Temperature (Boise)	Max Demand Reduction per Unit (kW)	Min Demand Reduction per Unit (kW)	Avg Demand Reduction per Unit (kW)
31-Jul	98	1.35	0.05	0.97

Duty Cycle and Non-contributing Participant Analysis

We examined both A/C unit run-time and the effect of non-contributing participants (participants that did not contribute to load reduction because their A/C unit was off for the entirety of the event) to better understand the demand reduction results for the Boise metro sample.

The duty cycle analysis is used to calculate the percentage of A/C units that met the cycling rate set by the load control devices. For example, the Boise metro area participants had a 50 percent cycling target during the curtailment events (i.e. the A/C units should have a maximum duty cycle of 50 percent during the curtailment event (newer load control devices, including the Aclara DRU device and the Cooper Power Systems LCR 5200 units, have adaptive controls which limit the duty cycle to 50 percent of the time compared to their normal run time If an A/C unit had a duty cycle higher than 55 percent during an event this indicated that the load control device did not execute the curtailment strategy and is, therefore, considered a non-responder. The reason a 55 percent duty cycle is used as the cut-off to define non-respondents instead of 50 percent is to allow for slight variability between the cycling target and actual performance of the devices. A non-contributing participant was defined as a

participant whose A/C unit was not running at all during the curtailment event, indicating that they are not contributing to the demand reduction during the event. The non-contributing participant rate (as a percent) can be subtracted from the percentage of the units that meet the cycling target to calculate the total percentage of units that contribute to demand reduction during curtailment events.

The A/C duty cycle analysis was completed for two Boise metro curtailment events. The duty cycle analysis results for these two curtailment events are representative of all curtailment events assuming paging issues are consistent throughout all events. The results of these analyses, shown in Table 15 and Table 16 below, indicate that 89 percent of the July 5th and 90 percent of the July 11th event participants achieved the cycling target. The participants that had duty cycles over 55 percent are presumed to have had issues with signal reception. A sensitivity analysis was also completed by looking at the percentage of units that had duty cycles less than 60 percent. For the July 5th event, 90 percent of the units had a duty cycle of 60 percent or less and 93 percent of the units had a duty cycle of 60 percent or less for the July 11th event.

Table 15. July 5th Boise Run-time Analysis – 50% Cycling Target

City	Total Units	Count With Duty Cycle <=55%	% With Duty Cycle <=55%	% With Duty Cycle <=60%	Avg Duty Cycle
Boise	29	27	93%	97%	31%
Meridian	15	13	87%	87%	42%
Nampa	14	12	86%	86%	43%
All others	13	11	85%	85%	35%
Total	71	63	89%	90%	36%

Table 16. July 11th Boise Run-time Analysis – 50% Cycling Target

City	Total Units	Count With Duty Cycle <=55%	% With Duty Cycle <=55%	% With Duty Cycle <=60%	Avg Duty Cycle
Boise	29	27	93%	97%	28%
Meridian	15	14	93%	93%	38%
Nampa	14	11	79%	86%	46%
All others	13	12	92%	92%	35%
Total	71	64	90%	93%	36%

Results of the non-contributing participant analysis are shown in Table 17. The average non-contributing participant rate across all curtailment events is 19 percent. The fact that almost 1/5th of the sampled participants did not contribute to load reduction is significant: This means that approximately 19 percent of the units in the Boise metro population are not contributing to demand savings, reducing the total demand reduction for events and the average demand per A/C unit. The high non-contributing participant rate may be indicative of a weak economy forcing consumers to cut costs wherever possible.

Taking the non-contributing participant rate and the run-time analysis into account, we calculate that 60 percent of the units met the cycling requirement for the July 5th event (77 percent that met the cycling requirement minus the 17 percent non-contributing participant rate for the event), and 56 percent met the cycling requirement for the July 11th event.

Table 17. Boise Non-Contributing Participant Analysis

Event	Total Participants	Non-Contributing Participants During CE (Count)	Non-Contributing Participants During CE (%)
5-Jul	71	12	17%
6-Jul	71	12	17%
11-Jul	71	16	23%
12-Jul	71	11	15%
18-Jul	71	16	23%
25-Jul	71	7	10%
29-Jul	71	11	15%
10-Aug	71	15	21%
17-Aug	71	19	27%
18-Aug	71	18	25%
22-Aug	71	12	17%
24-Aug	71	14	20%
26-Aug	71	8	11%
Average	71	13	19%

In order to better understand the natural duty cycle (percent of time that units run) of units in the Boise metro population, we analyzed the run-time of all units in the Boise metro sample population on baseline days with high temperatures within two degrees of the average high temperature during curtailment days. The results showed that the average natural duty cycle during the eight days analyzed was 43 percent and 58 percent of the units had a natural duty cycle less than 50 percent.

Table 18: Natural Duty Cycle of Boise A/C Units

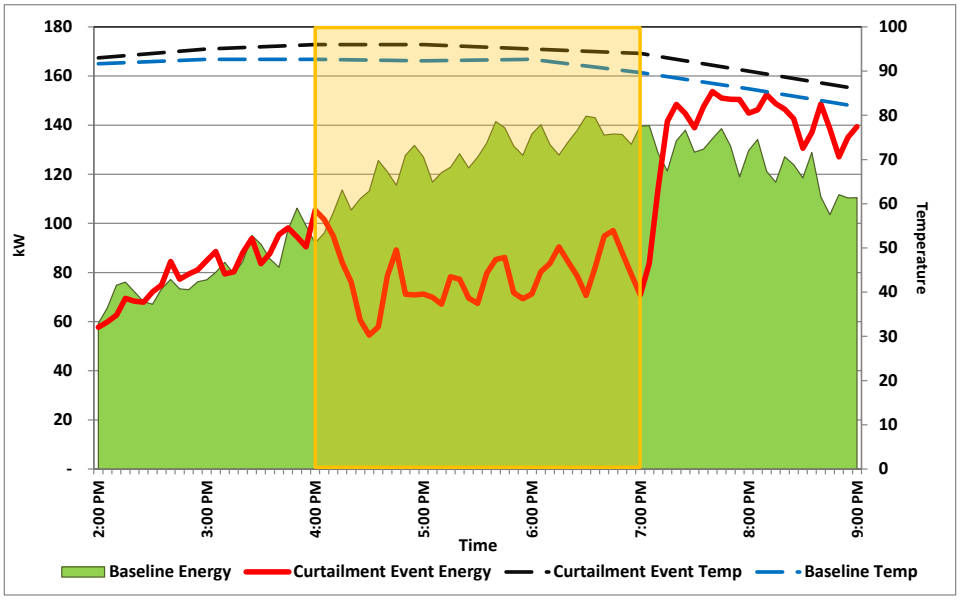
Date	High	Natural Duty Cycle	Units with Natural Duty Cycle <50%
22-Jun	95	33%	68%
27-Jun	94	22%	87%
01-Aug	94	59%	39%
02-Aug	97	54%	42%
03-Aug	97	52%	48%
08-Aug	95	41%	62%
23-Aug	94	35%	72%
25-Aug	97	50%	46%
Average	95	43%	58%

IPC System Peak Day Analysis

IPC's system peak for the summer of 2011 was on July 6th. The average demand savings per unit for the July 6th event was 0.69 kW (see Table 12). The event is shown below in Figure 12. The maximum demand savings for any 5 minute interval during the event was 1.03 kW per unit; the maximum savings for any 15 minute interval during the event was 0.86 kW per unit (interval ending at 6:00 pm); and the maximum savings for any one-hour during the event was 0.77 kW per unit (hour ending at 6:00pm).

In order to estimate the savings that would have been achieved if there were no non-respondents, we conducted an additional analysis on the July 6th event which excluded all non-responders, but still included all non-contributing participants. This analysis resulted in average demand savings of 0.74 kW per unit. The maximum demand savings for any 5 minute interval during the event was 1.08 kW per unit; the maximum savings for any 15 minute interval during the event was 0.91 kW per unit (interval ending at 6:00 pm); and the maximum savings for any one-hour during the event was 0.84 kW per unit (hour ending at 6:00pm). It should be noted that it is very unlikely that any program will have a zero percent non-responder rate.

Figure 12: Boise July 6th Curtailment Event Load Impact



Snapback and Net Energy Impact

A potential side benefit of demand response programs is energy consumption (kWh) savings. Energy savings of demand response events, however, are tempered by the "snapback" after the event, which results from participants operating their AC units for longer than normal after a curtailment event to make up for lost cooling during the curtailment event.

The results of the analysis show that curtailment events in the Boise metro region participants saved on average 1.29 kWh per unit during the curtailment event. The snapback period, defined as the two-hour period following the end of the curtailment event, resulted in an average kWh increase of 0.70 kWh per unit. When the curtailment event and snapback period are both taken into account, participants saved on average 0.59 kWh per unit. The three events with negative total energy savings (August 10th, August 17th, and August 18th) each had unusually low demand savings as well.

Table 19. Boise Snapback and Net Energy Impact Results

Event Date	Energy Savings During CE (kWh per unit)	Energy Penalty During 2 hr Snapback (kWh per unit)	Total Energy Savings During CE + 2 hr. Snapback (kWh per unit)
5-Jul	1.90	(0.17)	1.73
6-Jul	2.08	(0.44)	1.64
11-Jul	1.38	(0.78)	0.60
12-Jul	1.97	(0.40)	1.57
18-Jul	1.63	(0.37)	1.26
25-Jul	1.82	(0.58)	1.24
29-Jul	1.57	(0.46)	1.11
10-Aug	0.33	(1.16)	(0.84)
17-Aug	0.11	(1.20)	(1.09)
18-Aug	0.25	(1.16)	(0.91)
22-Aug	1.55	(0.75)	0.80
24-Aug	1.25	(0.75)	0.50
26-Aug	0.97	(0.86)	0.11
Average	1.29	(0.70)	0.59

Pocatello and Twin Falls Results

Demand Results

The Pocatello and Twin Falls sample consisted of 69 A/C units spread across the Pocatello and Twin Falls region. Table 20 shows the number of units located within different cities included in the region. The “all others” category contains units located in Blackfoot, Jerome, and Kimberly.

Table 20. Pocatello/Twin Falls Participant Sample

City	Total Units
Pocatello	35
Twin Falls	14
Chubbuck	11
All others	9
Total	69

The A/C Cool Credit program primarily uses power line carrier (PLC) load control devices in the Pocatello and Twin Falls area. Table 21 shows the number of each load control device type included in the Pocatello and Twin Falls participant sample.

Table 21. Pocatello/Twin Falls Load Control Device Types

Device Model	Device Type	Total Units
LCR	Pager	1
DRU	PLC	68
Total		69

Figure 13 below shows the AC demand profile for the Pocatello and Twin Falls sample during the July 5th curtailment event. The event shown is representative of the all of the Pocatello and Twin Falls event analyses. There is no clear indication that the units responded to the called demand response event and show curtailment event demand oscillating back and forth between positive and negative savings during the curtailment event and snapback period.

Figure 13. Pocatello/Twin Falls July 5th Curtailment Event Load Impact

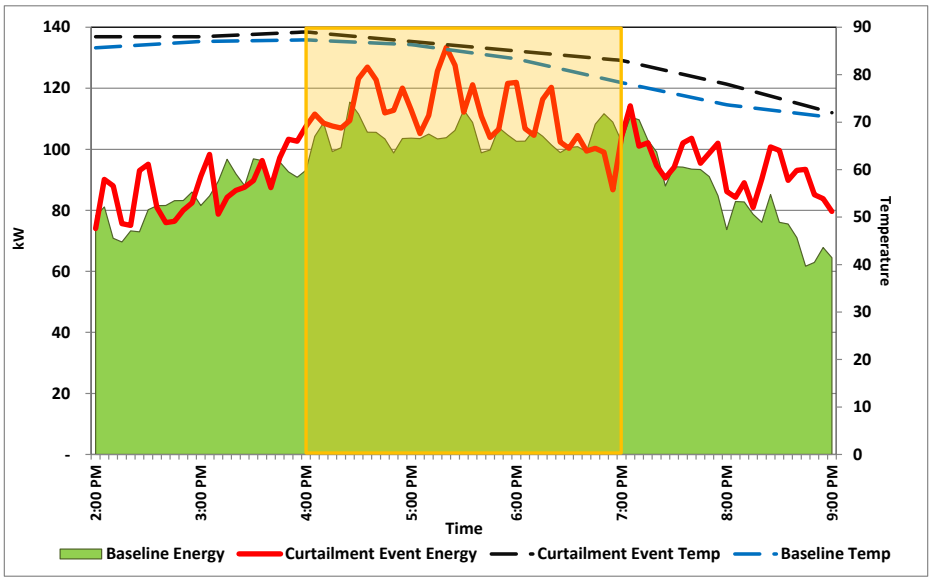


Figure 14 shows the A/C demand profile for the event that took place on July 12th. As with the July 5th event shown above, the load profile shows the curtailment day demand oscillating near the baseline demand.

Figure 14. Pocatello/Twin Falls July 12th Curtailment Event Load Impact

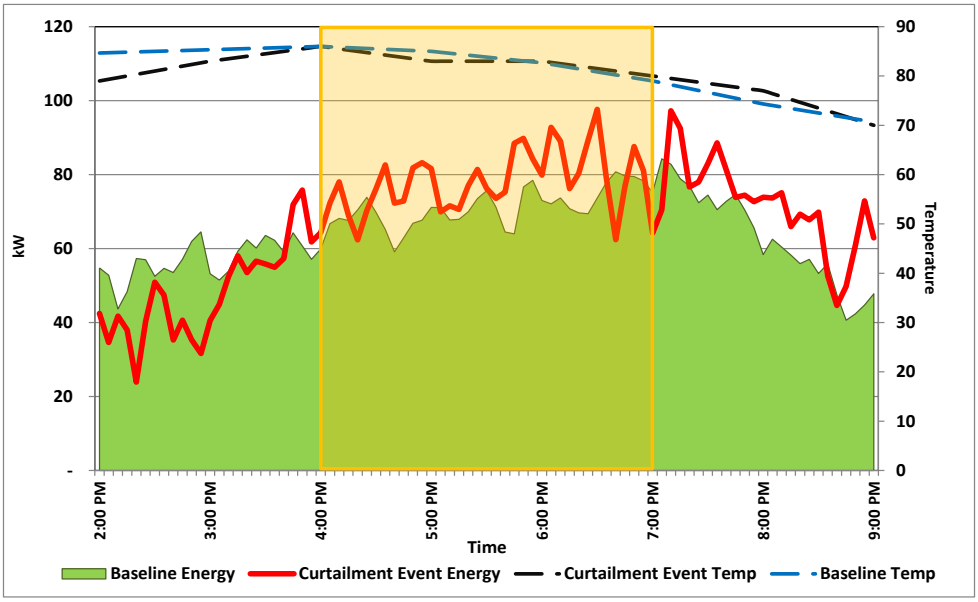


Figure 15 below shows average demand reduction per unit for the Pocatello and Twin Falls curtailment events. The daily high temperature is included in parentheses in the x-axis titles. The average demand for the 13 events oscillates around zero kW reduction per unit indicating that the A/C units did not receive the signal to curtail demand.

Figure 15. Pocatello/Twin Falls Demand Results – Average kW per Unit

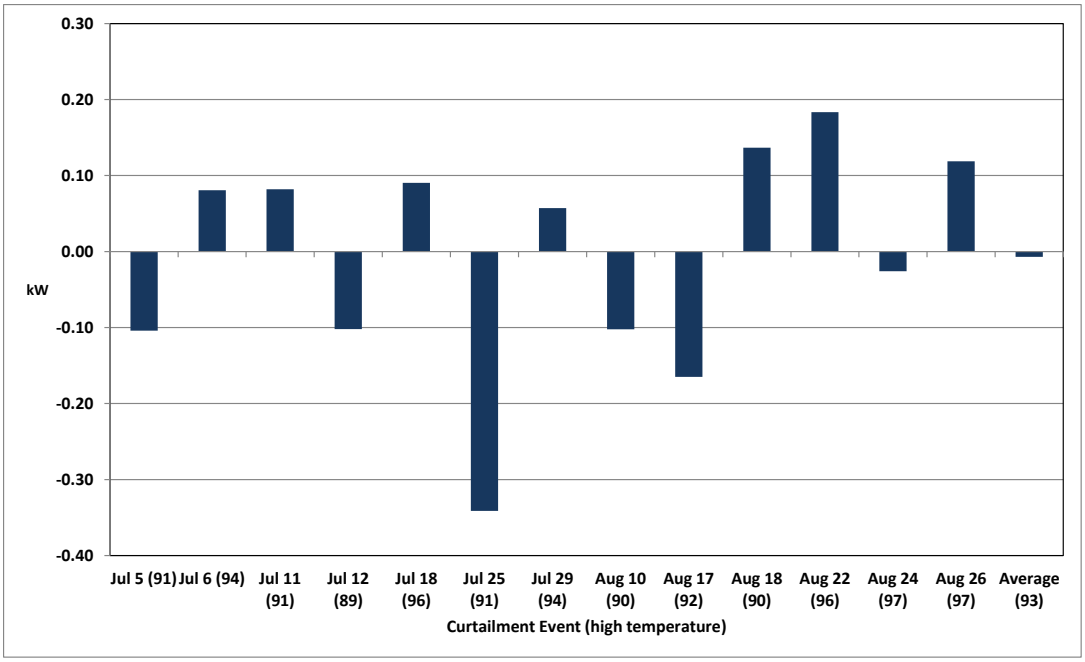


Table 22 below presents demand savings results on a per unit basis for all Pocatello and Twin Falls curtailment events. The demand reduction per unit varies between a high of 0.18 kW and a low of 0.34 kW, with an average demand reduction of -0.01 kW.

Table 22. Pocatello/Twin Falls Demand Results - per Unit

Event Date	High Temperature (Pocatello)	Max Demand Reduction per Unit (kW)	Min Demand Reduction per Unit (kW)	Avg Demand Reduction per Unit (kW)
5-Jul	91	0.32	-0.43	-0.10
6-Jul	94	0.41	-0.20	0.08
11-Jul	91	0.76	-0.27	0.08
12-Jul	89	0.27	-0.36	-0.10
18-Jul	96	0.37	-0.22	0.09
25-Jul	91	-0.01	-0.61	-0.34
29-Jul	94	0.41	-0.19	0.06
10-Aug	90	0.23	-0.37	-0.10
17-Aug	92	0.06	-0.40	-0.16
18-Aug	90	0.59	-0.26	0.14
22-Aug	96	0.54	-0.34	0.18
24-Aug	97	0.20	-0.22	-0.03
26-Aug	97	0.34	-0.14	0.12
Average	93	0.35	-0.31	-0.01

Duty Cycle and Non-contributing participant rate Analysis

Pocatello and Twin Falls area participants had a 60 percent cycling target during the curtailment events (i.e. their A/C units should have a maximum duty cycle of 40 percent during the curtailment event). An A/C duty cycle analysis was completed for two curtailment events to assess the percentage of load control devices that are effectively curtailing the loads of their A/C units. The duty cycle analysis results for the two curtailment events are representative of all curtailment events, assuming signal issues are consistent throughout all events.

Table 23 and Table 24 show the results of the duty cycle analysis for the events that took place July 5th and July 11th. Only 30 percent of the July 5th and 39 percent of the July 11th event participants had duty cycles that were less than 55 percent, indicating that a significant portion of the units did not respond to the events. These percentages drop significantly after accounting for units that were non-contributing participant, described below.

Table 23. July 5th Pocatello/Twin Falls Run-time Analysis – 60% Cycling Target

City	Total Units	Count With Duty Cycle <=45%	% With Duty Cycle <=45%	% With Duty Cycle <=50%	Avg Duty Cycle
Pocatello	35	8	23%	29%	59%
Twin Falls	14	6	43%	50%	56%
All others	20	7	35%	45%	55%
Total	69	21	30%	38%	57%

Table 24. July 11th Pocatello/Twin Falls Run-time Analysis – 60% Cycling Target

City	Total Units	Count With Duty Cycle <=55%	% Duty Cycle <=55%	% Duty Cycle <=50%	Avg Duty Cycle
Pocatello	35	16	46%	54%	45%
Twin Falls	14	4	29%	36%	61%
All others	20	9	45%	55%	40%
Total	69	29	39%	46%	57%

The non-contributing participant rate in the Pocatello and Twin Falls region was similar to the Boise metro region. On average, 18 percent of Pocatello and Twin Falls participants had their A/C unit off for the entirety of the curtailment event.

Table 25. Pocatello/Twin Falls Non-contributing Participant Analysis

Event	Total Participants	Non-Contributing Participants During CE (count)	Non-Contributing Participants During CE (%)
5-Jul	69	11	16%
6-Jul	69	11	16%
11-Jul	69	13	19%
12-Jul	69	23	33%
18-Jul	69	3	4%
25-Jul	69	3	4%
29-Jul	69	17	25%
10-Aug	69	18	26%
17-Aug	69	20	29%
18-Aug	69	17	25%
22-Aug	69	8	12%
24-Aug	69	8	12%
26-Aug	69	8	12%
Average	69	12	18%

Accounting for the non-contributing participant rate and the run time analysis, 10 percent of the units met the cycling requirement for the July 5th event (26 percent that meet the cycling requirement minus the 16 percent non-contributing participant rate for the event). For the July 11th event, 17 percent met the cycling requirement that were not non-contributing participants.

Because the kW results do not show demand reduction for the Pocatello participants, the run-time results can be used to estimate the natural duty cycle of the units that were running (excluding non-contributing participants). Table 26 shows the percentage of units that had natural duty cycles within the range of the A/C Cool Credit program cycling targets. The average of the two events analyzed indicated that approximately 13.5 percent of the units have a natural duty cycle less than 40 percent (meaning the compressors are off at least 60 percent of the time) and 24.5 percent of the units have a natural duty cycle lower than 50 percent. The low natural duty cycle of units in the Pocatello region reduce the amount of available demand that can be curtailed. Increasing the cycling rate during curtailment events could be a way to partially offset the lower available demand due to the natural duty cycle.

Table 26. Natural Duty Cycle for Pocatello Units

Event	Natural Duty Cycle <40%	Natural Duty Cycle <45%	Natural Duty Cycle <50%
5-Jul	10%	14%	22%
11-Jul	17%	20%	27%
Average	13.5%	17%	24.5%

Snapback and Net Energy Impact

Snapback and net energy impact analyses were not conducted because the Pocatello and Twin Falls region results did not show demand savings.

Mountain Home Air Force Base Results

The Mountain Home Air Force Base (MHAFB) sample consisted of 12 AC units. The AC Cool Credit program uses a pager load control device in the MHAFB area. Table 21 shows the number of each load control device type included in MHAFB participant sample.

Table 27. MHAFB load Control Device Types

Device Model	Device Type	Total Units
LCR	Pager	12

Demand Results

Figure 16 and
Figure 17 below show load impacts for the MHAFB August 10th and 22nd curtailment events. The relatively high variability seen in the figures is a result of the small sample size (12); if only a few units turn on or off, the cumulative demand will sharply spike or decline. The baseline day demand is not as volatile because it is the average demand of three baseline days.

Figure 16. MHAFB August 10th Curtailment Event Load Impact

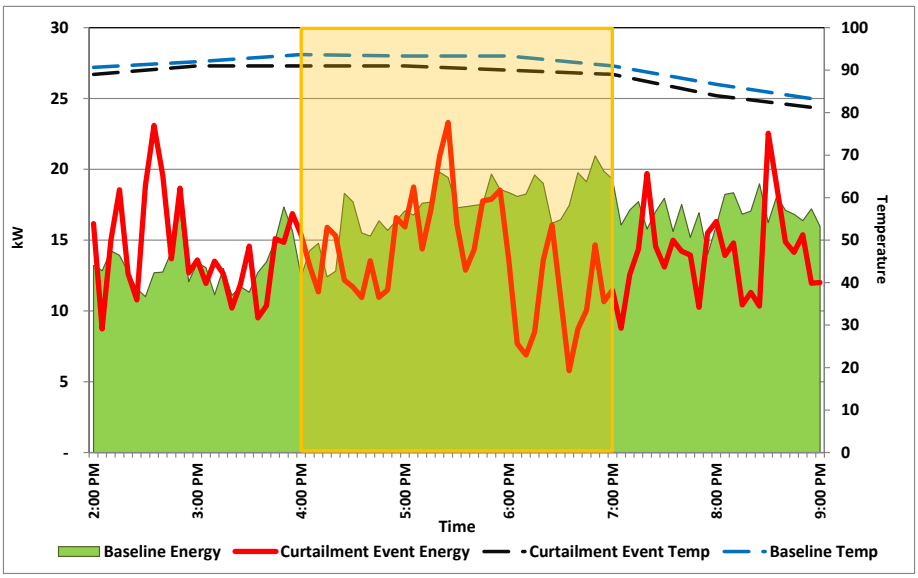


Figure 17. MHAFB August 22nd Curtailment Event Load Impact

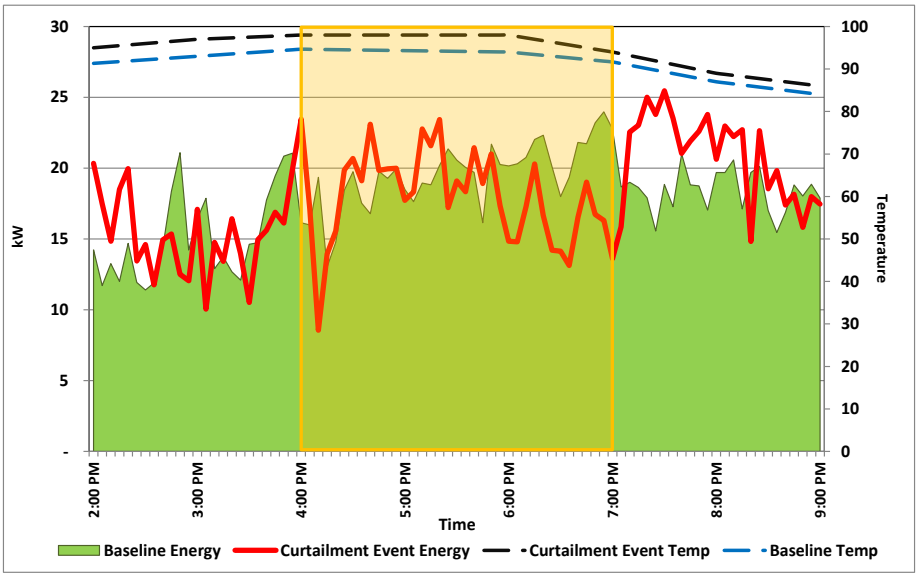


Figure 18 shows the average demand savings per unit for the MHAFB sample during each of the 13 events.

Figure 18. MHAFB Demand Results – Average kW per Unit

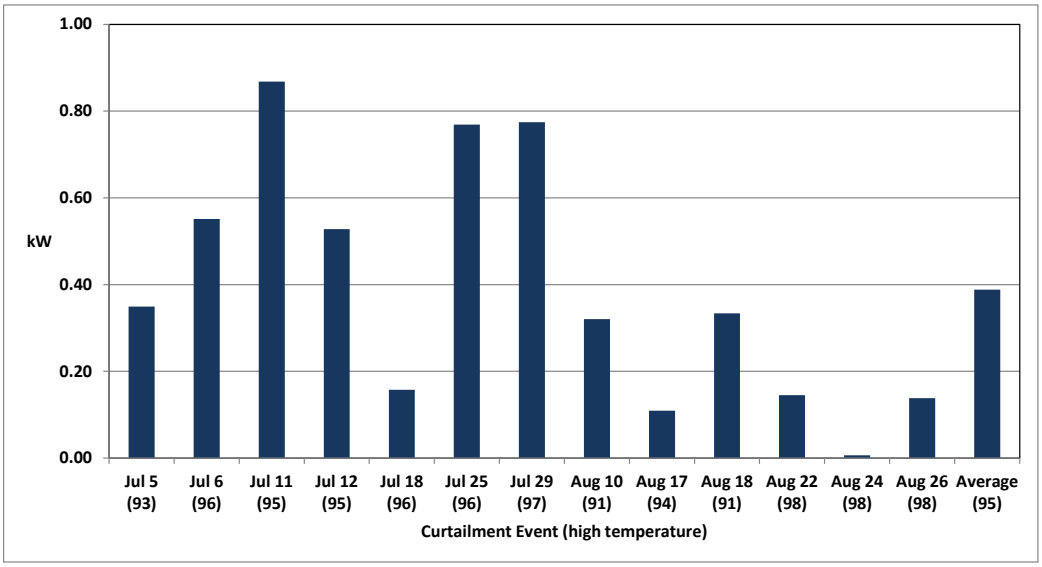


Table 28 presents the demand savings results on a per unit basis for the MHAFB sample for each of the curtailment events. The average kW per unit for the events ranged from a high of 0.87 kW (July 11th) to a low of 0.01 (August 24th). The average demand reduction per unit for all of the events combined was 0.39 kW.

Table 28. MHAFB Demand Results - per Unit

Event Date	High Temperature (Boise)	Max Demand Reduction per Unit (kW)	Min Demand Reduction per Unit (kW)	Avg Demand Reduction per Unit (kW)
5-Jul	93	1.15	-0.24	0.35
6-Jul	96	1.42	-0.25	0.55
11-Jul	95	1.46	-0.27	0.87
12-Jul	95	1.54	-0.41	0.53
18-Jul	96	0.77	-0.51	0.16
25-Jul	96	1.51	-0.04	0.77
29-Jul	97	1.60	-0.03	0.77
10-Aug	91	0.97	-0.32	0.32
17-Aug	94	0.63	-0.57	0.11
18-Aug	91	0.97	-0.36	0.33
22-Aug	98	0.90	-0.53	0.14
24-Aug	98	0.76	-0.55	0.01
26-Aug	98	0.68	-0.54	0.14
Average	95	1.10	-0.36	0.39

The AC Cool Credit program is designed to call curtailment events on weekday and non-holidays only. However, a curtailment event was called on Sunday, July 31st for the Boise metro and MHAFB regions. The results of this curtailment event are shown in Figure 19 and Table 29 below. The July 31st event took place on a relatively hot day with high demand compared to the weekday events. The average demand reduction for the July 31st event was 0.60 kW per unit. This result is 54 percent higher than the average demand reduction of 0.39 achieved during the 13 weekday events. While the IPC program is not designed to operate on weekends, the results from this event do suggest that the program could an effective demand response resource on weekends in emergency situations.

Figure 19. MHAFB July 31st Curtailment Event Load Impact

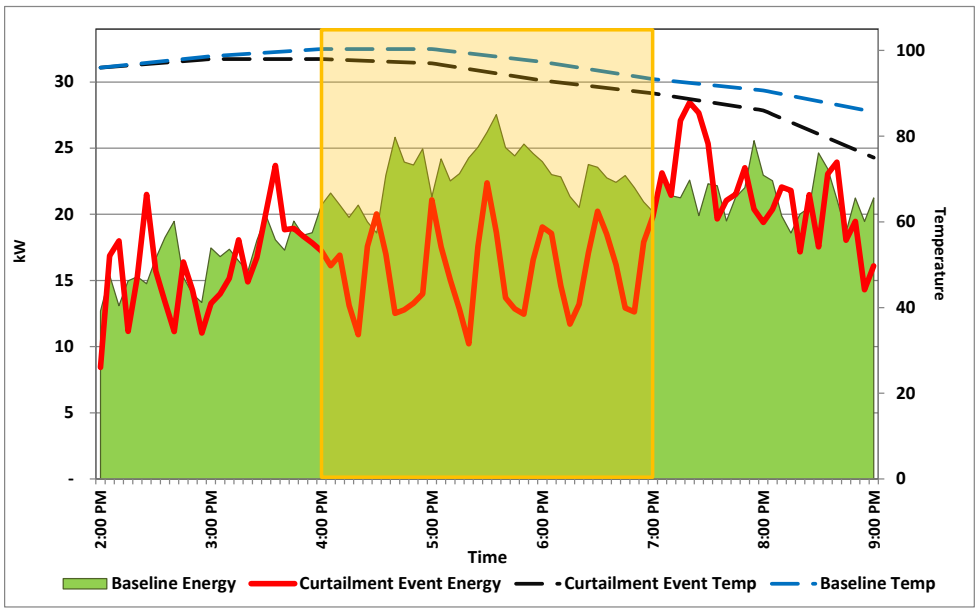


Table 29. MHAFB July 31st Curtailment Event Results

Event Date	High Temperature (Boise)	Max Demand Reduction per Unit (kW)	Min Demand Reduction per Unit (kW)	Avg Demand Reduction per Unit (kW)
31-Jul	98	1.17	(0.12)	0.60

Duty Cycle and Non-contributing Participant Rate Analysis

MHAFB had the same 50 percent cycling target as Boise metro participants. An A/C duty cycle analysis was completed for five curtailment events and results are shown in Table 30. The duty cycle results showed more variability than the results for the Boise metro and Pocatello and Twin Falls samples. For the five events analyzed below, the percentage of units that had a duty cycle less than 55 percent ranged from 50 percent to 92 percent, with an average of 68 percent. The high percentage of units that do not appear to be responding to the paging signals indicate that there are likely paging signal complications in the MHAFB population.

Table 30. July 5th MHAFB Run-time Analysis – 50% Cycling Target

Curtailment Event	Total Units	Count With Duty Cycle <=55%	% With Duty Cycle <=55%	% With Duty Cycle <=60%	Avg Duty Cycle
5-Jul	12	6	50%	50%	60%
11-Jul	12	11	92%	92%	33%
29-Jul	12	9	75%	75%	43%
17-Aug	12	8	67%	67%	46%
26-Aug	12	7	58%	67%	55%
Average	12	8	68%	70%	47%

The average non-contributing participant rate in MHAFB was 4 percent. This was significantly lower than that of Boise metro (19 percent) and Pocatello and Twin Falls (18 percent) regions. This result is likely explained by the fact that residents living on the MHAFB do not pay their electricity bill and thus have no personal incentive to turn off their A/C unit. The low non-contributing participant rate in the MHAFB explains why the average demand reduction per unit is similar to that of Boise metro participants even with the high percentage of units that did not respond to the paging signal.

Table 31. MHAFB Non-contributing Participant Analysis

Event	Total Participants	Non-Contributing Participants During CE (count)	Non-Contributing Participants During CE (%)
5-Jul	12	0	0%
6-Jul	12	0	0%
11-Jul	12	2	17%
12-Jul	12	1	8%
18-Jul	12	0	0%
25-Jul	12	0	0%
29-Jul	12	0	0%
10-Aug	12	0	0%
17-Aug	12	1	8%
18-Aug	12	2	17%
22-Aug	12	0	0%
24-Aug	12	0	0%
26-Aug	12	0	0%
Average	12	0	4%

Snapback and Net Energy Impact

The results of the MHAFB snapback and net energy impact analysis show that participants saved on average 1.17 kWh per unit during the curtailment event. MHAFB participants actually consumed less energy (0.03 kWh per unit) compared to the baseline during the two-hour snapback period, which is unexpected because when curtailment events end, A/C units are normally turned on for longer than normal. When the curtailment event and snapback period are both accounted for, participants saved on average 1.19 kWh per unit.

Table 32. MHAFB Snapback and Net Energy Impact Results

Event Date	Energy Savings During CE (kWh per unit)	Energy Savings During 2 hr Snapback (kWh per unit)	Energy Savings During CE + 2 hr. Snapback (kWh per unit)	Snapback % (2 hr. Snapback Impact as % of CE Impact)
5-Jul	1.05	0.77	1.82	-74%
6-Jul	1.65	1.50	3.16	-91%
11-Jul	2.60	0.28	2.88	-11%
12-Jul	1.58	(0.19)	1.40	12%
18-Jul	0.47	(0.59)	-0.12	126%
25-Jul	2.31	0.60	2.91	-26%
29-Jul	2.32	0.06	2.38	-3%
10-Aug	0.96	0.45	1.42	-47%
17-Aug	0.33	(0.40)	-0.08	123%
18-Aug	1.00	(0.01)	0.99	1%
22-Aug	0.43	(0.41)	0.03	93%
24-Aug	0.02	(1.16)	-1.14	6064%
26-Aug	0.41	(0.55)	-0.14	133%
Average	1.17	0.03	1.19	485%

Aggregate Results

Aggregate Demand Results

By extrapolating the per unit demand savings to the entire population, we can calculate the overall program savings. Table 33 shows the total number of program participants by region as of January 2011.

Table 33. Program Population by Region

Region	Program Population	% of Total
Boise	29,271	82%
Pocatello/Twin Falls	5,821	16%
MHAFB	803	2%
Total	35,895	100%

Table 34 shows the average demand reduction achieved for each event within Boise metro (29,271 total participants as of January 2011). The demand reduction varied from a high of 20,289 kW to a low of 1,108 kW. The average demand reduction for all events combined was 12,614 kW.

Table 34. Boise Demand Results - Total Program Population

Event Date	Total Max Demand Reduction (kW)	Total Min Demand Reduction (kW)	Total Avg Demand Reduction (kW)
5-Jul	27,201	(56)	18,520
6-Jul	30,099	(2,334)	20,289
11-Jul	25,573	1,253	13,416
12-Jul	30,499	(6,052)	19,242
18-Jul	24,786	2,276	15,925
25-Jul	30,666	(5,951)	17,771
29-Jul	21,534	(1,498)	15,342
10-Aug	10,847	(5,743)	3,179
17-Aug	9,486	(4,339)	1,108
18-Aug	9,848	(7,806)	2,402
22-Aug	23,258	3,516	15,119
24-Aug	19,875	348	12,211
26-Aug	21,842	(2,747)	9,454
Average	21,963	(2,241)	12,614

Table 35 shows the average demand reduction achieved for each event within the Pocatello and Twin Falls population (5,821 total participants as of January 2011). The demand reduction varied from a high of 1,067 kW on August 22nd to a low of -1,986 kW on July 25th. The average demand reduction for all events combined was -41 kW. By all indications, the Pocatello/Twin Falls devices were not functioning. The variation in savings and the negative average value are artifacts of noise in the baseline demand profile.

Table 35. Pocatello/Twin Falls Demand Results - Total Program Population

Event Date	Total Max Demand Reduction (kW)	Total Min Demand Reduction (kW)	Total Avg Demand Reduction (kW)
5-Jul	1,873	(2,497)	(605)
6-Jul	2,371	(1,140)	469
11-Jul	4,417	(1,548)	478
12-Jul	1,549	(2,068)	(594)
18-Jul	2,179	(1,300)	526
25-Jul	(44)	(3,555)	(1,986)
29-Jul	2,373	(1,086)	333
10-Aug	1,360	(2,130)	(595)
17-Aug	348	(2,355)	(960)
18-Aug	3,429	(1,510)	795
22-Aug	3,126	(1,976)	1,067
24-Aug	1,170	(1,303)	(151)
26-Aug	1,987	(830)	691
Average	2,011	(1,792)	(41)

Table 36 shows the average demand reduction achieved for each event within the MHAFB population (803 total participants as of January 2011). The demand reduction varied from a high of 697 kW to a low of 5kW. The average demand reduction for all events combined was 312 kW.

Table 36. MHAFB Demand Results - Total Program Population

Event Date	Total Max Demand Reduction (kW)	Total Min Demand Reduction (kW)	Total Avg Demand Reduction (kW)
5-Jul	923	(196)	280
6-Jul	1,139	(201)	443
11-Jul	1,172	(214)	697
12-Jul	1,234	(332)	424
18-Jul	617	(408)	127
25-Jul	1,211	(35)	618
29-Jul	1,287	(24)	622
10-Aug	781	(260)	257
17-Aug	505	(455)	88
18-Aug	781	(290)	268
22-Aug	722	(422)	116
24-Aug	607	(443)	5
26-Aug	543	(431)	111
Average	886	(286)	312

The results above are presented by region: Boise metro, Pocatello and Twin Falls, and MHAFB. To calculate the cumulative program impacts, the regional per unit demand savings results were weighted by each region's percentage of total program participants (Table 33) to show aggregate program impacts. Table 37 shows the average per unit demand reduction for all program participants for each event. The kW reduction per unit varies from a high of 0.59 kW on July 6th to a low of 0.01 kW on August 17th. The overall average kW per unit for the thirteen analyzed events combined is 0.36 kW.

Table 37. All Regions Demand Savings - per Unit

Event Date	Max Demand Reduction per Unit (kW)	Min Demand Reduction per Unit (kW)	Avg Demand Reduction per Unit (kW)
5-Jul	0.84	-0.08	0.51
6-Jul	0.94	-0.10	0.59
11-Jul	0.87	-0.01	0.41
12-Jul	0.93	-0.24	0.53
18-Jul	0.77	0.02	0.46
25-Jul	0.89	-0.27	0.46
29-Jul	0.70	-0.07	0.45
10-Aug	0.36	-0.23	0.08
17-Aug	0.29	-0.20	0.01
18-Aug	0.39	-0.27	0.10
22-Aug	0.76	0.03	0.45
24-Aug	0.60	-0.04	0.34
26-Aug	0.68	-0.11	0.29
Average	0.69	-0.12	0.36

Figure 20 shows the total kW demand reduction attributed to the entire program participant population (35,895) for each event. The vast majority of the demand savings for the program are attributed to the Boise metro region so the aggregated demand savings are similar to the demand savings described in the Boise metro results section.

Figure 20. Overall Program Demand Reduction per Event

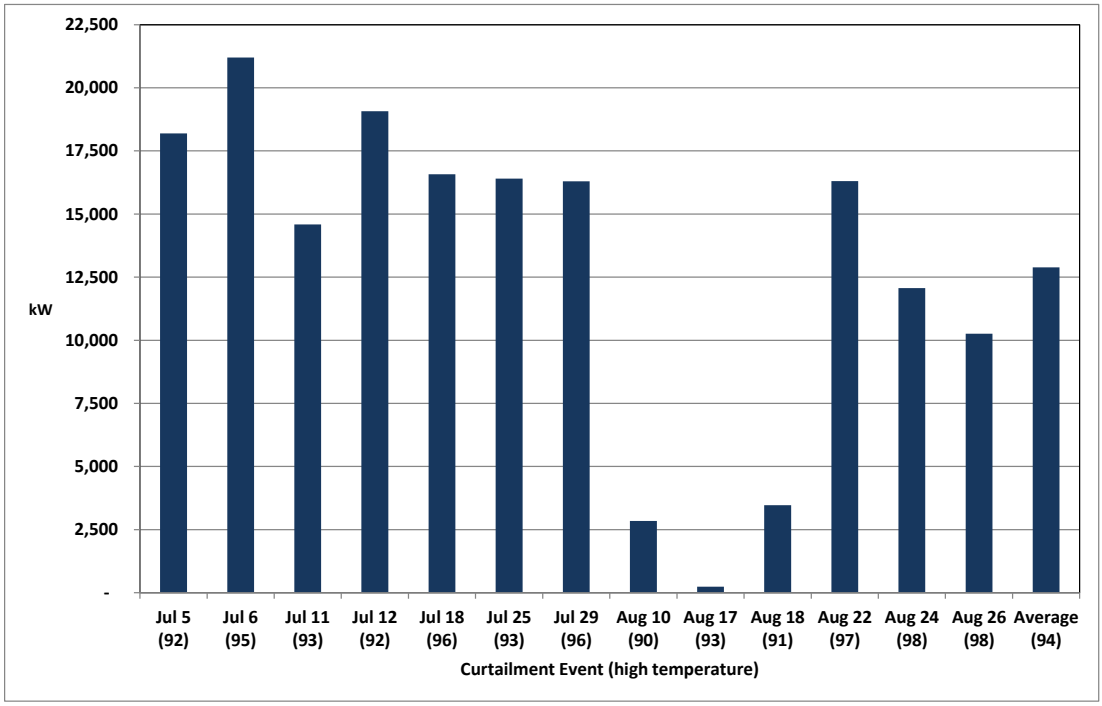


Table 38 presents the overall program demand reduction events for each event. The total demand reduction for each event ranged from a high of 21,200 kW (July 6th) to a low of 236 kW (August 17th). The average demand reduction for all 13 events combined was 12,885 kW.

Table 38. Overall Program Demand Reduction Results

Event Date	Total Max Demand Reduction (kW)	Total Min Demand Reduction (kW)	Total Avg Demand Reduction (kW)
5-Jul	29,997	(2,749)	18,196
6-Jul	33,609	(3,675)	21,200
11-Jul	31,162	(510)	14,591
12-Jul	33,282	(8,452)	19,072
18-Jul	27,582	568	16,577
25-Jul	31,833	(9,542)	16,403
29-Jul	25,193	(2,608)	16,297
10-Aug	12,988	(8,133)	2,841
17-Aug	10,338	(7,149)	236
18-Aug	14,058	(9,606)	3,465
22-Aug	27,106	1,118	16,303
24-Aug	21,652	(1,399)	12,064
26-Aug	24,372	(4,008)	10,256
Average	24,859	(4,319)	12,885

Aggregate Snapback and Net Energy Impact Results

Boise

When extended to the entire program population, the snapback and net energy impact analysis results for Boise metro show 37,841 kWh savings during the curtailment event, offset by a 20,449 kWh increase during the two-hour snapback period. The curtailment event and snapback period combined show 17,392 kWh savings for the region.

Table 39. Boise Snapback and Net Energy Impact Results - Total Program Population

Event Date	Total Energy Savings During CE (kWh)	Total Energy Savings During 2 hr Snapback (kWh)	Total Energy Savings During CE + 2 hr. Snapback (kWh)
5-Jul	55,561	(4,838)	50,724
6-Jul	60,866	(12,779)	48,087
11-Jul	40,249	(22,787)	17,462
12-Jul	57,725	(11,710)	46,015
18-Jul	47,774	(10,939)	36,835
25-Jul	53,314	(17,037)	36,277
29-Jul	46,027	(13,452)	32,575
10-Aug	9,538	(34,040)	(24,502)
17-Aug	3,324	(35,104)	(31,780)
18-Aug	7,205	(33,833)	(26,628)
22-Aug	45,358	(22,019)	23,338
24-Aug	36,632	(22,072)	14,560
26-Aug	28,363	(25,233)	3,130
Average	37,841	(20,449)	17,392

MHAFB

When extended to the entire program population, the snapback and net energy impact analysis results for MHAFB show 936 kWh savings during the curtailment event, with an additional 22 kWh savings during the two-hour snapback period. The curtailment event and snapback period combined show 957 kWh savings for the region.

Table 40. MHAFB Snapback and Net Energy Impact Results - Total Program Population

Event Date	Total Energy Savings During CE (kWh)	Total Energy Savings During 2 hr Snapback (kWh)	Total Energy Savings During CE + 2 hr. Snapback (kWh)
5-Jul	841	619	1,460
6-Jul	1,328	1,206	2,535
11-Jul	2,091	221	2,312
12-Jul	1,271	(151)	1,121
18-Jul	380	(477)	(98)
25-Jul	1,853	484	2,337
29-Jul	1,865	49	1,914
10-Aug	771	365	1,136
17-Aug	263	(324)	(61)
18-Aug	804	(10)	794
22-Aug	349	(326)	23
24-Aug	15	(933)	(918)
26-Aug	333	(442)	(109)
Average	936	22	957

Indoor Temperature Analysis Results

A potential concern of running demand response events that curtail customers' A/C units is the impact on indoor air temperature (IAT) and occupant comfort in the home during the curtailment event. To understand how much IAT is impacted during the curtailment event, temperature loggers were installed in a subset of participants' homes. The resulting data from the IAT loggers was analyzed to investigate how much IAT increased as a result of the homes' A/C units being cycled off.

This analysis was completed for the Boise metro and MHAFB region participants. IAT impacts to Pocatello/Twin Falls region participants were not analyzed because this region did not experience demand reductions due to issues with the AC units receiving the demand response signal

The results for Boise metro participants below show that the IAT increase during the curtailment event ranged on average from -0.19°°F to 0.59°F, with an average across all curtailment events of 0.19°F. This low IAT impact is due to the fact that residential AC units are typically oversized. The oversizing of the units means that cycling them at 50 percent can maintain an IAT not significantly higher than the IAT when the units are not cycled. This conclusion is supported by the Pocatello and Twin Falls run-time analyses results that showed 10 percent and 16 percent of A/C units (for July 5th and July 11th events, respectively) that were not being controlled still met the cycling target.

The minimal change of IAT indicates that the cycling rate implemented on the Boise metro participant population did not have a significant impact on the participants comfort. This suggests that Idaho Power could increase the cycling rate during curtailment events in order to achieve greater demand reduction while still not significantly impacting the comfort of participants.

Figure 21. Boise Average IAT Increase

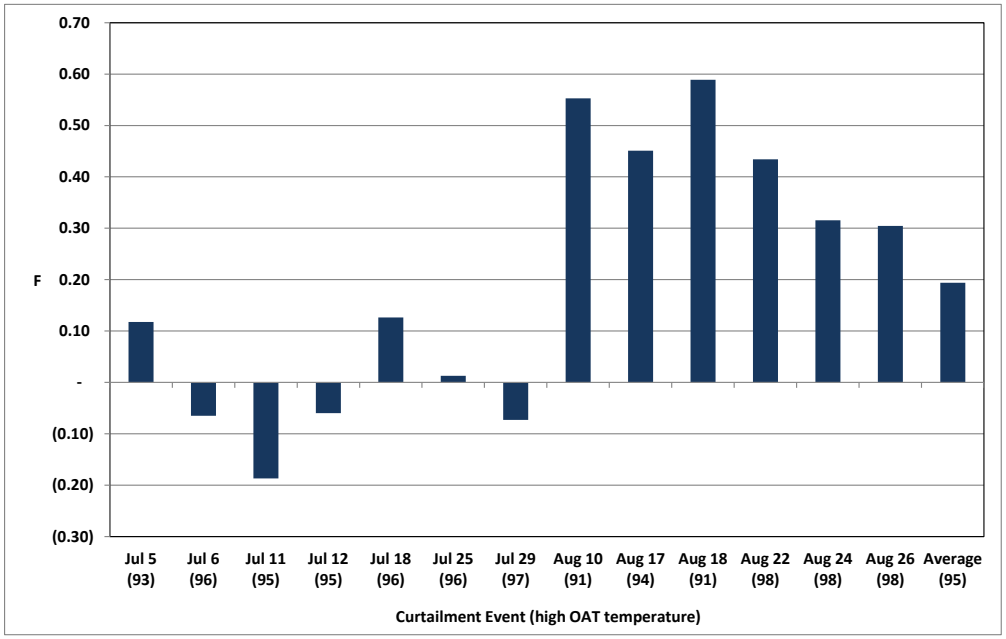


Table 41. Boise IAT Analysis Results

Event Date	Max IAT Increase (°F)	Min IAT Increase (°F)	Avg IAT Increase (°F)
5-Jul	0.30	(0.06)	0.12
6-Jul	0.07	(0.17)	(0.06)
11-Jul	(0.02)	(0.33)	(0.19)
12-Jul	0.13	(0.18)	(0.06)
18-Jul	0.28	(0.06)	0.13
25-Jul	0.17	(0.12)	0.01
29-Jul	0.18	(0.22)	(0.07)
10-Aug	0.89	0.00	0.55
17-Aug	0.93	(0.06)	0.45
18-Aug	0.80	0.11	0.59
22-Aug	0.90	0.06	0.43
24-Aug	0.73	(0.03)	0.32
26-Aug	0.71	(0.07)	0.30
Average	0.47	(0.09)	0.19

In order to make sure that non-responding and non-contributing participants were not skewing the IAT results, we excluded all non-responding and non-contributing participants for three event days (July 5th, July 11th, and August 24th) and analyzed the results. Table 42 shows the comparison between the results that included all participants with IAT loggers and the results from the analysis which excluded non-contributing and non-participating participants. The IAT increase was slightly higher after excluding non-contributing and non-participating participants, but the maximum increase of the three events analyzed still was less than one degree.

Table 42: IAT Analysis Comparison

	All participants			Excluding non-contributors and non-responders		
Event Date	Max IAT Increase (°F)	Min IAT Increase (°F)	Avg IAT Increase (°F)	Max IAT Increase (°F)	Min IAT Increase (°F)	Avg IAT Increase (°F)
5-Jul	0.30	(0.06)	0.12	0.74	(0.05)	0.38
11-Jul	(0.02)	(0.33)	(0.19)	0.08	(0.17)	(0.03)
24-Aug	0.73	(0.03)	0.32	0.87	(0.05)	0.38

The results for the MHAFB IAT analysis are shown in Figure 22 and

Table 43. The change in IAT ranged from a low of -0.12 degrees (July 5th) to a high of 1.06 degrees (July 25th). The average change in IAT during events was 0.38 degrees. The minimal change of IAT indicates that the cycling rate implemented on the MHAFB participant population did not have a significant impact on the participants comfort. This suggests that Idaho Power could increase the cycling rate during curtailment events in order to achieve greater demand reduction while still not significantly impacting the comfort of participants.

Figure 22: MHAFB Average IAT Increase

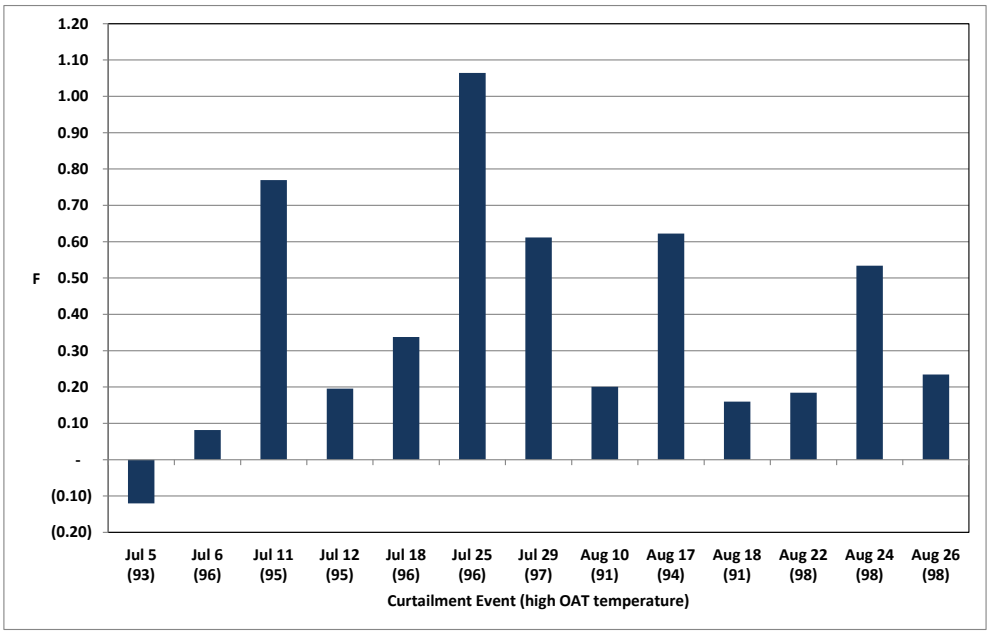


Table 43. MHAFB IAT Analysis Results

Event Date	Max IAT Increase (°F)	Min IAT Increase (°F)	Avg IAT Increase (°F)
5-Jul	0.08	(0.29)	(0.12)
6-Jul	0.36	(0.12)	0.08
11-Jul	1.76	(0.06)	0.77
12-Jul	0.62	(0.12)	0.20
18-Jul	0.86	0.01	0.34

25-Jul	2.35	(0.03)	1.06
29-Jul	1.37	0.03	0.61
10-Aug	0.49	(0.11)	0.20
17-Aug	0.87	0.04	0.62
18-Aug	0.42	(0.04)	0.16
22-Aug	0.70	(0.14)	0.18
24-Aug	0.87	(0.01)	0.53
26-Aug	0.42	0.02	0.23
Average	0.86	(0.06)	0.38

Conclusions

The evaluation successfully measured the net impacts of Idaho Power's AC Cool Credit program during the 2011 curtailment season. It is important to note that the results presented in this report reflect the specific characteristics of the events executed during the 2011 curtailment season and do not reflect an absolute savings value that the program can achieve. Factors such as weather and the cycling strategy can have a significant impact on the achieved demand savings. The total average demand reduction for the program was 0.36 kW per unit. This result was impacted by the fact that the Pocatello and Twin Falls participants' AC units were not being curtailed during events due to a software integration error related to the signal dispatch system for the PLC load control devices. The average impact excluding the Pocatello/Twin Falls and MHAFB regions was a reduction of 0.43 kW per unit. Key findings and recommendations are described below.

Key Findings

Key Findings

- Idaho Power's system peak occurred on July 6th. The average demand reduction for the entire program during this event was 0.59 kW per unit. The average and maximum reductions by region for this event are listed below. Since the results from the Pocatello/Twin Falls and MHAFB were impacted by signal problems, the Boise metro result of 0.69 kW per unit is the best approximation of the achievable demand savings for all units during the July 6th peak if the signal issues were resolved.
    - Bose metro:
        - Average demand reduction was 0.69 kW per unit
        - Maximum demand savings for any five minute interval was 1.03 kW per unit
        - Maximum demand reduction for any 15 minute interval was 0.86 kW per unit
        - Maximum demand reduction for any one hour interval was 0.77 kW per unit
    - MHAFB
        - Average demand savings of 0.55 kW per unit
        - Maximum demand savings for any five minute interval was 1.42 kW per unit
        - Maximum demand savings for any 15 minute interval was 1.00 kW per unit
        - Maximum demand savings for any one hour interval was 0.78 kW per unit
    - Pocatello/Twin Falls
        - Average demand savings of 0.08 kW per unit

- The average overall demand reduction for the entire program for the 2011 curtailment season was 0.36 kW per unit. The negative value for Pocatello, which is a result of noise in the baseline demand profile, should be considered zero demand reduction. By region, the average reductions were:
    - 0.43 kW per unit for Boise metro,
    - 0.39 kW per unit for MHAFB, and

- -0.01 kW per unit for Pocatello.

- The rate of non-contributing participants, defined as those participants whose AC units did not turn on for the entire duration of an event, for the civilian population was approximately 19 percent. This effectively means that 19 percent of the civilian participants are not contributing to any demand reduction when events are called, resulting in a lower average demand per unit and, therefore, a lower total kW reduction for the program.

- The duty cycle analysis results showed that 90 percent of the units in Boise metro had a duty of 55 percent or greater, which is the cut-off used to determine if an A/C unit responded to the curtailment signal. This indicates that approximately 10 percent of the units were not responding to the curtailment signal.

- Accounting for the non-contributing participants and the units that are not responding to the signal, it is estimated that 71 percent of the total participating units in Boise metro are contributing to the demand reduction in that area.

- An analysis was conducted on the July 6th event for the Boise metro region that excluded all non-responders, but still included all non-contributing participants. It is very unlikely that any program will have a zero percent non-responder rate, so the intent of this analysis was to show the maximum achievable savings for this event had there been no non-responders. This analysis had the following results:
  - Average demand reduction was 0.74 kW per unit.
  - Maximum demand reduction for any five minute interval was 1.08 kW per unit.
  - Maximum demand reduction for any 15 minute interval was 0.91 kW per unit.
  - Maximum demand reduction for any one hour interval was 0.84 kW per unit.

- The natural duty cycle (the percent of time the unit runs) for A/C units in the Boise metro population is approximately 43 percent on days with an average temperature of 95 degrees. An analysis of eight baseline days with high temperatures within two degrees of the average high temperature during curtailment days was conducted. The average temperature of the eight days was 95 degrees, which was the same average high of the Boise metro curtailment event days. The analyses results showed that the natural duty cycle was 43 percent and 58 percent of the units had a natural duty cycle less than 50 percent. This is significant because the lower natural duty cycle means that there is less available demand to curtail. In addition, the devices in Boise metro area that do not have adaptive controls will not make a significant contribution to demand savings if the natural duty cycle is at or less than the program's cycling target.

- For the Pocatello / Twin Falls population, approximately a quarter of the units had a natural duty cycle of 50 percent or lower (meaning that the units were running 50 percent of the time) and 13.5 percent of the units had a natural duty cycle 40 percent or lower. The low natural duty cycle reduces the available demand to that can be curtailed.

- Pocatello and Twin Falls participants' A/C units were not responding to the curtailment signals dispatched from the program. Pocatello and Twin Falls participants had power line carrier type devices installed on their AC units. The results showed that there was no demand reduction in the Pocatello and Twin Falls particpant population, indicating a fault in the dispatch system used for the power line carrier devices. This lowered the overall impacts of the A/C Cool Credit program.

- The non-contributing participant rate was very low (4 percent) for the MHAFB population. This is expected since residents living at the MHAFB do not pay utility bills, and therefore have no incentive to reduce their AC usage.

- The run-time analysis for the MHAFB sample showed that approximately 60 percent of the units were meeting the cycling requirement and that 40 percent of the units were not responding to the paging signal. The pager signal problems at the MHAFB resulted in a lower average kW per unit for this population.

- The three events that resulted in the lowest demand reduction (August 10th, 17th, and 18th) had on average 31 percent lower total demand during the 5- minute interval proceeding the start of the curtailment event than the other event days. This indicates that the program achieves significantly better demand reduction results during higher demand days compared to lower demand days.

- The average demand reduction for the single weekend event was significantly higher than the reduction for the weekday events. The weekend event resulted in a demand reduction of 0.97 kW per unit compared to an average weekday reduction of 0.43 kW per unit.

- The indoor air temperature analysis results, based on loggers installed in a sample of participant homes, showed that the curtailment events had minimal impact on indoor air temperature in participant homes. The average increase in indoor air temperature during events was de minimis (0.19 degrees) in the Boise metro population and the maximum increase for a single event never exceeded 1.0 degrees.

Recommendations

- To maximize the program's potential, IPC should experiment with increasing the cycling rate as a way to increase average demand savings. As discussed in the key findings above, analysis of Pocatello events showed that a significant portion of the population had AC units with a natural duty cycle in the 40 to 50 percent range. In order to ensure that the vast majority of participants do contribute to demand reduction, the program could increase the cycling rates, especially for older control devices that are not programmed with adaptive algorithms. The indoor air temperature analysis findings also support the recommendation that the program could increase the cycling rates. The results from the indoor air temperature analysis showed that the 50 percent cycling rate implemented on the Boise metro population had a minimal impact on the indoor temperature of the participating homes. This indicates that that there is room for the program to increase the cycling rates without making a substantial impact to the comfort of program participants.

- To maximize the program's potential, IPC should investigate ways to target users likely to contribute to demand reduction. For example, data from IPC's existing AMI system could be used to target high energy users which could lower the non-contributing participant rate.

- The program should account for non-contributing participants when developing demand reduction estimates for program planning. Since no other data is available for the Boise metro and Pocatello area, we suggest that the program assume a 19 percent non-contributing participant rate, which can be updated with future evaluation results.

- During the next process evaluation, Idaho Power should evaluate the program design to identify ways to minimize the number of non-contributing participants.

- The program should work to increase the average kW per unit reductions by identifying and addressing issues affecting the pager signal reception in both the Boise metro and MHAFB populations.

- If processes are not already in place, the program should verify communication systems are operating correctly, sending correct signals to devices, and that the devices, both pager type and power line carrier type, are receiving signals prior to curtailment season.

- It is recommended that IPC conduct research to ensure that the devices with adaptive control capabilities are programmed correctly so that they are reducing the duty cycle relative to the natural duty cycle, not relative to clock-time. This evaluation did not investigate whether or not the devices with adaptive controls were behaving as cycling based on the adaptive algorithyms or clock-time, though a 2010 evaluation of PG&E's Smart AC program found that devices with adaptive controls were cycling based on clock-time, therefore, reducing the potential savings from the units.

- The AC Cool Credit program should consider both temperature and demand when deciding when to excecute an event. The events that took place on August 10th, 17th, and 18th demonstrate that days with an overall demand that is lower than a typical peak day, even with relatively hot temperatures, result in lower achieved demand savings.

Appendix

Boise Demand Results – Individual Events

Figure 23. Boise July 5th Curtailment Event Load Impact

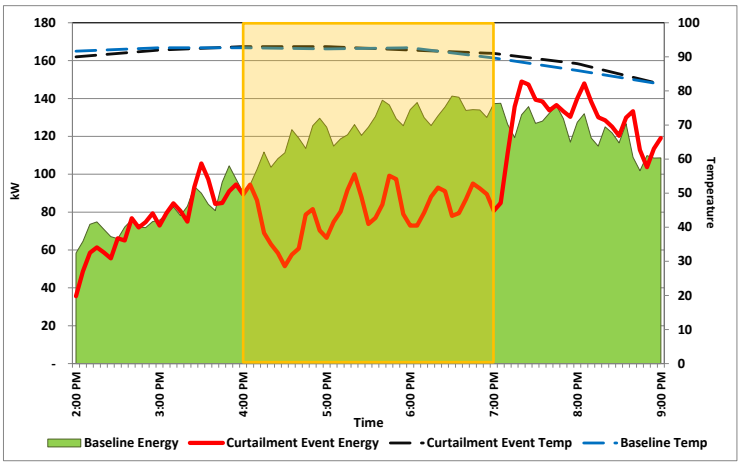


Table 44. Boise July 5th Curtailment Event Results

Item	Value
Date	5-Jul
High temperature	93
Max reduction per unit (kW)	0.93
Min reduction per unit (kW)	(0.00)
Avg reduction per unit (kW)	0.63

Figure 24. Boise July 6th Curtailment Event Load Impact

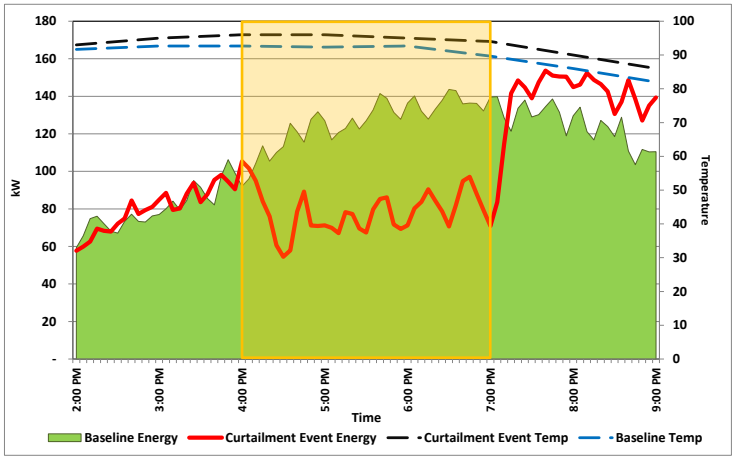


Table 45. Boise July 6th Curtailment Event Results

Item	Value
Date	6-Jul
High temperature	96
Max reduction per unit (kW)	1.03
Min reduction per unit (kW)	(0.08)
Avg reduction per unit (kW)	0.69

Figure 25. Boise July 11th Curtailment Event Load Impact

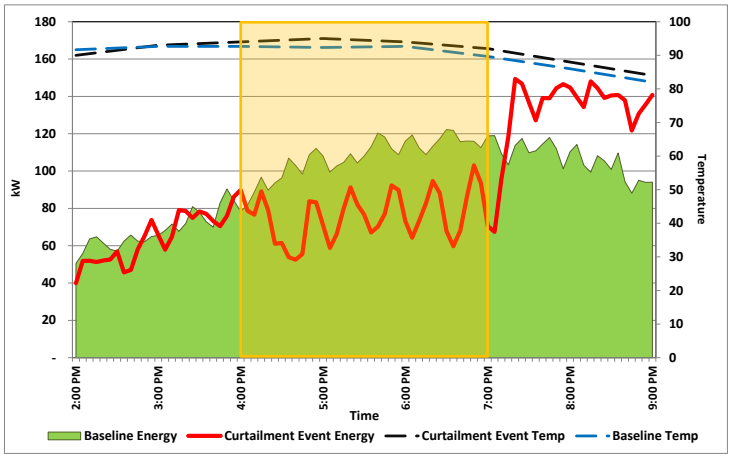


Table 46. Boise July 11th Curtailment Event Results

Item	Value
Date	11-Jul
High temperature	95
Max reduction per unit (kW)	0.87
Min reduction per unit (kW)	0.04
Avg reduction per unit (kW)	0.46

Figure 26. Boise July 12th Curtailment Event Load Impact

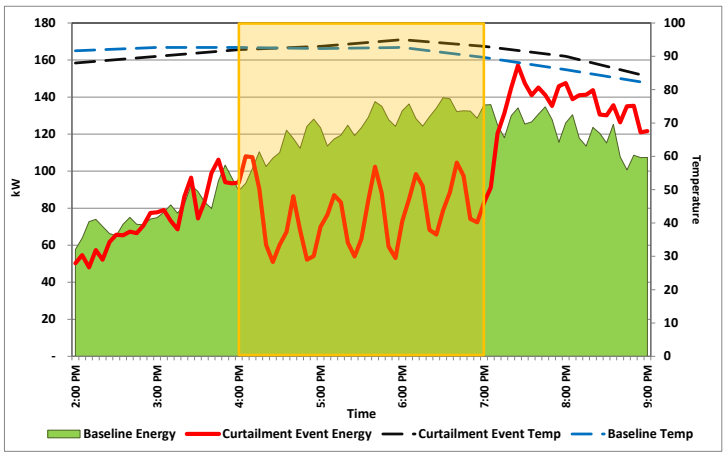


Table 47. Boise July 12th Curtailment Event Results

Item	Value
Date	12-Jul
High temperature	95
Max reduction per unit (kW)	1.04
Min reduction per unit (kW)	(0.21)
Avg reduction per unit (kW)	0.66

Figure 27. Boise July 18th Curtailment Event Load Impact

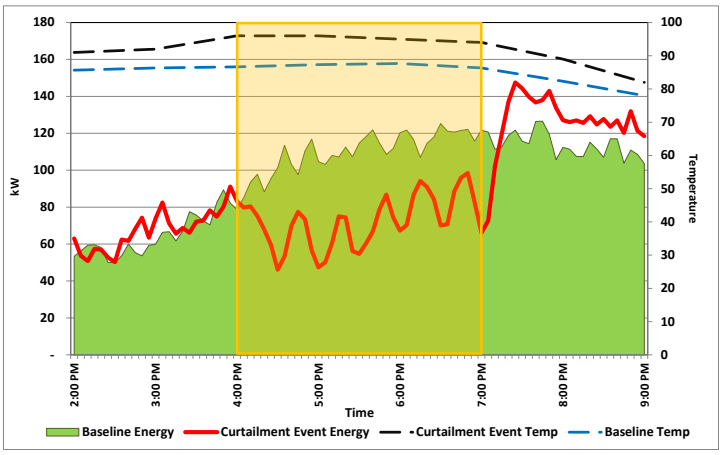


Table 48. Boise July 18th Curtailment Event Results

Item	Value
Date	18-Jul
High temperature	96
Max reduction per unit (kW)	0.85
Min reduction per unit (kW)	0.08
Avg reduction per unit (kW)	0.54

Figure 28. Boise July 25th Curtailment Event Load Impact

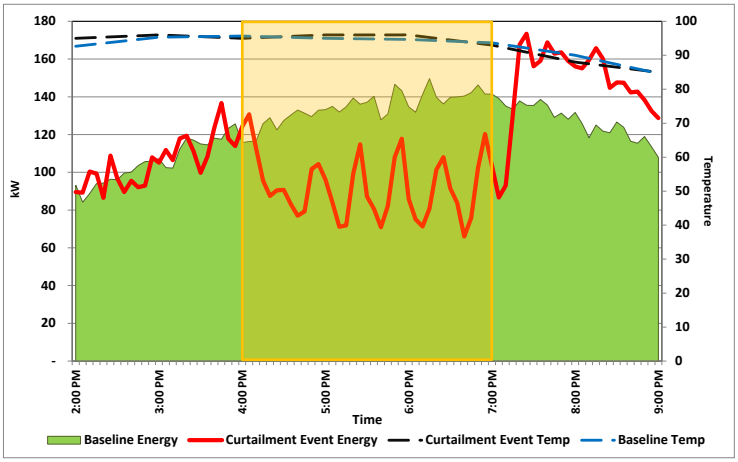


Table 49. Boise July 25th Curtailment Event Results

Item	Value
Date	25-Jul
High temperature	96
Max reduction per unit (kW)	1.05
Min reduction per unit (kW)	(0.20)
Avg reduction per unit (kW)	0.61

Figure 29. Boise July 29th Curtailment Event Load Impact

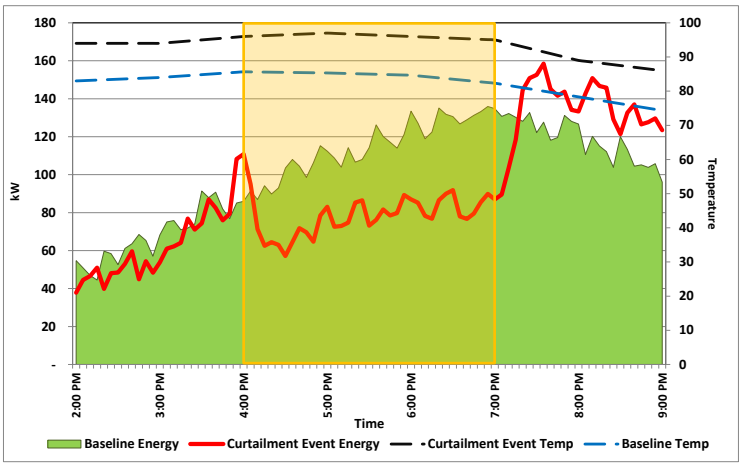


Table 50. Boise July 29th Curtailment Event Results

Item	Value
Date	29-Jul
High temperature	97
Max reduction per unit (kW)	0.74
Min reduction per unit (kW)	(0.05)
Avg reduction per unit (kW)	0.52

Figure 30. Boise July 31st Curtailment Event Load Impact

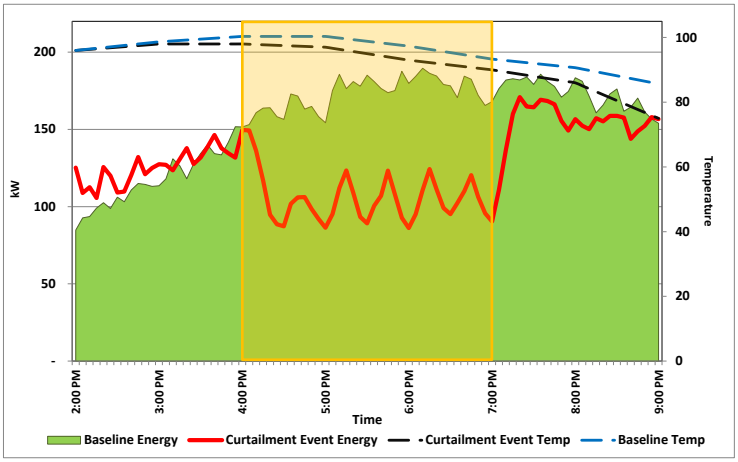


Table 51. Boise July 31st Curtailment Event Results

Item	Value
Date	31-Jul
High temperature	98
Max reduction per unit (kW)	1.35
Min reduction per unit (kW)	0.05
Avg reduction per unit (kW)	0.97

Figure 31. Boise August 10th Curtailment Event Load Impact

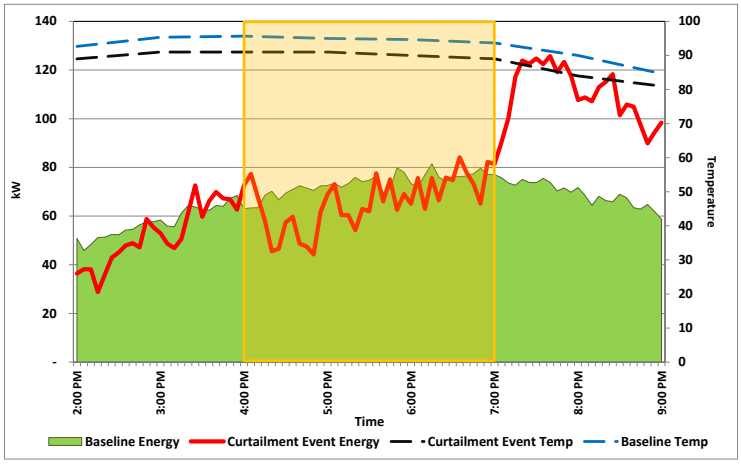


Table 52. Boise August 10th Curtailment Event Results

Item	Value
Date	10-Aug
High temperature	91
Max reduction per unit (kW)	0.37
Min reduction per unit (kW)	(0.20)
Avg reduction per unit (kW)	0.11

Figure 32. Boise August 17th Curtailment Event Load Impact

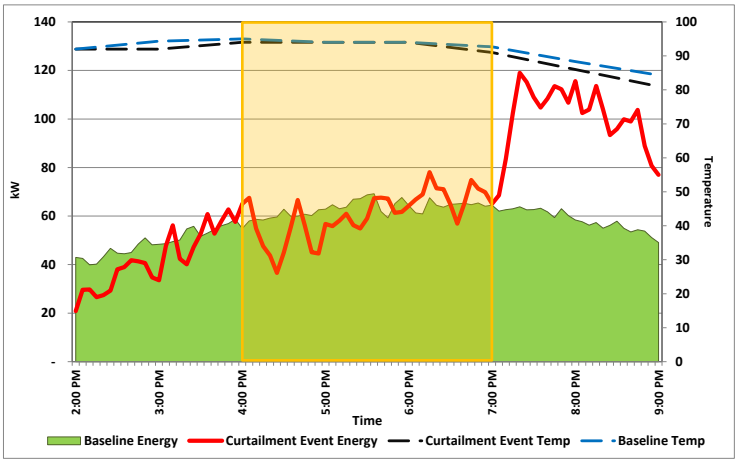


Table 53. Boise August 17th Curtailment Event Results

Item	Value
Date	17-Aug
High temperature	94
Max reduction per unit (kW)	0.32
Min reduction per unit (kW)	(0.15)
Avg reduction per unit (kW)	0.04

Figure 33. Boise August 18th Curtailment Event Load Impact

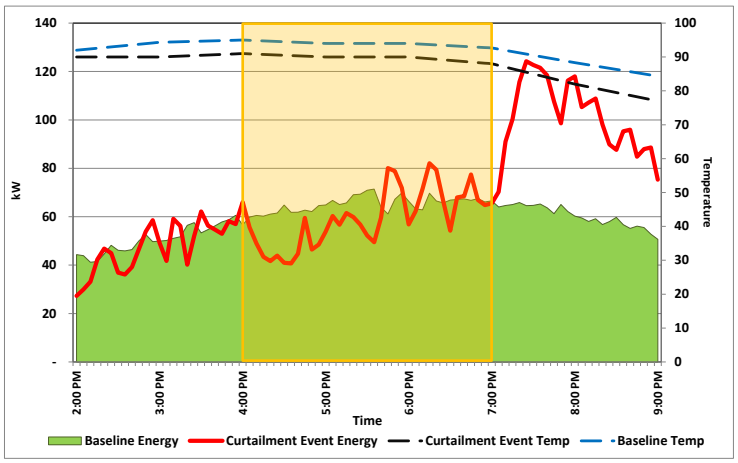


Table 54. Boise August 18th Curtailment Event Results

Item	Value
Date	18-Aug
High temperature	91
Max reduction per unit (kW)	0.34
Min reduction per unit (kW)	(0.27)
Avg reduction per unit (kW)	0.08

Figure 34. Boise August 22nd Curtailment Event Load Impact

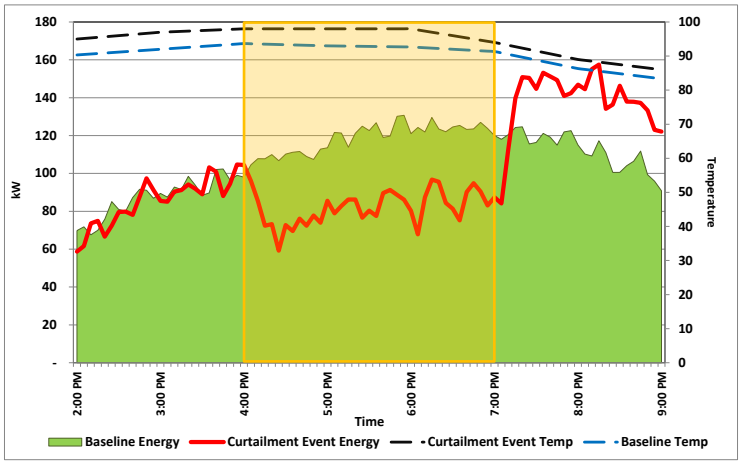


Table 55. Boise August 22nd Curtailment Event Results

Item	Value
Date	22-Aug
High temperature	98
Max reduction per unit (kW)	0.79
Min reduction per unit (kW)	0.12
Avg reduction per unit (kW)	0.52

Figure 35. Boise August 24th Curtailment Event Load Impact

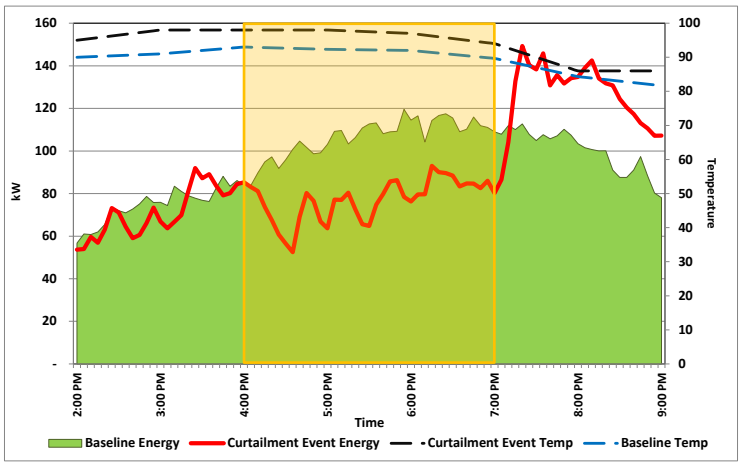


Table 56. Boise August 24th Curtailment Event Results

Item	Value
Date	24-Aug
High temperature	98
Max reduction per unit (kW)	0.68
Min reduction per unit (kW)	0.01
Avg reduction per unit (kW)	0.42

Figure 36. Boise August 26th Curtailment Event Load Impact

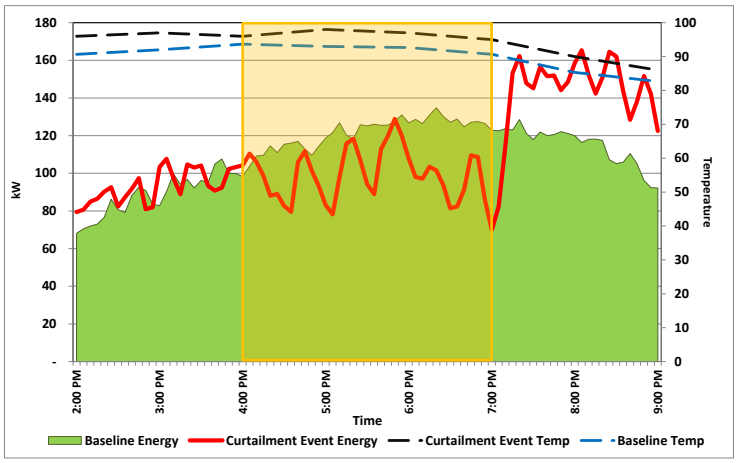


Table 57. Boise August 26th Curtailment Event Results

Item	Value
Date	26-Aug
High temperature	98
Max reduction per unit (kW)	0.75
Min reduction per unit (kW)	(0.09)
Avg reduction per unit (kW)	0.32

Pocatello/Twin Falls Demand Results – Individual Events

Figure 37. Pocatello/Twin Falls July 5th Curtailment Event Load Impact

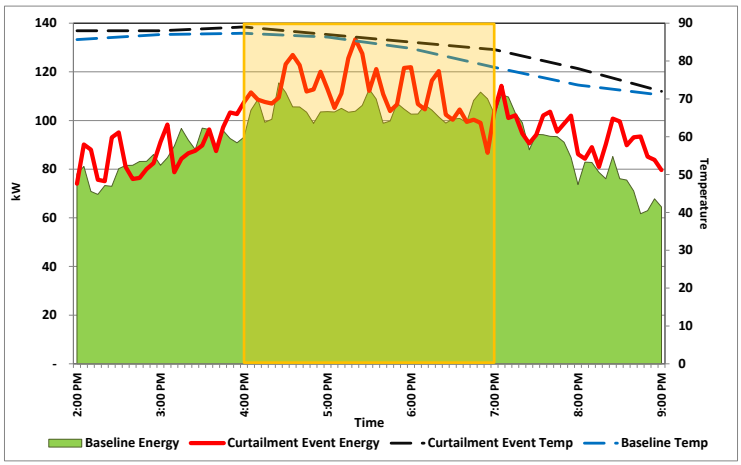


Table 58. Pocatello/Twin Falls July 5th Curtailment Event Results

Item	Value
Date	5-Jul
High temperature	91
Max reduction per unit (kW)	0.32
Min reduction per unit (kW)	(0.43)
Avg reduction per unit (kW)	(0.10)

Figure 38. Pocatello/Twin Falls July 6th Curtailment Event Load Impact

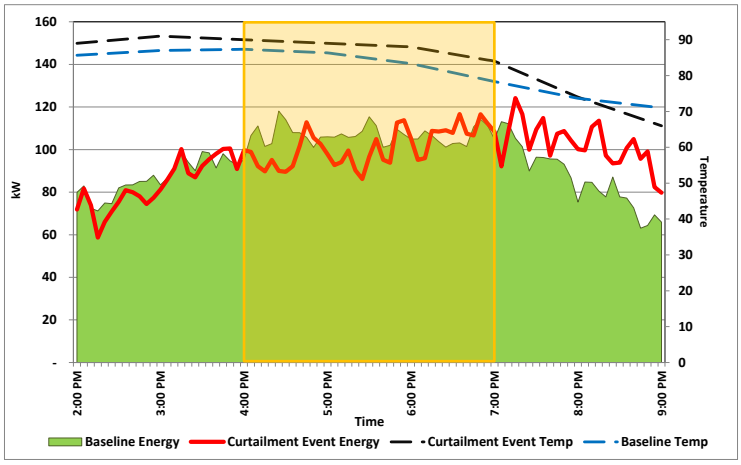


Table 59. Pocatello/Twin Falls July 6th Curtailment Event Results

Item	Value
Date	6-Jul
High temperature	94
Max reduction per unit (kW)	0.41
Min reduction per unit (kW)	(0.20)
Avg reduction per unit (kW)	0.08

Figure 39. Pocatello/Twin Falls July 11th Curtailment Event Load Impact

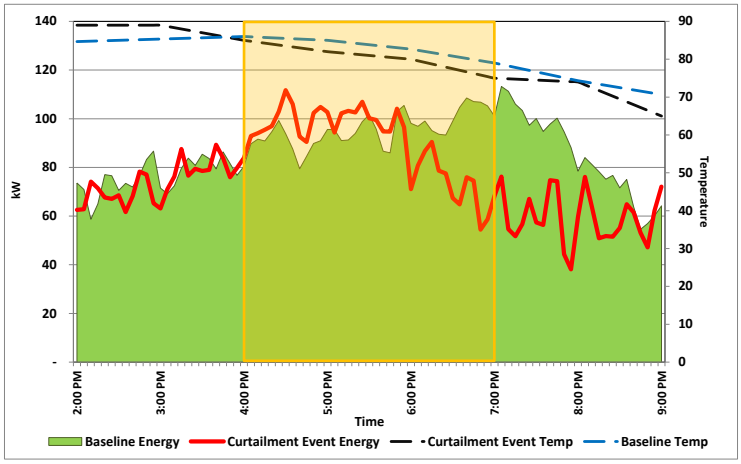


Table 60. Pocatello/Twin Falls July 11th Curtailment Event Results

Item	Value
Date	11-Jul
High temperature	91
Max reduction per unit (kW)	0.76
Min reduction per unit (kW)	(0.27)
Avg reduction per unit (kW)	0.08

Figure 40. Pocatello/Twin Falls July 12th Curtailment Event Load Impact

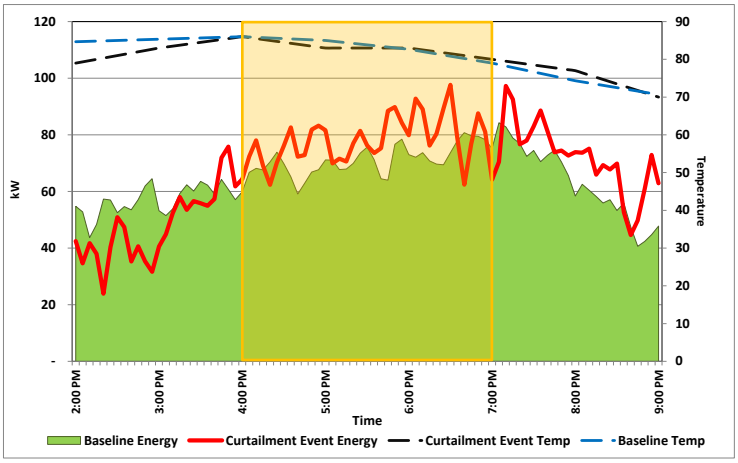


Table 61. Pocatello/Twin Falls July 12th Curtailment Event Results

Item	Value
Date	12-Jul
High temperature	89
Max reduction per unit (kW)	0.27
Min reduction per unit (kW)	(0.36)
Avg reduction per unit (kW)	(0.10)

Figure 41. Pocatello/Twin Falls July 18th Curtailment Event Load Impact

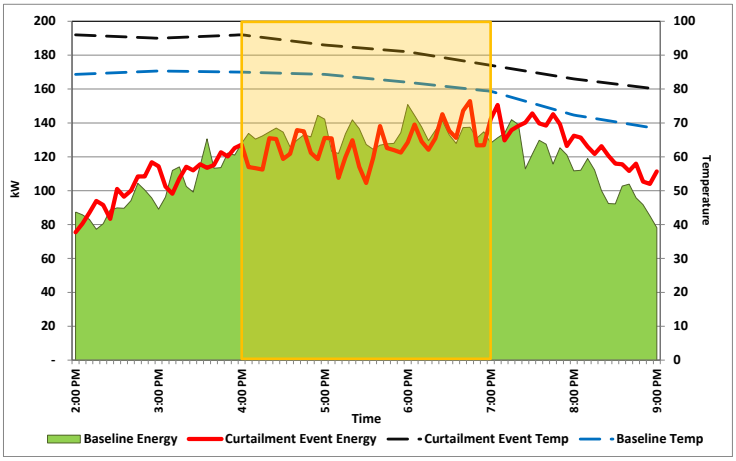


Table 62. Pocatello/Twin Falls July 18th Curtailment Event Results

Item	Value
Date	18-Jul
High temperature	96
Max reduction per unit (kW)	0.37
Min reduction per unit (kW)	(0.22)
Avg reduction per unit (kW)	0.09

Figure 42. Pocatello/Twin Falls July 25th Curtailment Event Load Impact

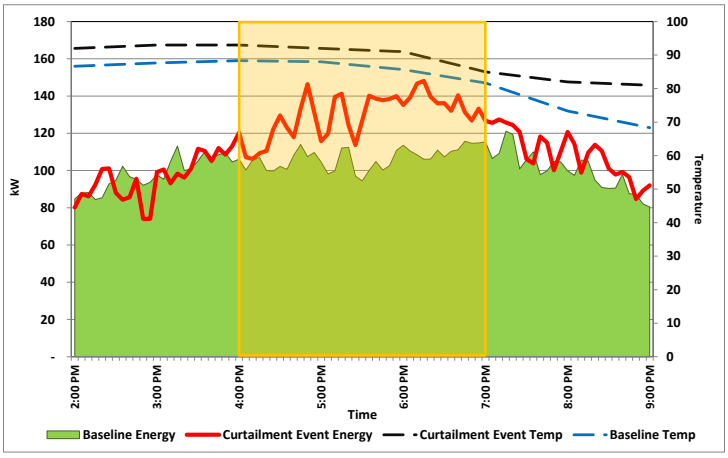


Table 63. Pocatello/Twin Falls July 25th Curtailment Event Results

Item	Value
Date	25-Jul
High temperature	91
Max reduction per unit (kW)	(0.01)
Min reduction per unit (kW)	(0.61)
Avg reduction per unit (kW)	(0.34)

Figure 43. Pocatello/Twin Falls July 29th Curtailment Event Load Impact

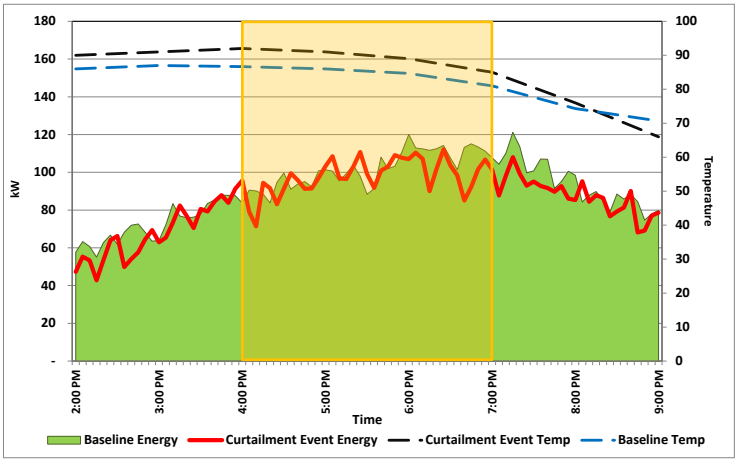


Table 64. Pocatello/Twin Falls July 29th Curtailment Event Results

Item	Value
Date	29-Jul
High temperature	94
Max reduction per unit (kW)	0.41
Min reduction per unit (kW)	(0.19)
Avg reduction per unit (kW)	0.06

Figure 44. Pocatello/Twin Falls August 10th Curtailment Event Load Impact

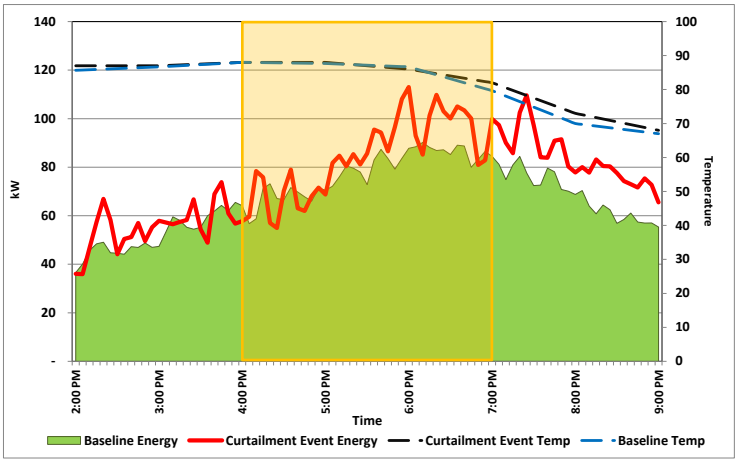


Table 65. Pocatello/Twin Falls August 10th Curtailment Event Results

Item	Value
Date	10-Aug
High temperature	90
Max reduction per unit (kW)	0.23
Min reduction per unit (kW)	(0.37)
Avg reduction per unit (kW)	(0.10)

Figure 45. Pocatello/Twin Falls August 17th Curtailment Event Load Impact

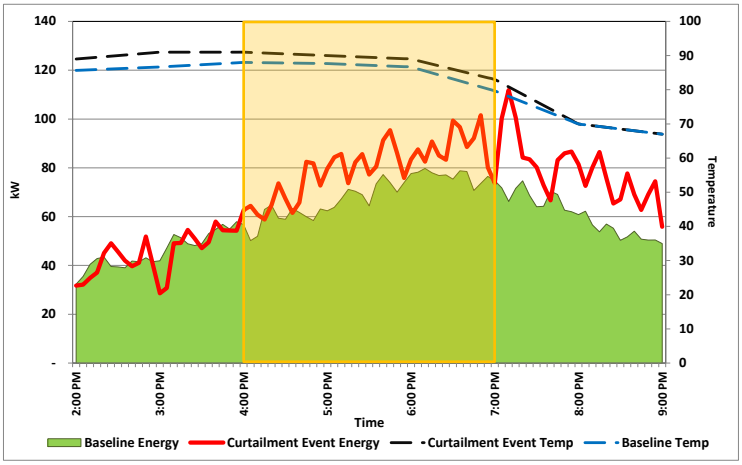


Table 66. Pocatello/Twin Falls August 17th Curtailment Event Results

Item	Value
Date	17-Aug
High temperature	92
Max reduction per unit (kW)	0.06
Min reduction per unit (kW)	(0.40)
Avg reduction per unit (kW)	(0.16)

Figure 46. Pocatello/Twin Falls August 18th Curtailment Event Load Impact

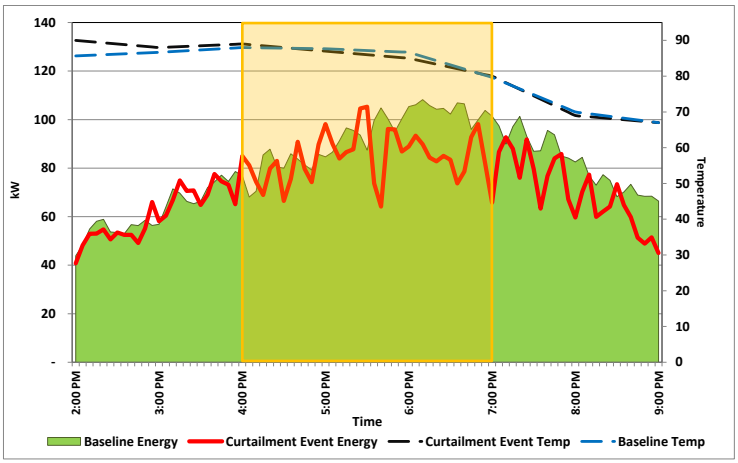


Table 67. Pocatello/Twin Falls August 18th Curtailment Event Results

Item	Value
Date	18-Aug
High temperature	90
Max reduction per unit (kW)	0.59
Min reduction per unit (kW)	(0.26)
Avg reduction per unit (kW)	0.14

Figure 47. Pocatello/Twin Falls August 22nd Curtailment Event Load Impact

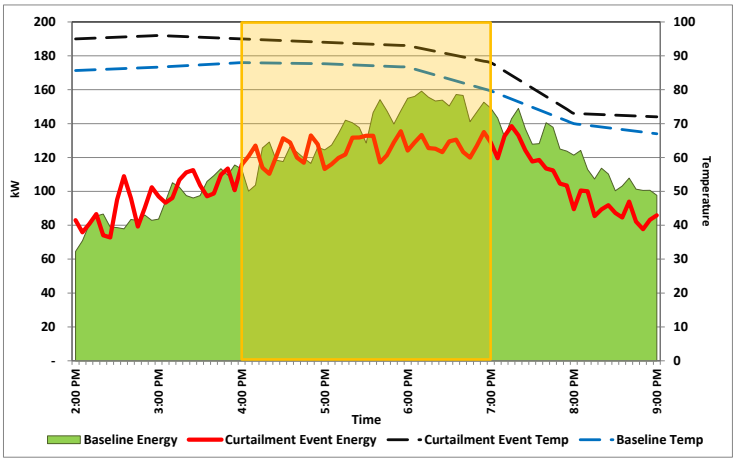


Table 68. Pocatello/Twin Falls August 22nd Curtailment Event Results

Item	Value
Date	22-Aug
High temperature	96
Max reduction per unit (kW)	0.54
Min reduction per unit (kW)	(0.34)
Avg reduction per unit (kW)	0.18

Figure 48. Pocatello/Twin Falls August 24th Curtailment Event Load Impact

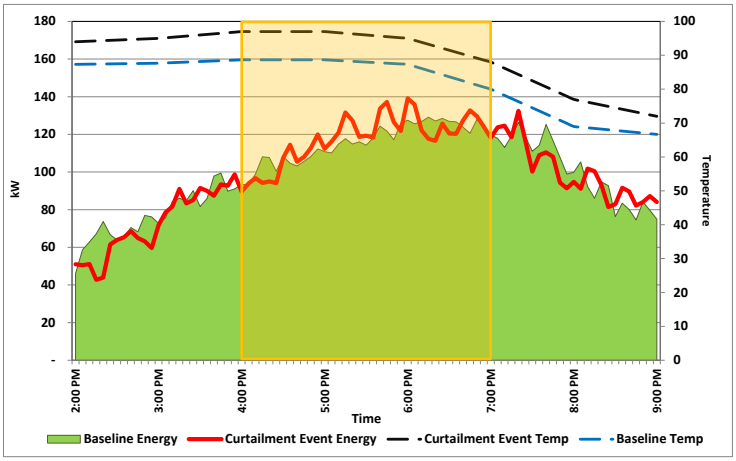


Table 69. Pocatello/Twin Falls August 24th Curtailment Event Results

Item	Value
Date	24-Aug
High temperature	97
Max reduction per unit (kW)	0.20
Min reduction per unit (kW)	(0.22)
Avg reduction per unit (kW)	(0.03)

Figure 49. Pocatello/Twin Falls August 26th Curtailment Event Load Impact

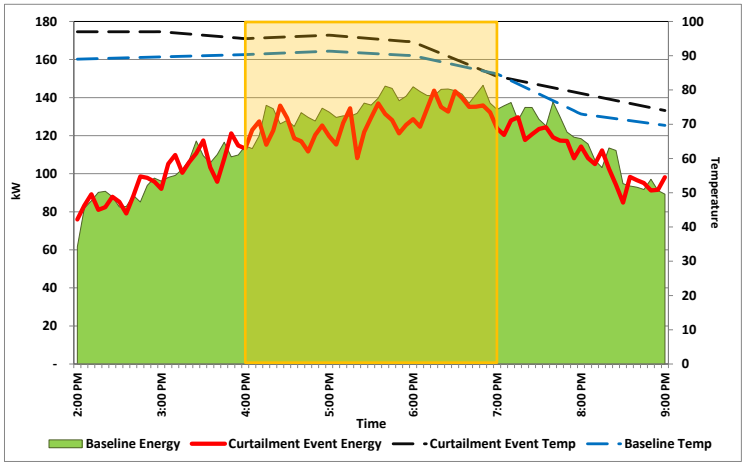


Table 70. Pocatello/Twin Falls August 26th Curtailment Event Results

Item	Value
Date	26-Aug
High temperature	97
Max reduction per unit (kW)	0.34
Min reduction per unit (kW)	(0.14)
Avg reduction per unit (kW)	0.12

MHAFB Demand Results – Individual Events

Figure 50. MHAFB July 5th Curtailment Event Load Impact

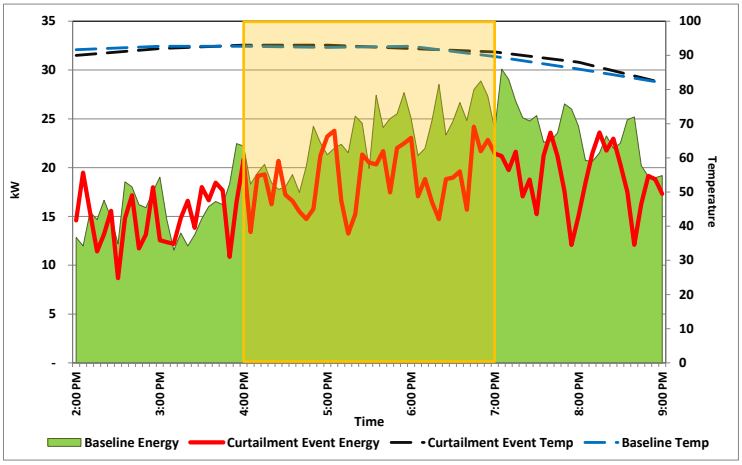


Table 71. MHAFB July 5th Curtailment Event Results

Item	Value
Date	5-Jul
High temperature	93
Max reduction per unit (kW)	1.15
Min reduction per unit (kW)	(0.24)
Avg reduction per unit (kW)	0.35

Figure 51. MHAFB July 6th Curtailment Event Load Impact

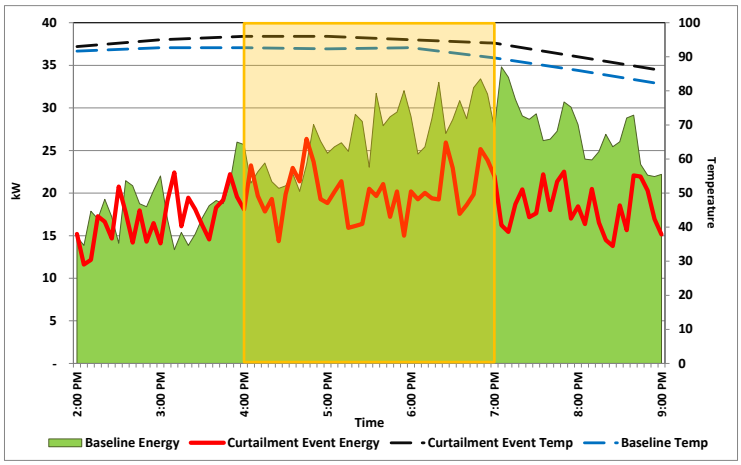


Table 72. MHAFB July 6th Curtailment Event Results

Item	Value
Date	6-Jul
High temperature	96
Max reduction per unit (kW)	1.42
Min reduction per unit (kW)	(0.25)
Avg reduction per unit (kW)	0.55

Figure 52. MHAFB July 11th Curtailment Event Load Impact

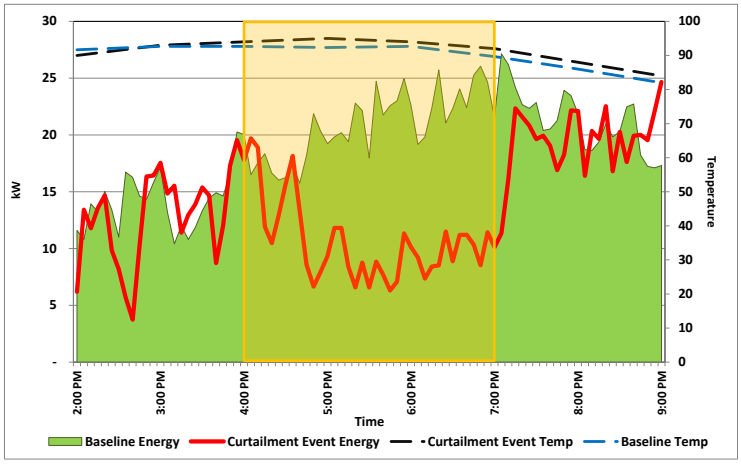


Table 73. MHAFB July 11th Curtailment Event Results

Item	Value
Date	11-Jul
High temperature	95
Max reduction per unit (kW)	1.46
Min reduction per unit (kW)	(0.27)
Avg reduction per unit (kW)	0.87

Figure 53. MHAFB July 12th Curtailment Event Load Impact

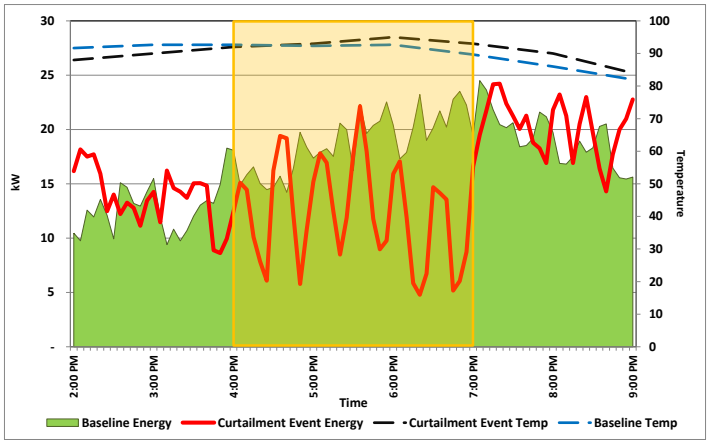


Table 74. MHAFB July 12th Curtailment Event Results

Item	Value
Date	12-Jul
High temperature	95
Max reduction per unit (kW)	1.54
Min reduction per unit (kW)	(0.41)
Avg reduction per unit (kW)	0.53

Figure 54. MHAFB July 18th Curtailment Event Load Impact

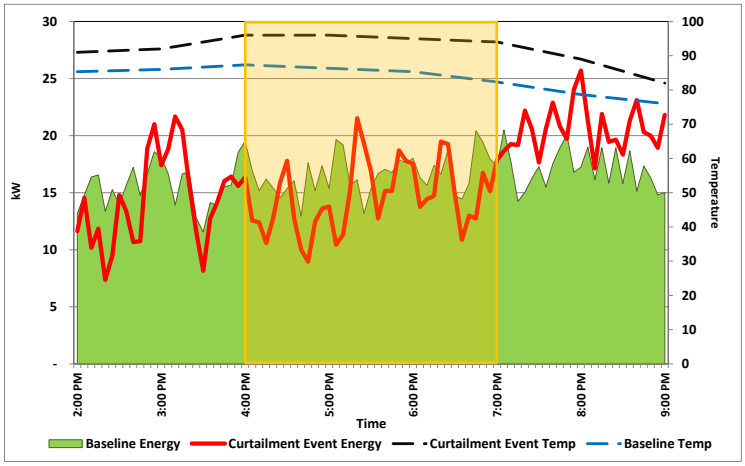


Table 75. MHAFB July 18th Curtailment Event Results

Item	Value
Date	18-Jul
High temperature	96
Max reduction per unit (kW)	0.77
Min reduction per unit (kW)	(0.51)
Avg reduction per unit (kW)	0.16

Figure 55. MHAFB July 25th Curtailment Event Load Impact

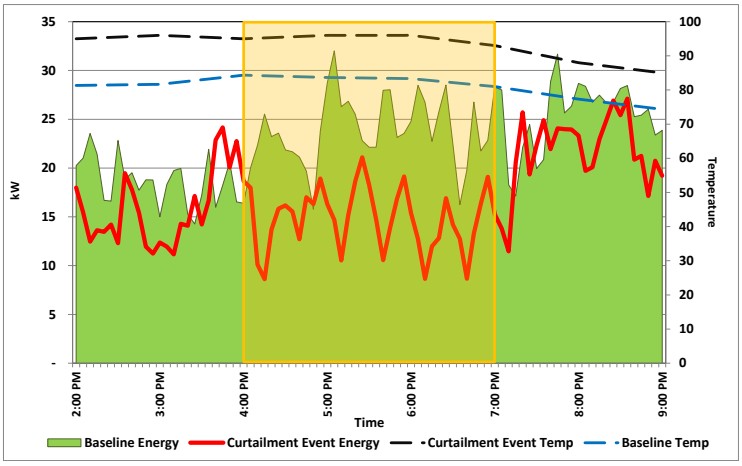


Table 76. MHAFB July 25th Curtailment Event Results

Item	Value
Date	25-Jul
High temperature	96
Max reduction per unit (kW)	1.51
Min reduction per unit (kW)	(0.04)
Avg reduction per unit (kW)	0.77

Figure 56. MHAFB July 29th Curtailment Event Load Impact

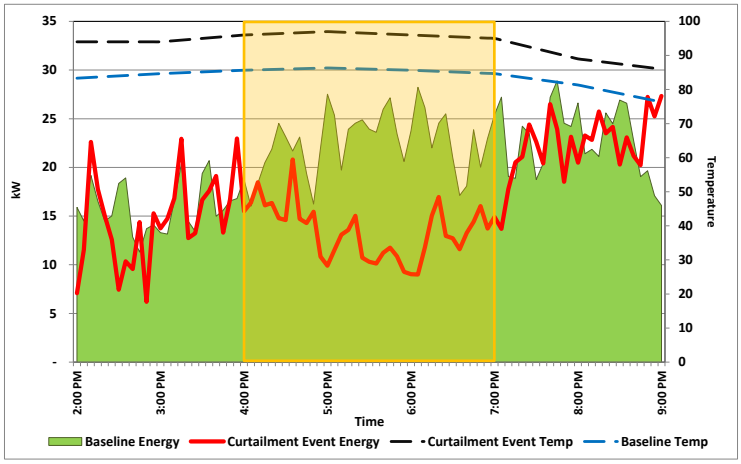


Table 77. MHAFB July 29th Curtailment Event Results

Item	Value
Date	29-Jul
High temperature	97
Max reduction per unit (kW)	1.60
Min reduction per unit (kW)	(0.03)
Avg reduction per unit (kW)	0.77

Figure 57. MHAFB July 31st Curtailment Event Load Impact

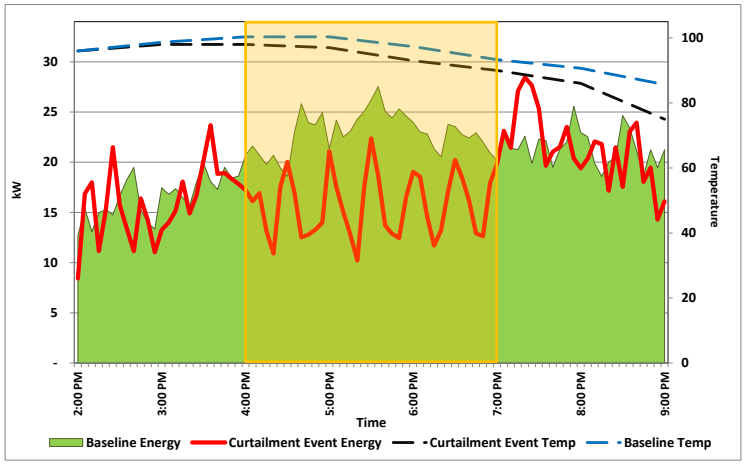


Table 78. MHAFB July 31st Curtailment Event Results

Item	Value
Date	31-Jul
High temperature	98
Max reduction per unit (kW)	1.17
Min reduction per unit (kW)	(0.12)
Avg reduction per unit (kW)	0.60

Figure 58. MHAFB August 10th Curtailment Event Load Impact

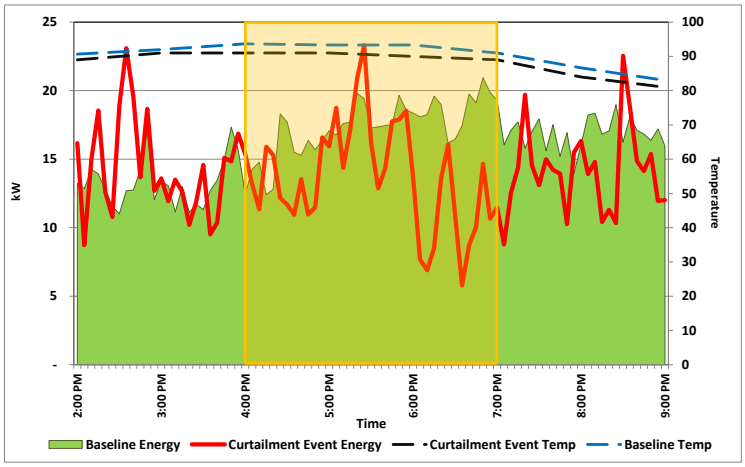


Table 79. MHAFB August 10th Curtailment Event Results

Item	Value
Date	10-Aug
High temperature	91
Max reduction per unit (kW)	0.97
Min reduction per unit (kW)	(0.32)
Avg reduction per unit (kW)	0.32

Figure 59. MHAFB August 17th Curtailment Event Load Impact

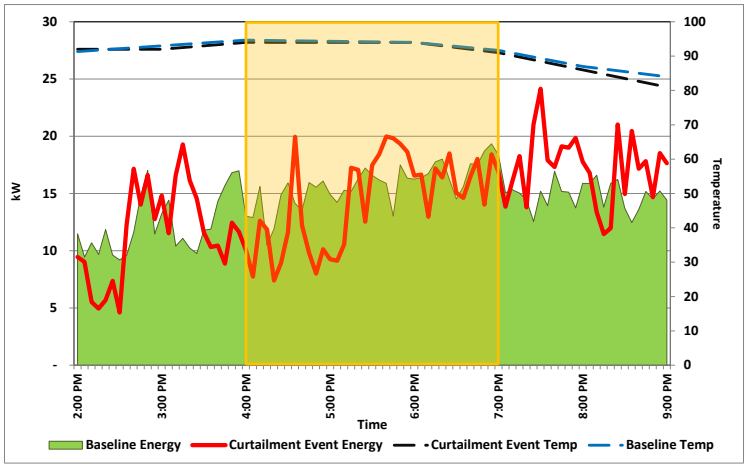


Table 80. MHAFB August 17th Curtailment Event Results

Item	Value
Date	17-Aug
High temperature	94
Max reduction per unit (kW)	0.63
Min reduction per unit (kW)	(0.57)
Avg reduction per unit (kW)	0.11

Figure 60. MHAFB August 18th Curtailment Event Load Impact

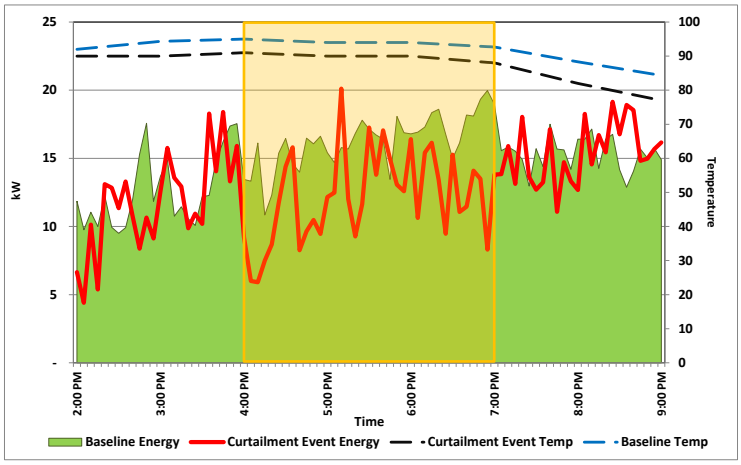


Table 81. MHAFB August 18th Curtailment Event Results

Item	Value
Date	18-Aug
High temperature	91
Max reduction per unit (kW)	0.97
Min reduction per unit (kW)	(0.36)
Avg reduction per unit (kW)	0.33

Figure 61. MHAFB August 22nd Curtailment Event Load Impact

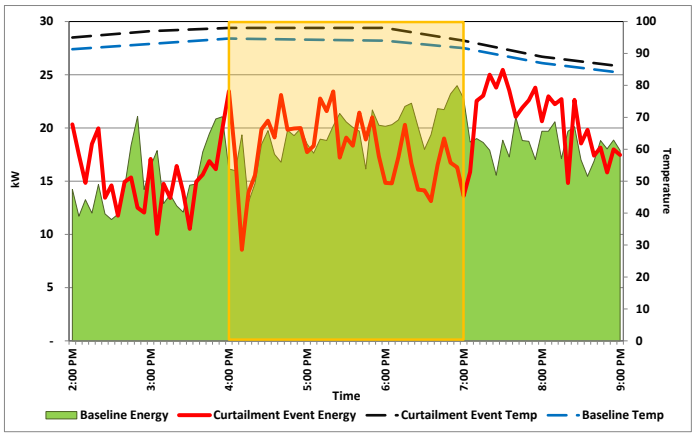


Table 82. MHAFB August 22nd Curtailment Event Results

Item	Value
Date	22-Aug
High temperature	98
Max reduction per unit (kW)	0.90
Min reduction per unit (kW)	(0.53)
Avg reduction per unit (kW)	0.14

Figure 62. MHAFB August 24th Curtailment Event Load Impact

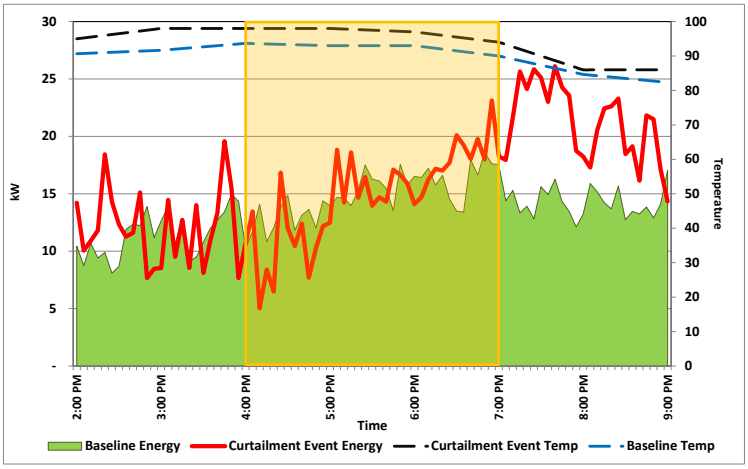


Table 83. MHAFB August 24th Curtailment Event Results

Item	Value
Date	24-Aug
High temperature	98
Max reduction per unit (kW)	0.76
Min reduction per unit (kW)	(0.55)
Avg reduction per unit (kW)	0.01

Figure 63. MHAFB August 26th Curtailment Event Load Impact

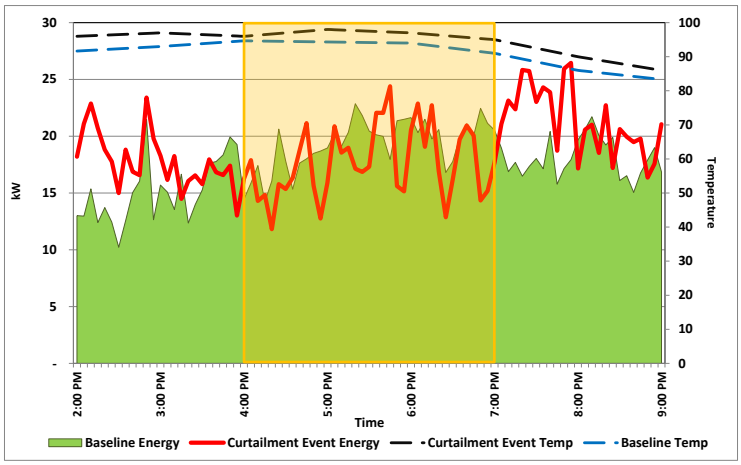


Table 84. MHAFB August 26th Curtailment Event Results

Item	Value
Date	26-Aug
High temperature	98
Max reduction per unit (kW)	0.68
Min reduction per unit (kW)	(0.54)
Avg reduction per unit (kW)	0.14

Boise Indoor Air Temperature Analysis Results – Individual Events

Figure 64. Boise July 5th Curtailment Event IAT Impact

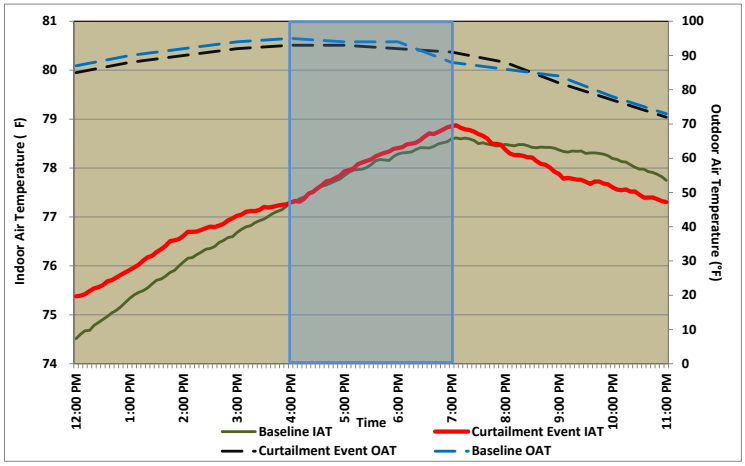


Table 85. Boise July 5th curtailment event IAT Impact Results

Item	Value
Date	5-Jul
High temperature	93
Max IAT increase (°F)	0.30
Min IAT increase (°F)	(0.06)
Avg IAT increase (°F)	0.12

Figure 65. Boise July 6th Curtailment Event IAT Impact

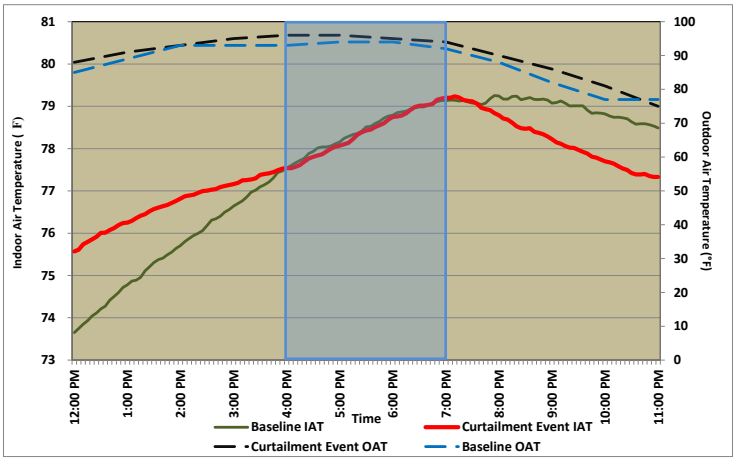


Table 86. Boise July 6th Curtailment Event IAT Impact Results

Item	Value
Date	6-Jul
High temperature	96
Max IAT increase (°F)	0.07
Min IAT increase (°F)	(0.17)
Avg IAT increase (°F)	(0.06)

Figure 66. Boise July 11th Curtailment Event IAT Impact

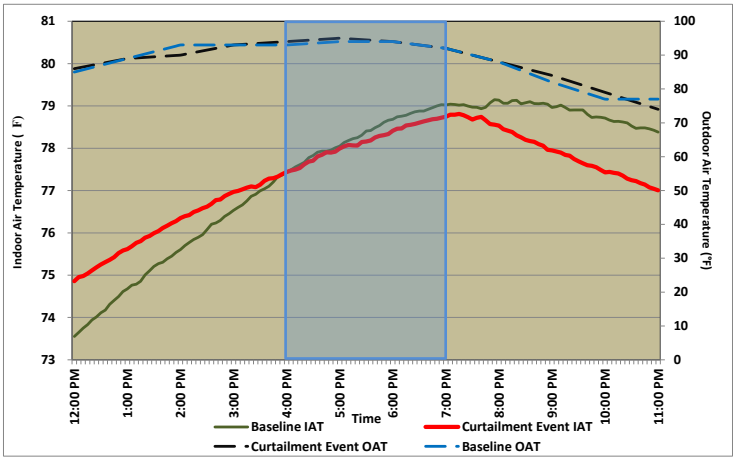


Table 87. Boise July 11th Curtailment Event IAT Impact Results

Item	Value
Date	11-Jul
High temperature	95
Max IAT increase (°F)	(0.02)
Min IAT increase (°F)	(0.33)
Avg IAT increase (°F)	(0.19)

Figure 67. Boise July 12th Curtailment Event IAT Impact

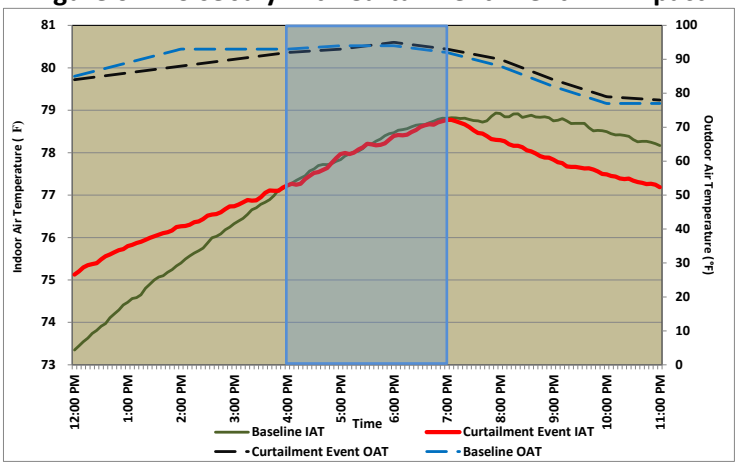


Table 88. Boise July 12th Curtailment Event IAT Impact Results

Item	Value
Date	12-Jul
High temperature	95
Max IAT increase (°F)	0.13
Min IAT increase (°F)	(0.18)
Avg IAT increase (°F)	(0.06)

Figure 68. Boise July 18th Curtailment Event IAT Impact

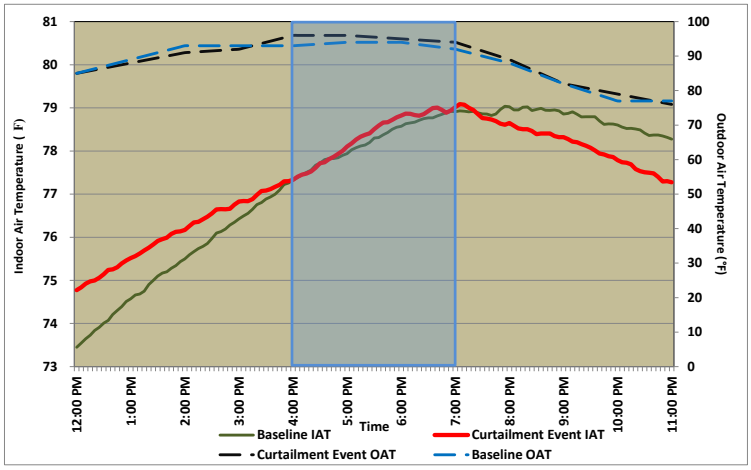


Table 89. Boise July 18th Curtailment Event IAT Impact Results

Item	Value
Date	18-Jul
High temperature	96
Max IAT increase (°F)	0.28
Min IAT increase (°F)	(0.06)
Avg IAT increase (°F)	0.13

Figure 69. Boise July 25th Curtailment Event IAT Impact

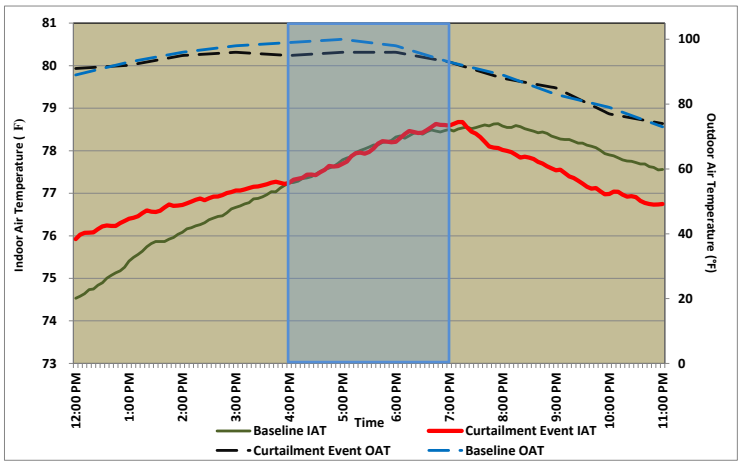


Table 90. Boise July 25th Curtailment Event IAT Impact Results

Item	Value
Date	25-Jul
High temperature	96
Max IAT increase (°F)	0.17
Min IAT increase (°F)	(0.12)
Avg IAT increase (°F)	0.01

Figure 70. Boise July 29th Curtailment Event IAT Impact

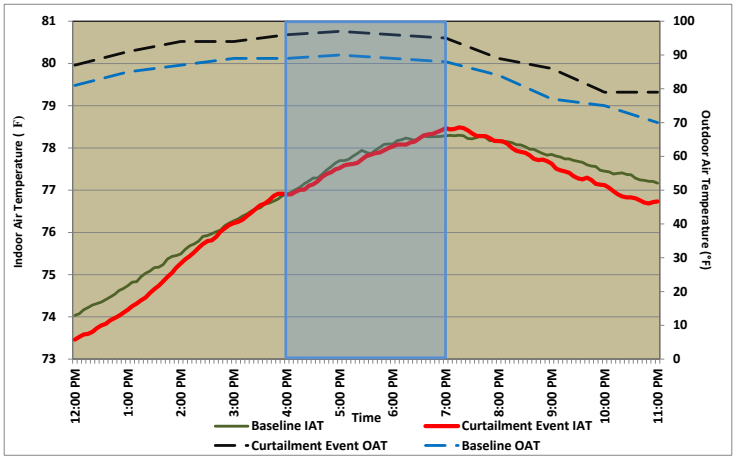


Table 91. Boise July 29th Curtailment Event IAT Impact Results

Item	Value
Date	29-Jul
High temperature	97
Max IAT increase (°F)	0.18
Min IAT increase (°F)	(0.22)
Avg IAT increase (°F)	(0.07)

Figure 71. Boise August 10th Curtailment Event IAT Impact

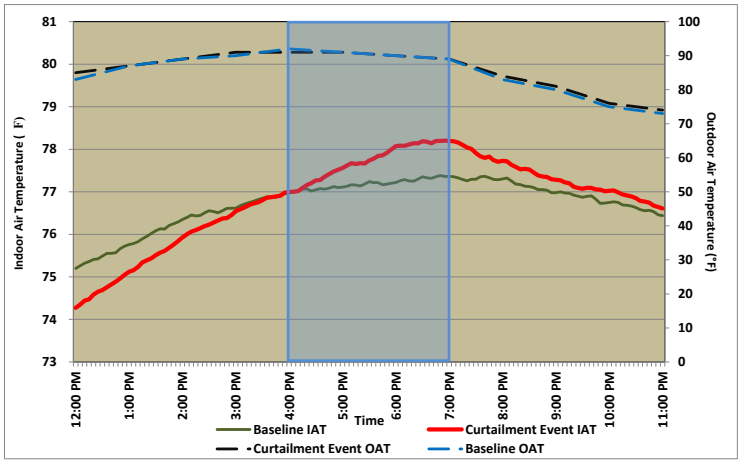


Table 92. Boise August 10th Curtailment Event IAT Impact Results

Item	Value
Date	10-Aug
High temperature	91
Max IAT increase (°F)	0.89
Min IAT increase (°F)	0.00
Avg IAT increase (°F)	0.55

Figure 72. Boise August 17th Curtailment Event IAT Impact

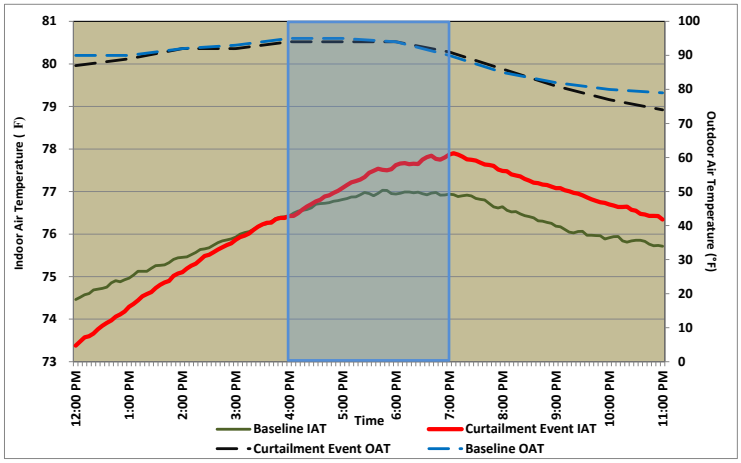


Table 93. Boise August 17th Curtailment Event IAT Impact Results

Item	Value
Date	17-Aug
High temperature	94
Max IAT increase (°F)	0.93
Min IAT increase (°F)	(0.06)
Avg IAT increase (°F)	0.45

Figure 73. Boise August 18th Curtailment Event IAT Impact

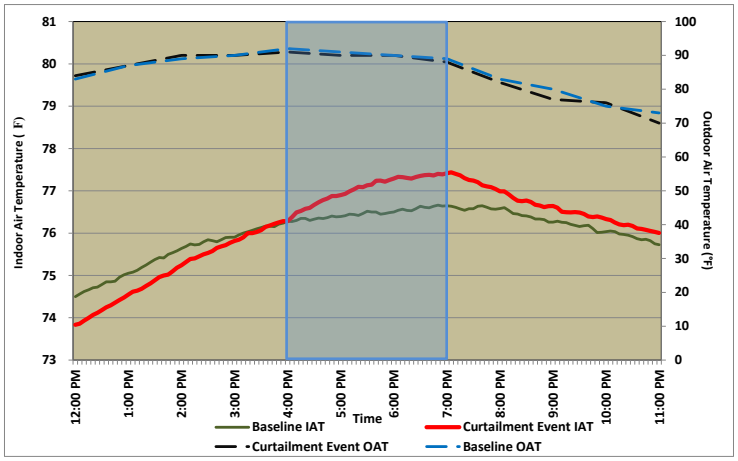


Table 94. Boise August 18th Curtailment Event IAT Impact Results

Item	Value
Date	18-Aug
High temperature	91
Max IAT increase (°F)	0.80
Min IAT increase (°F)	0.11
Avg IAT increase (°F)	0.59

Figure 74. Boise August 22nd Curtailment Event IAT Impact

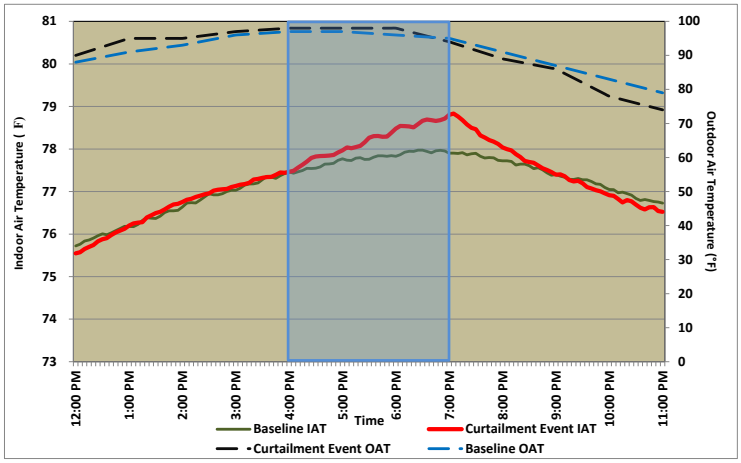


Table 95. Boise August 22nd Curtailment Event IAT Impact Results

Item	Value
Date	22-Aug
High temperature	98
Max IAT increase (°F)	0.90
Min IAT increase (°F)	0.06
Avg IAT increase (°F)	0.43

Figure 75. Boise August 24th Curtailment Event IAT Impact

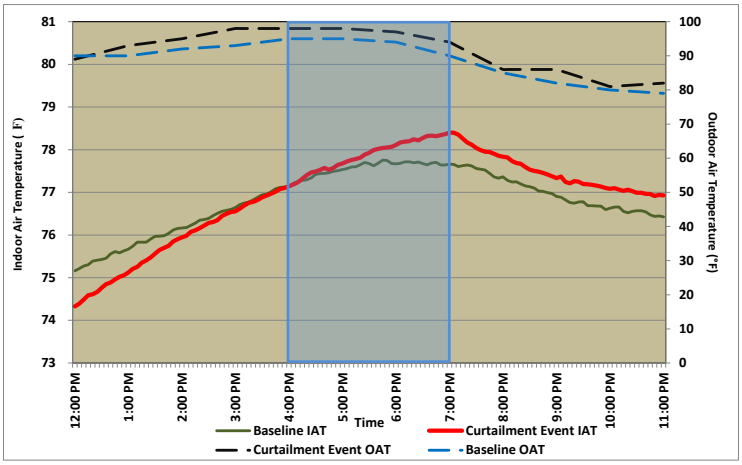


Table 96. Boise August 24th Curtailment Event IAT Impact results

Item	Value
Date	24-Aug
High temperature	98
Max IAT increase (°F)	0.73
Min IAT increase (°F)	(0.03)
Avg IAT increase (°F)	0.32

Figure 76. Boise August 26th Curtailment Event IAT Impact

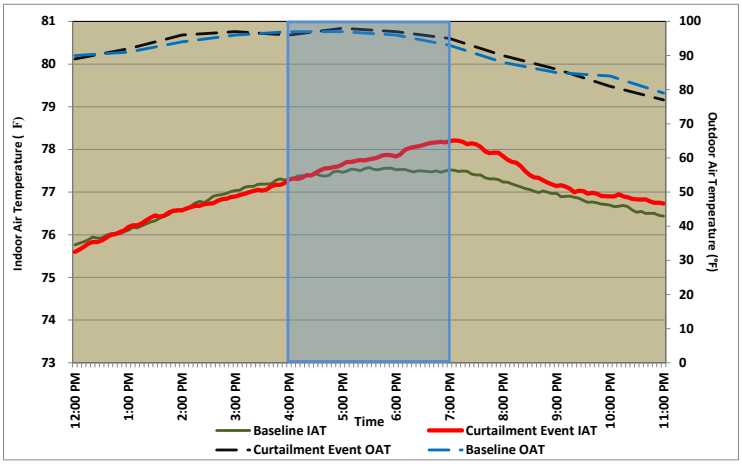


Table 97. Boise August 26th Curtailment Event IAT Impact Results

Item	Value
Date	26-Aug
High temperature	98
Max IAT increase (°F)	0.71
Min IAT increase (°F)	(0.07)
Avg IAT increase (°F)	0.30

IMPACT EVALUATION
OF THE
2010 ENERGY HOUSE CALLS
PROGRAM

Final Report

December 30, 2011

Prepared for:

IDAHO POWER®
An IDACORP Company

Prepared by:

ADM

ADM Associates, Inc.
3239 Ramos Circle
Sacramento, CA 95827
916-363-8383

TABLE OF CONTENTS

Chapter	*Title*	*Page*
1.	Executive Summary	1-1
2.	Introduction and Purpose of Study	2-1
3.	Description of Program	3-1
4.	Evaluation Methods	4-1
5.	Evaluation Findings	5-1
6.	Summary and Discussion of Findings	6-1
Appendix A.	Participant Survey Instrument	A-1
Appendix B.	Regression Analysis of Billing Data: Methodology	B-1
Appendix C.	Regression Analysis of Billing Data: Results	C-1
Appendix D.	Participant Satisfaction	D-1

LIST OF FIGURES

No. *Title* *Page*

Figure 5-1. Increased Home Comfort after Participation 5-6

Figure 5-2. Comfort Level Compared to Pre-Participation Level 5-7

Figure 5-3. Heating System Performance compared to Pre-Participation Levels 5-7

Figure D-1. Satisfaction with Service Provider D-1

Figure D-2. Satisfaction with Program Overall D-2

LIST OF TABLES

No. *Title* *Page*

Table 1-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Energy House Calls Program 1-1

Table 1-3. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Energy House Calls Program 1-1

Table 3-1. Program Participation by Job Type 3-2

Table 3-2. Participating Homes' Location by Climate Zone 3-2

Table 4-1. Sampling for Verification Activities 4-1

Table 5-1. Heating/Cooling System Type Comparison: Tracking Database vs. On-Site Data ... 5-2

Table 5-2. kWh Savings Estimates Comparison by Heating Zone – Average Heating/Cooling System 5-3

Table 5-3. Estimated kWh savings attributable to duct sealing performed through the 2010 Energy House Calls Program 5-4

Table 5-4. Estimated kWh savings attributable CFL s installed through the 2010 Energy House Calls Program 5-5

Table 5-5. Estimates of Distribution Peak Load Reductions by Measure Type 5-5

Table 5-6. Program-Level Carbon Reductions for the 2010 Energy House Calls Program 5-8

Table 6-1. Ex Post Savings for the 2010 Energy House Calls Program As Verified from Impact Evaluation 6-1

Table 6-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Products Program 6-2

Table B-1. Variables in ADM's Regression Models B-3

Table C-1. Regression Results for each Model C-2

Table C-2. RTF Annual HDD and CDD by Zone C-2

Table C-3. Annual kWh savings estimates for Duct Sealing C-3

1. EXECUTIVE SUMMARY

This report provides the results from an impact evaluation of the Energy House Calls Program that Idaho Power Company (IPC) offers to its residential customers living in mobile or manufactured homes in Idaho and eastern Oregon. The impact evaluation was conducted on projects completed in 2010.

There were a total of 1,598 participating households in the Energy House Calls Program in 2010, accounting for 1,420 PTCS certified duct sealing jobs performed. Estimates of the gross energy savings (kWh) and peak demand reductions (kW) from these projects are reported in Table 1-1. There are no gas savings (MBtu) resulting from the program as all participating homes were electrically heated.

Table 1-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Energy House Calls Program

Measure Type	***Ex Post Verified Savings***		
	kWh Savings	***kW Reductions***	***MBtu Savings***
All Measures	1,363,098	960.7	N/A
PTCS Duct Sealing	1,133,985	892.6	N/A
CFL Light Bulbs	229,113	68.1	N/A

The results in Table 1-1 show program-level ex post verified kWh savings of 1,363,098 kWh. Compared to ex ante expected program savings, this represents a realization rate for kWh savings of 113.7% for the entire program. However, as shown in Table 1-2, realization rates differ across different measures. For duct sealing, the biggest component of the program, the realization rate is 121.6%. For CFL light bulbs, the realization rate is 86.1%.

Table 1-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Energy House Calls Program

Measure Type	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
All Measures	1,198,655	1,363,098	113.7%
PTCS Duct Sealing	932,626	1,133,985	121.6%
CFL Light Bulbs	266,029	229,113	86.1%

2. INTRODUCTION AND PURPOSE OF STUDY

Under contract with Idaho Power Company (IPC), ADM Associates, Inc. (ADM) has performed an impact evaluation of the 2010 Energy House Calls Program that IPC offers its residential customers living in mobile or manufactured homes in Idaho and Eastern Oregon. The impact evaluation was conducted on projects completed in 2010. The services offered through the program are offered at no charge to the customer, with IPC financing all projects.

The objectives for the evaluation were as follows:

- Measure and verify the energy impacts attributable to the Energy House Calls Program in 2010;
- Provide credible and reliable program energy and non-energy impact estimates attributed to the Energy House Calls Program during the 2010 program year; and
- Report findings and observations, and provide recommendations that enhance the accuracy and transparency of reported program savings.

This report describes the effort undertaken to accomplish these objectives and presents the results of the evaluation. It is organized as follows:

- Chapter 3 provides a description of the Energy House Calls Program.
- Chapter 4 presents and discusses the methods used to verify energy and non-energy impacts resulting from the program in 2010.
- Chapter 5 presents the estimates of program impacts.
- Chapter 6 summarizes the results of the evaluation effort.
- Appendix A provides the participant survey instrument.
- Appendix B details the methodology of a regression analysis of billing data performed to assess the accuracy of RTF deemed savings estimates for duct sealing measures.
- Appendix C details the findings of the regression analysis of billing data.
- Appendix D provides an analysis of participant satisfaction.

3. DESCRIPTION OF PROGRAM

The Energy House Calls Program is aimed at helping manufactured and mobile home owners with electric heat reduce their electricity usage by improving the homes efficiency. This is accomplished by providing free duct-testing/sealing as well as CFL light bulbs and furnace filters. Program participants also receive energy efficiency educational materials and have their water heater temperature settings checked. The value of the service, on average between $325 and $550, is not charged to the customer. Rather, Idaho Power provides the customer with sub-contractor contact information and the subcontractor bills Ecos IQ, Inc (Ecos) (the implementation management provider for the program). Ecos coordinates with the sub-contractors, processes sub-contractor paperwork, and invoices Idaho Power for all work performed. The program is marketed to customers through a variety of channels including bill stuffers, direct mail pieces, radio promotions, and a program brochure distributed at IPC sponsored events.

The duct testing and sealing performed as part of the program is done according to Performance Tested Comfort System (PTCS) standards set by the Northwest Power & Conservation Council's Regional Technical Forum (RTF). This includes duct leakage testing performed by a PTCS Certified Technician or Inspector. The service providers also install up to five (5) CFL light bulbs and two (2) furnace filters.

As required by PTCS technical specifications, IPC hired a third party contractor to perform quality control (QC) testing on 5% of participating homes that received duct sealing services in 2010.

3.1 SUMMARY OF PARTICIPATION

The level of program participation for the Energy House Calls Program was reported to be 1,602 households in the Demand-Side Management 2010 Annual Report[1]. After reviewing the program tracking database provided by IPC, including removing duplicate entries, the final level of participation was determined to be 1,598 households. It was further determined that 1,420 of the participating households had PTCS certified duct sealing performed. The other 128 households either did not need duct sealing, or had duct sealing performed but with a reduction in leakage that did not meet PTCS standards. These households were still eligible to receive CFL light bulbs and furnace filters. Table 3-1 details the number of participating households.

[1] Appendix B – Demand-Side Management 2010 Annual Report for the 2011 Integrated Resource Plan. June 2011. http://www.idahopower.com/pdfs/AboutUs/PlanningForFuture/irp/2011/2011IRPAppendixBDSM2010AnnualReport.pdf

Table 3-1. Program Participation by Job Type

Type of Participant	***Ex Ante Reported Participation***	***Ex Post Verified Participation***	***Difference***
All Households	1,602	1,598	- 4
Duct-Sealing Performed	N/A	1,420	N/A
No Sealing Performed	N/A	128	N/A

The vast majority of program participants were located in the RTF defined heating zone one and cooling zone three. Table 3-2 below shows the location of the 1,420 homes that received PTCS certified duct sealing according to the RTF defined climate zones.

Table 3-2. Participating Homes' Location by Climate Zone

		Heating Zone			***Total***
		1	***2***	***3***	
Cooling Zone	***1***	0	13	38	51
	2	0	215	0	215
	3	1,021	133	0	1,154
Total		1,021	361	38	1,420

4. EVALUATION METHODS

Evaluation of the impacts of the 2010 Energy House Calls Program involved the following activities:

- Selecting 68 participants for verification surveys and a sub-sample of 23 participants for on-site verification visits
- Reviewing program tracking data for participating households
- Reviewing reported deemed savings values for each measure in each climate zone/heating system combination
- Performing on-site visits to verify duct sealing was performed and collect data to facilitate analysis
- Determining verified savings using data collected and revised deemed savings values
- Extrapolating sample-level findings to program-level savings

4.1 SAMPLING PLAN

ADM used a simple random sampling technique to perform impact evaluation for the Energy House Calls Program. Using secure data transfer protocols, IPC provided a complete list of participating customers during the 2010 program year including pertinent information such as phone numbers, job type performed, addresses, etc. Once the file was verified and checked for duplicate entries, each participant was assigned a random number which was used to prioritize the participant call list. Participants were then called to schedule on-site verification visits and to complete short verification surveys. The product of this effort was a total of 68 participant surveys, including 23 which were accompanied by data and documentation collected during an on-site verification visit. In other words, the on-site verification visits were a nested sample of the larger sample of participants who completed the survey. Table 4-1 below shows the breakdown of sampling for different verification activities.

Table 4-1. Sampling for Verification Activities

Number of Verification Surveys	***Number of Onsite Verification Visits (nested)***
68	23

The sample size to meet 90/10 requirements is calculated based on the coefficient of variation (CV) of savings for program participants, assumed to be approximately 0.50, based on the industry best practices[2].

Using a CV of .50, the minimum simple random sample size is estimated at:

With 10% relative precision (RP), this calls for a sample of 68. Thus, the total verification sample of 68 program participants, including 23 onsite verification visits, produces a verification rate reliable with ±10% relative precision at the 90% confidence level.

4.2 PARTICIPANT SURVEY

ADM administered a short participant survey with the goal of verifying participation of customers listed in the program tracking database. A copy of the survey instrument used can be found in Appendix A. In addition to asking respondents if they participated in the program during 2010, the survey also addressed non-energy impacts and participant satisfaction with the program. In accordance with the sampling plan outlined in the previous section, a total of 68 participants were surveyed. Twenty three (23) out of the 68 customers surveyed also had an on-site verification visit performed.

4.3 ON-SITE DATA COLLECTION

In evaluating this program, ADM conducted a total of 23 site visits to the homes of participating customers. During the site visits, ADM field staff:

- Verified that duct sealing had been performed as claimed in the program tracking database;
- Documented the number of CFL light bulbs installed through the program; and
- Recorded information about the homes' heating and cooling systems.

[2] The coefficient of variation, cv(x), is a measure of variation for the variable to be estimated. Its value depends on the mean and standard deviation of the distribution of values for the variable (i.e., cv(x) = sd(x)/mean(y)). Essentially, cv is a metric of how wide the distribution of values for the variable of interest is.

As set out in the *Model Energy Efficiency Program Impact Evaluation Guide*:

> Until the actual mean and standard deviation of the population can be estimated from actual samples, 0.5 is often accepted as an initial estimate for cv. The more homogenous the population, the smaller the cv.

Using a cv = 0.5 is also in accordance with California Evaluation Protocols for homogenous measures.

The data collected on-site was then compared to the values listed in the program tracking data to assess the accuracy of program records. This procedure helps verify that the correct information regarding delivered measures is transferred from program data input forms to the tracking database.

4.4 REVIEW OF DOCUMENTATION

To verify the number of participating homes in the program in 2010, a thorough review of the program tracking database was conducted. This review focused on five important issues:

- Program eligibility of the customer with respect to date work was performed
- Program eligibility of customer with respect to heating system
- Correspondence between heating/cooling system listed in the tracking database and data collected on-site for the sub-sample of 23 site visits
- Correspondence between listed climate zones and the RTF heating and cooling zone maps[3] by county
- Removal of duplicate or erroneous entries

Additionally, IPC provided current data input forms used by PTCS providers to record information about each participating home. These forms were reviewed to determine whether all necessary information was properly recorded.

4.5 METHODS TO ESTIMATE VERIFIED SAVINGS FOR INSTALLED MEASURES

The reported ex ante energy impacts provided by IPC were based on deemed savings values for each measure type installed through the program. For the CFL light bulbs, these deemed savings estimates come from the Northwest Power & Conservation Council's Regional Technical Forum (RTF) Current Measure list4. For duct sealing, these savings estimates are based on 2007 RTF deemed savings by climate zone and heating/cooling system type5. According to the RTF Operative Guidelines6, evaluation of the savings resulting from the delivery of active deemed savings measures requires verifying the correct number of units delivered, and applying the correct RTF-approved unit energy savings (UES) value to the delivered measures. This was the approach used in this evaluation. Additionally, the assumptions and methodologies used by the RTF in estimating deemed UES values were reviewed for reasonableness. Delivery of claimed measures was verified through the review of the program tracking database, the participant

[3] http://www.nwcouncil.org/energy/rtf/zones/zonemapsx.htm

[4] http://www.nwcouncil.org/energy/rtf/measures/Default.asp

[5] Ecos Consulting. CRC_Credits_FY2007.xls. 2007.

[6] RTF Operative Guidelines – Release 6-1-2011 http://www.nwcouncil.org/energy/rtf/subcommittees/deemed/Guidelines%20for%20RTF%20Savings%20Estimation%20Methods%20(Release%206-1-11).pdf

survey, and on-site data collection. The data collected from the documentation review, participant survey and on-site data collection effort were also analyzed to assess the assumptions used by the RTF. Additionally, a regression analysis of billing data from participating homes was performed to further assess the accuracy of the RTF deemed savings estimates. A detailed description of the methodology used for this regression analysis can be found in Appendix B. In 2010 and early 2011 the RTF updated its deemed savings estimates for duct sealing in manufactured homes7 8. Thus, the results of the regression analysis were compared to both of the FY2010 savings estimates along with the FY2007 values used for ex ante purposes.

4.6 ESTIMATING PROGRAM LEVEL REALIZED SAVINGS

Program-level savings were determined through a series of steps. First, the assumptions and methodologies underlying the ex ante claimed savings values for each product type were reviewed and revised where necessary. The resulting adjusted deemed savings values were applied to each measure incentivized through the program. Next, a verification rate for each measure type was estimated using information collected through on-site visits and the participant survey. Then, for each measure type, the sum of the adjusted deemed savings values was multiplied by the measure specific verification rate to determine verified savings for each measure category. Finally, to estimate total verified savings for a program, the estimates of verified savings for the different measures were summed. This process can be illustrated by the following formula:

Where:

$Verification\ Rate_i$ = Verification rate for measure i

$Deemed\ Savings_{ij}$ = Estimated deemed savings value for measure i in household j

4.7 ESTIMATING NON-ENERGY IMPACTS

Non-energy impacts of the Energy House Calls Program that were assessed included increased comfort in the home, increased heating system performance, and carbon offsets. Information for assessing non-energy impacts was collected through the participant survey.

Home comfort and heating system performance were assessed using customer comparisons to pre-participation levels on a scale of “much better, somewhat better, same, somewhat worse, much worse, and don’t know.” Participants were asked the following questions regarding their new appliances:

[7] http://www.nwcouncil.org/energy/rtf/measures/res/archive/Res_MHDuctSealingFY10v2_1.xls
[8] http://www.nwcouncil.org/energy/rtf/measures/res/Res_MHDuctSealingFY10v2_2.xls

- Have you noticed increased comfort in your home since having the Energy House Call/duct sealing performed?
- [If yes…] Using the following scale, how has the comfort level changed since having the House Call/duct sealing performed?
- Since having the Energy House Call performed, how would you compare the performance of your heating system to before the Energy House Call?

Responses to these questions were tabulated to quantify customer perceived benefits as a result of their participation in the program.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved by the program. Survey respondents were also asked if they noticed reductions in their electricity bills since participating in the program.

5. EVALUATION FINDINGS

To estimate gross kWh savings and peak kW reductions resulting from the measures incentivized through the Energy House Calls Program, the assumptions and methodologies used to estimate ex ante savings were reviewed and revised where necessary. Additionally, data was collected and analyzed for a sample of 68 participants. The data collected for these sample projects were analyzed using the methods described in Chapter 4 to estimate delivery verification rates. The results from the analysis of the sample projects were then applied to estimate program-level savings and demand reductions. The findings from this evaluation effort are detailed in this section.

5.1 VERIFICATION OF DELIVERED UNITS

All 68 of the participants surveyed indicated that they did indeed participate in the Energy House Calls Program in 2010 as indicated in the program tracking database. Additionally, all 23 of the on-site visits produced evidence of duct sealing having been performed. All 23 of the on-site visits also documented homes with electric heating systems, an important requirement for program participation. These findings resulted in a delivery verification rate of 100% for duct sealing measures.

Savings for the installation of CFL light bulbs were based on the assumption that each participating home received exactly five (5) bulbs. Indeed, the program tracking database listed five bulbs per home in 1,589 out of 1,598 cases (the other nine cases either had zero or two bulbs listed). However, results from the participant survey and on-site visits suggest that CFLs were not distributed in such a uniform manner. Survey responses and on-site data indicated that as many as 12 CFLs had been installed in a single home and as few as zero in another home. On average, survey responses and on-site data indicated 3.9 bulbs were installed per home. In calculating ex ante savings, IPC assigned CFL savings only to households that had duct sealing performed (approximatly1,420 households). However, the tracking database and participant survey results indicate that even households that did not receive duct sealing still received CFLs. In total, IPC's ex ante claims indicate that 7,190 bulbs were delivered. ADM estimates that 6,192 bulbs were delivered based on the data collected on-site and through the participant survey. This results in a CFL delivery verification rate of 86.1%.

5.2 ESTIMATES OF EX POST VERIFIED GROSS KWH SAVINGS

Estimates of ex post verified kWh savings for the program are presented in this section.

5.2.1 PTCS Duct Sealing for Manufactured Homes

For the purposes of estimating ex ante kWh savings values for duct sealing measures incentivized through the program, IPC staff used deemed savings values by climate zone and

heating/cooling system type. These deemed savings estimates come from s savings spreadsheet developed by Ecos, Inc. based on RTF deemed savings from 2007[9]. The RTF reviewed the savings assumptions for duct sealing in manufactured homes in 2010 and again in early 2011. Thus, there are three separate sets of savings estimates that were reviewed as part of this evaluation.

Before determining which RTF estimates were most appropriate, ADM reviewed the program tracking database to assess the accuracy of climate zone and heating/cooling system type reporting. To determine the accuracy of climate zone reporting, ADM developed a lookup by county based on the RTF heating and cooling zone maps[10]. This lookup revealed that the tracking database was 99.7% accurate in reporting heating zone and 98.0% accurate in reporting cooling zone. Overall, only 29 out of the 1,420 households that received duct sealing had improper climate zones reported. However, the tracking database was much less accurate in reporting heating/cooling system types. Of the 23 on-site visits where heating/cooling systems were verified, only nine (9) confirmed the systems reported in the tracking system. The two most common discrepancies were the presence of a central air conditioner not listed in the tracking database and the presence of a heat pump as opposed to the forced air furnace listed in the database. Table 5-1 shows the breakdown of heating/cooling systems as listed in the tracking database as compared to what was found on-site.

Table 5-1. Heating/Cooling System Type Comparison: Tracking Database vs. On-Site Data

System Type	***Tracking Database***	***On-Site***
Heat Pump	2.0%	21.7%
Forced Air Furnace Only	94.7%	26.1%
Forced Air Furnace w/AC	3.2%	52.2%

Table 5.1 shows that the tracking database overwhelmingly reported participating manufactured homes had forced air furnaces only, without a cooling system. ADM's review of current duct sealing data input forms revealed a likely cause of this mistake. The form that is currently being used does not have a data input field for cooling system type. Instead, it only has a field for heating system type with three options: electric furnace, central AC (only), and heat pump. This would explain why many participating homes' AC units were not reported, as field technicians likely chose electric furnace for heating system type and did not record the central AC unit as it was not a field on the form. Still, the underrepresentation of heat pumps is unexplained.

Based on these discrepancies, ADM does not believe the tracking database reported system types to be valid. As a result, using deemed savings values by system type is not possible. Instead, ADM performed a regression analysis using billing data from participating homes to assess the accuracy of RTF savings estimates for homes with "average heating/cooling systems." Detailed

[9] Ecos Consulting. CRC_Credits_FY2007.xls. 2007.

[10] http://www.nwcouncil.org/energy/rtf/zones/zonemapsx.htm

findings of this regression analysis can be found in Appendix C. To estimate deemed savings values for homes with average systems, the RTF makes a number of assumptions regarding system type saturation rates. Specifically, they assume that 78% of heating systems are forced air furnaces, while the remaining 22% are heat pumps. They also assume that 40% of homes have cooling systems, while 60% do not. The heat pump saturation rate assumed by the RTF matches almost perfectly with the data collected on-site. The cooling system saturation rate assumption is somewhat lower than found on-site, but considering the magnitude of cooling savings as compared to heating savings this assumption is unlikely to affect savings estimates significantly.

Table 5-2 compares three versions of RTF estimated deemed savings values for PTCS duct sealing in manufactured homes to the results of ADM's regression analysis. These savings estimates are for average heating/cooling systems based on the assumptions described above. IPC based its ex ante savings on RTF FY07 values, which did not include average system estimates by heating zone. The values listed in the FY07 column of Table 5-2 are averages from the IPC tracking database by heating zone.

Table 5-2. kWh Savings Estimates Comparison by Heating Zone – Average Heating/Cooling System

Heating Zone	***RTF FY07_v1* (kWh)***	***RTF FY10_v2.1 (kWh)***	***RTF FY10_v2.2 (kWh)***	***ADM Regression Analysis Estimated (kWh)***
1	567	690	1,082	663
2	869	1,049	1,806	1,323
3	1,042	1,337	2,426	1,486

**RTF FY07 did not report average system kWh savings for each heating zone. These are the average ex ante values claimed by IPC for each heating zone.*

ADM's regression analysis produced robust models of energy consumption for participating home both before and after participation in the program. The goal of the analysis was to check the applicability of RTF's deemed savings values. The results of the analysis show savings estimates that are most similar to the RTF FY10_v2.1 deemed savings estimates. This is particularly true for heating zone one, which accounts for over 70% of program participants. ADM's savings estimates are sufficiently close to corroborate the RTF FY10_v2.1 savings values.

The RTF FY10_v2.1 and FY10_v2.2 protocols both specify deemed savings for duct sealing in manufactured homes. Both deemed savings architectures are based on parametric simulations. Our inspection of model specification and outputs indicates that the underlying Simple Energy Enthalpy Model (SEEM) runs for both versions of RTF provide adequate descriptions of heating energy usage. For example, a typical prototype mobile home in Boise running a forced air furnace would require 7,198 kWh for the heating end use based on RTF 2.2, and 7105 kWh according to RTF 2.1. These numbers are in general agreement with the heating energy usage as

disaggregated from IPC provided customer billing data. However, the energy savings resulting from duct sealing for the RTF v2.2 protocol are much higher than those in the RTF v2.1 protocol: The same prototype would save 1,389 kWh according to RTF v2.1, but 853 kWh according to RTF v2.1. The simulation runs that inform RTF v2.2 effectively "degrade" the duct efficiency by about 19%, while the simulations that inform RTF v2.1 degrade the duct efficiency by 11%. It is the assumption regarding the baseline duct leakage that causes the difference in the two versions of the RTF deemed savings. If the baseline duct leakages are much higher than 20%, then RTF v2.2 would be more applicable. On the other hand, if the average baseline duct leakages were on the order of 20% or less, then RTF v2.1 would be a more applicable protocol. ADM's M&V findings confirm that RTF v2.1 most closely approximates the true program impacts. All versions of the RTF deemed savings for PTCS duct sealing require that existing leakage be at least 250 CFM50 or 15% of the homes floor area, whichever is less. While duct sealing was completed for 1,420 homes, only 1,190 of the 1,420 homes met this initial leakiness requirement. This is likely the reason that the savings estimates from ADM's regression analysis produced results lower than RTF v2.2. That is, the program in 2010 serviced a number of homes that had initial duct leakage rates less than the assumptions in RTF v2.2. ADM's findings indicate that the typical participant that has ducts sealed experiences approximately a 10 to 15% improvement in systemic HVAC efficiency resulting from duct sealing activities under the program. These findings provide additional corroboration of the deemed savings values from RTF FY10_v2.1.

Table 5-3 shows the estimates of total kWh savings attributable to duct sealing performed through the program.

Table 5-3. Estimated kWh savings attributable to duct sealing performed through the 2010 Energy House Calls Program

Heating Zone	***RTF FY10_v2.1 Deemed Savings per Home (kWh)***	***Number of Homes that Received PTCS Duct Sealing***	***Total Savings (kWh)***
1	690	1,021	704,490
2	1,049	361	378,689
3	1,337	38	50,806
Total		**1,420**	**1,133,985**

5.2.2 CFL Light Bulbs

For the purposes of estimating ex ante kWh savings values for ceiling fan light kits rebated through the program, IPC staff used deemed savings values for the RTF measure "ENERGY STAR® Lamp/bulb - Any Interior or Exterior Application – Direct Install."[11] This deemed

[11] http://www.nwcouncil.org/energy/rtf/measures/res/archive/EStarLighting_ExistingFY10v1_5.xls

savings value estimates annual savings of 37 kWh for any ENERGY STAR® CFL. ADM reviewed the assumptions and methodology used by the RTF and determined them to be reasonable. IPC staff estimated ex ante savings based on the assumption that each participating household received five (5) bulbs directly installed. This is equivalent to 185 kWh savings per participating household. However, as detailed in section 5.1, ADM estimated a delivery of 3.9 bulbs per participating home, including homes that did not receive duct sealing. Thus, ADM estimates CFL savings of 143.4 kWh per participating household. Table 5-4 shows the estimate of total kWh savings attributable to CFLs installed through the program.

Table 5-4. Estimated kWh savings attributable CFL s installed through the 2010 Energy House Calls Program

RTF Measure	***Deemed Per-Unit Savings (kWh)***	***Number of Units Per Household***	***Number of Participating Households***	***Total Savings (kWh)***
ENERGY STAR® Lamp/bulb - Any Interior or Exterior Application – Direct Install	37	3.9	1,598	229,113

5.3 ESTIMATES OF EX POST VERIFIED KW REDUCTIONS

Estimates of *ex post* verified demand reductions (kW) for the program were determined in a similar fashion to estimates of *ex post* verified kWh savings. That is, RTF deemed kW reductions were applied to measures verified to be delivered. For duct sealing, the distribution peak load reduction estimates from the RTF FY10_v2.1 spreadsheet were applied to homes in each of the three heating zones. For CFL light bulbs, the distribution peak load reduction estimates for the RTF measure "ENERGY STAR® Lamp/bulb - Any Interior or Exterior Application – Direct Install" were applied. Table 5-5 shows the estimated per-unit kW reductions and the total kW reductions for each measure.

Table 5-5. Estimates of Distribution Peak Load Reductions by Measure Type

RTF Measure Type	***Per-Unit Demand Reduction (kW)***	***Number of units***	***Total Demand Reduction (kW)***
ENERGY STAR® Lamp/bulb - Any Interior or Exterior Application – Direct Install	0.01	6,192	68.1
Manufactured Home Duct Tightness -PTCS Duct Sealing – Heating Zone 1 (Average Heating System)	0.54	1,021	554.4
Manufactured Home Duct Tightness -PTCS Duct Sealing – Heating Zone 2 (Average Heating System)	0.83	361	298.2
Manufactured Home Duct Tightness -PTCS Duct Sealing – Heating Zone 3 (Average Heating System)	1.05	38	40.0
Total		**7,616**	**960.7**

5.4 NON-ENERGY IMPACTS AND EFFECTS

To assess non-energy impacts and effects of the 2010 Energy House Calls Program, a telephone survey of a sample of participants was conducted. A total of 68 survey interviews were completed.

With respect to comfort level of the home compared before participating in the program, 57% of respondents indicated that they noticed increased comfort in their home. Of the 57% who noticed increased comfort, most indicated that the home felt "somewhat more comfortable." Figure 5-1 shows the breakdown of responses regarding noticing increased home comfort since participation. Figure 5-2 shows the reported level of comfort increase for those respondents who did notice an increase.

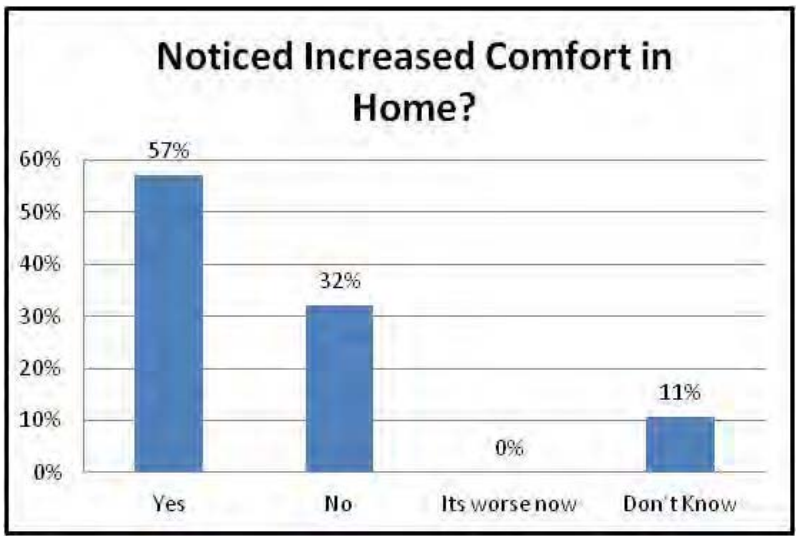


Figure 5-1. Increased Home Comfort after Participation

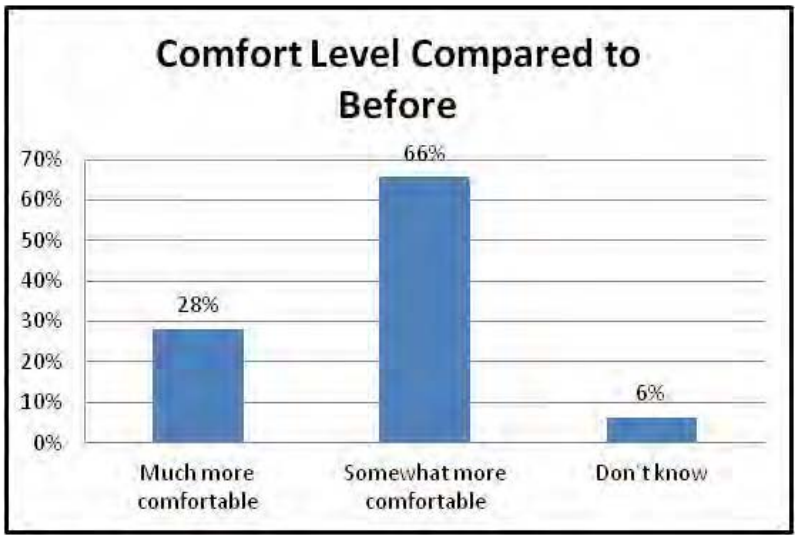


Figure 5-2. Comfort Level Compared to Pre-Participation Level

Regarding the performance of participants' heating system as compared to pre-participation, 50% of respondents indicated they noticed improvement. However, there were four respondents who indicated that the performance of the heating system decreased. Figure 5-3 below shows the breakdown of responses regarding heating performance.

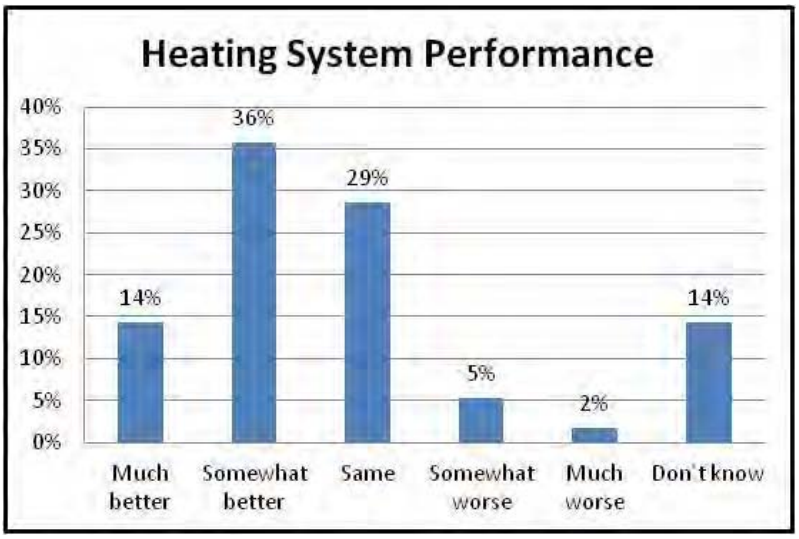


Figure 5-3. Heating System Performance compared to Pre-Participation Levels

In addition to these non-energy benefits, 30 respondents indicated that they had noticed a reduction in their energy bills since participating in the program. Finally, customers were largely satisfied with the service providers and the program overall. More details about participant satisfaction can be found in Appendix D.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved with projects undertaken through the program. The carbon reduction estimates are reported in Table 5-6[12].

Table 5-6. Program-Level Carbon Reductions for the 2010 Energy House Calls Program

Measure Type	***Program-Level Ex Post Verified kWh Savings***	***Program Realized CO2 Emissions Reduction (Tons)***
All Measures	1,363,098	872.1
PTCS Duct Sealing	1,133,985	725.5
CFL Light Bulbs	229,113	146.6

[12] CO2 emissions reductions were calculated using a factor of 6.398×10^{-4}.
Ref: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010V1_1_year07_GHGOutputrates.pdf

6. SUMMARY AND DISCUSSION OF FINDINGS

This report has provided the results from an impact evaluation of the Energy House Calls Program that Idaho Power Company (IPC) offered to its residential customers in Idaho and eastern Oregon during 2010.

6.1 SUMMARY OF FINDINGS

There were a total of 1,598 participants in the Energy House Calls Program in 2010, accounting for 1,420 PTCS certified duct sealing jobs performed. The ex post verified values of energy savings (kWh), and peak demand reductions (kW) from these projects that were developed during this impact evaluation are reported in Table 6-1. There are no gas savings (MBtu) resulting from the program as all participating homes were electrically heated.

Table 6-1. Ex Post Savings for the 2010 Energy House Calls Program As Verified from Impact Evaluation

Measure Type	***Ex Post Verified Savings***		
	kWh Savings	***kW Reductions***	***Mbtu Savings***
All Measures	1,363,098	960.7	N/A
PTCS Duct Sealing	1,133,985	892.6	N/A
CFL Light Bulbs	229,113	68.1	N/A

6.2 DISCUSSION OF FINDINGS

The results in Table 6-1 show program-level ex post verified kWh savings of 1,363,098 kWh. Compared to ex ante expected program savings, this represents a realization rate for kWh savings of 113.7% for all measures. However, as shown in Table 6-2, kWh savings realization rates differ between measures. For duct sealing, the realization rate is 121.6%. For CFL light bulbs, the realization rate is 86.1%.

Table 6-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Products Program

Measure Type	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
All Measures	1,198,655	1,363,098	113.7%
PTCS Duct Sealing	932,626	1,133,985	121.6%
CFL Light Bulbs	266,029	229,113	86.1%

There was one main reason for the gross kWh realization rate being greater than 100%. Namely, ex ante savings estimates for duct sealing were based on outdated RTF deemed values from 2007. A regression analysis of billing data from participating homes suggested that deemed savings values from the more recent RTF FY10_v2.1 spreadsheet were more applicable for 2010 program participants than those used for ex ante purposes.

6.3 RECOMMENDATIONS FOR IMPROVEMENT

Overall, the 2010 Energy House Calls Program received a high realization rate. However, ADM recommends the following to increase homogeneity in how savings are claimed, reduce uncertainty in the claimed savings, and prevent potentially low realization rates in the future:

1) Improve recording of heating and cooling system types for participating homes. Update duct sealing data input form to include cooling system data field.

The program tracking database did not provide accurate information regarding heating and cooling system types for participating homes. As a result, RTF deemed savings were applied based on assumptions about the saturation of different system types. Accurate records of heating and cooling system type will allow for more precise ex ante savings calculations in the future. As a corollary to this, the current duct sealing data input forms being used by PTCS providers for the program should be updated to include a field for cooling system type. This field should include the following options: Heat Pump, Central AC, Other (Window unit, ect), and None. This field, in conjunction with the current field for heating system type, will be sufficient to apply the system specific RTF deemed savings estimates.

2) Consider restricting duct sealing to homes that meet the initial leakiness requirements as defined in the RTF deemed savings spreadsheets.

The RTF provides deemed savings values for PTCS duct sealing under the requirement that the ducts sealed initially had a leakage rate of 250 CFM50 or higher OR at least 15% of the floor are of the home. Approximately 230 participating homes in 2010 did not meet this requirement. While there are still energy savings resulting from these projects, they are likely lower than the deemed savings as estimated by the RTF.

3) Improve reporting of the number CFLs delivered per home as part of the program.

The program tracking database assumed exactly five (5) CFLs were delivered to each participating home. Results from ADM's on-site visit and participant survey suggest CFLs were distributed in a much less homogeneous manner. The number of CFLs delivered to each home should be recorded on the duct sealing data input form, even for homes that did not receive duct sealing. These numbers should be accurately transferred to the program tracking database.

APPENDIX A. PARTICIPANT SURVEY INSTRUMENT

Idaho Power
Energy House Calls Program
Participant Survey

***NAME:*_____ *PROJECT NUMBER:* _____**
***ADDRESS:* _____ *CITY/ZIP:* _____**
***DATE:*_____**

Hello, is **[CUSTOMER NAME]** available?

If yes, wait for proper person and continue interview.
If no, continue interview only if respondent is familiar with participating in the program.

My name is _____ and I am with ADM Associates, an independent research firm, and we are conducting an evaluation of Idaho Power's Energy House Calls Program. Our records indicate that you participated in the program in 2010**.** I'd like to ask you a few questions about your experience. This should only take about 5 minutes and your answers will be kept confidential. Would this be a good time? (If no, ask if there is a better time to call back).

1. The Energy House Calls program includes duct leakage testing and sealing if necessary. Do you recall participating in the program?
    a. Yes
    b. No (thank and terminate)
    c. Don't know (thank and terminate)

2. As part of the Energy House Call you had at your house, did the contractor perform any duct sealing?
    a. Yes
    b. No
    c. Don't know

3. As part of the Energy House Call you had at your house, did the contractor install any CFL light bulbs? How many?
    a. Yes, Installed #_____
    b. No
    c. Don't Know

4. As part of the Energy House Call you had at your house, did the contractor install any furnace filters? How many?
    a. Yes, installed 1 filter
    b. Yes, installed 2 filters
    c. Yes, installed 1 filter and gave me a second
    d. Gave 2 spare filters
    e. Installed/Gave more than 2 filters
    f. No
    g. Don't Know

5. What was the approximate date that the Energy House Call was performed?
    a. List Date: _____
    b. Don't know

6. Have you noticed increased comfort in your home since having the Energy House Call/duct sealing performed? (**ASK ONLY IF Q2=YES)**
    a. Yes
    b. No (skip Q7)
    c. It's worse now
    d. Don't Know (skip Q7)

7. Using the following scale, how has the comfort level changed since having the House Call/duct sealing performed? (**ASK ONLY IF Q2=YES)**
    a. Much more comfortable
    b. Somewhat more comfortable
    c. Same level of comfort
    d. Somewhat less comfortable
    e. Much less comfortable
    f. Don't Know

8. Have you noticed a reduction in your electricity bills since having the House Call/duct sealing performed? (**ASK ONLY IF Q2=YES)**
    a. Yes
    b. No
    c. Don't Know

9. Since having the Energy House Call performed, how would you compare the performance of your heating system to before the Energy House Call? (**ASK ONLY IF Q2=YES)**
    a. Much better
    b. Somewhat better
    c. Same level of performance
    d. Somewhat worse
    e. Much worse
    f. Don't Know

10. Using the following scale, how satisfied were you with the contractor who performed the Energy House Call?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know
    f. I installed the insulation myself

11. Using the following scale, how satisfied were you with the program as a whole?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know

12. Are there any other benefits or problems you have experienced as a result of having the Energy House Call performed?

Record answer:

_____

_____

APPENDIX B. REGRESSION ANALYSIS OF BILLING DATA: METHODOLOGY

Analysis of the impact of duct sealing on energy consumption was conducted using a regression analysis of billing data. The main objective of the analysis was to quantify the impact of duct sealing for program participants after controlling for the effects of weather. The resulting kWh savings estimates were used to assess the reasonableness of RTF deemed savings values by climate zone.

The regression models allow correction for weather and customer-specific effects. The energy savings estimates are based on separate regression models for heating zone one and heating zone two/three. The main reason heating zone two and three were considered together rather than in separate models was the small sample size of zone three participants. The regression analysis isolates and quantifies the effects of measured characteristics on changes in electricity consumption by controlling for the effects of other factors specified in the model. The technique also lends itself to the analysis of interactions between pre-/post-participation and temperature.

Ambient weather conditions are represented in the regression models as heating and cooling degree-days, calculated in reference to a base temperature of 65˚F. Given that we are dealing with a cross section of households with observations through time for each customer, we have the exact structure necessary to conduct a fixed-effects regression technique specific to panel data. By utilizing a time series of monthly kWh values for each customer in the sample, we can estimate the effect of the program with greater accuracy than other methods which might simply utilize a mean kWh before and after to estimate the results. One benefit of having monthly data is that we can control for temperature and as such explain a large portion of the variation in monthly kWh values. Having explained that source of variation in the model, we are better able to isolate the impact of the duct sealing on participants' energy usage. The actual specification of the model is outlined here:

The subscript refers to the variation across participants while refers to the variation through time. The term *kWh* refers to monthly electric energy use, in kWh, as indicated by the billing data. These kWh values were carefully analyzed by billing period length and binned into the correct month. The terms *HDD* and *CDD* refer to heating and cooling degrees days respectively, and are specific to the month and location of the residence. Separate weather files were applied for each region where duct sealing took place. In term of calibrating the model, actual weather data from the corresponding month and year was used. When calculating kWh savings, however, RTF HDD and CDD values for each climate zone were used instead so that the results are not dependant on weather irregularities in a given year. The term *Post* is a binary variable taking on

the value 0 in the pre-participation period and 1 in the post-participation period. The terms *PostHDD* and *PostCDD* are interaction terms with the billing period and HDD or CDD. The estimated equation contains a vector of dummy variables (*EcosID*) that is unique to each participant household. The purpose of this constant term is to capture all the determinants of that participant's energy use that are constant over time, but are unique from participant to participant. In effect, this approach automatically controls for differences among participants that influence the average level of consumption across participants. The specification of customer-specific effects allows the model to capture much of the baseline differences across customers while obtaining reliable estimates of the impacts of the duct sealing.

Standard statistical tests and regression diagnostics were used to evaluate the performance of the models. Each model is screened for implausible results. The statistical tests and diagnostics included evaluating the t-statistics for estimated coefficients and the R-squared for equation fit and examining residuals from the fitted models. The results of the statistical testing and diagnostic screening were used to select the model that explains the data best. The models were also screened for autocorrelation using the Durbin-Watson statistic and heteroskedastisity-autocorrelation consistent (HAC) robust standard errors were used to assess coefficient significance when autocorrelation was present.

The data used in the regression models was provided by IPC and includes monthly kWh usage for participating households starting in January 2009 and ending with October 2011. Monthly bills were provided for a total of 1,439 participants. However, many of the households were ultimately removed from the regression analysis for any of the following reasons:

- Multiple account numbers associated with one household during the billing period (307 households). The high number reflects the somewhat transient nature of the manufactured homes market.
- Lack of consecutive bills for 12 months pre-participation and 12 months post-participation (129 households)
- Household participated in the program but did not receive duct sealing (152 households, which included listings for 2009 projects that were QC'd in 2010)
- Zero usage or very low usage (less than 150kWh) in some months, indicating vacation or unoccupied periods (185 households)

The final analysis group for the regression analysis consisted of 666 participating households, including 522 from heating zone one, 122 from heating zone two, and 12 from heating zone three.

There are three coefficients of interest in the model, which are used to calculate the kWh savings attributable to the program. They are: Post, PostHDD, and PostCDD. The coefficient for each of the three variable combinations was converted to a representative form for the weather related effects. In particular the average monthly HDD and CDD for each climate zone as defined by the RTF were applied to the weather influenced coefficients. These three coefficients were then

summed and multiplied by 12 to determine the annual kWh savings. The factor of twelve is necessary to convert monthly savings into an annual number. The resulting estimates of kWh savings for each heating zone not only represent savings from duct sealing, but also reflect any savings resulting from the installation of CFLs as part of the program. To correct for this effect, the evaluations verified deemed savings estimate of 143kWh CFL savings per household was subtracted from each estimate.

Table B-1 lists and defines the variables considered in the regression models. Variables that were not significant or jointly significant (in the case of Post, PostHDD, and PostCDD) at the 10% significance level were excluded from the final models.

Table B-1. Variables in ADM's Regression Models

Variable Name	***Variable Definition***	***Measurement Scale***
kWh	Monthly kWh for each customer	Continuous variable
EcosID	Implementer Customer ID number	Vector of binary variables
Post	Pre- or Post- participation billing period indicator (1=Post-Participation period, 0 = Pre-Participation period)	Binary variable
CDD	Cooling degree days referenced to 65°F	Continuous variable
HDD	Heating degree days referenced to 65°F	Continuous variable
PostHDD	Interaction of billing period & HDD	Continuous variable
PostCDD	Interaction of billing period & CDD	Continuous variable

APPENDIX C. REGRESSION ANALYSIS OF BILLING DATA: RESULTS

This appendix presents the results from the regression analysis and the application of those results in determining the savings resulting from duct sealing through the Energy House Calls program.

Regression coefficients and their corresponding standard errors are reported in Table C-1 for the included variables. Separate regressions were used for heating zone one and heating zone two/three. Negative coefficients in Table 5-1 signify energy savings for the program group; positive coefficients do not. The main program-level findings indicated by the results in Table C-1 are summarized below.

- Cooling savings are statistically significant in the heating zone one model, but not in heating zone two/three model. This is represented by the inclusion of the PostCDD term in model 1 but not model 2. This is caused by the fact that all of heating zone one participants were located in cooling zone three, which has higher CDDs than cooling zones one and two. Over 85% of heating zone two and three participants are located in cooling zone one or two.
- Program participants decreased their electricity consumption in comparison to the pre-participation period *regardless of weather conditions*. This is consistent with the installation of CFL light bulbs in participating homes.
- Both regressions have high R-squared values, indicating the majority of the variation in monthly kWh is explained by the independent variables included in the model.
- Both regressions exhibit positive autocorrelation, as indicated by the Durbin-Watson statistics. Autocorrelation violates the assumptions of the classical linear regression model as it indicates that error terms across time are correlated. Autocorrelation does not bias coefficient estimates, but can tend to underestimate standard errors. To correct for this, Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors are reported. The impacts of included variables remain statistically significant.
- While the coefficient for the variable Post is not individually significant at the 10% level in regression one, the variables Post and PostHDD along with Post and PostCDD are jointly significant, indicating all three variables have a significant effect on monthly kWh.

Table C-1. Regression Results for each Model

Variable	Heating Zone One		Heating Zones Two and Three	
	(1)		(2)	
1. Constant	**477.8485**	***	**491.1235**	***
	(19.8405)		(49.8549)	
2. HDD	**2.0960**	***	**2.2029**	***
	(0.0364)		(0.0769)	
3. CDD	**2.1810**	***	**2.1971**	***
	(2.1810)		(0.1785)	
4. Post	**-26.5240**		**-46.2069**	*
	(16.6366)		(24.7639)	
5. PostHDD	**-0.0828**	***	**-0.1373**	***
	(0.0291)		(0.0491)	
6. PostCDD	**-0.1013**	*		
	(0.0517)			
Mean of dependent Variable:	1,660.27		1,825.70	
Sample Size:	17,748 observations: 522 cross-sectional units across 34 time periods		4,896 observations: 144 cross-sectional units across 34 time periods	
R-Squared:	0.8141		0.7965	
Durbin-Watson Statistic	0.5699		0.5933	

Note 1. The dependent variable is monthly kWh for regressions (1), and (2).

Note 2. Statistical significance of individual coefficients is denoted with * to indicated the p = 0.10 level; ** to indicate the p = 0.05 level; and *** to indicate the p = the 0.01 levels, respectively.

Note 3. HAC Standard Errors are in parenthesis

Annual HDD and CDD as reported by the RTF for each climate zone are used in conjunction with the estimated coefficients in Table C-1 to compute annual kWh savings. Table C-2 below shows the annual HDD and CDD for each climate zone.

Table C-2. RTF Annual HDD and CDD by Zone

Heating Zone	***Annual HDD***		***Cooling Zone***	***Annual CDD***
1	4,974.7		1	139.8
2	6,639.6		2	391.6
3	7,828.0		3	756.0

We now have all of the required information to calculate annual kWh savings as estimated by the regression analysis. As an example, the following equation calculates the regression estimated savings resulting from program participation for a participant from heating zone three (cooling zone one).

However, this calculation of annual kWh savings includes all savings resulting from program participation. To isolate the impact of duct sealing, the effects of installed CFL light bulbs must be removed. As an approximation, the verified deemed savings from this evaluation are subtracted. At 3.9 bulbs per house hold and 37kWh annual savings per bulb a reduction of 143.4 kWh is called for. The final estimate of kWh savings for participants in heating zone one based on this regression analysis is thus 663 kWh. Similar calculations were computed for heating zones two and three. Table C-3 presents the estimates of annual kWh savings attributable to duct sealing performed through the program.

Table C-3. Annual kWh savings estimates for Duct Sealing

RTF Heating Zone	***ADM Regression Analysis Estimated (kWh)***
1	663
2	1,323
3	1,486

APPENDIX D. PARTICIPANT SATISFACTION

The participant survey that was completed by a sample of 68 customers who participated in the program during 2010 included two questions regarding satisfaction with the program. Overall, customers were highly satisfied with the program. Ninety percent of respondents were either somewhat satisfied or very satisfied with the service provider who completed the work. However, there were a number of open-ended remarks regarding the service providers worth noting. Figure D-1 below shows the response breakdown for satisfaction with the service provider.

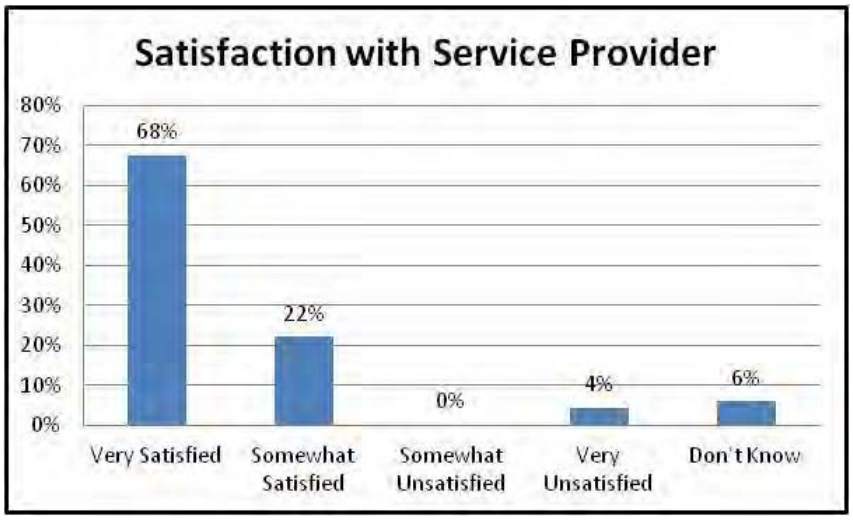


Figure D-1. Satisfaction with Service Provider

Comments regarding the service providers included:

1	They had a dog with them, the dog came into the house. He was nice but having the dog was inappropriate
2	Left goop on edge of vent. Left a mess.
3	Contractor told her a lot of ways to cut energy bill costs.
4	Thought they would do more. Didn't think they fixed all the leaks
5	Had scheduling problems.
6	Property (iTouch) was stolen by crew member. Ultimately was reimbursed.

Customers were also highly satisfied with the program overall. Only one out of 68 respondents reported being somewhat dissatisfied. Figure D-2 shows the response breakdown for overall program satisfaction.

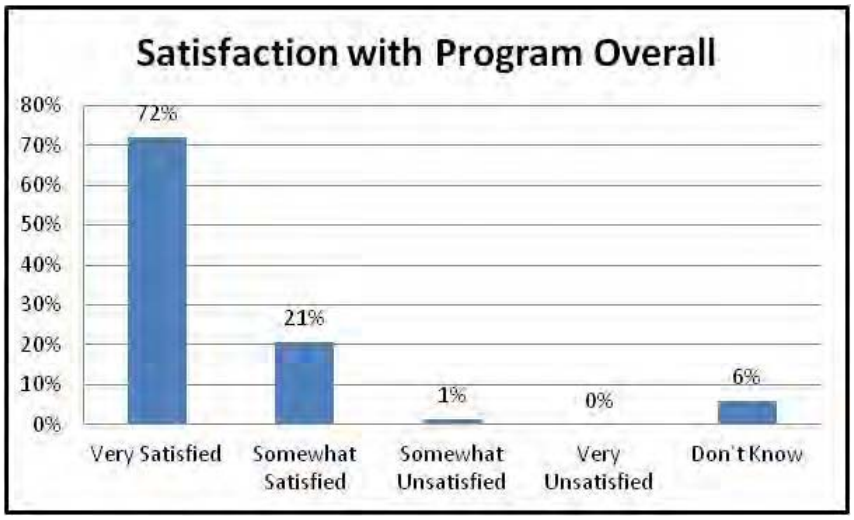


Figure D-2. Satisfaction with Program Overall

Responses to the open-ended question asking participants about additional benefits or problems as a result of participating included:

1	Needs new insulation
2	Did not have a mouse problem till ducts were sealed
3	Warmer house
4	Light bulbs not necessary, duct work most important. Does not live in house, owns multiple houses where program was performed

IMPACT EVALUATION
OF 2010
REBATE ADVANTAGE PROGRAM

Final Report
December 30, 2011

Prepared for:

IDAHO POWER®
An IDACORP Company

Prepared by:

ADM

ADM Associates, Inc.
3239 Ramos Circle
Sacramento, CA 95827
916-363-8383

TABLE OF CONTENTS

Chapter	*Title*	*Page*
1.	Executive Summary	1-1
2.	Introduction and Purpose of Study	2-1
3.	Description of Program	3-1
4.	Evaluation Methods	4-1
5.	Evaluation Findings	5-1
6.	Summary and Discussion of Findings	6-1
Appendix A.	Telephone Survey Form	A-1
Appendix B.	On-Site Home Verification Survey	B-1
Appendix C.	Manufacturing On-Site Plant Data Collection Form	C-1
Appendix D.	NEEM Program Exclusion Letter	D-1
Appendix E.	Participant Satisfaction	E-1

LIST OF TABLES

No. *Title* *Page*

Table 1-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Rebate Advantage Program 1-1

Table 1-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Products Program 1-1

Table 4-1 Sampling for Verification Activities 4-2

Table 4-2 Summary of Population by Desk Review Approach 4-4

Table 5-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Rebate Advantage Program 5-1

Table 5-2. List of Building Model Key Inputs by Program 5-2

Table 5-3. Regional Technical Forum Deemed Savings Comparison 5-4

Table 5-4. Heating and Cooling Zone Criteria 5-4

Table 5-5. Estimates of Distribution Peak Load Reductions by Weather Zone 5-5

Table 5-6. Program-Level Carbon Reductions for the 2010 Rebate Advantage Program 5-6

Table 6-1 Ex Post Savings for the 2010 Rebate Advantage Program As Verified from Impact Evaluation 6-1

Table 6-2. Lifetime Electricity Savings Summary 6-1

Table 6-3 Participant Interview Results 6-2

Table 6-4 Retailer Correspondence Results 6-2

LIST OF FIGURES

No. *Title* *Page*
Figure 5-1 Comfort Level of Manufactured Home Compared to Previous Residence 5-6

Figure E-1 Satisfaction with New Manufactured Home E-1

Figure E-2 Satisfaction with Incentive Amount E-2

Figure E-3 Satisfaction with Program Overall E-2

1. EXECUTIVE SUMMARY

This report provides the results from an impact evaluation of the Rebate Advantage Program that Idaho Power Company (IPC) offers to its residential customers in Idaho and eastern Oregon. The impact evaluation was conducted on rebate applications processed in 2010.

During 2010, the project provided incentives resulting in the installation of 35 ENERGY STAR® qualified manufactured homes. Estimates of the gross energy savings (kWh), peak demand reductions (kW) from these rebated manufactured homes are reported in Table 1-1.

Table 1-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Rebate Advantage Program

Program Component	***Ex Post Verified Savings***	
	kWh Savings	***kW Reductions***
ENERGY STAR® Manufactured Homes	167,681	106.20

M&V activities have concluded that the 2010 Rebate Advantage Program achieved verified energy savings of 167,681 kWh annually. The gross realization rate for the program is 102% based upon verified *ex post* kWh savings. A sample size was determined that provides a savings estimate for the program in Idaho with ±10% precision at the 90% confidence level. The results in Table 1-2 show program-level *ex post* verified kWh savings of 167,681 kWh compared to *ex ante* expected program savings of 164,894.

Table 1-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Rebate Advantage Program

Program Component	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
ENERGY STAR® Manufactured Homes	164,894	167,681	102%

,

2. INTRODUCTION AND PURPOSE OF STUDY

Under contract with Idaho Power Company (IPC), ADM Associates, Inc. (ADM) has performed an impact evaluation of the 2010 Rebate Advantage Program that IPC offers its residential customers in Idaho and eastern Oregon. The impact evaluation was conducted on rebate applications processed in 2010. Both the customer and the home salesperson received financial incentives by IPC.

The objectives for the evaluation were as follows:

- Measure and verify the energy impacts attributable to the Rebate Advantage Program in 2010.
- Provide credible and reliable program energy and non-energy impact estimates attributed to the Rebate Advantage Program during the 2010 program year.
- Report findings and observations, and provide recommendations that enhance the accuracy and transparency of reported program savings.

This report describes the effort undertaken to accomplish these objectives and presents the results of the evaluation. It is organized as follows:

- Chapter 3 provides a description of the Rebate Advantage Program.
- Chapter 4 presents and discusses the methods used to verify energy and non-energy impacts resulting from the program in 2010.
- Chapter 5 presents the estimates of program impacts.
- Chapter 6 summarizes the results of the evaluation effort.
- Appendix A provides the participant survey instrument.
- Appendix B provides the form used to perform the on-site home verification visit.
- Appendix C provides the manufacturing on-site plant collection form.
- Appendix D provides the NEEM program exclusion letter in comparison to ENERGY STAR® home requirements.
- Appendix E provides an analysis of program participation.

3. DESCRIPTION OF PROGRAM

The Rebate Advantage Program is a market-based strategy that reaches IPC's residential customers in the market for a new manufactured home through the retail channel. The program provides direct incentives to Idaho and Oregon residential customers to encourage retail purchases of energy-efficient manufactured homes. This enables the homebuyer to enjoy the long-term benefits of lower electric bills and greater comfort provided by these homes. Idaho Power residential customers who purchase a manufactured home and site it in Idaho Power's service territory are eligible for a $500 rebate. Additionally, salespersons receive a $100 incentive for each qualified home they sell.

In addition to offering financial incentives, the Rebate Advantage Program promotes and educates buyers and retailers of manufactured homes about the benefits of owning energy-efficient models. The Northwest Energy Efficient Manufactured Housing Program (NEEM) establishes quality control and energy efficiency specifications for qualified homes. Features of homes sold and constructed under this program include increased insulation, energy efficient air distribution systems, efficient equipment/control strategies, and efficient lighting.

The level of program participation in 2010 for the Rebate Advantage Program was reported to be 35 new manufactured homes in Idaho Power's "Demand-Side Management 2010 Annual Report".

4. EVALUATION METHODS

The following activities were performed during the 2010 Rebate Advantage Program impact evaluation:

- Selecting two manufacturing plants for site visits, contacting all retailers who sold the rebated homes, contacting 25 participants for verification surveys and a sub-sample of 10 participants for on-site home verification visits;
- Reviewing program tracking data and application materials for participating customers;
- Reviewing reported deemed savings values for each energy efficient manufactured home;
- Performing on-site visits to verify installation and collect data to facilitate analysis;
- Determining verified savings using data collected;
- Extrapolating sample-level findings to program-level savings.

4.1 SAMPLING PLAN

Estimation of the gross savings achieved through measures rebated under the Rebate Advantage Program were developed using data for a statistically valid sample of projects that had participated in the program during 2010. The focus of the sampling was on selecting a sample of homes that would allow for determining an installation verification rate with a high degree of confidence (i.e., ±10% precision at the 90% confidence level).

ADM employed four different data collection efforts to verify energy savings—on-site inspections of the home manufacturers' facilities, on-site inspections of rebated homes, a telephone participant verification survey, and a telephone verification survey with participating retailers.

ADM used simple random sampling to select program participants for on-site verification visits. Additionally, all participants in the program were contacted to complete a short verification survey. ADM also contacted all participating retailers who sold ENERGY STAR® manufactured homes that were rebated as part of this program to verify homes sold.

IPC provided a complete list of participating customers during the 2010 program year using a secure data transmission protocol, including pertinent information such as phone numbers, home manufacturer, addresses, etc. Once the file was verified, all participants were then called to schedule on-site verification visits and to complete short verification surveys. The product of this effort was a total of 17 participant surveys, including 10 which were accompanied by data and documentation collected during an on-site verification visit. In other words, the on-site verification visits were a nested sample of the larger sample participants who completed the survey. Finally, after the primary data collection was completed for these 17 participating

households, ADM requested the program application materials for each program participant, which were then reviewed.

For the on-site manufacturer facilities inspection, ADM visited two manufacturers that represent the vast majority of participating homes and resulting kWh savings. This sampling approach was determined by the knowledge that the design specifications and assembly processes used by each manufacturer of the homes contribute greatly to the variability of energy savings for the homes in the population.

Table 4-1 below shows the breakdown of sampling for different verification activities.

Table 4-1 Sampling for Verification Activities

Stratum	*Number of Program Application Reviews*	*Number of Verification Surveys*	*Number of Onsite Verification Visits (nested)*
Manufacturers' Facilities	0	0	2
Manufactured Homes	35	17	10
Retailers	0	35	0
Total	35	42	12

4.2 MANUFACTURER VISITS

ADM planned visits to manufacturers' facilities in order to verify the most energy savings possible while also limiting the impact on plant operations. Additionally, ADM had to ensure that there was still enough construction activity taking place at manufacturing plant facilities for accurate measurement and verification purposes.

Based on this sampling approach, ADM determined that visiting two manufacturers in November 2011 was sufficient for verification purposes. These two manufacturers alone represented 28 out of the total 35 rebated homes (80%) in this year's program.

Prior to these visits, ADM coordinated with manufacturing plant managers to schedule verification visits while an ENERGY STAR® manufactured home was on the construction assembly floor line. As part of the on-site inspections, ADM staff verified home building construction characteristics (e.g., R-values of insulation materials, high performance NFRC-

labeled windows) that would have otherwise been difficult to verify once an ENERGY STAR® home is completely constructed and occupied for end-use. Additionally, the site visits allowed for verification of inventories and supplies that manufacturers stocked for packaging into manufactured home units. This equipment included forced-air furnaces, domestic water heaters, and sometimes plug-load appliances (e.g., refrigerators, range-tops, microwaves). A blank copy of the on-site manufacturing plant data collection form is attached at the end of this report in Appendix C.

4.3 ON-SITE DATA COLLECTION

ADM conducted a total of 10 on-site visits to the homes of customers who received rebates for the purchase of ENERGY STAR® qualified manufactured homes. During the site visits, ADM field staff verified each home's address, the location of the ENERGY STAR® logo in the home, and the home's primary heating and cooling source. The data collected while on-site was further documented by taking pictures of the manufactured home and the ENERGY STAR® logo.

Each manufactured home's verified primary heating and cooling source was compared to the values listed in the program tracking data to assess the accuracy of program records. This information was also compared to the actual program application materials, allowing for a complete evaluation of how well information was transmitted from retailer purchases to program tracking records. A blank sample on-site verification form is attached at the end of this report in Appendix B.

4.4 PARTICIPANT SURVEY

ADM administered a short participant survey in order to verify participation of customers listed in the program tracking database. In addition to asking respondents if they purchased an ENERGY STAR® manufactured home (and applied for a rebate through IPC during 2010), the survey also addressed non-energy impacts and participant satisfaction with the program.

Seven-teen customers responded to the participant survey. Seven respondents had purchased an ENERGY STAR® home but did not receive an on-site inspection, while 10 respondents had been visited by ADM field staff. This additional verification effort helped increase our certainty level such that 32 out the 35 homes were verified through manufacturing plant visits, home visits, or telephone surveys. A copy of the survey instrument used can be found in Appendix A.

4.5 RETAILER VERIFICATION

ADM contacted participating retailers, who sold ENERGY STAR® manufactured homes that were rebated as part of this program. ADM confirmed and verified purchases of 100% of the

rebated ENERGY STAR® homes and requested information on primary space heating equipment, cooling equipment, and water heater fuel type. This effort helped serve as an engineering desk review of the tracking data contents and allowed ADM to achieve verification of all the homes in the program.

Table 4-2 summarizes the population of homes in the program and engineering desk review approach employed for each stratum (manufacturer).

Table 4-2 Summary of Population by Desk Review Approach

	Manufacturer	***Sum of Ex Ante Savings (kWh)***	***Representative Sample Number Verified***	***Number of Homes Represented***	***Plant Visit (P)/ Telephone Survey (T)/ Retailer Contact (R)***
1	Marlette Homes (OR)	12,970	3	3	T, & R
2	Champion Home Builders (ID)	109,950	24	24	P, T, & R
3	Kit Homebuilders West (ID)	12,970	3	3	T, & R
4	Nashua Homes (ID)	24,021	4	4	P, T, & R
5	Golden West (OR)	4,983	1	1	T & R
		164,894	**35**	**35**	

4.6 REVIEW OF DOCUMENTATION

For each of the 35 participants in the program, program application materials provided by IPC were reviewed. This review focused on three important issues:

- Program eligibility of the customer/manufactured home with respect to date of purchase;
- Correspondence between the primary heating and cooling source listed in the application and records listed in the program tracking database; and
- Correspondence between primary heating and cooling source listed in the application and data collected on-site for the sub-sample of 10 site visits.

In addition to reviewing the actual program application materials, a thorough review of the program tracking database was conducted.

4.7 METHODS TO VERIFY DEEMED SAVINGS FOR INSTALLED MEASURES

The reported ex ante energy impacts provided by IPC were based on deemed savings values by weather zone for each home rebated through the program. These deemed savings estimates come from the Northwest Power & Conservation Council's Regional Technical Forum (RTF) Current Measure list[1]. According to the RTF Operative Guidelines[2], evaluation of the savings resulting from the delivery of active deemed savings measures requires verifying the correct number of homes delivered, and applying the correct RTF-approved unit energy savings (UES) value to the delivered homes. This was the approach used in this evaluation in addition to reviewing the assumptions and methodologies used by the RTF in estimating deemed UES values.

Delivery of claimed units was verified through the review of the program tracking database, the participant survey, on-site data collection, and retailer verification surveys. The data collected from the documentation review, participant survey, on-site data collection effort, and retailer verification surveys were also analyzed to assess the assumptions used by the RTF. In addition, ADM checked the reasonability of the RTF deemed savings values using DOE2 building simulations informed by manufactured home models developed for the Database for Energy Efficient Resources (DEER). ADM developed two prototypical building models; the first to simulate a baseline home consistent with current HUD construction standards for manufactured homes and program guidelines, and the second to simulate the ~~"a~~s-built" homes. The baseline model is a home that just meets the minimum performance requirements as specified in the HUD regulations. Inputs for the as-built model were gathered through ADM's on-site activities, as described in the previous section. One simulation was performed for each unique climate zone in which program participant homes were located. Where necessary, assumptions and methodologies were modified and adjusted savings values were estimated.

4.8 ESTIMATING PROGRAM LEVEL REALIZED SAVINGS

Program-level savings were calculated using the following formula:

$$Verified\ Program\ Savings = \sum (Verification\ Rate_i * \sum Deemed\ Savings_{ij})$$

Where:

Verification Rate$_i$ = Verification rate for stratum i
Deemed Savings$_{ij}$ = Estimated deemed savings value for product j of stratum i

[1] http://www.nwcouncil.org/energy/rtf/measures/Default.asp
[2] RTF Operative Guidelines – Release 6-1-2011
http://www.nwcouncil.org/energy/rtf/subcommittees/deemed/Guidelines%20for%20RTF%20Savings%20Estimation%20Methods%20(Release%206-1-11).pdf

The verification rate was determined by the activities described in sections 4.2 through 4.6. The deemed savings values were defined by Northwest Power & Conservation Council's Regional Technical Forum and assessed for reasonability by ADM using DOE2 building simulation models for the appropriate weather zones.

4.9 ESTIMATING NON-ENERGY IMPACTS

Non-energy impacts of the Rebate Advantage Program assessed by ADM included increased comfort level in manufactured home for the participant and carbon offsets. Information for assessing non-energy impacts was collected through the participant survey.

Home comfort was assessed using customer comparisons to their previous residency on a scale of ~~"~~much more comfortable, somewhat more comfortable, same comfort, somewhat less comfortable, much less comfortable, and don't know." Participants were asked the following questions regarding their new manufactured home:

1) *How has your comfort level changed since moving into this new manufactured home? (compared to your last place of residency)*
2) *Are there any other benefits or problems you have experienced as a result of purchasing the new manufactured home?*

Responses to these questions were tabulated to quantify customer perceived benefits as a result of their new manufactured home.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved by the program. Survey respondents were also asked if they noticed reductions in their electricity bills since living in the new manufactured home.

5. EVALUATION FINDINGS

The data collected from program participants, home retailers, and home manufacturers encompassed a census of program participants. As described in section 4, ADM visited 10 homes for on-site verification, performed a telephone survey of 17 program participants (10 of which were those visited on-site), visited the two largest home manufacturers (81% of program savings), and verified each participant's application details with their retailers. This data was analyzed and the findings from this evaluation effort are detailed in this section. Additionally, ADM assessed the reasonability of the RTF deemed savings values using DOE2 simulation modeling. ADM found that the savings values were consistent and reasonable. Further detail regarding this verification can be found in Section 5.2.

M&V activities have concluded that the 2010 Rebate Advantage Program achieved verified energy savings of 167,681 kWh annually. The gross realization rate for the program is 102% based upon verified *ex post* kWh savings. A sample size was determined that provides a savings estimate for the program in Idaho with ±10% precision at the 90% confidence level. The results in Table 5-1 show program-level *ex post* verified kWh savings of 167,681 kWh compared to *ex ante* expected program savings of 164,894.

Table 5-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Rebate Advantage Program

Program Component	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
ENERGY STAR® Manufactured Homes	164,894	167,681	102%

5.1 VERIFICATION OF DELIVERED UNITS

All of the 17 participants surveyed indicated that they did indeed purchase and apply for a rebate for the manufactured home indicated in the program tracking database. Additionally, all of the retailers verified purchase of the homes. Based on these results, it was determined that a delivery verification rate of 100% was appropriate for the manufactured homes.

5.2 ESTIMATES OF EX POST VERIFIED GROSS KWH SAVINGS

ADM reviewed all of the documentation describing how the RTF deemed savings values were calculated in order to assess their reasonability. ADM also performed DOE2.2 building energy simulations to further confirm the soundness of the RTF savings values. The purpose of this review was not to duplicate the RTF efforts and re-derive savings values, but instead to independently confirm that the deemed savings values were appropriate. Furthermore, ADM

limited this review to *measures* (home space heating/cooling combinations) incentivized in the 2010 program year. Two measures were reviewed:

1) Homes using an electric resistance forced air furnace, but have no space cooling installed (FAF Only).
2) Homes using electric resistance forced air furnace and an efficient air conditioner for space cooling (FAF w/CAC).

The simulations were informed by residential manufactured home models developed for the Database for Energy Efficiency Resources (DEER) and the as-built models were simulated using Northwest Energy Efficient Manufactured Housing Program (NEEM) building standards. These parameters are listed in Table 5-2 below:

Table 5-2. List of Building Model Key Inputs by Program

Components	Baseline	ENERGY STAR®	EcoRated	NEEM
Ceilings (flat)	R-30 U=0.033	R-49 U=0.025	R-49 u=0.025	R-49 u=0.025
Ceilings (vaulted)	R-30 U=0.033	R-38 U=0.030	R-40 U=0.029	R-40 U=0.029
Wall Insulation	R-13 U=0.086	R-21 U=0.055	R-21 w/no trade off & requires insulated header u=0.55	R-30 U=0.033
Floors Insulation	R-22 U=0.044	R-33 u=0.033	R-38 Blown-in R-33 u=0.033	R-22 U=0.044
Window U-Value	U=0.35	U=0.35	U=0.33 area weighted avg	U=0.35
Skylights	U=0.50	40 sq. ft. max, U=0.50	40 sq. ft. max, U=0.50	40 sq. ft. max, U=0.50
Doors R-Value	R-5	R-5	R-5	R-5
Built-in Appliances	None	ENERGY STAR® dishwasher	ENERGY STAR® dishwasher	ENERGY STAR® dishwasher
Lighting	No requirement (assume 1.75 W/sq.ft.)	No requirement (assume 1.75 W/sq.ft.)	50 % fixture CFL (assume 1.1 W/sq.ft.)	50 % fixture CFL (assume 1.1 W/sq.ft.)
Minimum Infiltration	7.0 ACH 50	5.0 ACH 50	5.0 ACH 50	5.0 ACH 50

Components	Baseline	ENERGY STAR®	EcoRated	NEEM
Heating Equipment	78% AFUE Gas FAF; or Electric Furnace; or 7.7/13 Heat Pump	80% AFUE Gas FAF; or Electric Furnace; or 7.7/13 Heat Pump	90% AFUE Gas FAF; or Electric Furnace; or 7.7/13 Heat Pump	90% AFUE Gas FAF; or Electric Furnace; or 7.7/13 Heat Pump
Water Heater Efficiency	0.58 EF gas; 0.90 electric	0.58 EF gas; 0.93 electric	0.58 EF gas; 0.93 electric	0.58 EF gas; 0.93 electric
Duct Leakage	Ducts not tested	R-8 - tested ducts <0.06 CFM per ft2 or 75 CFM total @ 50 pa	R-8 - tested ducts <0.06 CFM per ft2 or 75 CFM total @ 50 pa	R-8 - tested ducts <0.06 CFM per ft2 or 75 CFM total @ 50 pa
Mechanical Ventilation	Spot Ventilation only	Exhaust Yes	Exhaust Yes	Exhaust Yes
Average Floor Area (ft^2)	1,750	1,750	1,750	1,750

While ENERGY STAR® requirements for maximum envelope U_0–Values differ across climate regions, ADM's on-site manufacturing plant visits suggested that a majority of ENERGY STAR® manufactured homes are built with constant envelope component U_0-Values regardless of the climate region in which the home will be built. Though these U_0-Values do not vary with climate region, they were found to be sufficiently low to meet ENERGY STAR® requirements for all three of the applicable climate regions. ADM also found that though the national ENERGY STAR® program requires a heat recovery ventilator for some ENERGY STAR® homes[3], no homes participating in the program met this requirement.

These divergences from the ENERGY STAR® requirements likely stem from the manufacturers' participation in the Northwest Energy Efficient Manufactured Housing Program (NEEM). NEEM has jurisdiction over manufactured housing design and construction procedures in four Pacific Northwest states (Idaho, Montana, Oregon, and Washington). As such the ENERGY STAR® guidelines do not necessarily apply to manufacturers participating in the NEEM program. This is supported by a letter (drafted July 2004) from the Environmental Protection Agency (EPA) to the Oregon Department of Energy states that the NEEM program has a separate prescriptive package design criteria that differs from that of the national ENERGY STAR® manufactured homes program.[4] At the time the letter was drafted, the state energy offices of the four Pacific Northwest states were in charge of the NEEM program.

As the state of Idaho does not stipulate that ENERGY STAR® manufactured homes entering the state be built to national ENERGY STAR® requirements (specifically those for the electric

[3] This applies only to homes designed with an electric resistance furnace in Climate Region 1

[4] A copy of this letter can be found in Appendix D

resistance furnace design criteria), the NEEM design package requirement were used to assess the claimed energy savings values.

Since hourly weather data for each of the RTF defined zones was not available, ADM used TMY weather data to estimate energy savings. ADM ran simulations using both TMY2 and TMY3 weather data in order to investigate how sensitive the simulated energy savings estimates were to weather. TMY3 weather data was only available for Boise and Pocatello. These data corresponded to the following RTF weather zones:

1) Heating Zone 1 / Cooling Zone 3
2) Heating Zone 2 / Cooling Zone 3

The results of ADM's simulated savings estimates are compared with the RTF values in Table 5-3.

Table 5-3. Regional Technical Forum Deemed Savings Comparison

	FAF Only			FAF w/CAC		
	RTF Energy Savings	ADM Energy Savings *(TMY2)*	ADM Energy Savings *(TMY3)*	RTF Savings Estimate	ADM Energy Savings *(TMY2)*	ADM Energy Savings *(TMY3)*
Heating Zone 1 / Cooling Zone 3	3,004 kWh	3,060 kWh	2,705 kWh	3,342 kWh	4,141 kWh	3,637 kWh
Heating Zone 2 / Cooling Zone 3	4,983 kWh	3,827 kWh	3,633 kWh	5,321 kWh	5,162 kWh	4,938 kWh

Much of the difference between ADM's simulated savings estimates and the RTF values is likely due to differences in the weather data used in the two efforts. The RTF savings values are defined for several different heating and cooling zones - which are defined (by the RTF) using their average annual heating and cooling degree days.[5] Each zone is listed with its respective heating and cooling degree days in Table 5-4.

Table 5-4. Heating and Cooling Zone Criteria

Heating Zone	Heating Degree Days	Cooling Zone	Cooling Degree Days
Zone 1	< 6,000	Zone 1	< 300
Zone 2	6,001 – 7,499	Zone 2	300 – 600
Zone 3	> 7,500	Zone 3	> 601

In ADM's simulations there was a non-negligible difference in estimated savings between the TMY2 and TMY3 weather data-sets - further implying that much of the difference in ADM's simulated savings estimates and those developed by the RTF is related to differences in the weather data used. Therefore, the savings estimates simulated by ADM are sufficiently close to corroborate the RTF savings values.

[5] Heating and Cooling degree days are both calculated using a base temperature of 60 Degrees Fahrenheit.

5.3 ESTIMATES OF EX POST VERIFIED KW REDUCTIONS

Estimates of *ex post* verified demand reductions (kW) savings for the program were determined in a similar fashion to estimates of *ex post* verified kWh savings. For each individual manufactured home, the resulting distribution system peak load reduction estimates were determined by applying RTF estimates for each weather zone. Table 5-5 shows the estimated per-unit kW reductions and the total kW reductions for each weather zone where the homes were located.

Table 5-5. Estimates of Distribution Peak Load Reductions by Weather Zone

Weather Zones	***Per-Unit Demand Reduction (kW)***	***Number of units***	***Total Demand Reduction***
Heating Zone 1 / Cooling Zone 3	1.9	4	7.6
Heating Zone 1 / Cooling Zone 3 (w/AC)	2.1	5	10.5
Heating Zone 2 / Cooling Zone 2	3.2	15	48
Heating Zone 2 / Cooling Zone 2 (w/AC)	3.3	1	3.3
Heating Zone 2 / Cooling Zone 3	3.2	2	6.4
Heating Zone 2 / Cooling Zone 1	3.2	4	12.8
Heating Zone 3 / Cooling Zone 1 (w/AC)	4.4	4	17.6
Total		35	106.2

5.4 NON-ENERGY IMPACTS AND EFFECTS

To assess non-energy impacts and effects of the 2010 Rebate Advantage Program, a telephone survey of a sample of participants was conducted. A total of 17 participant surveys were completed.

With respect to the participants comfort level in their home compared to their previous residence, 94% of respondents indicated that they saw their comfort level change for the better since purchasing the manufactured home. Figure 5-1 shows the breakdown of responses regarding participant comfort level.

Figure 5-1 Comfort Level of Manufactured Home Compared to Previous Residence

In addition to this non-energy benefit, 71% of respondents indicated that they had noticed a reduction in their energy bills since moving into the manufactured home.

Customers reported no significant problems since purchasing the home other than a few cracks in the walls and doors due to the transportation of the home to the final destination.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved with projects undertaken through the program. The carbon reduction estimates are reported in Table 5-6[6].

Table 5-6. Program-Level Carbon Reductions for the 2010 Rebate Advantage Program

Stratum	***Program-Level Ex Post Verified kWh Savings***	***Program Realized CO2 Emissions Reduction (Tons)***
ENERGY STAR® Manufactured Home	167,681	107.28

[6] CO2 emissions reductions were calculated using a factor of 6.398×10^{-4}.
Ref: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010V1_1_year07_GHGOutputrates.pdf

6. SUMMARY AND DISCUSSION OF FINDINGS

This report has provided the results from an impact evaluation of the Rebate Advantage Program that Idaho Power Company (IPC) offered to its residential customers in Idaho and eastern Oregon during 2010.

The following subsections contain detailed results of our findings:

6.1 GROSS ELECTRICITY IMPACTS AND VARIANCES

There were a total of 35 participants in the Rebate Advantage Program in 2010. The *ex post* verified values of energy savings (kWh) from this project that were developed during this impact evaluation are reported in Table 6-1. The reported savings are based on a sample size for the program with ±10% precision at the 90% confidence level.

Table 6-1 Ex Post Savings for the 2010 Rebate Advantage Program As Verified from Impact Evaluation

Unit Type	*Ex Post energy savings, (kWh)*	*Ex Ante energy savings, kWh*	*Difference*	*Realization Rate*
ENERGY STAR® Manufactured Homes	167,681	164,894	+2,787	102%

6.2 LIFETIME ELECTRICITY SAVINGS

ADM calculated lifetime electricity savings by the effective useful life of the program's main component, new ENERGY STAR® manufactured homes. A summary of these savings is shown in Table 6-2.

Table 6-2. Lifetime Electricity Savings Summary

Program Component	*Annual energy savings, kWh*	*Annual energy savings, kW*	*Effective Useful Life (EUL), years*	*Lifetime Energy Savings, kWh*	*Lifetime Energy Savings, kW*
ENERGY STAR® Manufactured Homes	167,681	106.20	45	7,545,780	4,779

6.3 RESULTS OF DOCUMENTATION REVIEW

ADM found an error in the primary heat source listed for one participant's home. The home was listed as having an electric heat pump instead of the electric furnace that was verified by the

participant and the retailer. The changes in savings (kWh) were a result of the higher realization rate.

6.4 ON-SITE DATA COLLECTION AND VERIFICATION SURVEY RESULTS

Table 6-3 summarizes the results from the on-site data collection and verification surveys of 17 ENERGY STAR® home occupants.

Table 6-3 Participant Interview Results

Questions	Results	Comments
Verify Purchase/Installation and equipment	100%	30% of participants had added an electric heat pump to their home. 18% of participants had removed the electric furnace originally installed in the home and installed a heat pump instead.
Verify Receipt of Rebate/Incentive from Idaho Power	100%	Participants complemented the fast turnaround from the time the application was submitted to the time the rebate was received.
Verify Amount of Rebate/Incentive	100%	All participants remembered distinctively the amount of the $500 rebate.

Table 6-4 summarizes responses from correspondence with participating retailers. All retailers were contacted to verify purchases of ENERGY STAR® manufactured homes and information regarding the rebated homes, which include:

1. Primary space heating equipment
2. Cooling equipment (if known)
3. Domestic water heaters

Table 6-4 Retailer Correspondence Results

Questions	Results	Comments
Verify Purchase/Installation and equipment	100%	- All retailers commented on the program as being —great”.

6.5 ON-SITE MANUFACTURING PLANT VISIT SUMMARY

As part of our measurement and verification data collection efforts, ADM visited manufacturing plant facilities. Our sampling plan allowed for the least number of visits, which was determined

to be two, to manufacturers while being able to verify energy savings at the 90/10 confidence interval.

Based on the tracking data contents, ADM determined that all of the program's five manufacturers in PY2010 were a part of the Northwest Energy Efficient Manufactured Housing (NEEM) Program, which has jurisdiction for ENERGY STAR® plant certification in four Pacific Northwest states (Idaho, Montana, Oregon, and Washington).

The NEEM program has separate requirements from the national ENERGY STAR® program and provides a suggested prescriptive design pathway that would enable its constructed homes to meet or exceed the performance requirements stipulated for the ENERGY STAR® climate regions 1 or 2, respectively. ADM made on-site visits to the following two manufacturers:

1. Champion Home Builders (ID)
2. Nashua Homes of Idaho (ID)

6.6 POTENTIAL ISSUES TO INVESTIGATE IN 2012

The Ex Post energy savings for this program are based on simulations using DOE2 building simulations informed by manufactured home models developed for the Database for Energy Efficient Resources (DEER). While performance modeling is not a requirement of HUD code or ENERGY STAR® certification, attention should be given to comparing different end-uses and their associated energy consumption in manufactured homes (i.e., space heating, cooling, and water heating) through comparisons between simulations of different modeling software. A number of other building simulation software could be used such as EnergyPro, eQuest, REM/Rate, etc.

Furthermore, visits to the manufacturing plant facilities revealed that constructed non-ENERGY STAR® HUD code homes may meet many of the performance criteria for attaining the ENERGY STAR® certification. This is reflected by the fact that manufacturers prefer to develop homes with one prescriptive design pathway to ease in-plant operations. With possible changes and more stringent requirements in federal HUD code to come in the near future, ADM's focus should be to determine the physical characteristics of HUD code homes being built presently and simulating baseline prototype models as needed.

In relation to baseline issues, the current 1994 federal HUD codes allows for manufactured homes to be constructed with electric resistance furnaces as the primary space heating source without employing an electric heat pump. While allowable by federal code, special attention should be given to capture information on whether current manufacturers and retailers construct or sell non-ENERGY STAR® homes with electric resistance space heating as their air leakage rates would presumably be higher than those of ENERGY STAR® homes. If there are none, arguably this would indicate that the HUD minimum space heating requirement is a relic and is

no longer an appropriate baseline for ENERGY STAR® homes with electric heat pumps. Furthermore, it should be explored whether or not electric resistance space heating is a cost-effective option for prospective home buyers; this is an issue that can potentially affect electric utility customers' monthly bills, as electricity consumption during winter months for a home with an electric resistance furnace as the primary heating source is higher than that of a home with heat provided by an electric heat pump.

APPENDIX A. TELEPHONE SURVEY FORM

This Appendix includes a blank copy of the telephone verification survey administered to occupied homeowners of the ENERGY STAR® manufactured homes.

Idaho Power
Rebate Advantage Program
Participant Telephone Survey

NAME:_____ PROJECT NUMBER: _____
ADDRESS: _____ CITY/ZIP: _____
DATE:_____

Hello, Is **[CUSTOMER NAME]** available?
If yes, wait for proper person and continue interview.
If no, continue interview only if respondent is familiar with participating in the program.

My name is _____ and I am with ADM Associates, an independent research firm, and we are conducting an evaluation of Idaho Power's Rebate Advantage Program. Our records indicate that you have participated in that program by purchasing an ENERGY STAR® qualified **manufactured home.** I'd like to ask you a few questions about your experience. This should only take about 5 minutes and your answers will be kept confidential. Would this be a good time? (If no, ask if there is a better time to call back).

1. Did you purchase an ENERGY STAR® manufactured home during 2010 and apply for a rebate through Idaho Power?
    a. Yes
    b. No (Thank and terminate interview)
    c. Don't know (Thank and terminate interview)

2. Do you recall receiving a rebate/incentive from Idaho Power for the purchase of this manufactured home?
    a. Yes
    b. No (skip Q2)
    c. Don't know (skip Q2)

3. Do you recall how much the rebate/incentive was for?
    a. Yes, It was $_____
    b. No
    c. Don't Know

4. What was the approximate date you purchased the manufactured home?
    a. List Date: _____
    b. Don't know

5. Is this your first manufactured home that you have purchased?
    a. Yes
    b. No
6. (If no to Q5) Was your previous manufactured home ENERGY STAR® rated?
    a. Yes
    b. No
7. How has your comfort level changed since moving into this ENERGY STAR® manufactured home? (compared to your last place of residency)
    a. Much more comfortable
    b. Somewhat more comfortable
    c. Same level of comfort
    d. Somewhat less comfortable
    e. Much less comfortable
    f. Don't know

8. Have you noticed a reduction in your electricity bills since purchasing this manufactured home?
    a. Yes
    b. No
    c. Don't Know

9. What is the fuel source for the water heater in your home? [READ OPTIONS ONLY IF NECESSARY]
    a. Electric
    b. Gas
    c. Propane
    d. Solar
    e. Other non-electric
    f. Don't know

10. What is your primary heat source in your home? [READ OPTIONS ONLY IF NECESSARY]
    a. Electric Heat Pump
    b. Gas Furnace
    c. Electric Furnace

d. Electric Baseboard
e. Other

11. Do you have central AC or window AC in your home?
    a. Central AC
    b. Window AC
    c. none

12. Using the following scale, how satisfied are you with your new manufactured home?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know

13. Using the following scale, how satisfied were you with the rebate/incentive you received from Idaho Power?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know

14. Using the following scale, how satisfied were you with the program as a whole?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know

15. Are there any other benefits or problems you have experienced as a result of purchasing the manufactured home?
    a. Record answer:

    _____
    _____
    _____

    Name
    Address

Thank you for your time and help. We will be sending a $25 VISA giftcard to you within a week. Thank you!

APPENDIX B. ON-SITE HOME VERIFICATION SURVEY

This Appendix includes a blank copy of the on-site data collection form used by ADM staff during on-site visits to participant homes.

Customer Name:_____ ADM Premise ID: _____
Customer Address:
_____
City: _____ Zip Code: _____
Field Tech Name: _____ Date of Visit: ____/____/_____

DWELLING DESCRIPTION

Building Type *(Circle One)*
1 Mobile Home
2 Manufactured Home

Primary Heat Source (Circle One)
1 Gas Furnace
2 Electric Heat Pump
3 Electric Furnace
4 Electric Baseboard
5 Other (Specify: _____)

Air Conditioning (Circle One)
1 Central AC
2 Window AC
3 None

Water Heat Source (Circle One)
1 Electric
2 Gas
3 Other (Specify:_____)

Instructions: For the measures monitored in Tables 1, please enter the required information (if applicable). Unless otherwise specified, two pictures are required per appliance. The first is a picture of the outside of the home with address shown, while the second is a shot of the nameplate (make/model) or the ENERGY STAR® label. Please write any notes in the space below as appropriate.

_____
_____
_____
_____
_____
_____

Manufactured Homes		
Manufacturer Name		
Model Number		
Serial Number		
Location of Label	☐ *Master Bedroom closet door*	☐ *Laundry room cabinet door*
	☐ *Electrical disconnect panel*	☐ *Did not find label*
Pictures Taken:	☐ *Picture of Home and Address*	☐ *Certificate (if available)*
	☐ *Manufacturer Name/Model Number/ENERGY STAR® Logo*	

Rebate Advantage Program Onsite Survey

16. Do you recall receiving a rebate/incentive from Idaho Power for the purchase of this manufactured home?
    a. Yes
    b. No (skip Q2)
    c. Don't know (skip Q2)
17. Do you recall how much the rebate/incentive was for?
    a. Yes, It was $_____
    b. No
    c. Don't Know
18. What was the approximate date you purchased this manufactured home?
    a. List Date: _____
    b. Don't know
19. Is this your first manufactured home that you have purchased?
    a. Yes
    b. No

    --(If No) Was your previous manufactured home ENERGY STAR® rated?
    c. Yes
    d. No

    --(If answered yes/no) Using the following scale, how has your comfort level changed since moving into this ENERGY STAR® manufactured home?

e. Much more comfortable
f. Somewhat more comfortable
g. Same level of comfort
h. Somewhat less comfortable
i. Much less comfortable
j. Don't Know

20. Using the following scale, how satisfied are you with this new manufactured home?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know
    f. I installed the insulation myself
21. Using the following scale, how satisfied were you with the rebate/incentive you received from Idaho Power?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know
22. Using the following scale, how satisfied were you with the program as a whole?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know
23. Are there any other benefits or problems you have experienced as a result of purchasing the manufactured home?
    a. Record answer:

    _____

    _____

    _____

APPENDIX C. MANUFACTURING ON-SITE PLANT DATA COLLECTION FORM

Site Visit Date/Time:	Manufacturer's Name & Location:
Field Tech Name:	Manufacturer's G.M. Name:
3rd Party Q/A Certifier Name:	Other Name(s):
Number of homes rebated in Idaho Power PY2010:	Percent of homes shipped to Idaho Power territory:
Number of floors/sections completed per day (On Average):	Part of NEEM? (Y/N)
Number of floors/day (Day of Visit):	Percent of homes built as ENERGY STAR®:

1. INSULATION & AIR INFILTRATION

	HUD[2] [Climate Region 3[3]]	ENERGY STAR® [Climate Region 1[4]]	ENERGY STAR® [Climate Region 2[5]]	NEEM/ ENERGY STAR®	PLANT SITE	NOTES
Ceilings	R-22 (double); R-19 (single)	not specified	not specified	R-38 blown (sloped) R-49 blown (flat)		
Exterior Walls	R-19	not specified	not specified	R-21		
Floors	R-22 (double); R-19 (single)	not specified	not specified	R-33		
Max. Natural Leakage	0.25 ACH	not specified	not specified	0.25 ACH or 5.0 ACH_{50}		
Maximum Shell Leakage	0.35 ACH	7.0 ACH_{50}[1]	7.0 ACH_{50}	7.0 ACH_{50}		
Crossover Duct Insulation	Not specified	R-8	R-8	R-8		

1. ACH_{50} is determined by a blower door test and it is the air changes per hours, induced by a 50 Pascal pressure from blower door operation. 7.0 ACH_{50} is equivalent to 0.35 ACH.
2. HUD Standards are performance-based, thus the manufacturer of the home determines how much and where insulation will be installed in the home as long as it meets the HUD overall U-value
3. There are 3 climate regions specified in the Federal HUD Code; 3 refers to the coldest and northernmost climate zone

2. HEAT LOSS & DUCT LEAKAGE

	HUD [Climate Region 3]	ENERGY STAR® [Climate Region 1]	ENERGY STAR® [Climate Region 2]	NEEM/ ENERGY STAR®	PLANT SITE	NOTES

Max. coefficient of heat transmission, U_0 value[6] [Btu/(hr)(sq ft)(F)]	0.079	0.048 – 0.063[7] (3% duct loss)	0.061 – 0.067 (3% duct loss)	0.0554[8]		
		0.051 – 0.061 (5% duct loss)	0.057 – 0.065 (5% duct loss)			
			0.054 – 0.064 (7% duct loss)			
Max. Allowable Duct Leakage		5%	7%	6% & less than 75 CFM_{50}		

4. $U_{o,standard}$ = Max. coefficient of heat transmission
   If high efficiency heating & cooling equipment is used, there is an adjustment:
   - $U_{0,adjusted} = U_{0,standard}$ * [1 + (0.6)(heating efficiency increase factor) + (cooling multiplier)(cooling efficiency increase factor)]; Cooling multiplier = 0.03 [HUD Climate Zone 3].
   - Heating efficiency increase factor = [AFUE (or HSPF) home - AFUE (or HSPF) NAECA req'ment] / AFUE (HSPF) NAECA requirement
   - Cooling efficiency increase factor = increase factor in the cooling equipment efficiency measured by SEER above that required by NAECA
5. The U_0 values vary greatly depending on the design package used, which allows for variability in heating fuel type (gas vs. electric), maximum allowable duct leakage, usage of a high efficiency Water Heater, and usage of a programmable thermostat.
6. The U_0 value is based on the prescriptive reference path outlined by NEEM (i.e. compliance to requirements of ceilings, walls, floors, glazing, exterior doors, infiltration rate, crossover duct insulation, main trunk duct sealing with mastic)

2A. DUCT LEAKAGE TEST (via Duct Blaster Test)

Total Floor Area [Sq ft]		Total Target CFM[9]		Total CFM @50 Pa	
# Sections		Fan Pressure Reading #1 @ 50 Pa[10]		Fan Pressure Reading #2 @ 50 Pa	
Ring					

7. Oregon D.O.E. offers a tax credit for duct systems that do not exceed 6% total losses at 50 Pa pressurized duct
8. Ducts are pressurized 50 Pa with reference to outside

3. HEATING & COOLING EQUIPMENT

		HUD [Climate Region 3]	ENERGY STAR® [Climate Region 1]	ENERGY STAR® [Climate Region 2]	NEEM/ ENERGY STAR®	PLANT SITE	NOTES
Minimum Heating Efficiencies	**Gas/Oil Furnace**	not specified	0.80 AFUE	0.80 AFUE	0.80 AFUE		
	Heat Pump	not specified	7.7 HSPF	7.7 HSPF	not specified		

	Electric Resistance[11]	not specified	1.0 EF	Not allowed	1.0 EF		
Minimum Cooling Efficiencies [12]	**A/C**	not specified	13 SEER	13 SEER	not specified		
	Heat Pump	not specified	7.7 HSPF	7.7 HSPF	not specified		
Minimum Water Heater Efficiencies [13]	**Gas**	not specified	0.59 EF (0.56 EF with R-5 pipe insul)	0.59 EF (0.56 EF with R-5 pipe insul)	0.55 EF (50 g); 0.56 EF (40 g); 0.58 EF (30 g)[14]		
	Electric	not specified	0.91 EF (0.88 EF with R-5 pipe insul)	0.91 EF (0.88 EF with R-5 pipe insul)	0.91 EF		
Programmable Thermostat		not required	required most of the time	required most of the time	required		

9. Electric Resistance (Forced Air) design packages require a maximum shell leakage of 4.0 ACH_{50} and a 70% efficient heat recovery ventilator to ensure total ventilation rate of 0.35 ACH
10. Cooling equipment must minimum NAECA requirements and while not a requirement, should be sized correctly depending on square footage of home and geographic location
11. High Efficiency Water Heater is not a requirement for the national ENERGY STAR® program; however, if it is used in the design package to allow for a higher envelope U_0 value, then it must meet these basic requirements.
12. For NEEM, gas fuel water heaters must meet these minimum requirements regardless of design package

3A. MECHANICAL VENTILATION[15]

	HUD [Climate Region 3]	ENERGY STAR® [Climate Region 1]	ENERGY STAR® [Climate Region 2]	NEEM/ ENERGY STAR®	PLANT SITE	NOTES
Heat Recovery Ventilation Unit (Air-to-Air Heat Exchanger)	not specified	70% efficiency	not specified	min. capacity of .035 cfm/ ft^2 of floor area		
Non-heat Recovery Ventilation Unit (Whole House Ventilation Fans)	not specified	not specified	not specified	50 – 90 CFM		

15. This is not a requirement if the total ventilation rate can be maintained at 0.35 ACH at all times.

4. WINDOWS

	HUD [Climate Region 3]	ENERGY STAR® [Climate Region 1]	ENERGY STAR® [Climate Region 2]	NEEM/ ENERGY STAR®	PLANT SITE	NOTES

Basic Window Requirements	(must be factory equipped and storm windows or insulating glass)	not specified	not specified	low-e or argon/ low-e; all windows must have NFRC label		
Max. SHGC	not specified	Any	0.55	not specified		
Max. Average U-Factor	not specified	unspecified	unspecified	0.35[16]		

16. Area weighted average shall be no greater than the U-Factor value of 0.35

6. PRELIMINARY PHOTOCHECKLIST (With approval of the Manufacturer)

____ Completed section of home
____ Different production/floor stage areas
____ Average Wall (*Try to capture the wall construction with insulation*)
____ Average Ceiling (*Try to capture the ceiling construction with insulation*)
____ Roof (*one from the inside and one from the outside*)
____ All available mechanical equipment
____ Ductwork
____ Nameplates of all mechanical equipment including condenser, furnace, water heater, etc
____ Any Additional Natural Ventilation (i.e. swamp cooler, whole house fan, etc)
____ Duct Blaster Setup
____ Return Plenum
____ Windows with NFRC label
____ ENERGY STAR® label in front of house (if possible)
____ HUD package label
____ ENERGY STAR® package label (if possible)

APPENDIX D. NEEM PROGRAM EXCLUSION LETTER

The following letter drafted in July 2004 by the Environmental Protection Agency (EPA) to the Oregon Department of Energy is documentation that the NEEM program has a separate builder option package (BOP) criteria that differs from the national ENERGY STAR® manufactured homes program.

It is ADM's understanding that the BOP will be updated once the federal HUD code is changed.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF AIR AND RADIATION

Climate Protection Partnerships Division
U.S. EPA 6202J
Washington, DC 20460

July 12, 2004

Thomas Hewes
Manager of Residential programs,
Oregon Department of Energy
625 Marion St., NE
Salem, OR 97301-3737

Dear Mr. Hewes,

The Environmental Protection Agency (EPA) has examined the "Proposed BOP for Pacific Northwest ENERGY STAR/NEEM Homes" sent on May 11, 2004 by Thomas Hewes, Manager, Northwest Energy Efficient Manufactured Home Program. Based on our analysis, EPA approves this BOP as the only ***single*** prescriptive package that applies to the entire four-state Pacific Northwest region (Oregon, Washington, Idaho and Montana). Otherwise, manufactured housing would have to comply with the requirements of the regionally-appropriate BOPs provided in the EPA publication, "ENERGY STAR Labeled Manufactured Homes; Design, Manufacturing, Installation, and Certification Procedures."

EPA's policy is to reference all inquiries regarding ENERGY STAR qualified homes to regional programs such as the Northwest Energy Efficient Manufactured Home Program initiative. Historically in markets with strong regional programs (e.g., Wisconsin, New York and Vermont), the vast majority, if not all ENERGY STAR activity, has taken place under the auspices of these regional programs even though the less rigorous EPA threshold remained valid.

Please distribute this letter to all stakeholders in your region. It has been a pleasure working with you on this effort.

Sincerely,

Glenn T. Chinery

Glenn Chinery
ENERGY STAR for Homes Program, Technical Coordinator

Super Good Cents Energy Efficient Manufactured Homes/
ENERGY STAR Co-Sponsoring Technical Specifications
(for Homes with Electric Resistance Heating Systems
in IECC 2000 Climate Zones 9-16)

Parameter	Specification	Comments
Duct Leakage Outside Conditioned Space	</=5% leakage to unconditioned spaces @ 25 Pa	It is understood that lower levels are consistently experienced; it is requested that supporting field data be reported to EPA when available.
Water Heating	>/= 0.93 EF	
Heating	Electric resistance forced air furnace or baseboard	
Cooling	>/= 13 SEER	When cooling equipment is installed at factory.
Thermostat	Digital programmable	
Active Ventilation	Required 25 watt whole house fan run 8 hrs./day (Furnace air handler blower running continuously to provide ventilation not acceptable)	Recommended systems to provide ~0.15 ACH: 1. Continuous- or intermittently-controlled low-sone, low-cfm, whole-house exhaust ventilation fan
Infiltration	Envelope leakage shall be no more than ACH50 </= 5.0 (~0.20 ACHnatural)	This leakage rate must be verified using a blower door.
Ceiling Insulation	>/=R38	These are nominal values.
Exterior Wall Insul.	>/=R21	
Floor Insulation Over Unccnd. Space	>/=R33	
Ducts (where applicable)	>/=R8 in unconditioned spaces, and crossover duct	Ducts in unconditioned crawl space serving floor registers are *within the thermal envelope* (i.e., "under" R33 floor insulation).
Windows	double pane, low-emiss. U-value </=0.34 SHGC </= 0.40	Target Home Up met at 14% window-to-floor-area (WFA). (Note that observed "fleet average" WFA is <12%)
Showerheads	Low-flow required	
Lighting	ENERGY STAR lighting encouraged	
Appliances	ENERGY STAR refrigerators, dishwashers and clothes washers encouraged	
Quality Management	Factory inspections are carried out on all units and random field inspections to determine duct leakage and infiltration levels are carried out on a regular basis.	

This BOP is valid through January 1, 2010

APPENDIX E. PARTICIPANT SATISFACTION

The participant survey that was completed by a sample of 17 customers who participated in the program during 2010 included three questions regarding satisfaction with various aspects of the program. Overall, customers were highly satisfied with the program. All respondents were either somewhat satisfied or very satisfied with their new manufactured home. Figure E-1 below shows the response breakdown for satisfaction with the new manufactured home.

Figure 6-1 Satisfaction with New Manufactured Home

Customers were also highly satisfied with the incentive level. All respondents indicated that they were either somewhat satisfied or very satisfied with their rebates. It is worth noting that all respondents except 1could correctly identify the amount of the rebate. Figure E-2 shows the response breakdown for satisfaction with incentive amount.

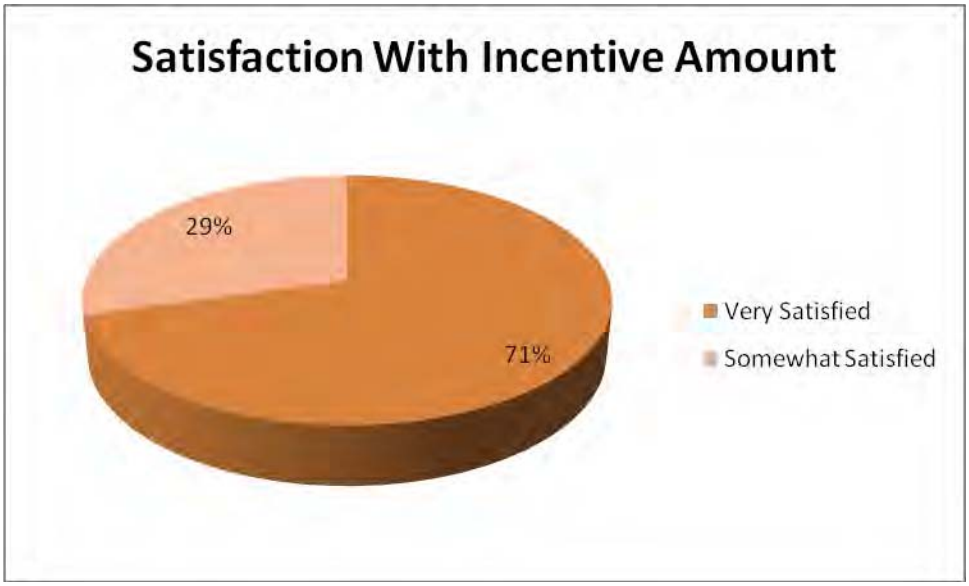


Figure E-2 Satisfaction with Incentive Amount

Finally, customers were also highly satisfied with the program overall. Figure E-3 shows the response breakdown for overall program satisfaction.

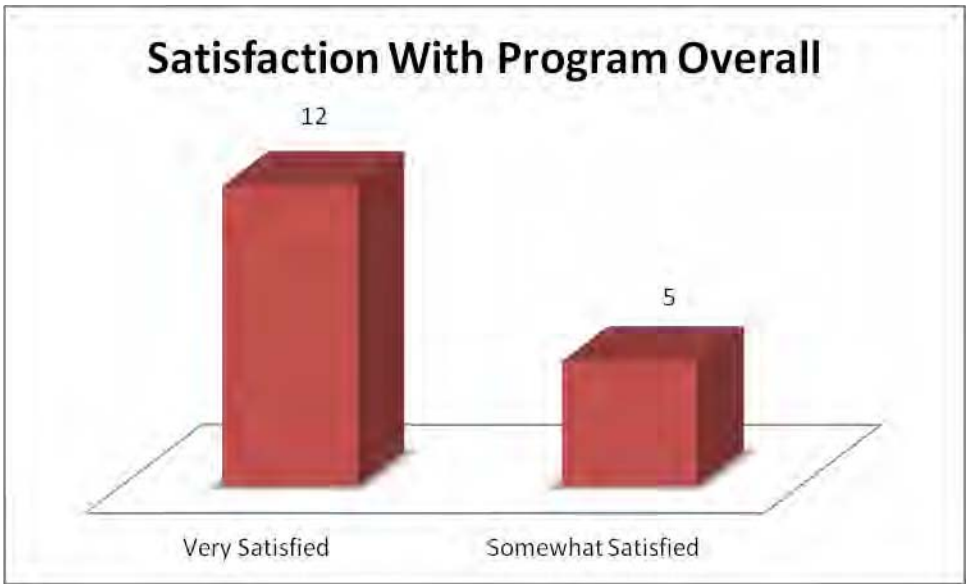


Figure E-3 Satisfaction with Program Overall

IMPACT EVALUATION
OF 2010
HOME PRODUCTS PROGRAM

Final Report

December 30, 2011

Prepared for:

Prepared by:

ADM Associates, Inc.
3239 Ramos Circle
Sacramento, CA 95827
916-363-8383

TABLE OF CONTENTS

Chapter	*Title*	*Page*
1.	Executive Summary	1-1
2.	Introduction and Purpose of Study	2-1
3.	Description of Program	3-1
4.	Evaluation Methods	4-1
5.	Evaluation Findings	5-1
6.	Summary and Discussion of Findings	6-1
Appendix A.	Participant Survey Instrument	A-1
Appendix B.	Participant Satisfaction	B-1

LIST OF FIGURES

No. *Title* *Page*

Figure 5-1. Type of Water Heater Fuel by Region 5-2

Figure 5-2. Performance of the New Appliance as Compared to the Old Unit 5-11

Figure 5-3. Appliance Noise Level as Compared to Old Unit 5-11

Figure B-1. Satisfaction with New Appliance B-1

Figure B-2. Satisfaction with Incentive Amount B-2

Figure B-3. Satisfaction with Program Overall B-2

LIST OF TABLES

No. *Title* *Page*

Table 1-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Home Products Program 1-1

Table 1-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Products Program 1-2

Table 3-1. Program Participation by Product Type 3-2

Table 4-1. Sampling for Verification Activities 4-2

Table 5-1. RTF Deemed kWh Savings* for Clothes Washers 5-4

Table 5-2. RTF Deemed kWh Savings for Refrigerators by Category 5-5

Table 5-3. RTF Deemed kWh Savings for Freezers by Category 5-5

Table 5-4. RTF Deemed kWh Savings for Light Fixtures by Category 5-6

Table 5-5. kWh Savings Estimates for Ceiling Fans with Light Kits 5-7

Table 5-6. Estimated Savings for Ceiling Fan Light Kits 5-7

Table 5-7. RTF Deemed Savings* for Showerheads by Type 5-8

Table 5-8. Estimates of Distribution Peak Load Reductions by Measure Type 5-9

Table 5-9. Estimates of Gas Savings by Measure Type 5-10

Table 5-10. Program-Level Carbon Reductions for the 2010 Home Products Program 5-12

Table 6-1. Ex Post Savings for the 2010 Home Products Program As Verified from Impact Evaluation 6-1

Table 6-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Products Program 6-2

1. EXECUTIVE SUMMARY

This report provides the results from an impact evaluation of the Home Products Program that Idaho Power Company (IPC) offers to its residential customers in Idaho and eastern Oregon. The impact evaluation was conducted on rebate applications processed in 2010.

There were a total of 13,996[1] participants in the Home Products Program in 2010, accounting for 16,312 ENERGY STAR® qualified product rebates. Estimates of the gross energy savings (kWh), peak demand reductions (kW), and gas savings (MBtu) from these rebated products are reported in Table 1-1.[2]

Table 1-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Home Products Program

Type of ENERGY STAR® Product	***Ex Post Verified Savings***		
	kWh Savings	***kW Reductions***	***MBtu Savings***
All Products	1,348,520	595.9	1,367.0
Clothes Washers	977,067	507.3	1,291.3
Refrigerators	262,239	50.5	0.0
Freezers	11,865	2.9	0.0
Light Fixtures	51,084	16.2	-104.6
Ceiling Fans	2,123	0.7	-5.1
Ceiling Fan Light Kits	144	0.0	-0.4
Showerheads (1.5 GPM)	25,566	10.6	50.1
Showerheads (2.0 GPM)	18,431	7.6	135.4

The results in Table 1-1 show program-level *ex post* verified kWh savings of 1,348,520 kWh. Compared to *ex ante* expected program savings, this represents a realization rate for kWh savings of 93.4% for the entire program. However, as shown in Table 1-2, realization rates differ across different products. For clothes washers, the biggest component of the program, the realization rate is 90.9%. For other products rebated at the customer level, the realization rate is 99.3%. For showerheads, which receive upstream incentives, the realization rate is 111.8%.

[1] Each unique account number is considered one participant.

[2] Note – The totals in the various tables throughout this report may not correspond to values listed to rounding errors.

Table 1-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Products Program

Stratum	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
All Products	1,443,580	1,348,520	93.4%
Clothes Washers	1,075,085	977,067	90.9%
Other Rebated Products	329,861	327,455	99.3%
Showerheads	39,366	43,997	111.8%

2. INTRODUCTION AND PURPOSE OF STUDY

Under contract with Idaho Power Company (IPC), ADM Associates, Inc. (ADM) has performed an impact evaluation of the 2010 Home Products Program that IPC offers its residential customers in Idaho and Eastern Oregon. The impact evaluation was conducted on rebate applications processed in 2010. Depending on the specific program component, customers or retailers who participate are provided with financial incentives by IPC.

The objectives for the evaluation were as follows:

- Measure and verify the energy impacts attributable to the Home Products Program in 2010;
- Provide credible and reliable program energy and non-energy impact estimates attributed to the Home Products Program during the 2010 program year; and
- Report findings and observations, and provide recommendations that enhance the accuracy and transparency of reported program savings.

This report describes the effort undertaken to accomplish these objectives and presents the results of the evaluation. It is organized as follows:

- Chapter 3 provides a description of the Home Products Program;
- Chapter 4 presents and discusses the methods used to verify energy and non-energy impacts resulting from the program in 2010;
- Chapter 5 presents the estimates of program impacts;
- Chapter 6 summarizes the results of the evaluation effort;
- Appendix A provides the participant survey instrument; and
- Appendix B provides an analysis of participant satisfaction.

3. DESCRIPTION OF PROGRAM

The Home Products Program is a market-based strategy that reaches IPC's residential customers through the retail channel. The program provides direct incentives to Idaho and Oregon residential customers to encourage retail purchases of energy-efficient lighting products and appliances. Direct incentives are delivered to IPC's customers through mail-in rebates. Idaho Power has contracted with ACB, Inc. to manage the processing of rebate applications.

In the 2010 program year, the rebated appliances and lighting products included the following:

- ENERGY STAR® Refrigerators
- ENERGY STAR® Freezers
- ENERGY STAR® Clothes Washers
- ENERGY STAR® Ceiling Fans with Light Kits
- ENERGY STAR® Light Fixtures
- ENERGY STAR® Ceiling Fan Light Kits

Additionally, in 2010 the program provided upstream discounts for Low Flow Showerheads (including 1.5 and 2.0 GPM varieties). Incentive amounts in 2010 were $50 for clothes washers, $30 for refrigerators, $20 for freezers, up to $15 per light fixture, and up to $20 per ceiling fan with light kit or separate light kit. Retailers selling qualified showerheads received a $7 incentive per unit, which can translate into lower retail prices or changes in stocking practices toward more efficient options.

3.1 SUMMARY OF PARTICIPATION

The level of program participation for the Home Products Program was reported to be 16,322 total appliances/fixtures in the Demand-Side Management 2010 Annual Report[3]. After reviewing the program tracking database provided by IPC, including removing duplicate entries and correcting one refrigerator that was misclassified as a clothes washer, the final level of participation was determined to be 16,312 appliances/fixtures. In total, this represents the identification and removal of ten duplicate entries, which were investigated and confirmed by IPC. Six of the ten duplicates did not receive a rebate, while the other four may have. Table 3-1 details the number of participating products by type.

[3] Appendix B – Demand-Side Management 2010 Annual Report for the 2011 Integrated Resource Plan. June 2011. http://www.idahopower.com/pdfs/AboutUs/PlanningForFuture/irp/2011/2011IRPAppendixBDSM2010AnnualReport.pdf

Table 3-1. Program Participation by Product Type

Type of ENERGY STAR® Product	***Ex Ante Reported Participation***	***Ex Post Verified Participation***	***Difference***
All Products	16,322	16,312	- 10
Clothes Washers	8,885	8,882	- 3
Refrigerators	6,025	6,018	- 7
Freezers	223	223	0
Light Fixtures	676	676	0
Ceiling Fans	36	36	0
Ceiling Fan Light Kits	3	3	0
Showerheads (2.0 GPM)	276	276	0
Showerheads (1.5 GPM)	198	198	0

4. EVALUATION METHODS

Evaluation of the impacts of the 2010 Home Products Program involved the following activities:

- Selecting 70 participants for verification surveys and a sub-sample of 25 participants for on-site verification visits
- Reviewing program tracking data for rebated products
- Reviewing program tracking data and participating retailer sales data for upstream low-flow showerhead measures
- Reviewing reported deemed savings values for each appliance and efficient lighting product
- Performing on-site visits to verify installation and collect data to facilitate analysis
- Determining verified savings using data collected and revised deemed savings values
- Extrapolating sample-level findings to program-level savings

4.1 SAMPLING PLAN

Estimation of the gross savings achieved through measures rebated under the Home Products Program was performed using data for a statistically valid sample of products for which rebates had been paid through the program during 2010. The focus of the sampling was on selecting a sample of rebates that would allow for determining an installation verification rate with a high degree of confidence (i.e., ±10% precision at the 90% confidence level).

ADM used a stratified sampling technique to select program participants for on-site verification visits and a short verification survey. Specifically, the sample was stratified by measure type into three strata: clothes washers, showerheads, and other appliances/fixtures. Clothes washers comprised a separate stratum because of the variance in savings unique to the measure resulting from different water heating and clothes dryer fuel sources.

The reason for stratification for showerheads was that this measure is discounted at the retailer level rather than the customer level. As such, sampling at the customer level is not possible, and instead a census of sales records from participating retailers was reviewed. IPC provided a complete list of participating customers during the 2010 program year, including pertinent information such as phone numbers, appliance type purchased, addresses, etc. Once the file was verified and duplicate entries were removed, each participant was assigned a random number which was used to prioritize the participant call list. Participants were then called to schedule on-site verification visits and to complete short verification surveys. The product of this effort was a total of 70 participant surveys, including 25 which were accompanied by data and documentation collected during an on-site verification visit. In other words, the on-site verification visits were a nested sample of the larger sample participants who completed the survey.

In addition to the sampling activities described above, ADM reviewed a census of ex ante energy and demand savings calculations as reported by IPC. This review focused on the underlying assumptions of deemed savings values for each product type rebated through the program.

Table 4-1 below shows the breakdown of sampling for different verification activities.

Table 4-1. Sampling for Verification Activities

Stratum	***Review of Ex Ante Deemed Savings Values***	***Sample of Verification Surveys***	***Sample of On-site Verification Visits (nested)***
Clothes Washers	Census	43	15
Other Products	Census	27	10
Shower Heads	Census	Census review of retailer sales data	0
Total	Census	70	25

4.2 PARTICIPANT SURVEY

ADM administered a short participant survey with the goal of verifying participation of customers listed in the program tracking database. A copy of the survey instrument used can be found in Appendix A. In addition to asking respondents if they purchased an ENERGY STAR® appliance and applied for a rebate through IPC during 2010, the survey also addressed non-energy impacts and participant satisfaction with the program. In accordance with the sampling plan outlined in the previous section, a total of 70 participants were surveyed. Twenty five (25) out of the 70 customers surveyed also had an on-site verification visit performed.

Customers who were rebated for clothes washers were also asked to specify the fuel source for their water heater and clothes dryer. The electric water heater and clothes dryer saturation rates were then compared to the results of the IPC 2010 Residential End-Use Survey[4] (REUS), conducted in January of 2011. These saturation rates were used to inform revisions to deemed savings assumptions as appropriate.

4.3 ON-SITE DATA COLLECTION

In evaluating this program, ADM conducted a total of 25 site visits to the homes of customers who received rebates for the purchase of ENERGY STAR® qualified products. During the site visits, ADM field staff verified that the rebated product was installed and operational and recorded the appliances' make and model information. For site visits to homes where clothes

[4] Idaho Power Demand-Side Management 2010 Annual Report: Supplement 2: Evaluation. March 15, 2011. Ref: http://www.idahopower.com/AboutUs/RatesRegulatory/Filings/filingsPDF.cfm?filing=441

washers were rebated, field staff also recorded the fuel source for water heaters and clothes dryers. The data collected while on-site was further documented by taking pictures of the appliance and appliance nameplate.

The make and model of each appliance verified on-site was then compared to the values listed in the program tracking data to assess the accuracy of program records. This procedure helps verify that the correct information regarding delivered unit is transferred from rebate applications to the tracking database.

4.4 REVIEW OF DOCUMENTATION

To verify the number of products incentivized through the program in 2010, a thorough review of the program tracking database was conducted. This review focused on four important issues:

- Program eligibility of the customer/product with respect to date of purchase;
- Program eligibility of rebated product using a lookup on ENERGY STAR® qualified product lists;
- Correspondence between make and model listed in the application and data collected on-site for the sub-sample of 25 site visits; and
- Removal of duplicate entries.

The tracking databases included make and model information for each product rebated through the program. These model numbers were checked against ENERGY STAR® qualified product lists to verify program eligibility using a lookup function. This same lookup was used to collect important appliance characteristics including clothes washer modified energy factors (MEFs) and refrigerator configurations.

4.5 METHODS TO ESTIMATE VERIFIED SAVINGS FOR INSTALLED MEASURES

The reported ex ante energy impacts provided by IPC were based on deemed savings values for each product type rebated through the program. For the majority of rebated products, these deemed savings estimates come from the Northwest Power & Conservation Council's Regional Technical Forum (RTF) Current Measure list[5]. According to the RTF Operative Guidelines[6], evaluation of the savings resulting from the delivery of active deemed savings measures requires verifying the correct number of units delivered, and applying the correct RTF-approved unit energy savings (UES) value to the delivered unit. This was the approach used in this evaluation in addition to reviewing the assumptions and methodologies used by the RTF in estimating deemed UES values.

---

5 http://www.nwcouncil.org/energy/rtf/measures/Default.asp

6 RTF Operative Guidelines – Release 6-1-2011 http://www.nwcouncil.org/energy/rtf/subcommittees/deemed/Guidelines%20for%20RTF%20Savings%20Estimation%20Methods%20(Release%206-1-11).pdf

Delivery of claimed units was verified through the review of the program tracking database, the participant survey, and on-site data collection. The data collected from the documentation review, participant survey and on-site data collection effort were also analyzed to assess the assumptions used by the RTF. Where necessary, assumptions were modified and adjusted savings values were estimated. ENERGY STAR® ceiling fans are the only rebated measure that does not currently have a deemed savings estimate listed in the RTF current measure list. Ex ante savings values for this measure were estimated by IPC staff using the ENERGY STAR® Ceiling Fan Savings Calculator[7]. To estimate verified ex post savings for ceiling fans ADM reviewed the assumptions of the ENERGY STAR® calculator and made adjustments where necessary.

4.6 ESTIMATING PROGRAM LEVEL REALIZED SAVINGS

Program-level savings were determined through a series of steps. First, the assumptions and methodologies underlying the ex ante claimed savings values for each product type were reviewed and revised where necessary. The resulting adjusted deemed savings values were applied to each product rebated through the program. Next, a verification rate for each stratum was estimated using information collected through on-site visits and the participant survey. Then, within each stratum the sum of the adjusted deemed savings values was multiplied by the strata specific verification rate to determine verified savings for each stratum. Finally, to estimate total verified savings for a program, the estimates of verified savings for the different strata were summed. This process can be illustrated by the following formula:

Where:

$Verification\ Rate_i$ = Verification rate for stratum i

$Deemed\ Savings_{ij}$ = Estimated deemed savings value for product j of stratum i

4.7 ESTIMATING NON-ENERGY IMPACTS

Non-energy impacts of the Home Products Program that were assessed included increased appliance performance, reduction in appliance noise, and carbon offsets. Information for assessing non-energy impacts was collected through the participant survey.

Appliance performance and noise level were assessed using customer comparisons to previous equipment on a scale of "much better, somewhat better, same, somewhat worse, much worse, and don't know." Participants were asked the following questions regarding their new appliances:

[7]ENERGY STAR® Ceiling Fan Savings Calculator http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Ceiling_Fan_Savings_Calculator_Consumer.xls

- How does the [Appliance Type] perform compared to the old unit?
- How does the noise level of the new [Appliance Type] compare to the old unit?
- Are there any other benefits or problems you have experienced as a result of purchasing the new appliance?

Responses to these questions were tabulated to quantify customer perceived benefits as a result of their new appliance installation.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved by the program. Survey respondents were also asked if they noticed reductions in their electricity bills since installing the new appliance.

5. EVALUATION FINDINGS

To estimate gross kWh savings and peak kW reductions resulting from the products rebated through the Home Products Program, the assumptions and methodologies used to estimate ex ante savings were reviewed and revised where necessary. Additionally, data was collected and analyzed for a sample of 70 participants. The data collected for these sample projects were analyzed using the methods described in Chapter 4 to estimate installation verification rates. The results from the analysis of the sample projects were then applied to estimate program-level savings and demand reductions. The findings from this evaluation effort are detailed in this section.

5.1 VERIFICATION OF DELIVERED UNITS

All of the 70 participants surveyed indicated that they did indeed purchase and apply for a rebate for the appliance/product indicated in the program tracking database. Additionally, 24 out of the 25 on-site visits produced make and model documentation that matched perfectly with what was reported in the program tracking database. The only appliance that was not the same model as listed in the database was a clothes washer from the same manufacturer, in the same product line, with a slightly larger capacity and similar efficiency. Based on these results, it was determined that a delivery verification rate of 100% was appropriate for the clothes washer and "other" products stratum.

Low-flow showerheads, which are incentivized at the retailer level and cannot be verified through customer surveying, also received a 100% delivery verification rate based on a review of participating retailers' sales data. Every 1.5 GPM and 2.0 GPM showerhead that was claimed in the program tracking database was represented in the sales data. Furthermore, showerhead model numbers were used to verify that the products did indeed have the appropriate GPM specifications.

5.2 ESTIMATES OF EX POST VERIFIED GROSS KWH SAVINGS

Estimates of *ex post* verified kWh savings for the program are presented in this section.

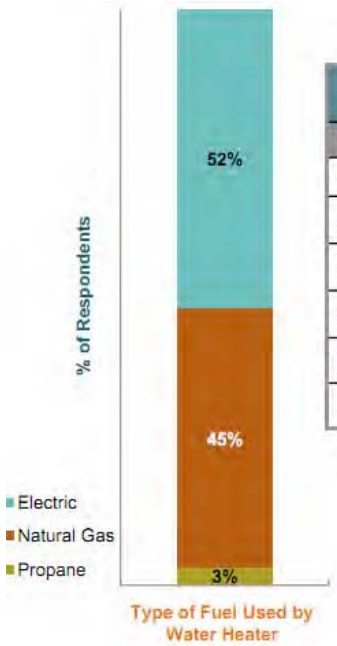
5.2.1 ENERGY STAR® Clothes Washers

For the purposes of estimating ex ante kWh savings values for clothes washers rebated through the program, IPC staff used deemed savings values for the RTF measure "ENERGY STAR® Clothes Washer – Any DHW, Any Dryer." This measure has an annual deemed savings value estimated at 121 kWh as compared to a baseline efficiency clothes washer.

ADM reviewed the RTF's assumptions and methodology for estimating this deemed savings value and believes the methodology to be sound. However, there were a few revisions necessary to the underlying assumptions in order to represent the population of clothes washers rebated through IPC's program. The RTF calculates energy impacts of ENERGY STAR® clothes

washers as compared to a baseline case. Different energy impacts are attributed to the clothes washers depending on the characteristics of the household in which it is installed. For example, a clothes washer installed in a home with electric water heating and a gas clothes dryer has different energy impact estimates than if it were installed in a home with gas water heating and electric clothes dryer. To account for these differing home characteristics, the RTF uses assumed saturation rates for electric water heating and electric clothes dryers to estimate generic deemed energy savings values.

Specifically, the RTF estimates assume an electric water heater saturation rate of 64% and an electric clothes dryer saturation rate of 82%. The IPC 2010 Residential End-Use Survey (REUS) estimated a lower electric water heater saturation rate of 52%. A summary of the electric water heater saturation rates estimated from this survey is shown in Figure 5-1.



	Total	Canyon (a)	Capital (b)	Eastern (c)	Western (d)	Southern (e)	Idaho (f)	Oregon* (g)
Type of Fuel Used by Water Heater								
Electric	52%	53% (b)	34%	60% (b)	82% (a,b,c,e)	68% (a,b)	51%	87% (f)
Natural Gas	45%	43% (d,e)	65% (a,c,d,e)	38% (d)	9%	30% (d)	46% (g)	11%
Propane	3%	4% (b)	1%	2%	9% (a,b,c,e)	2%	3%	2%
Other	<1%	0%	0%	0%	<1%	0%	<1%	0%
Base (unweighted)	*1607*	*253*	*615*	*200*	*244*	*295*	*1557*	*167*
Base (weighted)	*1607*	--	--	--	--	--	*1566*	--

Figure 5-1. Type of Water Heater Fuel by Region[8]

ADM's sample of rebated clothes washers found regional electric water heater saturation rates relatively consistent with those identified in the REUS survey. Because of the much larger sample size (1,607 compared to 43), ADM determined that using a saturation rate of 52% for all IPC territory was appropriate. This reduction from the RTF's assumption of 60% lowered per unit kWh savings for clothes washers rebated through the program.

Similarly, the electric clothes dryer saturation rate estimated by the REUS survey differed from the RTF's assumption of 82%. The REUS survey found a saturation rate of 95%, which was

[8] Taken directly from 2010 Idaho Power Residential End-Use Survey.
Ref: http://www.idahopower.com/AboutUs/RatesRegulatory/Filings/filingsPDF.cfm?filing=441

consistent with the saturation rate indicated by ADM's sample of rebated clothes washers. This increase from the RTF's assumption resulted in additional kWh savings per clothes washer rebated through the program.

These two changes in the RTF's assumptions essentially offset each other. The deemed savings value for the measure "ENERGY STAR® Clothes Washer – Any DHW, Any Dryer" changed from 121.0 to 122.0. However, the program tracking database includes model numbers for each clothes washer rebated through the program. These model numbers were used to identify important unit characteristics including modified energy factor (MEF), water factor (WF) and capacity using a lookup on the ENERGY STAR® qualified product list[9]. This information allowed for more accurate classification within the RTF's deemed measure list. Specifically, instead of using one deemed savings value for every clothes washer rebated, different savings values were used for different efficiency levels based on the individual units' MEF.

There are a number of requirements that must be met for the application of the deemed savings values to be justified. Specifically, the clothes washer must comply with the January 1, 2011 ENERGY STAR® specifications (modified energy factor of 2.0 or greater and water factor of 6.0 or lower). Prior to 2011, clothes washers met ENERGY STAR® specifications with an MEF of 1.80. Thus, a number of clothes washers rebated through the program in 2010 met the old ENERGY STAR® specifications, but do not meet the requirements necessary for the application of the RTF's deemed savings values. Additionally, the RTF deemed savings values assume a baseline MEF of 1.939, based on an analysis of the California Energy Commission's Appliance Database[10]. To compute this baseline, the RTF took the average MEF of all clothes washers added to the CEC database since 2007. ADM believes that this is a much more reasonable baseline than the minimum federal requirement (MEF of 1.26). However, this means that all clothes washers rebated through the program in 2010 with a MEF between 1.80 and 1.93 should not be considered energy saving measures. Additionally, all clothes washers rebated with MEFs between 1.93 and 1.99 should not receive the same deemed savings value as those with MEFs at or above 2.0.

After making the appropriate adjustments to the RTF's underlying assumptions and identifying the efficiency level for each clothes washer rebated through the program, ADM applied the per unit kWh savings estimates shown in Table 5-1.

9 http://downloads.energystar.gov/bi/qplist/res_clothes_washers.xls

10 http://www.appliances.energy.ca.gov/

Table 5-1. RTF Deemed kWh Savings for Clothes Washers*

Clothes Washer Category	***Per-Unit Savings (kWh)***	***Number of Units***	***Total Savings (kWh)***
MEF 1.93 or lower Clothes Washer - Any DHW, Any Dryer	0	1,399	0.0
MEF 1.94 to 1.99 Clothes Washer - Any DHW, Any Dryer**	43.59	373	16,259
MEF 2.00 to 2.19 Clothes Washer - Any DHW, Any Dryer	68.27	651	44,447
MEF 2.20 to 2.45 Clothes Washer - Any DHW, Any Dryer	112.72	3,198	360,487
MEF 2.46 or higher Clothes Washer - Any DHW, Any Dryer	170.46	3,261	555,875
Total		**8,880**	**977,067**

**With electric water heater saturation rate adjusted to 52%.*

***Not a RTF deemed savings value; estimated using RTF methodology and average characteristics for participating units with MEFs between 1.94 and 1.99.*

5.2.2 ENERGY STAR® Refrigerators

For the purposes of estimating ex ante kWh savings values for refrigerators rebated through the program, IPC staff used deemed savings values for the RTF measure "ENERGY STAR® Refrigerator – Any Refrigerator." This RTF measure has an annual energy savings value of 44 kWh. Multiplying by the 6,026 refrigerator rebates claimed by IPC, total ex ante savings for refrigerators rebated in 2010 were estimated to be 265,144. ADM reviewed the RTF's underlying assumptions and determined that they were reasonable. However, because the program tracking database provided model numbers for each rebated refrigerator, information about refrigerator configuration was readily available using a lookup on the ENERGY STAR® qualified refrigerator list[11]. This information allowed for more accurate classification within the RTF's deemed measure list. Specifically, instead of using a deemed savings value of 44 kWh for every refrigerator rebated, different savings values were used depending on the specific units configuration. Table 5-2 below identifies the RTF measure name and the associated kWh savings values used.

[11] http://downloads.energystar.gov/bi/qplist/refrigerators.xls

Table 5-2. RTF Deemed kWh Savings for Refrigerators by Category

Refrigerator Category	***Deemed Per-Unit Savings (kWh)***	***Number of Units***	***Total Savings (kWh)***
ENERGY STAR® Refrigerator - Bottom Freezer w/Ice thru door	45	1,092	49,140
ENERGY STAR® Refrigerator - Bottom Freezer w/o Ice thru door	40	1,238	49,520
ENERGY STAR® Refrigerator - Side-by-Side w/Ice thru door	44	2,447	107,668
ENERGY STAR® Refrigerator - Side-by-Side w/o Ice thru door	51	11	561
ENERGY STAR® Refrigerator - Top Freezer w/Ice thru door	40	0	0
ENERGY STAR® Refrigerator - Top Freezer w/o Ice thru door	45	1,230	55,350
Total		**6,018**	**262,239**

5.2.3 ENERGY STAR® Freezers

For the purposes of estimating ex ante kWh savings values for freezers rebated through the program, IPC staff used deemed savings values for the RTF measure "ENERGY STAR® Freezer (no tiers) - Any Freezer." This RTF measure has an annual energy savings value of 42 kWh. Multiplying by the 223 freezer rebates claimed by IPC, total ex ante savings for freezers rebated in 2010 were estimated to be 9,366. ADM reviewed the RTF's underlying assumptions and determined that they were reasonable. However, because the program tracking database provided model numbers for each rebated freezer, information about freezer configuration was readily available using a lookup on the ENERGY STAR® qualified freezer list[12]. This information allowed for more accurate classification within the RTF's deemed measure list. Specifically, instead of using a deemed savings value of 42 kWh for every freezer rebated, different savings values were used depending on the specific units configuration. Table 5-3 below identifies the RTF measure name and the associated kWh savings values used.

Table 5-3. RTF Deemed kWh Savings for Freezers by Category

Freezer Category	***Deemed Per-Unit Savings (kWh)***	***Number of Units***	***Total Savings (kWh)***
ENERGY STAR® Freezer (no tiers) - Chest, Any Defrost	35	66	2,310
ENERGY STAR® Freezer (no tiers) - Upright, Automatic Defrost	61	156	9,516
ENERGY STAR® Freezer (no tiers) - Upright, Manual Defrost	39	1	39
Total		**223**	**11,865**

[12] http://downloads.energystar.gov/bi/qplist/Freezers%20Product%20List.xls

5.2.4 ENERGY STAR® Light Fixtures

For the purposes of estimating ex ante kWh savings values for lighting fixtures rebated through the program, IPC staff used deemed savings values for the RTF measure "ENERGY STAR® Fixture (Hard wired) - Any Fixture." ADM reviewed the RTF's underlying assumptions and determined that they were reasonable. However, because the program tracking database provided model numbers for each rebated light fixture, information about indoor/outdoor fixture type was readily available using a lookup on the ENERGY STAR® qualified light fixture list[13]. This information allowed for more accurate classification within the RTF's deemed measure list. Specifically, instead of using a deemed savings value of 74 kWh for every fixture rebated, different savings values were used depending on the specific fixtures type. Additionally, ADM reviewed the RTF's savings estimates for LED fixtures and determined that they were reasonable. Table 5-4 below identifies the RTF measure name and the associated kWh savings values used.

Table 5-4. RTF Deemed kWh Savings for Light Fixtures by Category

Fixture Category	***Deemed Per-Unit Savings (kWh)***	***Number of Units***	***Total Savings (kWh)***
ENERGY STAR® Fixture (Hard wired) - Any Exterior Fixture	102	150	15,300.00
ENERGY STAR® Fixture (Hard wired) - Any Interior Fixture	69	511	35,259.00
LED Retail_LED Downlight- Inc_base	35	15	525.00
Total		**676**	**51,084.00**

5.2.5 ENERGY STAR® Ceiling Fans

For the purposes of estimating ex ante kWh savings values for ceiling fans with light kits rebated through the program, IPC staff used the ENERGY STAR® Ceiling Fan Savings Calculator with the mountain region selected. This calculator produces savings estimates of 159.36 kWh per fan. ADM reviewed the assumptions for this calculator and determined that two changes were needed. Firstly, the calculator assumes that the average ENERGY STAR® ceiling fan uses three 20W CFL bulbs, and that non-ENERGY STAR® ceiling fans use 3 60W incandescent bulbs. ADM reviewed the ceiling fan models rebated through the program and determined that, on average, the ENERGY STAR® ceiling fans use a total of 24W for lighting. This was significantly lower than the 60W assumed by the calculator. ADM determined that an

[13] http://downloads.energystar.gov/bi/qplist/fixtures_prod_list.xls

appropriate baseline for this level of lighting would be a 100W incandescent fixture.[14] As such, the delta wattage was reduced from 120W to 76W.

Secondly, the calculator assumed that the ceiling fan light fixture would be on 3 hours per day, 365 days per year. This value was changed to the RTF assumption of 1.9 hours per day for a CFL installed in any room. These changes to the calculator produced revised savings estimates of 58.97 kWh per rebated fan. Table 5-5 shows the total kWh savings attributable to fans rebated through the program.

Table 5-5. kWh Savings Estimates for Ceiling Fans with Light Kits

Measure	***Per-Unit Savings (kWh)***	***Number of Units***	***Total Savings (kWh)***
ENERGY STAR® Ceiling Fan with Light Kit	59	36	2,123

5.2.6 ENERGY STAR® Ceiling Fan Light Kits

For the purposes of estimating ex ante kWh savings values for ceiling fan light kits rebated through the program, IPC staff used deemed savings values for the RTF measure "ENERGY STAR® Lamp/bulb - Any Interior or Exterior Application - Retail." This deemed savings value estimates annual savings of 24 kWh for any ENERGY STAR® CFL. ADM reviewed the assumptions and methodology used by the RTF and determined them to be reasonable. IPC assumed that the light kits rebated through the program would have 3 bulbs on average, for an estimated savings of 72 kWh per light kit. ADM reviewed the two model numbers rebated through the program and determined that both models only contain 2 bulbs. As such, the per unit kWh savings estimates were adjusted to 48 kWh. Table 5-6 shows the total kWh savings attributable to ceiling fan light kits rebated through the program.

Table 5-6. Estimated Savings for Ceiling Fan Light Kits

Measure	***Per-Unit Savings (kWh)***	***Number of Units***	***Total Savings (kWh)***
ENERGY STAR® Ceiling Fan Light Kit	48	3	144

5.2.7 Low-Flow Showerheads

For the purposes of estimating ex ante kWh savings values for showerheads rebated through the program, IPC staff used deemed savings values for the RTF measures "Residential Showerhead Replacement_2_00gpm_Any Shower_ Any Water Heating_Retail" and "Residential Showerhead Replacement_1_50gpm_Any Shower_ Any Water Heating_Retail." IPC staff

[14] This is consistent with current RTF equivalency assumptions for ENERGY STAR® qualified lighting replacement options. See: http://www.nwcouncil.org/energy/rtf/measures/res/ResCFLLighting_v2_1.xlsm.

adjusted the electric water heater saturation rate from the 60% assumed by RTF to the 52% found in the REUS survey. ADM reviewed the assumptions and methodology used by the RTF and determined that they were reasonable. The adjustment to a 52% electric water heater saturation rate is also reasonable. IPC staff used the most recent RTF measure savings spreadsheet[15] at the time the 2010 annual report was written. However, that measure savings spreadsheet is now outdated. In a June 2011 update to the savings worksheet[16], the RTF changed the assumption that people showering using a 1.5 GPM showerhead would tend to shower 10% longer than the baseline (2.5 GPM) situation. The new spreadsheet assumes that shower length remains the same in the baseline and retrofit scenarios. Based on this change, the kWh savings attributable to the purchase of a 1.5 GPM showerhead was greater than originally estimated. Table 5-7 shows the total kWh savings attributable to low-flow showerheads incentivized through the program.

Table 5-7. RTF Deemed Savings for Showerheads by Type*

Fixture Category	***Per-Unit Savings (kWh)***	***Number of Units***	***Total Savings (kWh)***
Residential Showerhead Replacement_1_50gpm_Any Shower_ Any Water Heating_Retail	129	198	25,566
Residential Showerhead Replacement_2_00gpm_Any Shower_ Any Water Heating_Retail	67	276	18,431
Total		**474**	**43,997**

**With electric water heater saturation rate adjusted to 52%*

5.3 ESTIMATES OF EX POST VERIFIED KW REDUCTIONS

Estimates of *ex post* verified demand reductions (kW) savings for the program were determined in a similar fashion to estimates of *ex post* verified kWh savings. That is, the adjustments to RTF assumptions and methodologies outlined in Section 5.2 also affected kW. For each individual product type, any necessary revisions to the RTF's assumptions were implemented in the measure spreadsheet and the resulting distribution system peak load reduction estimates were determined. These distribution system peak load reduction estimates are based on measure specific load shapes used by the RTF. For ceiling fans, peak load reductions for the attached light kit are based on the same RTF assumptions as the separate light kit measure. To estimate demand reductions for higher efficiency fan motor, the ENERGY STAR® calculator's estimated kWh savings for the fan motor alone were divided by the assumed annual run-time hours. Table 5-8 shows the estimated per-unit kW reductions and the total kW reductions for each measure.

[15] RTF Current Measures. Residential: DHW – Showerheads. Savings Worksheet v2.0. May 12, 2010. http://www.nwcouncil.org/energy/rtf/measures/res/archive/ResDHW_LowFlowShowerheads_FY10v2_0.xls

[16] RTF Current Measures. Residential: DHW – Showerheads. Savings Worksheet v2.1. July 12, 2011. http://www.nwcouncil.org/energy/rtf/measures/res/ResShowerheads_v2_1.xlsm

Table 5-8. Estimates of Distribution Peak Load Reductions by Measure Type

Measure Type	***Per-Unit Demand Reduction (kW)***	***Number of units***	***Total Demand Reduction (Mbtu)***
MEF 1.93 or lower Clothes Washer - Any DHW, Any Dryer	0	1,399	0.0
MEF 1.94 to 1.99 Clothes Washer - Any DHW, Any Dryer	0.022	373	8.4
MEF 2.00 to 2.19 Clothes Washer - Any DHW, Any Dryer	0.032	651	21.0
MEF 2.20 to 2.45 Clothes Washer - Any DHW, Any Dryer	0.057	3,198	183.7
MEF 2.46 or higher Clothes Washer - Any DHW, Any Dryer	0.090	3,261	294.3
ENERGY STAR® Refrigerator - Bottom Freezer w/Ice thru door	0.009	1,092	9.8
ENERGY STAR® Refrigerator - Bottom Freezer w/o Ice thru door	0.008	1,238	9.9
ENERGY STAR® Refrigerator - Side-by-Side w/Ice thru door	0.008	2,447	19.6
ENERGY STAR® Refrigerator - Side-by-Side w/o Ice thru door	0.010	11	0.1
ENERGY STAR® Refrigerator - Top Freezer w/Ice thru door	0.008	0	0.0
ENERGY STAR® Refrigerator - Top Freezer w/o Ice thru door	0.009	1,230	11.1
ENERGY STAR® Freezer (no tiers) - Chest, Any Defrost	0.009	66	0.6
ENERGY STAR® Freezer (no tiers) - Upright, Automatic Defrost	0.015	156	2.3
ENERGY STAR® Freezer (no tiers) - Upright, Manual Defrost	0.010	1	0.0
ENERGY STAR® Fixture (Hard wired) - Any Exterior Fixture	0.032	150	4.8
ENERGY STAR® Fixture (Hard wired) - Any Interior Fixture	0.022	511	11.2
LED Retail_LED Downlight- Inc_base	0.011	15	0.2
ENERGY STAR® Ceiling Fan with Light Kit	0.019	36	0.7
ENERGY STAR® Ceiling Fan Light Kit	0.016	3	0.0
Residential Showerhead Replacement_1_50gpm_Any Shower_ Any Water Heating_Retail	0.054	198	10.6
Residential Showerhead Replacement_2_00gpm_Any Shower_ Any Water Heating_Retail	0.028	276	7.6
Total		**16,312**	**595.9**

5.4 ESTIMATES OF GAS SAVINGS

Estimates of *ex post* verified gas (MBtu) savings for the program were determined in a similar fashion to estimates of *ex post* verified kWh savings. That is, the adjustments to RTF assumptions and methodologies outlined in Section 5.2 also affected gas savings. For each individual product type, any necessary revisions to the RTF's assumptions were implemented in the measure spreadsheet and the resulting gas savings estimates were determined. For ceiling fans, gas savings from heating and cooling interactive affects were assumed to be the same as for

ceiling fan light kits, which is based on the RTF measure "ENERGY STAR® Lamp/bulb - Any Interior or Exterior Application – Retail." Estimated per unit gas savings (Mbtu) are reported in Table 5-9.

Table 5-9. Estimates of Gas Savings by Measure Type

Measure Type	***Per-Unit Gas Savings (Mbtu)***	***Number of units***	***Total Gas Savings (Mbtu)***
MEF 1.93 or lower Clothes Washer - Any DHW, Any Dryer	0	1,399	0.00
MEF 1.94 to 1.99 Clothes Washer - Any DHW, Any Dryer	0.020	373	7.37
MEF 2.00 to 2.19 Clothes Washer - Any DHW, Any Dryer	0.106	651	68.78
MEF 2.20 to 2.45 Clothes Washer - Any DHW, Any Dryer	0.161	3,198	513.92
MEF 2.46 or higher Clothes Washer - Any DHW, Any Dryer	0.215	3,261	701.63
ENERGY STAR® Refrigerator - Any	0	6,018	0.00
ENERGY STAR® Freezer - Any	0	223	0.00
ENERGY STAR® Fixture (Hard wired) - Any Exterior Fixture	0	150	0.00
ENERGY STAR® Fixture (Hard wired) - Any Interior Fixture	-0.201	511	-102.79
LED Retail_LED Downlight- Inc_base	-0.118	15	-1.77
ENERGY STAR® Ceiling Fan with Light Kit	-0.142	36	-5.12
ENERGY STAR® Ceiling Fan Light Kit	-0.142	3	-0.43
Residential Showerhead Replacement_1_50gpm_Any Shower_ Any Water Heating_Retail	0.253	198	50.06
Residential Showerhead Replacement_2_00gpm_Any Shower_ Any Water Heating_Retail	0.491	276	135.38
Total		**16,312**	**1,367.04**

5.5 NON-ENERGY IMPACTS AND EFFECTS

To assess non-energy impacts and effects of the 2010 Home Products Program, a telephone survey of a sample of participants was conducted. A total of 70 survey interviews were completed. The breakdown of respondents included 42 customers who purchased clothes washers, 25 customers who purchased refrigerators, two customers who purchased freezers and one customer who purchased an efficient light fixture.

With respect to appliance performance compared to the unit that was being replaced, 83% of respondents indicated that the new appliance performed much better or somewhat better. Five respondents did indicate that they felt the new appliance was somewhat or much worse than the old appliance. The few customers who indicated that the new appliance performed worse than the old unit provided reasons such as: "New clothes washer is noisy and shakes a lot" and "I do not like the washer at all." Figure 5-2 shows the breakdown of responses regarding appliance performance.

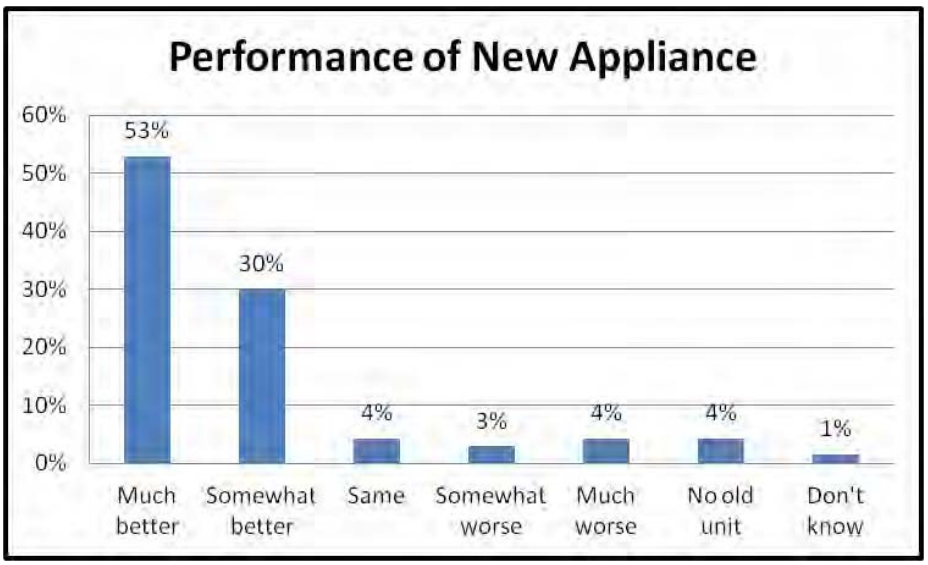


Figure 5-2. Performance of the New Appliance as Compared to the Old Unit

Regarding the noise level of the new appliance as compared to the old, 73% of respondents indicated that the new unit produced less noise. Only 7% indicated that the new unit was noisier than the old unit. The reduced noise level of newer appliances can be considered a benefit to customers as it improves the home environment. Figure 5-3 below shows the breakdown of responses regarding appliance noise level.

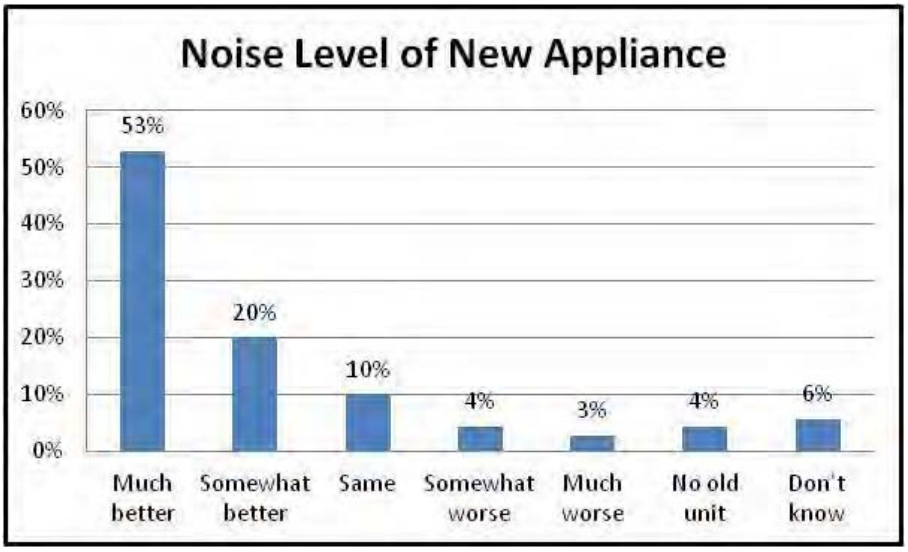


Figure 5-3. Appliance Noise Level as Compared to Old Unit

In addition to these non-energy benefits, 10 respondents indicated that they had noticed a reduction in their energy bills since installing the new appliance. Additionally, one customer indicated he was saving water with his new clothes washer as well. Similarly, another respondent noted that he noticed gas savings after installing the new clothes washer. Finally, customers were

largely satisfied with their appliances, the incentive they received, and the overall program. More details about participant satisfaction can be found in Appendix B.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved with projects undertaken through the program. The carbon reduction estimates are reported in Table 5-10[17].

Table 5-10. Program-Level Carbon Reductions for the 2010 Home Products Program

Stratum	***Program-Level Ex Post Verified kWh Savings***	***Program Realized CO2 Emissions Reduction (Tons)***
All Products	1,348,520	862.8
Clothes Washers	977,067	625.1
Other Rebated Products	327,455	209.5
Showerheads	43,997	28.1

[17] CO2 emissions reductions were calculated using a factor of 6.398×10^{-4}.
Ref: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010V1_1_year07_GHGOutputrates.pdf

6. SUMMARY AND DISCUSSION OF FINDINGS

This report has provided the results from an impact evaluation of the Home Products Program that Idaho Power Company (IPC) offered to its residential customers in Idaho and eastern Oregon during 2010.

6.1 SUMMARY OF FINDINGS

There were a total of 13,996 participants in the Home Products Program in 2010, accounting for 16,312 rebates for ENERGY STAR® qualified products. The *ex post* verified values of energy savings (kWh), peak demand reductions (kW), and gas savings (MBtu) from these projects that were developed during this impact evaluation are reported in Table 6-1.

Table 6-1. Ex Post Savings for the 2010 Home Products Program As Verified from Impact Evaluation

Type of Project	***Ex Post Verified Savings***		
	kWh Savings	***kW Reductions***	***Mbtu Savings***
All Products	1,348,520	595.94	1,367.04
Clothes Washers	977,067	507.30	1,291.70
Other Rebated Products	327,455	70.37	-110.11
Showerheads	43,997	18.27	185.45

6.2 DISCUSSION OF FINDINGS

The results in Table 6-1 show program-level *ex post* verified kWh savings of 1,348,520 kWh. Compared to *ex ante* expected program savings, this represents a realization rate for kWh savings of 93.4% for all projects. However, as shown in Table 6-2, kWh savings realization rates differ between product types. For clothes washers the realization rate is 90.9%. For other rebated products, the realization rate is 99.3%. Finally, for showerheads the realization rate is 111.8%.

Table 6-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Products Program

Stratum	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
All Products	1,443,580	1,348,520	93.4%
Clothes Washers	1,075,085	977,067	90.9%
Other Rebated Products	329,861	327,455	99.3%
Showerheads	39,366	43,997	111.8%

There was one main reason for the gross kWh realization rate being less than 100%. Namely, 1,399 clothes washers were rebated that had efficiency levels lower than that of the baseline assumptions of the RTF. These clothes washers were eligible for the program because they met 2010 ENERGY STAR® specifications, but they were not significantly more efficient than the average clothes washer available to consumers. Recognizing the increasing efficiency of clothes washers in the market, ENERGY STAR® changed its qualifications effective January 1, 2011. For a clothes washer to gain an ENERGY STAR® label in 2011, it must have an MEF of 2.0 or above. This is the same efficiency level required for the use of RTF deemed savings estimates to be justified. This issue should not be present in future program years, as program eligibility is based on the ENERGY STAR® qualified products list, which only includes units with an MEF of 2.0 or above as of 2011.

A secondary reason that the gross realization rate for clothes washers was lower than expected was that the RTF assumed electric water heater saturation rate was a higher than appropriate for the IPC territory. However, this effect was almost entirely offset by an underestimation of the electric clothes dryer saturation rate.

6.3 RECOMMENDATIONS FOR IMPROVEMENT

Overall, the 2010 Home Products Program received a high realization rate. However, ADM recommends the following to increase homogeneity in how savings are claimed, reduce uncertainty in the claimed savings, and prevent potentially low realization rates in the future:

1) Adjust RTF electric saturation rates for applicable products.

IPC claimed savings for showerheads incentivized through the program appropriately adjusted the RTF assumption regarding the electric water heater saturation rate to the 52% found in the 2010 REUS survey. However, this assumption was not changed for clothes washers rebated through the program. For future program years, it would be advisable to change RTF assumptions regarding electric water heating and electric clothes drying saturation rates. Additionally, it would be advisable to add a field on the rebate application for customers to self report water heating and clothes drying fuel sources. This would allow for more accurate use of the RTF deemed savings categories. Customers' self reported fuel sources might not be 100%

accurate, but they could at least be used to check the electric saturation rate assumptions made by the RTF.

2) Continue to collect make and model number information for every incentivized product. Use that information along with ENERGY STAR® qualified product lists to ensure eligibility and to categorize products by efficiency level, configuration, or type.

The RTF provides deemed savings values for products based on important efficiency affecting characteristics. For example, different deemed savings values are available for top-freezer and side-by-side refrigerators. The RTF does provide deemed savings estimates for "any" ENERGY STAR® refrigerator, but those deemed savings require assumptions about the percentage of different types of refrigerators rebated through the program. A more accurate estimate of program savings can be achieved through properly documenting each refrigerators configuration. The same is true with respect to freezers (document configuration), clothes washers (document MEF) and light fixtures (document indoor vs. outdoor).

APPENDIX A. PARTICIPANT SURVEY INSTRUMENT

Idaho Power
Home Products Program
Participant Telephone Survey

***NAME:*_____ *PROJECT NUMBER:* _____**
***ADDRESS:* _____ *CITY/ZIP:* _____**
***DATE:*_____**
Hello, Is **[CUSTOMER NAME]** available?
If yes, wait for proper person and continue interview.
If no, continue interview only if respondent is familiar with participating in the program.

My name is _____ and I am with ADM Associates, an independent research firm, and we are conducting an evaluation of Idaho Power's Home Products Program. Our records indicate that you have participated in that program by purchasing an ENERGY STAR® qualified **[APPLIANCE TYPE].** I'd like to ask you a few questions about your experience. This should only take about 5 minutes and your answers will be kept confidential. Would this be a good time? (If no, ask if there is a better time to call back).

1. Did you purchase an ENERGY STAR® [Appliance Type] during 2010 and apply for a rebate through Idaho Power?
    a. Yes
    b. No (Thank and terminate interview)
    c. Don't know (Thank and terminate interview)

2. Do you recall receiving a rebate/incentive from Idaho Power for the purchase of this [Appliance Type]?
    a. Yes
    b. No (skip Q3)
    c. Don't know (skip Q3)

3. Do you recall how much the rebate/incentive was for?
    a. Yes, It was $_____
    b. No
    c. Don't Know

4. What was the approximate date you purchased the [Appliance Type]?
    a. List Date: _____
    b. Don't know

5. How does the [Appliance Type] perform compared to the old unit?
    a. Much better
    b. Somewhat better
    c. Same
    d. Somewhat worse
    e. Much worse
    f. Don't Know
    g. No old unit

6. How does the noise level of the new [Appliance Type] compare to the old unit?
    a. Much better
    b. Somewhat better
    c. Same
    d. Somewhat worse
    e. Much worse
    f. Don't Know
    g. No old unit

7. Have you noticed a reduction in your electricity bills since purchasing the [Appliance Type]?
    a. Yes
    b. No
    c. Don't Know

8. **CLOTHES WASHERS ONLY**: What is the fuel source for the water heater in your home? [READ OPTIONS ONLY IF NECESSARY]
    a. Electric
    b. Gas
    c. Propane
    d. Solar
    e. Other non-electric
    f. Don't know

9. **CLOTHES WASHERS ONLY**: What is the fuel source for the clothes dryer in your home? [READ OPTIONS ONLY IF NECESSARY]
    a. Electric
    b. Gas
    c. Propane
    d. Solar
    e. Other non-electric
    f. Don't have clothes dryer
    g. Don't know

10. Using the following scale, how satisfied are you with the new [Appliance Type]?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know

11. Using the following scale, how satisfied were you with the rebate/incentive you received from Idaho Power?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know

12. Using the following scale, how satisfied were you with the program as a whole?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know

13. Are there any other benefits or problems you have experienced as a result of purchasing the new appliance?
    a. Record answer:

    _____

    _____

APPENDIX B. PARTICIPANT SATISFACTION

The participant survey that was completed by a sample of 70 customers who participated in the program during 2010 included three questions regarding satisfaction with various aspects of the program. Overall, customers were highly satisfied with the program. Over 90% of respondents were either somewhat satisfied or very satisfied with their new appliance. Figure B-1 below shows the response breakdown for satisfaction with the new appliance.

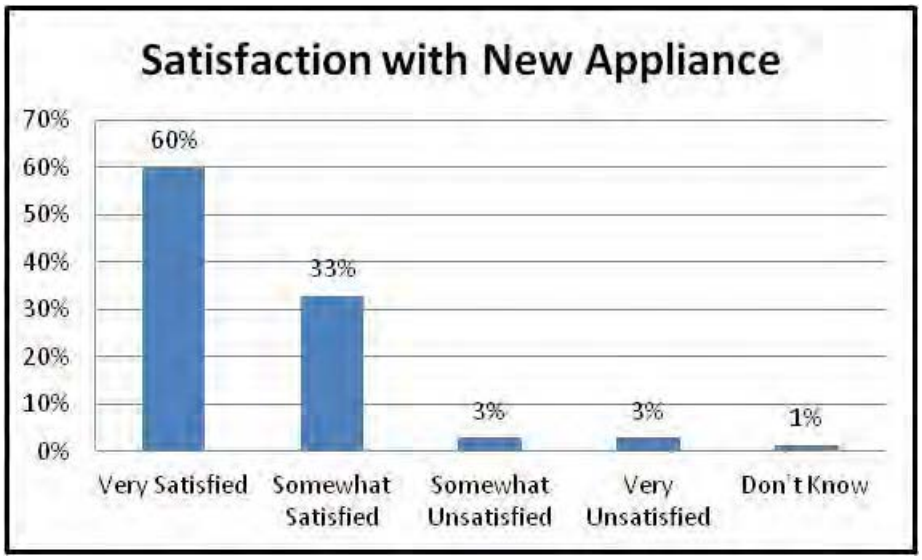


Figure B-1. Satisfaction with New Appliance

Customers were also highly satisfied with the incentive level. 91% of respondents indicated that they were either somewhat satisfied or very satisfied with their rebates. It is worth noting that many of these respondents could not correctly identify the rebate level (only 34% of respondents correctly identified the rebate amount they should have received). Still, it appears they were happy to have received a rebate at all. Figure B-2 shows the response breakdown for satisfaction with incentive amount.

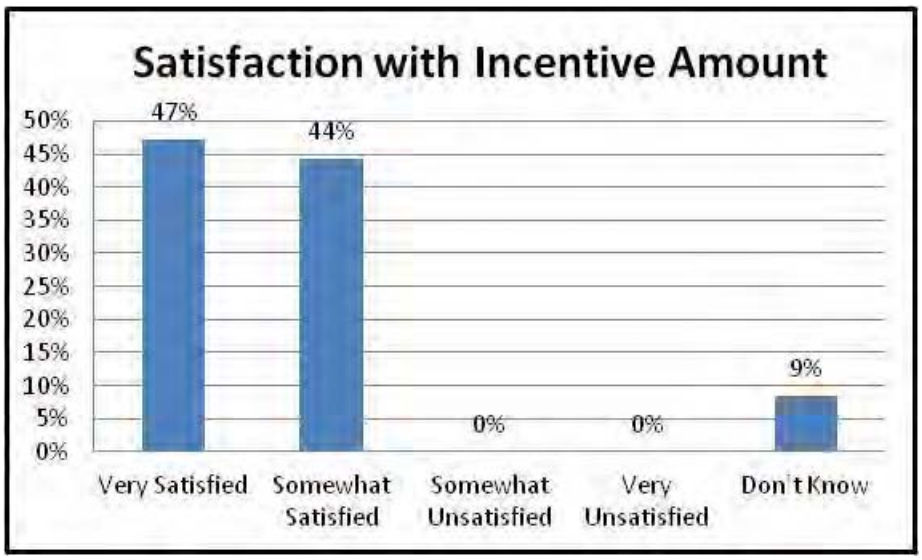


Figure B-2. Satisfaction with Incentive Amount

Finally, customers were also highly satisfied with the program overall. Only one out of 70 respondents reported being somewhat dissatisfied overall. Figure B-3 shows the response breakdown for overall program satisfaction.

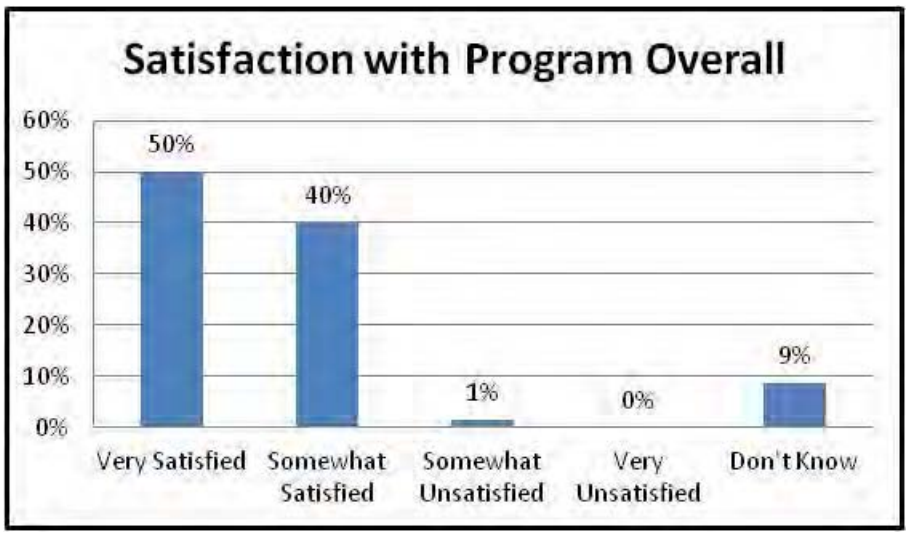


Figure B-3. Satisfaction with Program Overall

IMPACT EVALUATION
OF 2010
HOME IMPROVEMENT PROGRAM

Final Report, Draft 1
December 30, 2011

Prepared for:

IDAHO POWER®
An IDACORP Company

Prepared by:

ADM
ENERGY RESEARCH AND EVALUATION

3239 Ramos Circle
Sacramento, CA 95827
916-363-8383

TABLE OF CONTENTS

Chapter	*Title*	*Page*
1.	Executive Summary	1-1
2.	Introduction and Purpose of Study	2-1
3.	Description of Program	3-1
4.	Evaluation Methods	4-1
5.	Evaluation Findings	5-1
6.	Summary and Discussion of Findings	6-1

APPENDIX A. PARTICIPANT SURVEY INSTRUMENT A-1

APPENDIX B. ON-SITE VERIFICATION SURVEY B-1

APPENDIX C. PARTICIPANT SATISFACTION.....C-1

LIST OF FIGURES

No. *Title* *Page*
Figure 5-1. Comfort level of New Insulation Compared to Previous Levels 5-7

Figure C-1 Satisfaction with Contractor C-1

Figure C-2 Satisfaction with Incentive Amount C-2

Figure C-3 Satisfaction with Program Overall C-2

LIST OF TABLES

No. *Title* *Page*

Table 1-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Home Improvement Program 1-1

Table 1-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Improvement Program 1-1

Table 4-1 Sampling for Verification Activities 4-2

Table 5-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Home Improvement Program 5-1

Table 5-2. Program-Level Deemed Values for the 2010 Home Improvement Program. 5-3

Table 5-3. Program-Level Carbon Reductions for the 2010 Home Improvement Program 5-8

Table 6-1 Ex Post Savings for the 2010 Home Improvement Program As Verified from Impact Evaluation 6-1

Table 6-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Improvement Program 6-1

Table 6-3 Participant Interview Results..... 6-2

1. EXECUTIVE SUMMARY

This report provides the results from an impact evaluation of the Home Improvement Program that Idaho Power Company (IPC) offers to its residential customers in Idaho. The impact evaluation was conducted on rebate applications processed in 2010. The Home Improvement Program provides financial incentives for installation of attic insulation by IPC residential customers. During 2010, the program had 3,537 participants. Estimates of the gross energy savings (kWh), peak demand reductions (kW), and gas savings from these rebated attic insulated homes are reported in Table 1-1.

Table 1-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Home Improvement Program

Program Component	***Ex Post Verified Savings***		
	kWh Savings	***kW Reductions***	***Therms Savings***
Residential Attic Insulation	1,099,456	118.48	79,154

M&V activities have concluded that the 2010 Home Improvement Program achieved *ex post* verified kWh savings of 1,099,456. Compared to *ex ante* expected program savings, this represents a realization rate for kWh savings of 28% for the entire program. A sample size was determined that provides a savings estimate for the program in Idaho with ±10% precision at the 90% confidence level. The results in Table 1-2 show program-level *ex post* verified kWh savings of 953,132 kWh compared to *ex ante* expected program savings of 3,986,199.

Table 1-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Improvement Program

Program Component	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
Residential Attic Insulation	3,986,199	1,099,456	28%

The values used by Idaho Power to claim program savings were based on the model used to generate savings estimates for residential attic insulation improvements from the Regional Technical Forum (RTF). Idaho Power hired Ecotope Inc. to use these models to develop an

Idaho specific savings value which could be used to more accurately characterize savings for this measure in Idaho. ADM started our verification effort by evaluating the RTF deemed savings estimates for insulation improvements (in units of kWh/ft^2) to assess their reasonability, before reviewing Ecotope Inc.'s updates to the model. ADM used DOE 2 simulations of a representative residential single family home to verify savings for this measure, the results of this effort are explained in further detail in Section 5.

ADM's M&V effort found savings were lower than expected due to:

- Idaho Power used a value of .76 kWh/ft^2 of installed attic insulation to claim savings for each participant. This value was based on a simulation performed by Ecotope Inc. which estimated an average savings of 1670 kWh per home, and assumed an average 2,200 square feet per home. ADM reviewed the original simulations with Ecotope Inc. and Idaho Power in order to understand how the claimed savings were generated. Upon review, ADM found that the original model was not completely representative of the measures being implemented which led to an overestimation of savings. Specifically the models included energy savings for upgraded windows which were not included in the incentivized homes.
- 30% of 2010 program participants had pre-existing insulation of R-30 or greater; this level of insulation is an exceedingly high baseline, and in many service territories actually constitutes an "energy-efficient" level.
- 70% of 2010 program participants had non-electric space-heating (natural gas, propane, or stove insert). This significantly reduces the kWh/ft.2 savings. Further, of the subset of the population with R-30 or greater baseline insulation, 82% had non-electric space heating. The confluence of R-30 baseline and non-electric space heating resulted in 25% of the population (82% of 30% = 25%), displaying negligible kWh savings.

As stated prior, the program used a value of .76 kWh/ft^2 to claim savings for each participant. Through the M&V effort, ADM found values of:

- .82/ft^2 for homes with electric heating;
- .37/ft^2 for homes with heat pumps;
- .0035/ft^2 for homes with non-electric heating; and
- .21/ft^2 for the participant population overall.

2. INTRODUCTION AND PURPOSE OF STUDY

Under contract with Idaho Power Company (IPC), ADM Associates, Inc. (ADM) has performed an impact evaluation of the 2010 Home Improvement Program that IPC offers its residential customer in Idaho and eastern Oregon. The impact evaluation was conducted on rebate applications processed in 2010.

The objectives for the evaluation were as follows:

- Measure and verify the energy impacts attributable to the Home Improvement Program in 2010;
- Provide credible and reliable program energy and non-energy impact estimates attributed to the Home Improvement Program during the 2010 program year; and
- Report findings and observations, and provide recommendations that enhance the accuracy and transparency of reported program savings.

This report describes the effort undertaken to accomplish these objectives and presents the results of the evaluation. It is organized as follows:

- Chapter 3 provides a description of the Home Improvement Program.
- Chapter 4 presents and discusses the methods used to verify energy and non-energy impacts resulting from the program in 2010.
- Chapter 5 presents the estimates of program impacts.
- Chapter 6 summarizes the results of the evaluation effort.
- Appendix A provides the participant survey instrument.
- Appendix B provides the form used to perform the on-site home verification visit.
- Appendix C provides an analysis of program participation.

3. DESCRIPTION OF PROGRAM

The Home Improvement Program offers incentives to residential customers for installing attic insulation, resulting in reduced heating and cooling loads. The Program pays an incentive of $.15 per-square-foot for additional attic insulation professionally installed. In 2010 any insulation contractor could provide this service and there was no preferred contractor list associated with this program. New insulation must increase the R-value by R-10 or greater.

A large majority of Idaho Power's residential customers qualify for the program, though specific program qualifications are required to receive the incentive. Participation requirements include:

- Only existing, single-family homes qualify for an incentive. This includes duplexes and townhomes with the attic area over conditioned space.
- Homes must have central A/C or be electrically heated. Only attic insulation installed over conditioned space qualifies for an incentive.
- An insulation contractor must professionally install the insulation. Incentives are paid on added attic insulation up to an R-50.

According to the "Appendix B-Demand Side Management 2010 Annual Report," the Program provided incentives to 3,537 homes resulting in 3,986,199 kWh savings.

4. EVALUATION METHODS

The following activities were performed during the 2010 Home Improvement Program impact evaluation:

- Selecting 71 participants for verification surveys and a sub-sample of 24 participants for on-site home verification visits;
- Reviewing program tracking data and application materials for participating customers;
- Reviewing reported deemed savings values for each insulated home;
- Performing on-site visits to verify installation and collect data to facilitate analysis;
- Extrapolating the verification rate of deemed savings inputs from sampled sites to the overall population;
- Calculating savings for a census of participants using Regional Technical Forum (RTF) protocols; and
- Providing recommendations for revisions to deemed savings values.

4.1 SAMPLING PLAN

Estimation of the gross savings achieved through measures rebated under the Home Improvement Program were developed using data for a statistically valid sample of projects that had participated in the program during 2010. The focus of the sampling was on selecting a sample of homes that would allow for determining an installation verification rate with a high degree of confidence (i.e., ±10% precision at the 90% confidence level).

ADM employed two different data collection efforts to verify energy savings—an on-site inspection of the attic insulated home and a telephone survey with program participants. ADM used random sampling to select program participants for on-site verification visits and to complete a short telephone verification survey. IPC provided a complete list of participating customers during the 2010 program year, including pertinent information such as customer contact information, pre and post R-values for attic insulation installed, square footage of insulated area, and heating and cooling type. Data was transfered using established secure data transfer protocols. Once the file was verified, each participant was assigned a random identification number[1]. With this number assigned, participants where then sorted in order of highest to lowest value of their randomly assigned number; by this method, the participants are then in a randomly generated order, with the top values selected for surveying and/or onsite verification. Participants were then called to schedule on-site verification visits and to complete

[1] In practice, this is achieved using the RAND() function in Microsoft Excel.

short verification surveys. The product of this effort was a total of 71 participant surveys, including 24 which were accompanied by data and documentation collected during an on-site verification visit. Essentially, the on-site verification visits constituted a nested sample of the larger sample participants who completed the survey. Table 4-1 below shows the breakdown of sampling for different verification activities.

Table 4-1 Sampling for Verification Activities

Program Component	***Number of Desk Reviews***	***Number of Verification Surveys***	***Number of Onsite Verification Visits (nested)***
Residential Attic Insulation	71	71	24

4.2 ON-SITE DATA COLLECTION

ADM conducted a total of 24 on-site visits at the homes of customers who received rebates for the purchase and installation of attic insulation. During the site visits, ADM field staff verified that the rebated insulation was installed, and recorded the pre-existing and installed insulation R-values. Attic insulation is installed on top of pre-existing insulation, in order to add to the total R-value, so ADM field staff were able to discern what level of insulation was installed prior to participation. Additionally, field staff verified the square footage of insulated area and primary heating and cooling sources of the home. The data collected while on-site was further documented by photographing the insulation and HVAC systems.

The pre-existing and installed R-values of insulation verified on-site were then compared against the values listed in the program tracking data to assess the accuracy of program records. These are used in developing Verification Rates for each input in the savings calculations, confirming whether program implementation staff are accurately collecting and reporting participant data. A blank sample on-site verification form is attached at the end of this report in Appendix B.

4.3 PARTICIPANT SURVEY

ADM administered a short participant survey in order to verify participation of customers listed in the program tracking database. In addition to asking respondents if they installed attic insulation (and applied for a rebate through IPC during 2010), the survey also addressed non-energy impacts and participant satisfaction with the program.

In accordance with the sampling plan outlined in the previous section, a total of 71 participants were surveyed. Twenty-four (24) out of the 71 customers surveyed also had an on-site verification visit performed. A copy of the survey instrument used can be found in Appendix A.

4.4 METHODS TO ESTIMATE VERIFIED SAVINGS FOR INSTALLED MEASURES

In 2007, Idaho Power contracted with Ecotope Inc. to develop Idaho specific savings value which could be used to characterize savings for attic insulation in Idaho. In 2008, after the program was piloted, Idaho Power hired Ecotope to refresh their analysis based on information gathered from the pilot. The values used by Idaho Power to claim program savings were based on the model used to generate savings estimates for residential attic insulation improvements for the Regional Technical Forum (RTF). In 2011, the RTF developed a savings analysis specifically for Idaho Power's climate zones. This analysis included heating and cooling savings for Idaho specific weather zones and was approved by the RTF specifically for IPC. ADM determined that this most recent RTF savings spreadsheet from the RTF current measure list[2] specific for the state of Idaho was appropriate for assessing *ex post* verified savings.

In addition to calculating a weighted gross of kWh savings based on cooling and heating load after adding new insulation, ADM calculated Therms savings, which were not considered in Idaho Power's calculations of *ex ante* savings. These Therms savings were calculated separately based on whether customers had gas heating.

Claimed installation of attic insulation was verified through the review of the program tracking database, the participant survey and on-site data collection. The data collected from the participant survey and on-site data collection efforts were also analyzed to assess the assumptions used by the RTF. In addition, ADM checked the reasonability of the RTF deemed savings values using DOE 2 simulations of a typical residential home calibrated using weather and billing cycles for Idaho to run pre and post savings comparisons.

4.5 ESTIMATING PROGRAM LEVEL REALIZED SAVINGS

Program-level savings were determined through a series of steps. First, the assumptions and methodologies underlying the *ex ante* claimed savings values for each home were reviewed and revised where necessary. The resulting adjusted deemed savings values were applied to each home rebated through the program. Next, a verification rate was estimated using information collected through on-site visits and the participant survey. Finally, to estimate total verified savings for a program, the estimates of verified savings were summed. This process can be illustrated by the following formula:

Where:

Verification Rate = Verification rate for the sampled residences

Deemed Savings = Estimated deemed savings value for each measure

[2] ResSFWx v2 5 Idaho Power with CAC By Cooling Zone.xls

4.6 ESTIMATING NON-ENERGY IMPACTS

Non-energy impacts of the Home Improvement Program assessed by ADM included increased comfort level in the home for the participant, reduction in home noise level, and carbon offsets. Information for assessing non-energy impacts was collected through the participant survey.

Home comfort was assessed using customer comparisons to their previous attic insulation levels on a scale of "much more comfortable, somewhat more comfortable, same comfort, somewhat less comfortable, much less comfortable, and don't know." Participants were asked the following questions regarding their new insulation:

1) *How has the comfort level changed since having the insulation installed?*
2) *Have you noticed a change in outside noise level since having the insulation installed?*
3) *Are there any other benefits or problems you have experienced as a result of having the insulation installed?*

Responses to these questions were tabulated to quantify customer perceived benefits as a result of the increased insulation in the participant's homes.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved by the program. Survey respondents were also asked if they noticed reductions in their electricity bills since increasing the attic insulation R-value.

5. EVALUATION FINDINGS

The data collected from program participant on-site visits and participant surveys encompassed a variety of program participants. As described in section 4, ADM visited 24 homes for on-site verification and performed a telephone survey of 71 program participants (24 of which were those visited on-site). This data was analyzed and the findings from this evaluation effort are detailed in this section. Additionally, ADM assessed the reasonability of the Idaho-specific RTF deemed savings values using DOE 2 residential modeling and benchmarking. ADM found that the savings values were reasonable for homes who had a baseline of R-19 and above. For homes with a baseline of R-0, ADM's calculations found higher savings than what is used by the RTF. However, for consistency, the RTF deemed savings values were used to calculate *ex post* verified savings for each R- value baseline. Further detail regarding this verification can be found in Section 5.2.

M&V activities have concluded that the 2010 Home Improvement Program achieved verified energy savings of 1,099,456 kWh and 79,154 Therms annually. The gross realization rate for the program is 28% based upon verified *ex post* kWh savings. A sample size was determined that provides a savings estimate for the program in Idaho with ±10% precision at the 90% confidence level. The results in Table 5-1 show program-level *ex post* verified kWh savings of 1,099,456 kWh compared to *ex ante* expected program savings of 3,986,199.

Table 5-1. Ex Post Verified Savings from Impact Evaluation of the 2010 Home Improvement Program

Program Component	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
Residential Attic Insulation	3,986,199	1,099,456	28%

5.1 VERIFICATION OF INSTALLED INSULATION

All of the 71 participants surveyed indicated that they did install attic insulation, and all but 17 participants surveyed recalled receiving a rebate. This is likely due to the time elapsed between implementation and evaluation, as customers receiving relatively small rebates may not recall the check. Based on these results, it was determined that a delivery verification rate of 100% was appropriate for the attic insulation.

5.2 ESTIMATES OF EX POST VERIFIED GROSS KWH SAVINGS

ADM started our verification effort by evaluating the RTF deemed savings estimates for insulation improvements (in units of kWh/ft^2) to assess their reasonability. This was accomplished by creating eQuest models based upon DEER Residential models, which were

compiled using typical construction methods and schedules for common residential homes. According to the RTF Operative Guidelines, evaluation of the savings resulting from the delivery of active deemed savings measures requires verifying the correct number of units delivered, and applying the correct RTF-approved unit energy savings (UES) value to the delivered measures. The following equation shows how individual *ex-ante* savings were calculated for each of the 3,527 program participants:

Where,

A_{Ins} is the total surface area of the ceiling insulation

$H_{Savings}$ is the annual heating savings reported in $kWh/ft^2/yr$

$C_{Savings}$ is the annual cooling savings reported in $kWh/ft^2/yr$

ADM found that the cooling and heating savings values were reasonable for homes which had a baseline of R-19 and above. For homes with a baseline of R-0, ADM's calculations found higher savings than what are reported by the RTF.

In addition to calculating kWh savings based on cooling and heating load after adding new insulation, ADM calculated Therms savings, which were not considered in Idaho Power's calculations of *ex ante* savings. Due to Therms savings values not being supplied by the RTF, ADM reverse-calculated the savings from the provided heating savings numbers for the forced electric air furnace. Since it is assumed that electric heating has a COP of 1.0, the applicable kWh savings were converted to Therms savings with the assumption that the average residential furnace in Idaho has an efficiency of 80%. The Therms savings were calculated separately based on whether customers had gas heating.

In 2007, Idaho Power contracted with Ecotope Inc. to develop Idaho specific savings value which could be used to characterize savings for attic insulation in Idaho. In 2008, after the program was piloted, Idaho Power hired Ecotope to refresh their analysis based on information gathered from the pilot. The values used by Idaho Power to claim program savings were based on the model used to generate savings estimates for residential attic insulation improvements for the Regional Technical Forum (RTF). In 2011, the RTF developed a saving analysis specifically for Idaho Power's climate zones. This analysis include heating and cooling savings for Idaho specific weather zones and were approved by the RTF specifically for IPC. ADM determined that this most recent RTF savings spreadsheet from the RTF current measure list[3] specific for the state of Idaho was appropriate for assessing *ex post* verified savings. ADM reviewed the original simulations with Idaho Power and Ecotope Inc. in order to understand how the claimed savings were generated. Idaho Power used a value of .76 kWh/ft^2 of installed attic insulation to claim savings for each participant. This value was based on a simulation performed by Ecotope Inc which estimated an average savings of 1,670 kWh per home, and assumed an average 2,200 square feet per home. Upon review, ADM found that the original model was not completely

[3] ResSFWx v2 5 Idaho Power with CAC By Cooling Zone.xls

representative of the measures being implemented which led to an overestimation of savings. Specifically the models included energy savings for upgraded windows which were not included in the incentivized homes. Table 5-2 provides the Idaho specific RTF deemed values used to calculate individual site savings and program savings.

Table 5-2. Program-Level Deemed Values for the 2010 Home Improvement Program

					Energy Savings (kWh/yr/ft^2)		Peak (kW/ ft^2)
Measure Type	**Pre**	**Post**	**Climate**	**Heating System**	**Heating**	**Cooling**	**Cooling**
Ceiling	R-0	R-19	Heating Zone 1	Electric FAF Heating System	1.77	0.01	0.0010
Ceiling	R-0	R-38	Heating Zone 1	Electric FAF Heating System	2.43	0.02	0.0010
Ceiling	R-0	R-49	Heating Zone 1	Electric FAF Heating System	2.59	0.02	0.0020
Ceiling	R-30	R-38	Heating Zone 1	Electric FAF Heating System	0.18	0.00	0.0000
Ceiling	R-30	R-49	Heating Zone 1	Electric FAF Heating System	0.34	0.00	0.0000
Ceiling	R-19	R-30	Heating Zone 1	Electric FAF Heating System	0.48	0.00	0.0000
Ceiling	R-19	R-38	Heating Zone 1	Electric FAF Heating System	0.66	0.00	0.0000
Ceiling	R-19	R-49	Heating Zone 1	Electric FAF Heating System	0.81	0.01	0.0000
Ceiling	R-38	R-49	Heating Zone 1	Electric FAF Heating System	0.15	0.00	0.0000
Ceiling	R-0	R-19	Heating Zone 2	Electric FAF Heating System	2.39	0.02	0.0010
Ceiling	R-0	R-38	Heating Zone 2	Electric FAF Heating System	3.29	0.03	0.0020
Ceiling	R-0	R-49	Heating Zone 2	Electric FAF Heating System	3.50	0.03	0.0020
Ceiling	R-30	R-38	Heating Zone 2	Electric FAF Heating System	0.25	0.00	0.0000
Ceiling	R-30	R-49	Heating Zone 2	Electric FAF Heating System	0.46	0.00	0.0000
Ceiling	R-19	R-30	Heating Zone 2	Electric FAF Heating System	0.65	0.00	0.0000
Ceiling	R-19	R-38	Heating Zone 2	Electric FAF Heating System	0.90	0.01	0.0010
Ceiling	R-19	R-49	Heating Zone 2	Electric FAF Heating System	1.11	0.01	0.0010
Ceiling	R-38	R-49	Heating Zone 2	Electric FAF Heating System	0.21	0.00	0.0000
Ceiling	R-0	R-19	Heating Zone 3	Electric FAF Heating System	2.85	0.03	0.0020
Ceiling	R-0	R-38	Heating Zone 3	Electric FAF Heating System	3.92	0.04	0.0020
Ceiling	R-0	R-49	Heating Zone 3	Electric FAF Heating System	4.17	0.04	0.0020

Ceiling	R-30	R-38	Heating Zone 3	Electric FAF Heating System	0.30	0.00	0.0000
Ceiling	R-30	R-49	Heating Zone 3	Electric FAF Heating System	0.55	0.01	0.0000
Ceiling	R-19	R-30	Heating Zone 3	Electric FAF Heating System	0.77	0.01	0.0000
Ceiling	R-19	R-38	Heating Zone 3	Electric FAF Heating System	1.07	0.01	0.0010
Ceiling	R-19	R-49	Heating Zone 3	Electric FAF Heating System	1.32	0.01	0.0010
Ceiling	R-38	R-49	Heating Zone 3	Electric FAF Heating System	0.25	0.00	0.0000
Ceiling	R-0	R-19	Heating Zone 1	Heat Pump Heating System	0.90	0.07	0.0010
Ceiling	R-0	R-38	Heating Zone 1	Heat Pump Heating System	1.22	0.10	0.0010
Ceiling	R-0	R-49	Heating Zone 1	Heat Pump Heating System	1.30	0.10	0.0010
Ceiling	R-30	R-38	Heating Zone 1	Heat Pump Heating System	0.09	0.01	0.0000
Ceiling	R-30	R-49	Heating Zone 1	Heat Pump Heating System	0.16	0.01	0.0000
Ceiling	R-19	R-30	Heating Zone 1	Heat Pump Heating System	0.23	0.02	0.0000
Ceiling	R-19	R-38	Heating Zone 1	Heat Pump Heating System	0.32	0.02	0.0000
Ceiling	R-19	R-49	Heating Zone 1	Heat Pump Heating System	0.40	0.03	0.0000
Ceiling	R-38	R-49	Heating Zone 1	Heat Pump Heating System	0.07	0.01	0.0000
Ceiling	R-0	R-19	Heating Zone 2	Heat Pump Heating System	1.54	0.11	0.0010
Ceiling	R-0	R-38	Heating Zone 2	Heat Pump Heating System	2.08	0.14	0.0010
Ceiling	R-0	R-49	Heating Zone 2	Heat Pump Heating System	2.21	0.15	0.0010
Ceiling	R-30	R-38	Heating Zone 2	Heat Pump Heating System	0.15	0.01	0.0000
Ceiling	R-30	R-49	Heating Zone 2	Heat Pump Heating System	0.27	0.02	0.0000
Ceiling	R-19	R-30	Heating Zone 2	Heat Pump Heating System	0.39	0.03	0.0000
Ceiling	R-19	R-38	Heating Zone 2	Heat Pump Heating System	0.54	0.04	0.0000
Ceiling	R-19	R-49	Heating Zone 2	Heat Pump Heating System	0.67	0.05	0.0000
Ceiling	R-38	R-49	Heating Zone 2	Heat Pump Heating System	0.12	0.01	0.0000
Ceiling	R-0	R-19	Heating Zone 3	Heat Pump Heating System	2.07	0.16	0.0010
Ceiling	R-0	R-38	Heating Zone 3	Heat Pump Heating System	2.81	0.22	0.0020
Ceiling	R-0	R-49	Heating Zone 3	Heat Pump Heating System	2.98	0.23	0.0020
Ceiling	R-30	R-38	Heating Zone 3	Heat Pump Heating System	0.20	0.02	0.0000
Ceiling	R-30	R-49	Heating Zone 3	Heat Pump Heating System	0.37	0.03	0.0000
Ceiling	R-19	R-30	Heating Zone 3	Heat Pump Heating System	0.53	0.04	0.0000

Ceiling	R-19	R-38	Heating Zone 3	Heat Pump Heating System	0.74	0.06	0.0000
Ceiling	R-19	R-49	Heating Zone 3	Heat Pump Heating System	0.90	0.07	0.0010
Ceiling	R-38	R-49	Heating Zone 3	Heat Pump Heating System	0.17	0.01	0.0000
Ceiling	R-0	R-19	Heating Zone 1	Gas Furnace	0.08*	0.01	0.0010
Ceiling	R-0	R-38	Heating Zone 1	Gas Furnace	0.10*	0.02	0.0010
Ceiling	R-0	R-49	Heating Zone 1	Gas Furnace	0.11*	0.02	0.0010
Ceiling	R-30	R-38	Heating Zone 1	Gas Furnace	0.01*	0.00	0.0000
Ceiling	R-30	R-49	Heating Zone 1	Gas Furnace	0.01*	0.00	0.0000
Ceiling	R-19	R-30	Heating Zone 1	Gas Furnace	0.02*	0.00	0.0000
Ceiling	R-19	R-38	Heating Zone 1	Gas Furnace	0.03*	0.00	0.0000
Ceiling	R-19	R-49	Heating Zone 1	Gas Furnace	0.03*	0.01	0.0000
Ceiling	R-38	R-49	Heating Zone 1	Gas Furnace	0.01*	0.00	0.0000
Ceiling	R-0	R-19	Heating Zone 2	Gas Furnace	0.10*	0.02	0.0010
Ceiling	R-0	R-38	Heating Zone 2	Gas Furnace	0.14*	0.03	0.0010
Ceiling	R-0	R-49	Heating Zone 2	Gas Furnace	0.15*	0.03	0.0010
Ceiling	R-30	R-38	Heating Zone 2	Gas Furnace	0.01*	0.00	0.0000
Ceiling	R-30	R-49	Heating Zone 2	Gas Furnace	0.02*	0.00	0.0000
Ceiling	R-19	R-30	Heating Zone 2	Gas Furnace	0.03*	0.00	0.0000
Ceiling	R-19	R-38	Heating Zone 2	Gas Furnace	0.04*	0.01	0.0000
Ceiling	R-19	R-49	Heating Zone 2	Gas Furnace	0.05*	0.01	0.0000
Ceiling	R-38	R-49	Heating Zone 2	Gas Furnace	0.01*	0.00	0.0000
Ceiling	R-0	R-19	Heating Zone 3	Gas Furnace	0.12*	0.03	0.0010
Ceiling	R-0	R-38	Heating Zone 3	Gas Furnace	0.17*	0.04	0.0020
Ceiling	R-0	R-49	Heating Zone 3	Gas Furnace	0.18*	0.04	0.0020
Ceiling	R-30	R-38	Heating Zone 3	Gas Furnace	0.01*	0.00	0.0000
Ceiling	R-30	R-49	Heating Zone 3	Gas Furnace	0.02*	0.01	0.0000
Ceiling	R-19	R-30	Heating Zone 3	Gas Furnace	0.03*	0.01	0.0000
Ceiling	R-19	R-38	Heating Zone 3	Gas Furnace	0.05*	0.01	0.0000
Ceiling	R-19	R-49	Heating Zone 3	Gas Furnace	0.06*	0.01	0.0010
Ceiling	R-38	R-49	Heating Zone 3	Gas Furnace	0.01*	0.00	0.0000

Note: The reported heating savings values for Gas Furnaces are reported in Therms/yr/sqft.

The values in Table 5-2 were applied to each line item in the Home Improvement Program tracking database, calculating unique savings values for each program participant. This resulted in a gross realization rate of 28%, as the mix participants differed vastly from program expectations, in both baseline R-Value and heating system type. Thirty percent of the 2010 participants had pre-existing insulation of R-30 or greater. This is a level of insulation that in many territories constitutes an "energy efficient" level.Of these, 82% had natural-gas furnace space heating. With this baseline, little to no savings are realized, particularly when the home is gas-heated. In 2010, Idaho Power used a value of .76 kWh/ft^2 of installed attic insulation to claim savings for each participant. As a point of comparison, in 2010, ADM found average savings of

- .82/ft^2 for homes with electric heating;
- .37/ft^2 for homes with heat pumps;
- .0035/ft^2 for homes with non-electric heating; and
- .21/ft^2 for the participant population overall.

Seventy percent (70%) of the population had non-electric space heating (heated by a source other than electric resistance or a heat pump). This subset of the population had an average installed insulation covering 1,499 ft^2 and an average baseline R-Value of 27.4. With the savings per square foot of .0035, these homes saved an average of:

- 1,498.54 ft^2*.0035/ft^2 = 5.24 kWh annually

Essentially, 70% of the participant population provided IPC with near zero kWh savings. There were 2,509 participants that fell into this category. The realization rate for this subset is:

- Verified Savings = 5.24 kWh/home*2,509 Homes = 13,147 kWh
- Expected Savings = 1,498.54 ft^2/Home*.76 kWh/ft^2 * 2,509 Homes = 2,857,476
- Realization Rate for Non-Electric Heated Homes = 13,147 / 2,857,476 = 0.46%

Thus, the vast majority of *ex ante* estimates that were not achieved are attributable to non-electric heated participants; realization is significantly higher when limiting the analysis to homes with heat pumps or electric resistance heating. Realization for this subset is:

- Verified Savings of Heat Pump & Electric Resistance Homes = 968,942 kWh
- Expected Savings of Heat Pump & Electric Resistance Homes = 1,135,872 kWh
- Realization Rate for Heat Pump & Electric Resistance Homes = 968,942 / 1,135,872 = 85%

Due to these combined factors, overall program realization was 28%.

5.3 ESTIMATES OF EX POST VERIFIED KW REDUCTIONS

Estimates of *ex post* verified demand reductions (kW) savings for the program were determined in a similar fashion to estimates of *ex post* verified kWh savings. For each individual attic insulated home, the resulting distribution system peak load reduction estimates were determined by applying RTF estimates for each weather zone and primary and cooling heating source.

5.4 NON-ENERGY IMPACTS AND EFFECTS

With respect to the participants comfort level in their home due to the new attic insulation installed compared to the old level of insulation, 76% respondents indicated that they had felt their comfort level improve, with 40% indicated that their home was "much more comfortable", 36% stating it was "somewhat more comfortable". Figure 5-1 presents the breakdown of responses regarding participant comfort level.

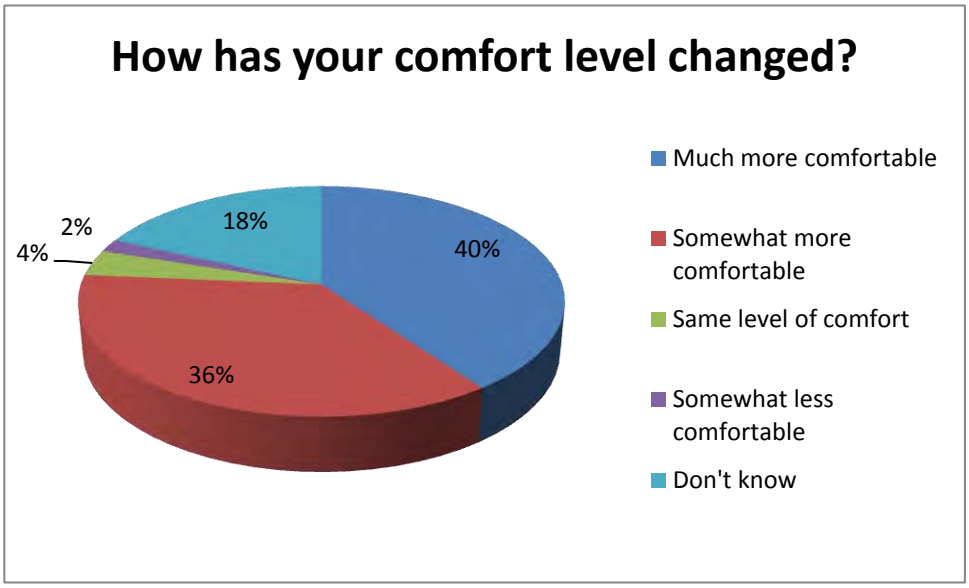


Figure 5-1. Comfort level of New Insulation Compared to Previous Levels

Furthermore, 15% of respondents indicated that the attic insulation resulted in reduced noise from the outside.

In addition to these non-energy benefits, 41% of respondents indicated that they had noticed a reduction in their energy bills since installing the insulation. Finally, customers were largely satisfied with the service providers and the program overall. More details about participant satisfaction can be found in Appendix C.

The other non-energy effect in this evaluation was the reduction in carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved with projects undertaken through the program. The carbon reduction estimates are reported in Table 5-3[4].

Table 5-3. Program-Level Carbon Reductions for the 2010 Home Improvement Program

Program Component	***Program-Level Ex Post Verified kWh Savings***	***Program Realized CO2 Emissions Reduction (Tons)***
Residential Attic Insulation	1,099,456	703

[4] CO2 emissions reductions were calculated using a factor of 6.398×10^{-4}.
Ref: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010V1_1_year07_GHGOutputrates.pdf

6. SUMMARY AND DISCUSSION OF FINDINGS

The following subsections contain detailed results of our findings:

6.1 SUMMARY OF FINDINGS

There were a total of 3,537 participants in the Home Improvement Program in 2010. The *ex post* verified values of energy savings (kWh), peak demand reductions (kW), and gas savings (Therms) from these projects that were developed during this impact evaluation are reported in Table 6-1.

Table 6-1 Ex Post Savings for the 2010 Home Improvement Program As Verified from Impact Evaluation

Program Component	***Ex Post Verified Savings***		
	kWh Savings	***kW Reductions***	***Therms Savings***
Residential Attic Insulation	1,099,456	118.48	79,154

The results in Table 6-1 show program-level *ex post* verified kWh savings of 3,986,199 kWh. Compared to *ex ante* expected program savings, this represents a realization rate for kWh savings of 28% for all projects. Table 6-2 compares the *ex post* verified kWh savings to the *ex ante* expected kWh.

Table 6-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for the 2010 Home Improvement Program

Program Component	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
Residential Attic Insulation	3,986,199	1,099,456	28%

ADM's M&V effort found savings were lower than expected due to:

- Idaho Power used a value of .76 kWh/ft^2 of installed attic insulation to claim savings for each participant. This value was based on a simulation performed by Ecotope Inc which estimated an average savings of 1670 kWh per home, and assumed an average 2,200

square feet per home. ADM reviewed the original simulations with Ecotope Inc. and Idaho Power in order to understand how the claimed savings were generated. Upon review, ADM found that the original model was not completely representative of the measures being implemented which led to an overestimation of savings. Specifically the models included energy savings for upgraded windows which were not included in the incentivized homes.

- 30% of 2010 program participants had pre-existing insulation of R-30 or greater; this level of insulation is an exceedingly high baseline, and in many service territories actually constitutes an "energy-efficient" level.
- 70% of 2010 program participants had non-electric space-heating (natural gas, propane, or stove insert). This significantly reduces the kWh/ft.2 savings. Further, of the subset of the population with R-30 or greater baseline insulation, 82% had non-electric space heating. The confluence of R-30 baseline and non-electric space heating resulted in 25% of the population (82% of 30% = 25%), displaying negligible kWh savings.

6.2 RESULTS OF TRACKING DATA REVIEW

In reviewing the Home Improvement Program tracking data, ADM found 11 participants who did not have their primary heating source and cooling equipment listed. Also, out of the 24 participants who had an on-site visit performed, ADM found three errors when it came to the participant homes' primary heat source. Out of those three errors, one participant was not eligible for the program due to an incorrect primary heat source found when visited. ADM's site visit found the home to have a gas stove with no central A/C instead of the gas furnace listed in the tracking data.

Overall it should be noted that Idaho Power keeps a very good record of participant information about primary heating and cooling source, pre and post R-values, and square footage of homes.

6.3 ON-SITE AND TELEPHONE VERIFICATION SURVEY RESULTS

Table 6-3 summarizes the results from the on-site data collection and verification surveys of 71 program participants.

Table 6-3 Participant Interview Results

Questions	Results	Comments
Verify Purchase/Installation and equipment	100%	All participants verified purchase and installation of the attic insulation.
Verify Receipt of Rebate/Incentive from Idaho Power	76%	Most respondents recalled receiving a rebate for installing additional insulation.
Verify Timing of Attic	54%	Very few respondents recalled the month in 2010 when

Insulation Installed		the insulation was installed. Most respondents indicated installing it in September or October.
Verify Amount of Rebate/Incentive	27%	Very few respondents recalled the incentive amount. Responses varied between $83 and $700.

6.4 RECOMMENDATIONS

Overall, the 2010 Home Improvement Program received a low realization rate. However, ADM recommends the following to increase homogeneity in how savings are claimed, reduce uncertainty in the claimed savings, and prevent potentially low realization rates in the future:

1) *Impose limits on pre-existing R-Values of Insulation.*

   Presently, there is no restriction on the maximum allowable pre-existing R-Value of insulation for the Home Improvement Program. The baseline assumption of .76 kWh/ft^2 assumes a certain average level of pre-existing R-Value as well as a weighted mix of heating and cooling types, and these assumptions were found not to hold when examining the characteristics of the 2010 participants. Thirty percent of the 2010 participants had pre-existing insulation of R-30 or greater. Of these, 82% had natural-gas furnace space heating. With this baseline, little to no savings are realized, particularly when the home is gas-heated.

   ADM recommends a two-tiered guideline for maximum allowable pre-existing R-Value, surmised as:

   - For homes with natural gas heating, pre-existing insulation of R-11 or less;
   - For homes with Heat Pumps or Electric Heating, R-19 or less.

2) *Apply appropriate RTF savings parameters to each participating residence.*

   In evaluating savings from the 2010 Home Improvement Program, ADM developed an automated spreadsheet that applies the appropriate savings per square foot for varied weather zones, heating types, cooling types, and pre-existing and installed R-values. This could be expanded upon to provide IPC with an automated tool for calculating expected savings for incoming applications using data that are already collected during the implementation process. In 2010, the expected savings were calculated at .76 kWh/ft^2. As a point of comparison, in 2010, ADM found average savings of

   - .82/ft^2 for homes with electric heating;
   - .37/ft^2 for homes with heat pumps;
   - .0035/ft^2 for homes with non-electric heating; and
   - .21/ft2 for the participant population overall.

   The savings per square foot that IPC can realize from a program such as this can be volatile and subject to many participant-specific idiosyncrasies; inputs such as an

assumed mix of heating sources can remain constant year-to-year or could prove to be different in future years, and as such Idaho Power should be cautious in applying an overarching fixed value to all participants which could lead to inaccurate saving estimates.

3) *Allow participants to sign the rebate rights to their installing contractor.*

   In many similarly-run programs, customers have the option of having the rebate check signed over to the installing contractor. The contractor discounts the installation cost of the insulation, allowing the customer to see the rebate instantly. This procedure is often successful in engaging local firms, as it allows them to more effectively market and sell insulation improvements. ADM suspects that with this process in place, IPC could see increased participation.

4) *Consider conducting real-time impact evaluations in future program years.*

   Real-time evaluation could have forestalled many of the issues that caused low realization for the Home Improvement Program. ADM has conducted real-time evaluation of similarly designed programs for other utilities, and has in those instances caught and corrected issues with program design before they grow to a significant level. For example, when evaluating the Residential Insulation Program for New Mexico Gas Company, real-time evaluation allowed ADM to catch that there were applications being processed for customers that did not have gas heating, and therefore providing New Mexico Gas with no Therms savings. In a similar manner, real-time evaluation will identify areas in which Idaho Power can make mid-year adjustments due to discrepancies between ex-ante estimates and verified savings. For example, last year 30% of program participants had pre-existing R-30 attic insulation, however, the *ex ante* savings estimates were based on no pre-existing attic insulation (R-0). During the course of a real-time evaluation this difference in baseline values would have been identified early-on, providing Idaho Power with the opportunity to adjust the ex-ante savings estimates to account for these differences.

   Further, while customers contacted for the participant survey recalled purchasing the attic insulation and applying for a rebate through IPC, many of the customers could not remember the amount of the rebate and questioned why they were being asked about their participation in the program after so much time had elapsed. Real-time impact evaluation allows for interaction with participants while the program is still fresh in their mind.

APPENDIX A. PARTICIPANT SURVEY INSTRUMENT

Idaho Power

Home Improvement Program

Participant Telephone Survey

***NAME:*_____ *PROJECT NUMBER:* _____**
***ADDRESS:* _____ *CITY/ZIP:* _____**
***DATE:*_____**

Hello, Is **[CUSTOMER NAME]** available?
If yes, wait for proper person and continue interview.
If no, continue interview only if respondent is familiar with participating in the program.

My name is _____ and I am with ADM Associates, an independent research firm, and we are conducting an evaluation of Idaho Power's Home Improvement Program. Our records indicate that you have participated in that program by having attic insulation installed at your home in 2010**.** I'd like to ask you a few questions about your experience. This should only take about 5 minutes and your answers will be kept confidential. Would this be a good time? (If no, ask if there is a better time to call back).

1. Did you have attic insulation installed in your home sometime in 2010?
    a. Yes
    b. No (thank and terminate)
    c. Don't know (thank and terminate)

2. Do you recall receiving a rebate/incentive from Idaho Power for the installation of additional attic insulation?
    a. Yes
    b. No (skip Q3)
    c. Don't know (skip Q3)

3. Do you recall how much the rebate/incentive was for?
    a. Yes, It was $_____
    b. No
    c. Don't Know

4. What was the approximate date you had the attic insulation installed?
    a. List Date: _____
    b. Don't know

5. Have you noticed increased comfort in your home since having the insulation installed?
    a. Yes
    b. No (skip Q6)
    c. It's worse now
    d. Don't Know (skip Q6)

6. Using the following scale, how has the comfort level changed since having the insulation installed?
    a. Much more comfortable
    b. Somewhat more comfortable
    c. Same level of comfort
    d. Somewhat less comfortable
    e. Much less comfortable
    f. Don't Know

7. Have you noticed a reduction in your electricity bills since having the insulation installed?
    a. Yes
    b. No
    c. Don't Know

8. Have you noticed a change in outside noise level since having the insulation installed?
    a. Yes
    b. No
    c. Don't know

9. Using the following scale, how satisfied were you with the contractor who installed the additional insulation?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know
    f. I installed the insulation myself

10. Using the following scale, how satisfied were you with the rebate/incentive you received from Idaho Power?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied

e. Don’t Know

11. Using the following scale, how satisfied were you with the program as a whole?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don’t Know

12. Are there any other benefits or problems you have experienced as a result of having the insulation installed?
    a. Record answer:

    _____

    _____

    _____

APPENDIX B. ON-SITE VERIFICATION SURVEY

Site Verification Form – Attic Insulation
Idaho Power
2010 Home Improvement Program

Inspection Date		ADM Sample #	
Inspection Start Time		Program IOU	Home Improvement
Inspection End Time		Account / Site Number	
Inspector Name / Initials			
Primary Contact Name		Original Site Visit Date	
Phone 1		Original Site Visit Time	
Phone 2			
Phone 3		New Confirmed Date	
email		New Confirmed Time	
Alternate Contact Name			
Phone 1		Incentive Paid	
Phone 2		Initials or Signature	
Phone 3		**Notes**	
email			
Address 1			
Address 2			
City			
State			
Zip Code			

Home and HVAC	Onsite	Notes
Estimated Home Size (Sq. Ft. Cond. Space)		
Number of Occupants		
Type of Basement	Full finished basement/Unfinished Basement/ Crawlspace/ Slab on Grade/ OTHER	
Year home was built		
Cooling System Type		
Primary Heating Fuel Type	Electric / Gas / Propane/ Oil/ Coal/ WoodOther	
Primary Heating System Type	Furnace/ Boiler/ Air Source Heat Pump/Ground Source Heat Pump/ Stove/Baseboard	
Secondary Heating System Type	Furnace/ Boiler/ Air Source Heat Pump/Ground Source Heat Pump/ Stove/Baseboard	
Secondary Heating Fuel Type	Electric / Gas / Propane/ Oil/ Coal/ WoodOther	

Attic Insulation	Database	Onsite	Notes
Unit Quantity (Sq feet)			
Sq feet installed over conditoned living area			Required
Method of determination		Cust SR / Insp Estimate / Other	Required
Location(s) rebated			
New Insulation material		Fiberglass batts/ Blown in Fiberglass/ Blown in Cellulose/Rockwool/Spray Foam/Foam boards/ Other	Required
Method of determination		Cust SR / Insp / Invoice / Printed on Insul / Other	Required

R-Value Information on Existing Attic Insulation

Total Thickness of Insulation			Required Note: Full depth between Studs
Minimum Total Thickness			Required
Maximum Total Thlckness			Required
If different layers of material, describe individual layer material and thicknesses of individual layers.			Required
Method of determination		Cust SR / Measurement / Invoice / Printed / Other	Required
Total R-value present			Required
Method of determination		Cust SR / Calculation / Invoice / Printed / Other	Required

Old Attic Insulation

Was old attic insulation still present?		Yes / No	Required
Old attic insulation material		Fiberglass batts/ Blown in Fiberglass/ Blown in Cellulose/Rockwool/Spray Foam/Foam boards/ Other	
Square footage of old attic insulation material			
Thickness of Old Attic Insulation			
Method of determination		Cust SR / Measurement / Invoice / Printed / Other	
Pre-Existing R-Value			
Method of determination		Cust SR / Calculation / Invoice / Printed / Other	
Access Panel Insulated	Not Relevant if Attic Doorway…	Yes / No / NA	Required, Note N/As

Floor Plan Sketch. Note Measurements

Home Improvement Program Onsite Survey

1. Do you recall receiving a rebate/incentive from Idaho Power for the installation of additional attic insulation?
    a. Yes
    b. No (skip Q2)
    c. Don't know (skip Q2)

2. Do you recall how much the rebate/incentive was for?
    a. Yes, It was $_____
    b. No
    c. Don't Know
3. What was the approximate date you had the attic insulation installed?
    a. List Date: _____
    b. Don't know
4. (If yes to Question 4) Have you noticed increased comfort in your home since having the insulation installed?
    a. Yes
    b. No (skip Q5)
    c. It's worse now
    d. Don't Know (skip Q5)
5. Using the following scale, how has the comfort level changed since having the insulation installed?
    a. Much more comfortable
    b. Somewhat more comfortable
    c. Same level of comfort
    d. Somewhat less comfortable
    e. Much less comfortable
    f. Don't Know
6. Have you noticed a reduction in your electricity bills since having the insulation installed?
    a. Yes
    b. No
    c. Don't Know
7. Have you noticed a change in outside noise level since having the insulation installed?
    a. Yes
    b. No
    c. Don't know
8. Using the following scale, how satisfied were you with the contractor who installed the additional insulation?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know
    f. I installed the insulation myself
9. Using the following scale, how satisfied were you with the rebate/incentive you received from Idaho Power?

a. Very Satisfied
b. Somewhat Satisfied
c. Somewhat Unsatisfied
d. Very Unsatisfied
e. Don't Know

10. Using the following scale, how satisfied were you with the program as a whole?
    a. Very Satisfied
    b. Somewhat Satisfied
    c. Somewhat Unsatisfied
    d. Very Unsatisfied
    e. Don't Know
11. Are there any other benefits or problems you have experienced as a result of having the insulation installed?
    a. Record answer:

    _____
    _____
    _____

APPENDIX C. PARTICIPANT SATISFACTION

The participant survey included three questions regarding satisfaction with various aspects of the program. Overall, customers were highly satisfied with the program. A majority of respondents were either somewhat satisfied or very satisfied with the service provider who installed the attic insulation in their home. Only one participant was somewhat unsatisfied with the service provider but would not indicate why. Figure C-1 below shows the response breakdown for satisfaction with the service provider.

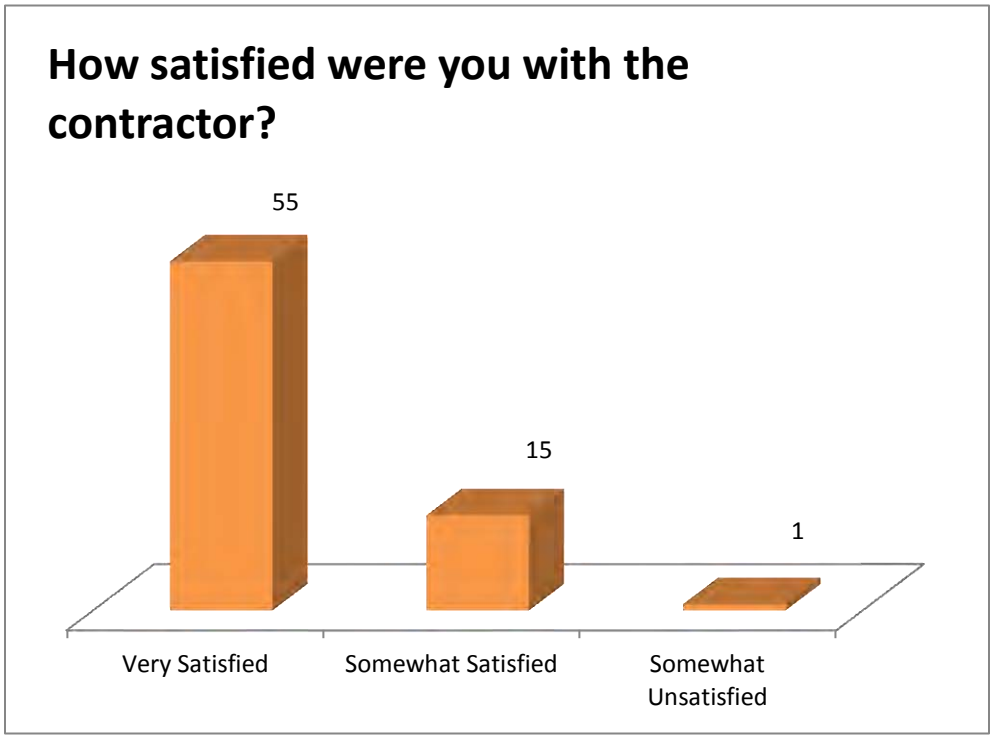


Figure C-1 Satisfaction with Contractor

Customers were also highly satisfied with the incentive level. A majority of respondents indicated that they were either somewhat satisfied or very satisfied with their rebates. 7% of respondents answered that they did not know if they were satisfied with the incentive amount due to the amount of time that had passed since receiving the rebate from IPC. It is worth noting that only 27% of respondents could correctly identify the amount of the rebate. Figure C-2shows the response breakdown for satisfaction with incentive amount.

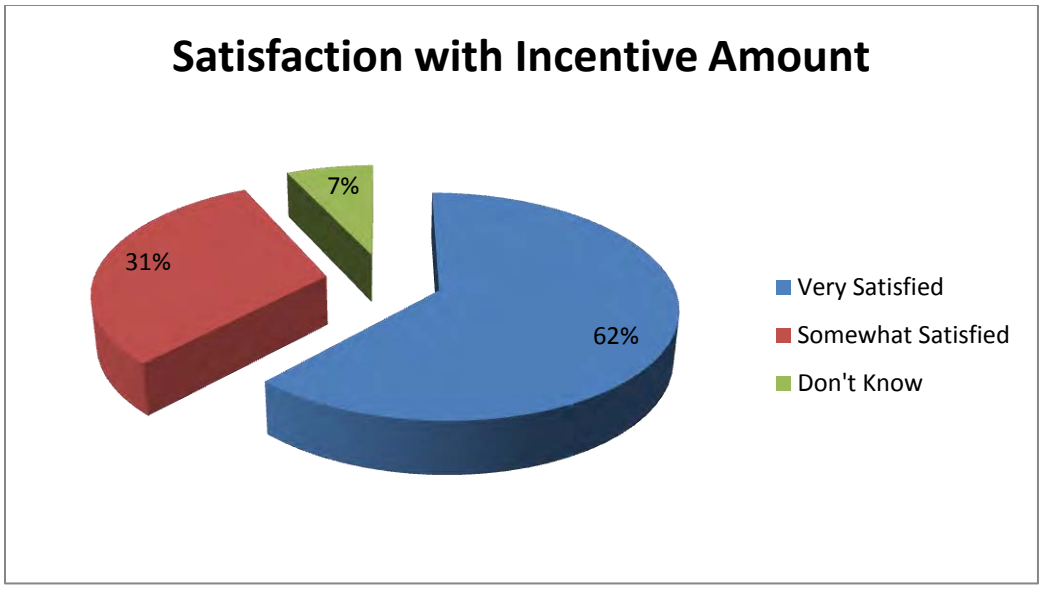


Figure C-2 Satisfaction with Incentive Amount

Finally, customers were also highly satisfied with the program overall. Figure C-3 shows the response breakdown for overall program satisfaction.

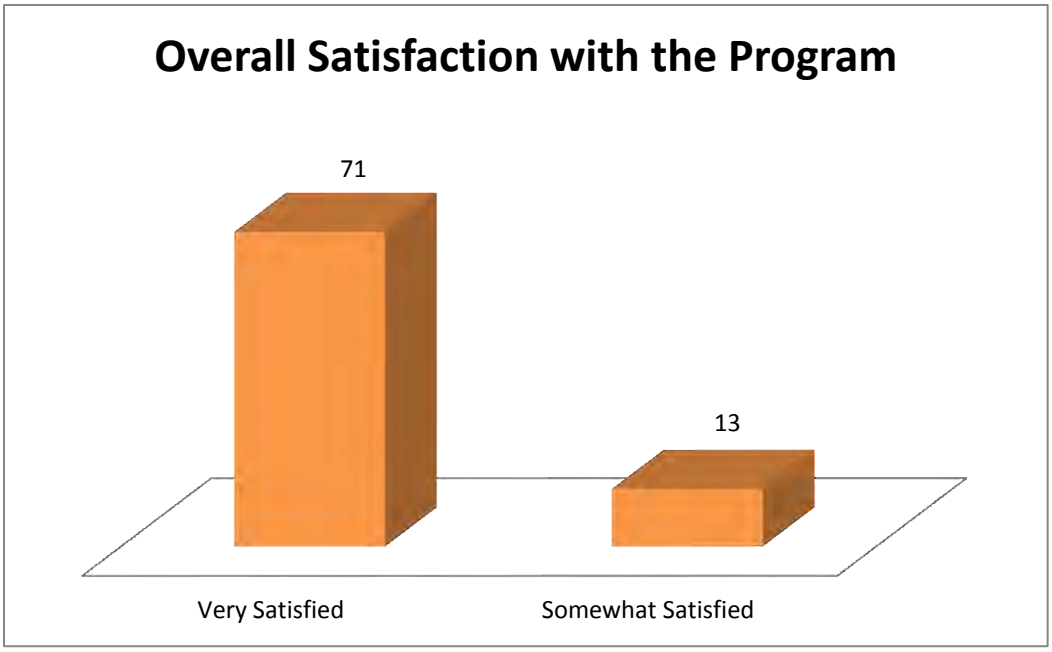


Figure C-3 Satisfaction with Program Overall

IMPACT EVALUATION OF 2010 CUSTOM EFFICIENCY PROGRAM

Final Report, Final Version
November 29, 2011

Prepared for:

IDAHO POWER®
An IDACORP Company

Prepared by:

ADM Associates, Inc.™

3239 Ramos Circle
Sacramento, CA 95827
916-363-8383

TABLE OF CONTENTS

Chapter	*Title*	*Page*
1.	Executive Summary	1-1
2.	Introduction and Purpose of Study	2-1
3.	Description of Program	3-1
4.	Methods	4-1
5.	Evaluation Findings	5-1
6.	Summary and Discussion of Findings	6-1

LIST OF FIGURES

No.	*Title*	*Page*
5-1.	Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for Lighitng Projects in Analysis Sample	5-1
5-2.	Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for Non-Lighitng Projects in Analysis Sample	5-2

LIST OF TABLES

No.	Title	Page
1-1.	Ex Post Verified Savings from Impact Evaluation of 2010 Custom Efficiency Program	1-1
1-2.	Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for 2010 Custom Efficiency Program	1-1
3-1.	Number of Projects and Expected kWh Saved for 2010 Custom Efficiency Program, by Type of Measure	3-2
4-1.	Population Statistics Used for Developing Sampling Plan	4-2
4-2.	Allocation of Desk Review Sample by Type of Project and kWh Savings Strata	4-2
4-3.	Allocation of On-Site Data Collection Sample by Type of Project and kWh Savings Strata	4-3
5-1.	Realization Rates for Gross kWh Savings by Type of Project and Sampling Strata for Projects in Analysis Sample	5-2
5-2.	Program-Level Ex Ante (Expected) and Ex Post (Verified) kWh Savings by Type of Project and Sample Stratum	5-3
5-3.	Peak kW Reductions per kWh Saved, by Sampling Strata for Analysis Sample	5-4
5-4.	Program-Level Ex Post (Verified) Gross kW Reductions by Type of Project and Sample Stratum	5-5
5-5.	MBtu Savings per kWh Savings by Sampling Strata for Projects in Analysis Sample	5-6
5-6.	Program-Level Ex Ante (Expected) and Ex Post (Verified) MBtu Savings by Type of Project and Sample Stratum	5-7
5-7.	Improvements in Quality of Work Environment for Commercial Facilities	5-8
5-8.	Improvements in Quality of Work Environment for Industrial Facilities	5-8
5-9.	Improvements in Quality of Products for Industrial Facilities	5-9

LIST OF TABLES

No.	*Title*	*Page*
5-10.	Improvements in Quality of Work Environment for Government/Non-Profit/Schools	5-9
5-11.	Program-Level Carbon Reductions for 2010 Custom Efficiency Program	5-10
6-1.	Ex Post Savings for 2010 Custom Efficiency Program As Verified from Impact Evaluation	6-1
6-2.	Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for 2010 Custom Efficiency Program	6-1

1. EXECUTIVE SUMMARY

This report provides the results from an impact evaluation of the Custom Efficiency Program that Idaho Power Company (IPC) offers to its commercial and industrial customers in Idaho and eastern Oregon. The impact evaluation was conducted on Custom Efficiency projects implemented in 2010.

There were a total of 223 participants in the Custom Efficiency Program in 2010, accounting for 230 energy efficiency projects. Estimates of the gross energy savings (kWh), peak demand reductions (kW), and gas savings (MBtu) from these projects are reported in Table 1-1.

Table 1-1. Ex Post Verified Savings from Impact Evaluation of 2010 Custom Efficiency Program

Type of Project	***Ex Post Verified Savings***		
	kWh Savings	***kW Reductions***	***MBtu Savings***
All Projects	67,207,515	12,863	-237,853
Lighting	34,029,269	7,187	-429,745
Non-Lighting	33,178,246	5,676	191,892

The results in Table 1-1 show program-level *ex post* verified kWh savings of 67,207,515 kWh. Compared to *ex ante* expected program savings, this represents a realization rate for kWh savings of 94.0% for all projects. However, as shown in Table 1-2, realization rates differ between lighting projects and non-lighting projects. For lighting projects the realization rate is 102.4%. For non-lighting projects, the realization rate is 86.6%.

Table 1-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for 2010 Custom Efficiency Program

Stratum	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
All Project	71,524,949	67,207,515	94.0%
Lighting	33,234,770	34,029,269	102.4%
Non-Lighting	38,290,179	33,178,246	86.6%

2. INTRODUCTION AND PURPOSE OF STUDY

Under contract with Idaho Power, ADM Associates, Inc. (ADM) has performed an impact evaluation of the Custom Efficiency Program that Idaho Power offers its large commercial and industrial customers in Idaho and Eastern Oregon. The impact evaluation was conducted on Custom Efficiency projects implemented in 2010. Customers who undertake complex energy efficiency projects that improve the efficiency of their overall energy system or processes are provided financial incentives through the program.

The objectives for the evaluation were as follows.

- Measure and verify the energy impacts attributable to projects in the 2010 Custom Efficiency Program;
- Provide credible and reliable program energy and non-energy impact estimates attributed to the Custom Efficiency Program for the 2010 program year; and
- Report findings and observations, and provide recommendations that enhance the effectiveness of future engineering analysis and the accurate and transparent reporting of program savings.

This report describes the effort undertaken to accomplish these objectives and presents the results of the evaluation effort. It is organized as follows.

- Chapter 3 provides a description of the Custom Efficiency Program.
- Chapter 4 presents and discusses the methods used to verify kWh savings and kW reductions for projects implemented through the program.
- Chapter 5 presents the estimates of verified kWh savings and kW reductions.
- Chapter 6 summarizes the results of the evaluation effort.
- Appendix A provides the M&V results for the projects in the analysis sample.

3. DESCRIPTION OF PROGRAM

Through its Custom Efficiency Program, Idaho Power offers commercial and industrial customers in Idaho and eastern Oregon training and education on energy efficiency, energy auditing services for project identification and evaluation, and financial incentives for project implementation.

Technical training and education are offered through the program to help customers identify where they may have energy efficiency opportunities within their facilities. During 2010, technical training classes were offered on various topics that included compressed air, chilled water systems, pumping systems, variable frequency drives, and refrigeration.

Potential energy efficiency projects can be identified by a third-party consultant, by Idaho Power, or by the customer, as applicable to the facility. As part of the program, Idaho Power has a number of contractors available to conduct scoping audits at customers' facilities. Engineering firms are selected for this auditing work based on the expertise in all major equipment areas and on ability to provide resources for customers throughout Idaho Power's service area. Idaho Power engineers work with customers and vendors to gather sufficient information to support the energy-savings calculations. Project implementation begins after Idaho Power reviews and approves an application, followed by the finalization of the terms and conditions of the applicant's and Idaho Power's obligations. Idaho Power conducts follow-up or post-inspection validation via third-party engineering firms or internal Idaho Power engineers

Financial incentives are provided for accepted energy efficiency projects. Incentive levels for projects implemented through the Custom Efficiency Program in 2010 were twelve cents per kWh of first year savings or seventy percent of project cost, whichever was less.

Data provided by IPC showed that there was a total of 230 projects undertaken through the Custom Efficiency Program in 2010, with total expected kWh savings of approximately 71,525 MWh. Table 3-1 shows the number of projects and kWh saved by type of measure (i.e., lighting versus non-lighting). Lighting projects accounted for 46 percent of total expected kWh savings and non-lighting projects for 54 percent.

Table 3-1. Number of Projects and Expected kWh Saved for 2010 Custom Efficiency Program, by Type of Measure

Type of Measure in Project	***Number of Projects***	***Total Expected kWh Saved***
All Lighting Projects	166	33,234,770
All Non-lighting Projects	64	38,290,179
Fans	28	13,614,289
Refrigeration	14	10,387,189
Compressed Air	5	6,738,503
Pumps	3	2,567,460
HVAC	4	1,962,343
Controls	2	1,162,754
Commissioning	1	1,134,000
Motors	6	456,201
Battery charger	1	267,440
Totals	230	71,524,949

4. METHODS

Evaluation of the impacts of the 2010 Custom Efficiency Program involved the following activities:

- Selecting 75 projects for desk review of savings calculations
- Selecting a sample of sites for on-site visits
- Reviewing program data and work paper documentation (desk review and on-site samples)
- Performing on-site visits to verify installation of claimed measures and to collect data to facilitate analysis
- Determining verified savings using data collected and appropriate engineering methods (This included developing whole-building thermal building simulation models, if required.)
- Extrapolating site-level savings to program-level savings

The methods used for these evaluation activities are described in this chapter.

4.1 SAMPLING PLAN

Estimation of the gross savings achieved through projects undertaken under the Custom Efficiency Program were developed using data for a statistically valid sample of projects that had been enrolled in the program by the end of 2010. The focus of the sampling was on selecting a sample of projects (1) that accounts for a significant portion of estimated savings and (2) that includes projects for which savings estimates seem most uncertain. The sample was selected so that results are representative of the population to a high degree of confidence (i.e., ±10% precision at the 90% confidence level).

4.1.1 Preparation of Sample Frame

A sample frame with which to examine alternative sample designs was constructed using the information on projects provided by Idaho Power. These data allowed construction of a sample frame. The design variable used in developing a sampling plan was *ex ante* expected gross annual kWh savings. Sample strata were defined by applying a stratification procedure to the data on *ex ante* kWh savings (based on the data provided by IPC). The population statistics, used to develop the sampling plan, are shown in Table 4-1.

Table 4-1. Population Statistics Used for Developing Sampling Plan

Stratum	Stratum Boundaries (kWh)	Number of Projects	Ex Ante Expected kWh Savings			
			Total	Average	Standard Deviation	Coefficient of Variation
1	Minimum – 14,140	5	43,980	8,796	2,007	22.8%
2	14,140 – 37,040	22	637,691	28,986	5,330	18.4%
3	37,040 – 97,030	43	3,044,097	70,793	17,640	24.9%
4	97,030 – 254,205	94	15,978,799	169,987	46,914	27.6%
5	254,205 – 655,980	42	17,428,197	414,957	120,583	29.1%
6	655,980 – 1,744,775	13	11,177,991	859,845	97,377	11.3%
7	1,744,775 – Maximum	11	23,214,194	2,110,381	1,138,915	54.0%
All		230	71,524,949	310,978	513,748	165.2%

The sample frame was used to select a sample of 75 projects for desk review of calculations. For the sampling of projects, consideration was given to the nature of the measure(s) implemented in each incentivized project. In particular, lighting projects were stratified separately from non-lighting projects. The allocation of the desk review sample by type of project and kWh savings stratum is shown in Table 4-2.

Table 4-2. Allocation of Desk Review Sample by Type of Project and kWh Savings Strata

Sample Stratum	Lighting Projects	Non-Lighting Projects	Sum across End Uses
1	1		1
2	2	3	5
3	4	5	9
4	14	6	21
5	9	9	18
6	4	6	10
7	1	10	11
Total	35	40	75

A total of 35 lighting projects were selected for the desk review sample, with these sample points allocated across strata as shown in Table 4-2. For lighting projects, there was only one project in Stratum 7, accounting for 3.6% of total program-level savings for lighting projects. The lighting project in Stratum 7 was selected for the sample with certainty, but samples of lighting projects from other stratum were selected randomly.

A total of 40 non-lighting projects were selected for the sample. For non-lighting projects, there were 10 projects in Stratum 7, and these projects accounted for 58 percent of the total program-

level kWh savings for non-lighting projects. Stratum 7 projects account for fairly high percentages of the savings for the different types of projects.

- For refrigeration projects, 4 projects in Stratum 7 account for 68 percent of total refrigeration kWh savings;
- For compressed air projects, 2 projects in Stratum 7 account for 65 percent of total compressed air kWh savings;
- For fan, pump and motor projects, 4 projects in Stratum 7 account for 56 percent of total fan, pump, and motor kWh savings;
- For HVAC, controls and commissioning projects, 1 project in Stratum 7 accounts for 27 percent of total HVAC, controls, and commissioning kWh savings;

From the 75 projects chosen for the desk review sample, 35 were chosen for on-site data collection and verification visits. The allocation of the desk review sample by type of project and kWh savings stratum is shown in Table 4-3.

Table 4-3. Allocation of On-Site Data Collection Sample by Type of Project and kWh Savings Strata

Sample Stratum	***Lighting Projects***	***Non-Lighting Projects***	***Sum across End Uses***
1	-	-	-
2	1	1	2
3	1	1	2
4	6	1	7
5	6	3	9
6	2	3	5
7	1	9	10
Total	17	18	35

4.2 REVIEW OF DOCUMENTATION

For the desk review sample of 75 projects, documentation pertaining to those projects was obtained from Idaho Power. For each project, the available documentation (e.g., audit reports, savings calculation work papers, etc.) for each incentivized measure was reviewed, with particular attention given to the calculation procedures and documentation for savings estimates. Documentation was reviewed to determine whether the following types of information had been provided:

- Documentation for the equipment changed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information
- Documentation for the new equipment installed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information

- Information about the savings calculation methodology, including (1) what methodology was used, (2) specifications of assumptions and sources for these specifications, and (3) correctness of calculations

If project documentation was incomplete or there was uncertainty regarding a project, ADM staff worked with Idaho Power staff or with the customer to seek further information to ensure that the analysis of project savings was based on proper information.

4.3 ON-SITE DATA COLLECTION

On-site visits were used to collect data on which to base the analysis of savings impacts for 35 projects in the analysis sample. These visits were used to collect primary data on the measures implemented through the projects.

During an on-site visit, the field staff accomplished three major tasks.

- First, they verified the implementation status of all measures for which customers received incentives. They verified that the energy efficiency measures were indeed installed, that they were installed correctly and that they still functioned properly.
- Second, they collected the physical data needed to analyze the energy savings that had been realized from the installed improvements and measures. Data were collected using a form that was prepared specifically for the project in question after an in-house review of the project file.
- Third, they interviewed the contact personnel at a facility to obtain additional information on the installed system to complement the data collected from other sources.

Estimates of energy use and savings for energy efficiency measures depend significantly on having accurate data for such factors as operating hours and usage patterns. At some sites, monitoring was conducted to gather such information (e.g., on the operating hours of the installed measures). Monitoring was conducted at sites where it was judged that the monitored data would be useful for further refinement and higher accuracy of savings calculations.

Monitoring was not considered necessary for some sites. This included facilities where project documentation allowed for sufficiently detailed calculations or where this type of information was available from an energy management control system. For other facilities, information could be obtained through relatively simple monitoring using loggers.

4.4 METHODS TO ESTIMATE VERIFIED SAVINGS FOR INSTALLED MEASURES

The data collected from the documentation review and on-site data collection were analyzed to develop estimates of energy impacts at the project and program levels. Assumptions and engineering models used by IPC engineers were compared with data collected from site visits, customer interviews, and “best practice” engineering methods. Project realization rates were calculated to assist in determining program-level *ex post* gross energy savings.

To determine energy savings impacts (i.e., kWh, kW, MBtu), methods were used that depended on the type of measure.

- *Savings from Lighting Measures.* Lighting measures could include retrofits of existing fixtures, lamps and/or ballasts with energy efficient fixtures, lamps and/or ballasts. These types of measures reduce demand, but operating hours for fixtures are the same pre- and post-retrofit. Also examined were any proposed lighting control strategies that might include the addition of energy conserving control technologies such as motion sensors or daylighting controls. These measures typically involve a reduction in hours of operation and/or lower current passing through the fixtures. Savings from lighting measures were analyzed using data for retrofitted fixtures on (1) wattages before and after retrofit and (2) hours of operation. Fixture wattages were taken from a table of standard wattages, with corrections made for non-operating fixtures. For some projects, data to determine average operating hours for retrofitted fixtures were collected by using Time-of-Use (TOU) data loggers to monitor a sample of "last points of control" for unique usage areas in sites where lighting efficiency measures had been installed.
- *Savings from Air Compressor Measures.* Savings from air compressor system measures were analyzed using the AirMaster+ tool (available from the U. S. Department of Energy's Industrial Technologies Program). The characteristics and monitored data collected on-site were used to develop the air flow and kWh load profiles that are the inputs to AirMaster+. These data will include not only electrical load measurements for compressors and auxiliary equipment (e.g., dryers, fans, etc.) but also inlet and discharge pressure measurements to calculate flows and pressure measurements for the compressor, dryer, and other critical components of the air compression system. If pre- and post-installation monitoring data were available, a comparison was made to the results from AirMaster+ to make sure that they reasonably match.
- *Savings from Refrigeration Measures.* Refrigeration measures are usually project-specific, and the methods used to evaluate savings may differ from case to case. In most cases, we perform the analysis using engineering principles aided by monitored data. Data on the efficiency of new equipment installed will be gathered from program records and verified with the manufacturers. Data on equipment runtime will be collected through short-term monitoring where applicable. We use these data to develop inputs for the eQuest energy analysis program (version 3.6.1b), which has the capability for simulating the energy use associated with various types of refrigeration. Simulations of eQuest with and without the refrigeration measure being analyzed are made to determine the amount of savings.
- *Savings from Process Improvement Measures.* Analysis of savings from process improvements, including changes to process equipment, is inherently project-specific. Because of the specificity of such processes, analyzing the processes through simulations is generally not feasible. Rather, we rely on engineering analysis of the process affected by the improvements. Major factors in our engineering analysis of process savings are operating schedules and load factors. Information on these factors is developed through short-term monitoring of the affected equipment. Monitoring is done after the process change, and the data gathered on operating hours and load factors are used in engineering analysis to define

"before" conditions for the analysis of savings. Where appropriate, we use a specialized analysis tool available from the U.S. Department of Energy's Industrial Technologies Program. In addition to the AIRMaster+ tool for compressed air measures, these tools include the following:

- Pumping System Assessment Tool 2004 (PSAT)
- Fan System Assessment Tool (FSAT)
- Chilled Water System Analysis Tool (CWSAT)
- Combined Heat and Power Application Tool (CHP)
- Insulation Thickness Calculation Program (3E Plus)
- NOx and Energy Assessment Tool (NxEAT)
- Plant Energy Profiler for the Chemical Industry (ChemPEP Tool)
- Process Heating Assessment and Survey Tool (PHAST)
- Steam System Tool Suite

- *Savings from High Efficiency Motors and VFDs.* Estimates of the energy savings from use of high efficiency motors or of VFDs are derived through an "after-only" analysis. With this method, energy use is measured for the high efficiency motor or VFD after it has been installed. We (1) make one-time measurements of voltage, current, and power factor of the ASD/motor and (2) use ACR loggers to take continuous measurements of amps over a period of time in order to obtain the data needed on operating schedules. The data thus collected are then used in estimating what energy use would have been for the motor application if the high efficiency motor or VFD had not been installed. Where appropriate, we use MotorMaster+ and MotorMaster+ International, specialized motor analysis tools available from the U.S. Department of Energy's Industrial Technologies Program.
- *Savings from HVAC Measures.* For the analysis of HVAC measures, we develop estimates of the savings through simulations with our energy analysis models (e.g., CPA-123, DOE-2, Equest). The HVAC simulations allow us to assess the primary and secondary effects of lighting measures on energy use. Each simulation produces estimates of HVAC energy and demand usage to be expected under different assumptions about equipment and/or construction conditions. For the analysis of HVAC measures, we draw on the data collected through on-site visits and monitoring.

Using these methods, estimates were developed of kWh savings and realization rates for projects in the analysis sample. These calculations of savings produced two estimates of gross savings for each sample project: an *ex ante* expected gross savings estimate (as reported in the project documentation) and the *ex post* verified gross savings estimates developed through the M&V analysis. Using these two estimates of energy savings, realization rates[1] were calculated for each project in the analysis sample. Sites with relatively high or low realization rates were further

[1] The savings realization rate for a project is calculated as the ratio of the achieved savings for the project (as measured and verified through the M&V effort) to the expected savings (as determined through the project application procedure and recorded in the tracking system for the program).

analyzed to determine the reasons for the discrepancy between expected and verified energy savings.

Peak demand reduction was estimated on a site by site basis using one of the following methods.

- For sites selected for a desk review only, the ex ante savings estimates were checked for reasonability, along with the algorithms used to generate those estimates. For such sites ADM used engineering calculations and industry best practices to evaluate the appropriateness of the savings. If no peak demand savings was claimed, then ADM would apply the ratio of our calculated energy savings (kWh) estimate and our calculated demand (kW) estimate to the claimed, or adjusted, ex ante savings. This was then reported as the site demand savings.
- Some desk review sites were based on building simulation models, or engineering models built with proprietary software. For such sites, ADM reviewed the model inputs and outputs against facility bills for reasonability. If no demand savings were claimed, ADM calculated demand savings by dividing the claimed, or adjusted, energy savings (kWh) estimates by 8760.

Gas savings were estimated on a site by site basis using one of the following methods:

- For sites at which lighting measures were installed, ADM applied interactive factors to account for the increase in heating usage due to the decrease in connected load. These factors were developed using DOE2 simulations of various building types using TMY3 weather for Idaho. The simulated buildings were based on simulations generated by the Database for Energy Efficiency Resources (DEER) and spanned the breadth of building types evaluated.
- For all other sites, ADM developed spreadsheet models and used engineering calculations to estimate gas savings.

4.5 ESTIMATING PROGRAM-LEVEL REALIZED SAVINGS

Program-level savings were developed by applying savings realization rates calculated for the analysis sample to program-level data for expected savings. This procedure for estimating gross savings for the program is an application of ratio estimation.

Given a stratified sample design, a gross realization rate (GRR) for a stratum is defined as the ratio of the sum of the realized savings determined for the analysis sample to the sum of the *ex ante* expected savings recorded in the tracking database for the same sample. The following formula illustrates the calculation made for each stratum:

$$\text{Estimated Verified Savings for Stratum} = \left(\frac{\sum_{\text{sample}} \text{Verified Savings}_i}{\sum_{\text{sample}} \text{Expected Savings}_i} \right) \sum_{\text{Population}} \text{Expected Savings}_i$$

Verified Savings$_i$ is an ex post estimate calculated for each site *i* in the analysis sample for the stratum. *Expected Savings*$_i$ is the ex ante expected savings for site *i* as recorded in the program tracking database. The *GRR* is given by the term in brackets.

To estimate total verified savings for a program, the estimates of verified savings for the different strata are summed. Note that this gives a realization rate at the program-level that is a weighted average of the realization rates for the different strata, with claimed savings being the weights.

4.6 ESTIMATING NON-ENERGY IMPACTS

Non-energy impacts of the Custom Efficiency Program that were assessed included employment effects and carbon offsets. Information for assessing non-energy impacts was collected through telephone interviews with program participants. The questionnaire used is provided in Appendix B.

Employment effects were assessed in terms of the number of full time equivalent ("FTE") direct jobs resulting from the investment and activities for a project. Participants were asked the following questions regarding job creation.

- Has participation in the Custom Efficiency Program allowed you to hire any new employees or avert any layoffs?
- What types of employees have you hired (or been able to keep) for these jobs (job categories)?
- What are the qualifications, salaries or hourly wages of the employees have been able to hire due to program participation?
- What is the anticipated growth for these jobs in the next 5 years?

Responses to these questions were tabulated to quantify the number of jobs created as a result of the Custom Efficiency Program.

Participants were also asked other questions about the non-energy effects of the program, such as effects on the quality of their product.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved with the projects undertaken through the program.

5. EVALUATION FINDINGS

To estimate gross kWh savings and peak kW reductions resulting from the projects in the Custom Efficiency Program, data were collected and analyzed for a sample of 35 projects. The data collected for these sample projects were analyzed using the methods described in Chapter 4 to estimate project energy (kWh) savings and peak demand (kW) reductions and to determine realization rates. The results from the analysis of the sample projects were then applied to estimate program-level savings and demand reductions. The findings from this evaluation effort are detailed in this section. Project-specific M&V results for the projects in the analysis sample are provided in Appendix A.

5.1 ESTIMATES OF EX POST VERIFIED GROSS KWH SAVINGS

Estimates of *ex post* verified kWh savings for the program are presented in this section.

5.1.1 Results from Analysis of kWh Savings for Sample Projects

For each project in the analysis sample, there are two estimates of gross kWh savings: the *ex ante* (expected) gross kWh savings estimate (as reported in the documentation for a project) and the estimate of *ex post* (verified) gross savings developed through the analysis of the sample projects. Figure 5-1 provides a summary comparison between the two values for the 35 lighting projects in the analysis sample. The correspondence is close, with a R^2 of 0.8997 between the two values across the sample projects.

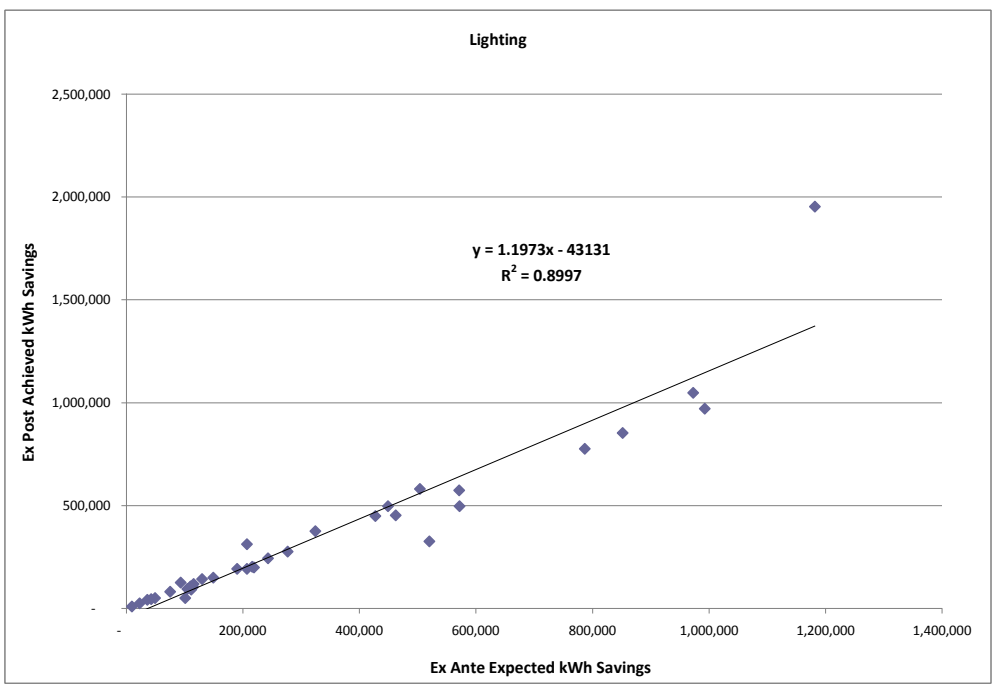


Figure 5-1. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for Lighting Projects in Analysis Sample

Figure 5-2 provides a summary comparison between the *ex ante* and *ex post* kWh savings values for the 40 non-lighting projects in the analysis sample. The correspondence is close, with a R^2 of 0.9504 between the two values across the sample projects.

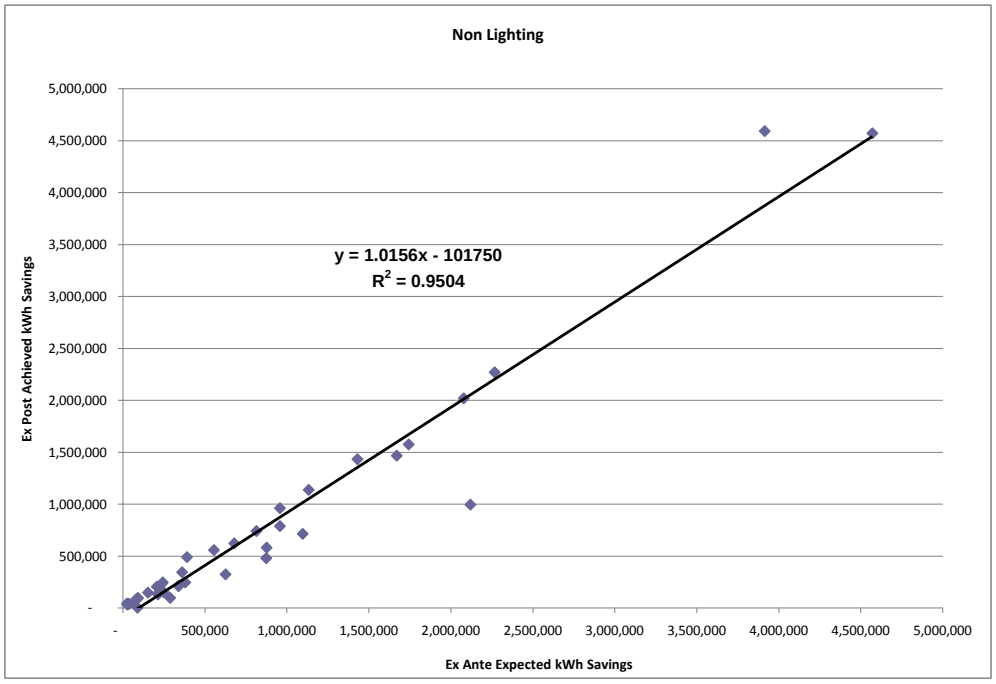


Figure 5-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for Non-Lighting Projects in Analysis Sample

The estimated realization rates for gross kWh savings for lighting and non-lighting projects when calculated by sampling stratum in the analysis sample are shown in Table 5-1.

Table 5-1. Realization Rates for Gross kWh Savings by Type of Project and Sampling Strata for Projects in Analysis Sample

Stratum	***Number of Sample Sites***	***Total Ex Ante Expected kWh Savings***	***Total Ex Post Verified kWh Savings***	***Realization Rate***
		Lighting Projects		
1-3	7	328,868	376,481	114.5%
4	14	2,220,022	2,194,711	98.9%
5	9	4,107,679	4,021,947	97.9%
6	4	3,604,813	3,645,385	101.1%
Certainty	1	1,182,165	1,953,032	165.2%
Totals	35	11,443,547	12,191,556	

Stratum	Number of Sample Sites	Total Ex Ante Expected kWh Savings	Total Ex Post Verified kWh Savings	Realization Rate
		Non-Lighting Projects		
1-3	8	480,752	410,211	85.3%
4	7	1,522,272	1,239,132	81.4%
5	9	3,832,913	2,463,425	64.3%
6	6	5,165,687	4,161,755	80.6%
Certainty	10	22,032,029	20,748,614	94.2%
Totals	40	33,033,653	29,023,137	

5.1.2 Program-Level Verified kWh Savings

The estimated program-level *ex post* (verified) gross kWh savings for the Custom Efficiency Program were developed by applying the stratum-specific realization rates from Table 5-1 to the stratum-level *ex ante* (expected) kWh savings. Table 5-2 shows the estimated *ex post* program-level gross kWh savings resulting from applying this procedure. The overall realization rate was 94.5 percent (with an error bound of ±8.3 percent at the 90 percent confidence level).

Table 5-2. Program-Level Ex Ante (Expected) and Ex Post (Verified) Gross kWh Savings by Type of Project and Sample Stratum

Stratum	Program-Level Ex Ante Expected kWh Savings	Gross Realization Rate	Program-Level Ex Post Verified kWh Savings
	Lighting Projects		
1-3	2,624,124	114.5%	3,004,622
4	12,310,993	98.9%	12,175,572
5	12,801,309	97.9%	12,532,482
6	4,316,179	101.1%	4,363,657
Certainty	1,182,165	165.2%	1,952,937
Totals, Lighting	33,234,770		34,029,269
	Non-Lighting Projects		
1-3	1,101,644	85.3%	939,702
4	3,667,806	81.4%	2,985,594
5	4,626,888	64.3%	2,973,715
6	6,861,812	80.6%	5,530,620
Certainty	22,032,029	94.2%	20,748,614
Totals, Non-Lighting	38,290,179		33,178,246
Totals, All Projects	71,524,949		67,207,515

The results in Table 5-2 show program-level *ex post* verified kWh savings of 67,207,515 kWh, with a realization rate for kWh savings of 94.0% for all projects. However, realization rates differ between lighting projects and non-lighting projects. For lighting projects the realization rate is 102.4%. For non-lighting projects, the realization rate is 86.6%.

5.2 ESTIMATES OF EX POST VERIFIED KW REDUCTIONS

Estimates of *ex post* verified coincident kW reductions for the program are presented in this section.

5.2.1 Results from Analysis of Peak Demand Reductions for Sample Projects

For each project in the analysis sample, an estimate of *ex post* (verified) gross kW reduction for the project was developed through the analysis. The estimated *ex post* verified kW reductions per *ex* post verified MWh savings for the strata in the analysis sample are shown in Table 5-3. For purposes of calculating these ratios, sampling strata 1, 2, and 3 were collapsed into one stratum (referred to in Table 5-3 as Stratum 1-3.)

Table 5-3. Peak kW Reductions per kWh Saved, by Sampling Strata for Analysis Sample

Stratum	***Number of Sample Sites***	***Total Ex Post Verified kWh Savings***	***Total Ex Post Verified Peak kW Reductions***	***kW Reduced per MWh Saved***
		Lighting Projects		
1-3	7	376,481	59.90	0.1591
4	14	2,194,711	549.14	0.2502
5	9	4,021,948	848.35	0.2109
6	4	3,645,385	595.00	0.1632
Certainty	1	1,953,032	307.31	0.1574
Totals	35	12,191,556	2,359.70	
		Non-Lighting Projects		
1-3	8	410,211	51.39	0.1253
4	7	1,239,132	291.83	0.2355
5	9	2,463,425	602.05	0.2444
6	6	4,161,755	443.02	0.1065
Certainty	10	20,748,614	3,539.50	0.1706
Totals	40	29,023,137	4,927.79	

5.2.2 Program-Level Verified kW Reductions

The estimated program-level *ex post* (verified) gross kW reductions for the Custom Efficiency Program were developed by applying the stratum-specific values for kW reduced per MWh saved from Table 5-3 to the stratum-level *ex post* (verified) kWh savings reported in Table 5-2. Table 5-4 shows the estimated *ex post* program-level gross kW reductions resulting from applying this procedure.

Table 5-4. Program-Level Ex Post (Verified) Gross kW Reductions by Type of Project and Sample Stratum

Stratum	***Ex Post Verified kWh Savings***	***kW Reduced per MWh Saved***	***Ex Post Verified kW Reductions***
	Lighting Projects		
1-3	3,004,622	0.1591	478.04
4	12,175,572	0.2502	3,046.33
5	12,532,482	0.2109	2,643.10
6	4,363,657	0.1632	712.15
Certainty	1,952,937	0.1574	307.39
Totals, Lighting	34,029,269		7,187.01
	Non-Lighting Projects		
1-3	939,702	0.1253	117.74
4	2,985,594	0.2355	703.11
5	2,973,715	0.2444	726.78
6	5,530,620	0.1065	589.01
Certainty	20,748,614	0.1706	3,539.71
Totals, Non-Lighting	33,178,246		5,676.35
Totals, All Projects	67,207,515		12,863.36

The results in Table 5-4 show total *ex post* kW reductions for the program of 12,863 kW, of which 7,187 kW are from lighting projects and 5,676 kW are from non-lighting projects.

5.3 ESTIMATES OF GAS SAVINGS

Estimates of *ex post* verified gas savings (MBtu) savings for the program are presented in this section.

5.3.1 Results from Analysis of Gas Savings for Sample Projects

For each project in the analysis sample, an estimate of *ex post* (verified) gross gas savings (MBtu) for the project was developed through the analysis. The estimated *ex post* verified MBtu savings for the strata in the analysis sample are shown in Table 5-5. For purposes of calculating these realization rates, sampling strata 1, 2, 3, and 4 were collapsed into one stratum (referred to in Table 5-5 as Stratum 1-4.)

The estimated ratios for MBtu savings per kWh saved for lighting and non-lighting projects in the analysis sample are shown in Table 5-5.

Table 5-5. MBtu Savings per kWh Savings by Sampling Strata for Projects in Analysis Sample

Stratum	Number of Sample Sites	Total Ex Post Verified kWh Savings	Total Ex Post Verified MBtu Savings	MBtu Saved per kWh Saved
		Lighting Projects		
1-3	7	376,481	-3,476	-0.009232870
4	14	2,194,711	-31,361	-0.014289353
5	9	4,021,948	-69,461	-0.017270491
6	4	3,645,385	-9,348	-0.002564338
Certainty	1	1,953,032	-391	-0.000200202
Totals	35	12,191,556	-114,037	
		Non-Lighting Projects		
1-3	8	410,211	7,942	0.019360768
4	7	1,239,132	-	_
5	9	2,463,425	51,496	0.020904229
6	6	4,161,755	83,930	0.020166973
Certainty	10	20,748,614	-	_
Totals	40	29,023,137	143,368	

5.3.2 Program-Level Verified Gas (MBtu) Savings

The estimated program-level *ex post* (verified) gross gas savings for the Custom Efficiency Program were developed by applying the stratum-specific ratios for MBtu saved per kWh saved from Table 5-5 to the stratum-level *ex post* (verified) kWh savings from Table 5-2. Table 5-6 shows the estimated *ex post* program-level gross MBtu savings resulting from applying this procedure.

For lighting projects, there was generally a gas penalty rather than a gas saving because of the reduction in the contribution of lighting to the internal heating load. On the other hand, there were gas savings for the non-lighting projects. While it was estimated that lighting projects increase gas usage by 429,745 MBtu, non-lighting projects produce gas savings of 191,892 MBtu. The net impact for the program would be increased gas usage of 237,853 MBtu.

Table 5-6. Program-Level Ex Ante (Expected) and Ex Post (Verified) MBtu Savings by Type of Project and Sample Stratum

Stratum	***Ex Post Verified kWh Savings***	***MBtu Saved per kWh Saved***	***Ex Post Verified MBtu Savings***
	Lighting Projects		
1-3	3,004,622	-0.009232870	(27,741)
4	12,175,572	-0.014289353	(173,981)
5	12,532,482	-0.017270491	(216,442)
6	4,363,657	-0.002564338	(11,190)
Certainty	1,952,937	-0.000200202	(391)
Total, Lighting	34,029,269		(429,745)
	Non-Lighting Projects		
1-3	939,702	0.019360768	18,193
4	2,985,594	_	-
5	2,973,715	0.020904229	62,163
6	5,530,620	0.020166973	111,536
Certainty	20,748,614	_	-
Total, Non-Lighting	33,178,246		191,892
Total, All Projects	67,207,515		(237,853)

5.4 NON-ENERGY IMPACTS AND EFFECTS

To assess non-energy impacts and effects of the 2010 Custom Efficiency Program, a telephone survey of a sample of participants was conducted. A total of 27 survey interviews were completed. The breakdown of respondents by type of facility shows 5 Commercial, 18 Industrial, and 4 Government/Non Profit/Schools.

With respect to employment effects, all respondents indicated that participation in the Custom Efficiency program had not lead to their hiring of any new employees or to averting any layoffs.

Respondents did indicate that the Custom Efficiency Program did have other, non-energy effects. For commercial facilities, all five respondents indicated that participation in the Custom Efficiency Program did improve the quality of their facility's work environment. Comments on ways in which the quality of the facility's work environment improved are listed in Table 5-7.

Table 5-7. Improvements in Quality of Work Environment for Commercial Facilities

• THE QUALITY OF LIGHTING IN OUR WORKING AREAS.
• BETTER EFFICIENCY IN COOLING AND LIGHTING.
• BETTER LIGHTING
• IT WAS A LIGHTING UPGRADE AND IT HAS IMPROVED THE WORK ENVIRONMENT. THE LIGHTING LEVEL IS BETTER AND WE'RE PAYING LESS FOR IT. NO OTHER INFORMATION AVAILABLE, TOO SOON TO TELL.
• WELL, IT'S LOWERED THE OPERATING COST, SO I THINK IT'S A BENEFIT TO EVERYONE WORKING HERE.

For industrial facilities, just under three-fourths (73%) of participants responded that the program did improve the quality of their facility's work environment. Comments on ways in which the quality of the facility's work environment improved are listed in Table 5-8.

Table 5-8. Improvements in Quality of Work Environment for Industrial Facilities

• BETTER LIGHTING
• WE IMPROVED OUR LIGHTING WITH OUR ENERGY EFFICIENCY PROJECT. WITH THE OLDER LIGHTING THERE'S A LOSS OF LIGHT OVER TIME. WITH THE HIGH EFFICIENCY FLUORESCENT AND LED LIGHTING WE HAVE BETTER LIGHTING AND WE HAVE LESS OF A DEPRECIATION CURVE OVER TIME.
• MADE THE LIGHTING MUCH BETTER, IT SEEMS A MORE EVEN LIGHT, BRIGHTER, MORE NATURAL LIGHT, MORE OF A WHITE LIGHT, THE OTHER WAS A YELLOWISH LIGHT.
• IT HAS REDUCED THE MAINTENANCE REQUIRED ON THEIR SYSTEMS, SO LESS WORK.
• BROUGHT POWER BILL DOWN.
• BETTER LIGHTING, WE'RE ABLE TO SEE BETTER. IT'S SO MUCH BRIGHTER, AND IT'S IMPROVED OUR SAFETY. WE'RE ABLE TO SEE WHERE WE'RE GOING.
• MAKES THINGS EASIER, LIGHT ARE ON SENSORS.
• LIGHTING IMPROVEMENTS, THE ENERGY EFFICIENCY. ANOTHER IS MORE LIGHT, WE UPGRADED LIGHTING TO INCREASE FOOT CANDLES AND LIGHT COLOR. WE REDUCED THE NUMBER OF KILOWATT HOURS USED WHICH DOES REDUCE OUR COST.
• SAVES ON ENERGY.
• IN THE REDUCTION OF WHAT WE HAVE TO USE, THE ENERGY AND THE NOISE FROM THE FAN SYSTEM.
• IT'S HELPED IMPROVE THE QUALITY OF OUR PRODUCT, THE CONTROL, WE HAVE VARIABLE FREQUENCY ON OUR FANS, WHICH

ALLOWS US TO MEET THE OPTIMUM AIR MOVEMENT. WE'VE HAD SOME POWER SAVINGS AS WELL, WHICH HAS SAVED MONEY.
• BETTER LIGHTING.
• LESS BREAK-DOWNS, BETTER PRODUCTION OF EQUIPMENT.

Moreover, just under half (8 of 18, or 45%) of industrial respondents indicated that their participation in the Custom Efficiency Program improved the quality of the products produced by the facility. Figure 2 shows this breakdown. Comments on ways in which the quality of the products improved are listed below:

Table 5-9. Improvements in Quality of Products for Industrial Facilities

• MAKE PRODUCT FOR LESS MONEY
• ON OUR FREEZER WAREHOUSE PROJECT, OUR FREEZER IS ABLE TO OPERATE AT MORE CONSISTENT TEMPERATURE.
• PROBABLY BECAUSE MY EMPLOYEES CAN SEE MUCH BETTER WHAT THEY'RE DOING.
• IT HAS ALLOWED US TO FREEZE THE PRODUCTS TO COLDER TEMPERATURES DURING THE SUMMER MONTHS.
• BETTER LIGHTS WHICH PRODUCE BETTER QUALITY OF WORK.
• EMPLOYEES ARE ABLE TO SEE BETTER
• IT HELPED IMPROVE THE QUALITY OF OUR PRODUCT, AS I SAID BEFORE.
• EQUIPMENT IS RUNNING BETTER.

Over four-fifths (83%) of industrial respondents indicated that there has been no increase in the quantity of products produced at their facility due to the participation in the program.

For government/non-profit/schools, all respondents indicated that participation in the Custom Efficiency Program did improve the quality of their facility's work environment. Comments on ways in which the quality of the facility's work environment improved are listed in Table 5-10.

Table 5-10. Improvements in Quality of Work Environment for Government/Non-Profit/Schools

• BETTER LIGHTING IN THE OFFICE AND WORK PRODUCTION, AND HAPPY EMPLOYEES AND IMPROVED WORK SPACE.
• IT MADE FOR MORE LIGHTING AT A LOWER PRICE.
• WE DID A LIGHTING DEAL AND IT HELPED THERE; WITH BETTER VISIBILITY IN THE CLASSROOM AND WITH THE BILLS. LOWERING THE BILLS.
• BETTER LIGHTING FOR THE CHILDREN IN THE SCHOOL.

The other major non-energy effect assessed pertains to carbon emissions. Standardized emission factors were used to determine carbon offsets resulting from the savings achieved with the

projects undertaken through the program. These carbon reduction estimates are reported in Table 5-11.[2]

Table 5-11. Program-Level Carbon Reductions for 2010 Custom Efficiency Program

Stratum	***Program-Level Ex Post Verified kWh Savings***	***Program Realized CO2 Emissions Reduction (Tons)***
All Projects	67,207,515	42,999
Lighting Projects	34,029,269	21,772
Non-Lighting Projects	33,178,246	21,227

[2] CO2 emissions reductions were calculated using a factor of 6.398×10^{-4}.
Ref: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010V1_1_year07_GHGOutputrates.pdf

6. SUMMARY AND DISCUSSION OF FINDINGS

This report has provided the results from an impact evaluation of the Custom Efficiency Program that Idaho Power Company (IPC) offered to its commercial and industrial customers in Idaho and eastern Oregon during 2010.

6.1 SUMMARY OF FINDINGS

There were a total of 223 participants in the Custom Efficiency Program in 2010, accounting for 230 energy efficiency projects. The *ex post* verified values of energy savings (kWh), peak demand reductions (kW), and gas savings (MBtu) from these projects that were developed during this impact evaluation are reported in Table 6-1.

Table 6-1. Ex Post Savings for 2010 Custom Efficiency Program As Verified from Impact Evaluation

Type of Project	***Ex Post Verified Savings***		
	kWh Savings	***kW Reductions***	***MBtu Savings***
All Projects	67,207,515	12,863	-237,853
Lighting	34,029,269	7,187	-429,745
Non-Lighting	33,178,246	5,676	191,892

6.2 DISCUSSION OF FINDINGS

The results in Table 6-1 show program-level *ex post* verified kWh savings of 67,207,515 kWh. Compared to *ex ante* expected program savings, this represents a realization rate for kWh savings of 94.0% for all projects. However, as shown in Table 6-2, kWh savings realization rates differ between lighting projects and non-lighting projects. For lighting projects the realization rate is 102.4%. For non-lighting projects, the realization rate is 86.6%.

Table 6-2. Comparison of Ex Post Verified kWh Savings to Ex Ante Expected kWh Savings for 2010 Custom Efficiency Program

Stratum	***Program-Level Ex Ante Expected kWh Savings***	***Program-Level Ex Post Verified kWh Savings***	***kWh Savings Realization Rate***
All Project	71,524,949	67,207,515	94.0%
Lighting	33,234,770	34,029,269	102.4%
Non-Lighting	38,290,179	33,178,246	86.6%

6.3 RECOMMENDATIONS FOR IMPROVEMENT

Overall, the Custom Efficiency Program received a high realization rate. However, ADM recommends the following to increase homogeneity in how savings are claimed, reduce uncertainty in the claimed savings, and prevent potentially low realization rates in the future:

1) Base claimed savings for lighting projects off of a standard lighting calculator

Though the project documentation for most of the incentivized lighting projects included a standard lighting calculator, often the claimed savings values corresponded to a separate set of calculations – usually performed by the facility. This may be due to the fact that many of the installed fixtures were not listed in the fixture wattage table used in the standard calculator. ADM recommends that the standard lighting calculator be revised to increase the variety of available "standard" fixture types and to allow for custom fixtures to be defined.

Additionally, facilities should provide itemized invoices indicating model numbers and quantities of purchased fixtures along with the fixture/bulb cut-sheets. This would significantly reduce the uncertainty in realized savings for sites receiving only desk reviews. As such fewer on-site visits would be required to achieve the same confidence and precision. This would both reduce the number of customers who would need to open their facilities to evaluation personnel, and increase the cost effectiveness of the program evaluation.

2) Include Heating and Cooling Interactive Effects in claimed savings for lighting projects

ADM recommends that, in addition to the revisions suggested above, Idaho Power start including heating and cooling interactive effects (HCIFs) into claimed savings for incentivized lighting projects. This was the primary reason for differences in the realized energy savings from the claimed savings for lighting projects. Though, most of the time, this resulted in a realization rate greater than 1, in a few instances this resulted in a lower realization rate. The reason is that in some climates the heating penalty can be larger than the cooling savings for lighting retrofits. If a facility is electrically heated, the HCIFs can result in an overall reduction in savings (depending on the heating efficiency). This did not have a significant impact on the overall results due to the fact that most of the facilities were gas heated. However, if future programs target rural areas in which many facilities are electrically heated, it would have a larger effect.

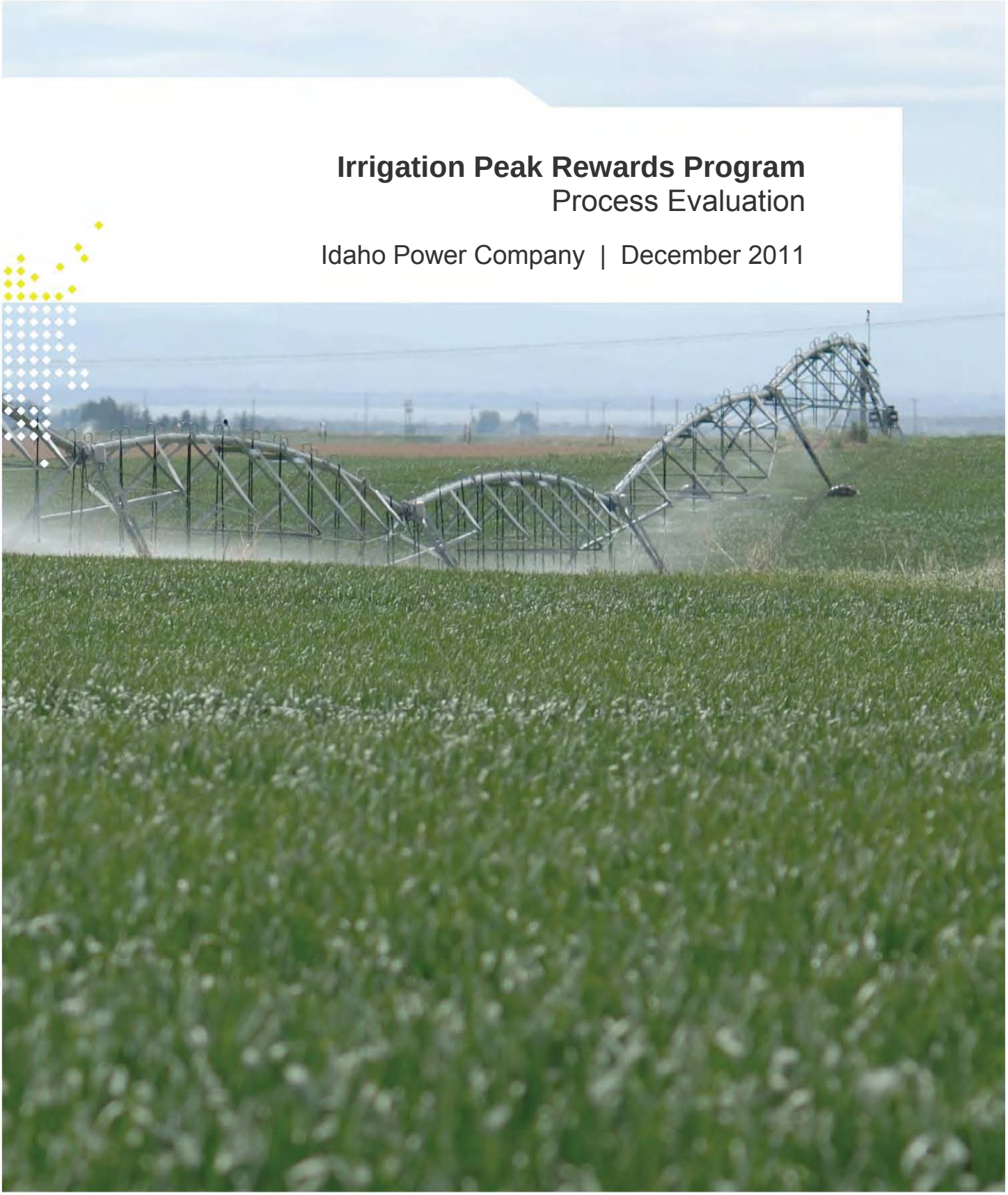
3) Apply more rigor to assumed parameters in custom calculations

For most of the incentivized custom (non-lighting) projects, the engineering algorithms used to derive the claimed savings were appropriate and sufficiently rigorous. However, sometimes the assumptions that fed into those algorithms did not accurately reflect the site equipment. For example, one project's claimed savings were calculated based on an average package system cooling efficiency. Though this may be sufficient when estimating a "ball-park" value, the actual system efficiency was different – resulting in a reduction in realized savings. There are two general areas in which ADM has identified opportunities for improvement: specifying equipment

performance, and in specifying equipment loading. Equipment performance should be specified using either monitored data or manufacture's specifications. In particular, air compressors and chillers are sensitive to variations in load and require specific part-load curves to define a spectrum of performance. In some instances generic part-load curves can be used for families of equipment (i.e. centrifugal compressors, axial fans, etc.). Also, equipment loading should be specified using monitored data, billing data, and/or detailed facility interviews. Many industrial sites keep archived production data that can be used to help define process equipment loads.

Irrigation Peak Rewards Program
Process Evaluation

Idaho Power Company | December 2011



Demand Response

peci®

Page intentionally left blank

Contents

1. Executive Summary 5
2. Introduction 6
Program Description 6
Dispatch Option 8
Timer Option 9
3. Process Evaluation Objectives and Approach 10
4. Program Comparisons 11
5. Program Operations and Process Findings 13
Overall Program Processes 13
Overall Process Findings 13
Marketing and Customer Outreach 14
Prepared Marketing Materials 14
Enrollment Outreach 14
Workshops 15
Marketing and Outreach Findings 15
Data System and Reporting (CIS information integration) 15
Data System and Reporting Findings 16
Equipment Installation and Operation 17
Timer Option 17
Dispatch Option 17
Previous Equipment Issues 18
Equipment Installation and Operation Findings 18
Load Curtailment Process 19
Cancelling Events 20
Load Curtailment Process Findings 20
Customer Incentives 21
Findings 22
Customer and Program Support 22
Customer Support 22
Opting Out 22
Customer and Program Support Findings 23

6. Key Observations and Recommendations 24
Recommendations 24
Appendix A: Interview Guide 27

1. Executive Summary

Idaho Power Company (Idaho Power) contracted with PECI to conduct a process evaluation of its Irrigation Peak Rewards Program. The evaluation is part of Idaho Power's commitment to continuous program improvement and is in compliance with the memorandum of understanding with the Idaho Public Utilities Commission (IPUC). This report presents the findings of the evaluation to Idaho Power.

The primary objectives of the evaluation were to document and evaluate the current program processes, identify best practices, and make recommendations for improvements where applicable. Idaho Power is preparing a separate report estimating and reporting program impacts for 2010 and 2011. Over the course of this evaluation, PECI conducted interviews with 13 key Idaho Power staff members and contractors. PECI also reviewed program documents, forms, surveys, and marketing materials to evaluate primary processes and provide feedback to Idaho Power.

The Irrigation Peak Rewards program is a voluntary demand response program designed to reduce peak load in the summer season (June 15 - August 15) by offering a financial incentive to irrigators for turning off their irrigation pumps during peak hours. Idaho Power has been successful in using this program to reduce peak load during afternoon and early evening hours. In 2009, the program underwent significant changes by adding a dispatch option which allows pumps to be shutoff remotely through cellular and satellite signals. The dispatch option expanded program enrollment as well as the capability of Idaho Power to reduce system demand during critical summer peak load events. The program team made another significant change to the incentive structure for the 2011 program. Whereas incentives during the 2009 and 2010 programs were fixed dollar amounts per kW and kWh, the participants who chose to participate in the 2011 dispatch option received a fixed incentive for enrolling in the program and a variable incentive for called events.

Because the Irrigation Peak Rewards program is a tariff-based program, any changes made by Idaho Power must be preauthorized by the IPUC. The seasonality and timing of this program are such that it is susceptible to delay pending an approval by the IPUC. In addition to its internal staff, Idaho Power partners with contractors who manage crucial components of the program's communications and infrastructure.

It is the finding of this evaluation that, in general, Idaho Power's Irrigation Peak Rewards Program is a well run program that consistently delivers on its intended objective of securing load reduction resources to be used during summer peak times.

Key strengths of the program include consistent program delivery framework, a clear and consistent understanding of the program and how it operates among internal program staff and contracted vendors, a high level of respect for the key program staff, and an incentive structure that provides a reliable resource delivered to Idaho Power and benefits the agricultural customer as well.

Identified program limitations include a manual process for creating the enrollment forms and the need to manually update Idaho Power's customer database. Additionally, successful program delivery relies on institutional knowledge of staff and short timeframes to make program changes within the regulatory process.

A full discussion of findings and recommendations can be found in Section 6.

2. Introduction

Idaho Power contracted with PECI to conduct a process evaluation of the Irrigation Peak Rewards Program. This report provides Idaho Power with the process evaluation findings of the Irrigation Peak Rewards program. This process evaluation is part of Idaho Power's program evaluation schedule in compliance with the memorandum of understanding with the Idaho Public Utilities Commission (IPUC). Idaho Power is estimating and reporting program impacts for 2010 and 2011 in a separate report.

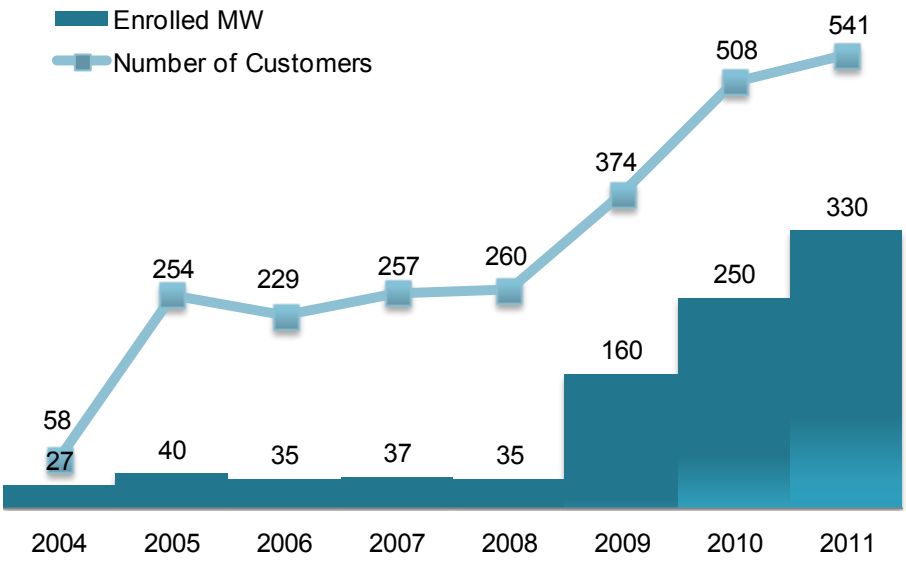
Program Description

The Irrigation Peak Rewards program is a voluntary demand response program which has been available to Idaho Power's agricultural irrigation customers since 2004. The program is designed to reduce peak load by turning off participating irrigation pumps during summer peak demand hours in return for a financial incentive. Through this program, Idaho Power has been successful in reducing load during the summer afternoon and early evening hours, the hours driving Idaho Power's potential need for new generation resources. The Irrigation Peak Rewards program is a tariff-based program and the IPUC must approve any changes to the program tariff.

The program started in 2004 as a timer-based load control program. From 2004 through 2008, demand reduction was achieved using preprogrammed timers controlling pumping loads from 4-8 p.m. on weekdays during the months of June, July and August. Growers were able to choose the number of days their pumps participated in the program, but not which days. Idaho Power staff was able to lower demand across all weekdays during the summer season. In 2009, the program underwent significant changes by adding a dispatch option to the program. The dispatch option expanded program enrollment as well as the load dispatch capability of Idaho Power to reduce system demand during critical summer peak load events, matching demand response resources with Idaho Power's actual system peaks.

The addition of the dispatch option grew the program significantly, from approximately 40 MW with the timer-only program to 160 MW in 2009. Since 2009, the enrolled load has increased every year experiencing a 250MW load reduction capability in 2010 and had a 330 MW load reduction potential for the 2011 season. This resource is over 10 percent of Idaho Power's total peak demand. Figure 1 shows the program growth since its inception in 2004. Actual demand reductions vary by event based on the weather, level of irrigation and Idaho Power need. A majority of the enrolled load participates through the dispatch option though some load is still controlled via timers.

Figure 1. Irrigation Peak Rewards Program Growth

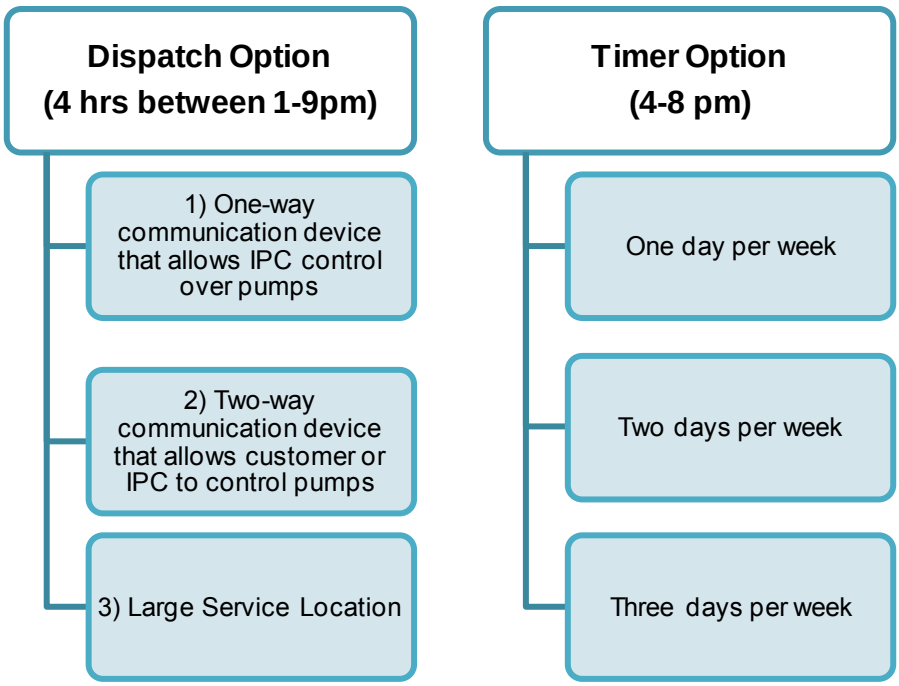


The dispatch incentives during the 2009 and 2010 programs were fixed dollar amounts per kW and kWh that Idaho Power paid customers for participating in the program. The program team made a significant change to the program incentive structure for the 2011 program. Participants choosing to participate in the dispatch option received a fixed incentive for enrolling in the program and a variable incentive if Idaho Power called events. This incentive structure resulted in a slightly smaller fixed payment than 2010 (approximately 75 percent of previous fixed payment), but also included an additional payment for each time a curtailment is called. This formula would result in reducing program costs if fewer events were called but could also result in higher incentive payments if the maximum number of events were called. However, due to a mild summer and low market prices, Idaho Power did not call the program resources during 2011 and did not pay any variable incentives.

There are a number of ways customers engage with the Irrigation Peak Rewards program. Figure 2 provides an overview of the different program participation options followed by a description of the different participation parameters for the dispatch and timer options.

Program participants can also terminate their participation in the program after enrolling. However, if customers terminate their participation for the program season after June 15, they are assessed a fee. The fee covers a portion of the cost of the equipment installation and maintenance. Participants are also allowed to opt out of individual curtailment events up to five times. The event opt-out incurs a per kWh fee based on the current month's billing kWh.

Figure 2. Irrigation Peak Rewards 2011 Participation Options



Dispatch Option

The dispatch option allows Idaho Power to initiate load control events that turn pumps off at participating metered service points. Pumps smaller than 30 hp require an installation fee between $500 and $1,000 because these smaller service points are not as cost effective as larger pumps. A majority of program service points (95 percent) enrolled through the dispatch option and could participate in one of three ways:

1. Have a one-way communication device installed that allows Idaho Power to control all the customer's pumps at a single metered service point. This one-way communication can be controlled via Idaho Power's Automated Metering Infrastructure system or by using external communication such as cellular or satellite.

2. Have a two-way communication device installed that allows both Idaho Power and the customer to control all the pumps at a single service point. This option provides the customer additional control of pumps outside the load control events.

3. Service points with multiple pumps and over 1,000 cumulative hp are eligible to participate as a Large Service Location. Customers under this classification choose to manually control which pumps are controlled during a load control event.

Idaho Power initiates curtailment events for the majority of participants by using a customized M2M Communications (M2M) web site. For a few service pump locations, Idaho Power utilizes their existing AMI system. M2M has proprietary switches to control pumps. AMI switches are provided by Aclara and are proprietary to the AMI system.

The program includes defined parameters for the dispatch option to limit the impact on customers' agricultural operations:

- Dispatch load control events can occur any weekday, excluding July 4, between the hours of 1-9 p.m. The customers that choose to voluntarily curtail through the extended 9PM hour receive an extra variable incentive.
- Load control events can 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 must give notice by 4 p.m. the day prior to the initiation of a control event.
- If prior notice of a load control event has been sent, Idaho Power may choose to cancel the event by 12:30 p.m. on the scheduled day of the event.
- Idaho Power will give 30 minutes notice prior to start of all actual events and prior to the end of all actual events.

The provisions for this program do not apply for any time Idaho Power interrupts the customer's load for a system emergency or any other time that a customer's service is interrupted by events outside the control of Idaho Power.

Timer Option

The pre-programmed timer option is available to irrigation customers that prefer a predetermined interruption schedule. Participation in the timer option is generally driven by customer preference, crop type and its drought tolerance, and farm management practices. Idaho Power charges installation fees between $250 and $500 to participating service locations less than 75 hp. Only 5 percent of all participating service points are enrolled in the timer option.

At the time of enrollment, customers chose to have all irrigation pumps on a single metered service point scheduled to be turned off on one, two, or three weekdays per week during the curtailment season (June 15 - August 15) from 4-8 p.m. Idaho Power determines the specific weekday or weekdays to schedule the interruption of pumps at each service point.

Further details on the program are in the Program Operations and Process Findings section of this report.

3. Process Evaluation Objectives and Approach

The primary objectives of the evaluation were to:

- Document and evaluate the current program processes,
- Identify best practices, and
- Make recommendations for improvements where applicable.

PECI completed a number of tasks to accomplish the evaluation objectives. Specific data collection and program review activities are outlined below.

Review Program Materials

PECI reviewed program documents, forms, surveys, and marketing materials to document the key processes as well as provide program feedback to Idaho Power.

Staff Interviews

PECI conducted staff interviews with key Idaho Power and contractor staff in October 2011. In total, 13 staff provided input in 30-60 minute phone interview sessions. Table 1 summarizes the interviews targeted and completed. Staff interviews included the Idaho Power agricultural program staff, agricultural customer representatives, and third-party contractors. Questions were formulated to determine general program awareness, customer behavior and decision-making, and other findings that would be beneficial regarding future program design and implementation. PECI developed an interview guide to facilitate the interviews (see Appendix A: Interview Guide). Interview questions were tailored to the interviewee's particular area of the program.

Table 1. Staff Interviews Targeted and Completed

Staff Type	Targeted	Completed
Idaho Power Program Staff (all departments)	7	5
Idaho Power Customer Representatives	6	5
Contractors	4	3
Total	**17**	**13**

Review of Participant Feedback

Idaho Power contracted with another third-party firm to conduct a survey of Irrigation Peak Rewards customers. The survey collected feedback from agricultural customers on the incentive structure, program satisfaction, and how participants would tolerate different events and levels of participation. PECI reviewed the results from the participant survey. The review focused on cross-referencing participant feedback to confirm other process findings as well as identify any additional relevant feedback or gaps from participants.

Secondary Research on Agricultural Load Reduction Programs

The evaluation team also conducted high level research on similar utility agricultural load reduction programs. Other agricultural programs were identified through PECI staff's knowledge or through program staff input on other programs that operate in other states. PECI conducted secondary research on the internet and by contacting utilities to obtain information on comparative programs.

4. Program Comparisons

PECI staff researched three other utility-operated irrigation dispatch load curtailment programs to better understand opportunities that may be available for the Irrigation Peak Rewards program.

- Midwest Energy – Pump Smart Program
- Entergy – Agricultural Load Control Program
- Rocky Mountain Power

These programs were selected due to their resemblance to the Irrigation Peak Rewards program either in terms of their overall size, age, rate of growth, or incentive structure. PECI obtained details regarding these programs through information available online, and through direct contact with the utilities via email correspondence and phone conversations. Although these programs varied in size in terms of utility service territory, strong similarities exist in terms of program design and structure. Table 2 provides an overview of the comparison program and Table 3 provides an expanded view of the IPC program incentive structure compared to the other irrigation programs listed in Table 2, column 5.

Table 2. Summary of Dispatch Load Curtailment Programs

Utility	State	Season Duration (2011)	Load Reduction (MW 2011)	Credit (2011)	Connections	Max Hrs per Season	Max Events per Season	Event Duration	Agreement Duration
Midwest[1] Energy	Kansas	June 1 – August 1	10.4 MW	1 yr - $20/kW/yr 2 yrs - $24/kW/yr 3 yrs - $28/kW/yr	211 meters	Max 80 hrs	Max 20	Max 4 hrs – 16 hrs/wk	3-year
Entergy[2]	Arkansas	June 1- August 31	N/A	$4.16/kW/mo	N/A	Max 39 hrs	Max 13	Max 3 hrs/day	N/A
Rocky Mountain Power	Idaho	June 1- August 31	232 MW	$28.55/kW/yr		Max 52 hrs	Max 13	Max 4 hrs/day – 12 hrs/wk	1-year Agreement
Idaho Power	Idaho[3]	June 15 – August 15	330MW[(a)]	**See Table 3 below**	2,214 Dispatch; 128 timer	Max 60 hrs	N/A	Max 4 hrs/day, 15 hrs/wk	1-year Agreement w/auto renewal if both parties agree

[(a)] Realized load reduction if Idaho Power were to have called an event

[1] http://www.mwenergy.com/documents/PCR.pdf

[2] http://www.entergy-arkansas.com/content/price/tariffs/eai_ailcsr.pdf

[3] http://www.puc.idaho.gov/internet/press/050311_RMPirrigationloadcontrol.htm

Table 3. Idaho Power Dispatchable Load Credit

Fixed Incentive Payment			Variable Incentive Payment	
Dispatchable Option	Demand Credit ($ per Program kWh)	Energy Credit ($ per Program kWh)	Standard Interruption Variable Energy Credit ($ per Variable Program kWh)	Extended Interruption Variable Energy Credit
1	$5.00	$0.019	$0.159	$0.209
2	$5.00	$0.019	$0.159	$0.209
3	$5.00	$0.019	$0.159	$0.209

These utilities experienced high levels of growth in program participation during their first several years of operation, similar to the growth the Irrigation Peak Rewards program has experienced since 2009. In its first year in operation Midwest Energy achieved 10.4 MW of enrolled savings in their Pump Smart program, equivalent to 3 percent of their peak load. The utility anticipates doubling enrollment to over 20 MW during the next program cycle. Similarly, Rocky Mountain Power's irrigation load control program experienced an increase in enrollment of over 400 percent since its inception in 2007. In this particular case, the loads being curtailed were concentrated in a single part of the system and the curtailment of the loads has reportedly caused voltage issues at substations and transformers.

As a result of the growth and popularity, utilities have taken subsequent steps to control the scale of their programs. Rocky Mountain Power's response was to propose a reduction in credit from $30 per kW to $25.30, as well as a penalty for opting out of scheduled curtailments.[4] Most programs have minimum size criteria for participation. Midwest Energy, for example, requires a pump to be at least 40hp for eligibility in their Load Control Service Credit[5]. The Irrigation Peak Rewards program is available to all irrigation customers but utilizes an installation fee which discourages smaller horsepower service locations from participating. In addition to a size requirement, Midwest Energy also requires commitment to a three year participation agreement, with the customer's payout dependent upon their number of years in the program without bypassing a curtailment event. An additional benefit to Midwest's three year participation agreement is the opportunity it provides for greater time and flexibility with planning and equipment procurement for upcoming seasons.

[4] http://www.puc.idaho.gov/internet/press/050311_RMPirrigationloadcontrol.htm

[5] http://www.mwenergy.com/documents/PCR.pdf

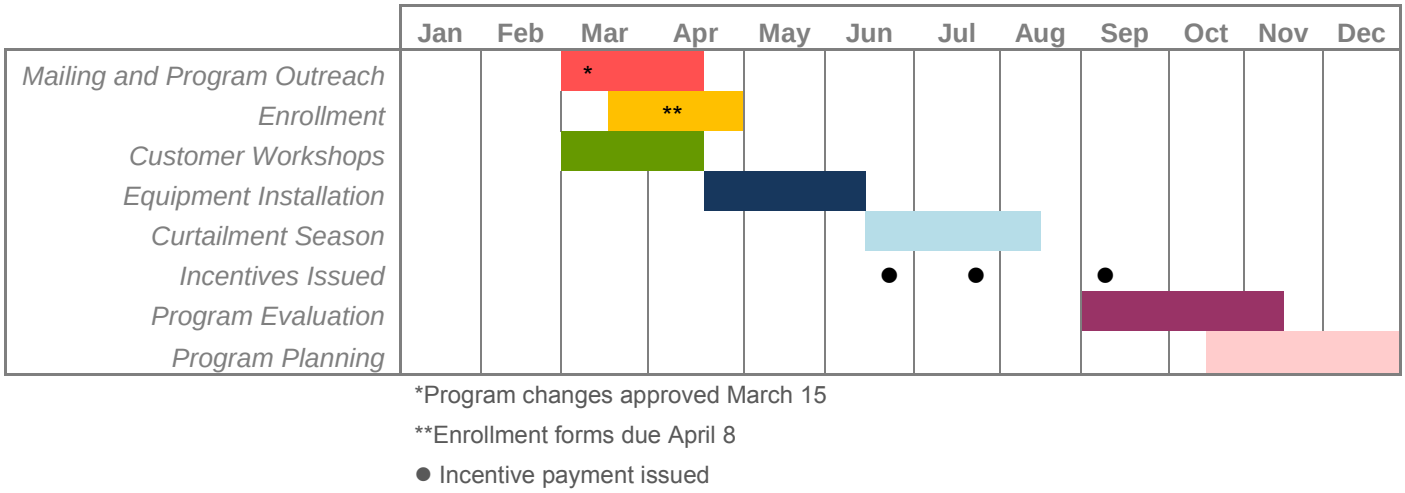
5. Program Operations and Process Findings

This section provides information on the different program processes for the Irrigation Peak Rewards Program. We provide an overview of the 2011 program process followed by an in depth discussion of the different program activities and our corresponding findings on the topic based on a review of materials and process interviews.

Overall Program Processes

The majority of 2011 Irrigation Peak Rewards program activities occurred between March and September. Figure 3 provides an overview of the 2011 program implementation with key activities and events highlighted.

Figure 3. 2011 Timeline of Program Events



*Program changes approved March 15

**Enrollment forms due April 8

● Incentive payment issued

Marketing and outreach typically occur during late-winter and early-spring. However, the timing of marketing and outreach is dependent on when Idaho Power has received IPUC approval of proposed changes. If Idaho Power has program changes, it submits a tariff and IPUC reviews and approves the tariff and corresponding changes. The IPUC approval process did not conclude until March 15 for the 2011 program cycle. Because of this timing, program information was sent at the end of March and required agricultural customers return enrollment forms by April 8, 2011. Idaho Power adapted their marketing processes to the new schedule and the agricultural customer representatives hosted informational workshops in March to provide information on the program and other topics. In addition, a collateral piece summarizing the program changes was quickly produced to assist in communicating the changes to agricultural customers.

The 2011 curtailment season occurred between June 15 - August 15, the typical curtailment season for Idaho Power. However, Idaho Power system loads did not reach levels to justify the need to pay the variable incentive to customers. The split incentive enables Idaho Power to value the demand reduction against the cost of purchased power for specific periods of need. Program wrap up, including program evaluation and planning for the next program year, occurs after the curtailment season ends.

Overall Process Findings

Key overall program process findings are listed below.

- Program staff and agricultural representatives were consistent in their descriptions of program processes, indicating that the program has thoroughly communicated program operation to all parties involved. One interviewee noted that one program strength is the cohesive relationship among agricultural representatives and program staff and their ability to interact with customers.

- Program processes are effective; however the effectiveness of some processes may be dependent on the skill and knowledge of the person currently conducting the tasks. One interviewee even commented on this risk, noting, “As long as [the Program Manager] is there it would be fine. He makes everything run smoothly.”
    - Recommendation: Ensure new staff have comparable skill sets. As an active part of succession planning, Idaho Power needs to ensure that future program staff apply the same skills, knowledge, and attention to detail.
    - Revisit and update program documentation frequently. The existing program documentation is very good; however, much of the excellence in program delivery relies on the institutional knowledge of a few key staff. Program documentation should capture as much institutional knowledge as possible. While this will never fully replace the knowledge of staff, it can be useful in the event of long or unforeseen staff absences (e.g. illness or injury).
- Half the interviewees reported the timing of the IPUC approval was difficult to navigate in 2011 because the program changes must be approved by the IPUC. Any unforeseen delays in this process can impact the program’s ability to deploy the program in a timely manner. Interviewees understood that the approval process was necessary but would have liked more time to conduct outreach, enrollment, and equipment installation activities.
    - Recommendation: Unless program changes are critical for operations, take a full year to submit changes to stakeholders and the IPUC for approval.

Marketing and Customer Outreach

The program team conducts a series of marketing and outreach activities during the early part of the year to raise awareness of the program, answer questions, and enroll customers. These activities are comprised of written communications and in-person meetings.

Prepared Marketing Materials

Idaho Power has produced collateral material for the Irrigation Peak Rewards Program. The program brochure is updated and printed each year. In addition, Idaho Power has program information on its web site, including an electronic version of the brochure as well as links to the contract and Schedule 23 (the governing tariff for the program), and contact information for the agricultural representatives for the program.

Enrollment Outreach

Initial direct marketing to enroll agricultural customers is conducted via a mailing that Idaho Power sends to all potential agricultural customers to provide information on the program and enrollment materials. The mailing contains a letter to the customer and an enrollment worksheet that lists all the customer’s irrigation service points. The letter describes the program and the application process. If a customer previously participated, the letter reminds them of their participation and includes a summary of their 2010 incentives.

While these activities are usually implemented as early as possible to allow for enrollment and equipment installation, the timing of IPUC approval created a tight timeline for the program to develop materials, conduct meetings, enroll participants and install equipment.

The program team also creates an informational brochure with the Idaho Power corporate communications department. The brochure update process is also dependent on the IPUC review of program changes. Program staff update the program brochure to the best of their ability pending the IPUC ruling on program changes. Once the IPUC approves program changes, the program team completes the update of the marketing collateral. The 2011 updates were made through an iterative review process with final sign off from the department head. Agricultural representatives and other staff distributed the brochures at meetings and other industry events such as agricultural trade shows.

Workshops

During early spring, the agricultural representatives host meetings for customers within their territory on a variety of agricultural programs and topics. The Irrigation Peak Rewards program staff travels to these meetings to present the program structure, incentives and the enrollment process. These meetings provide the customers an opportunity to ask questions and review participation options.

Marketing and Outreach Findings

Key findings related the outreach process are highlighted below:

- The workshops are a very effective way to communicate to agricultural customers about the program. The interactive nature of the outreach effort allows for effective communication between program staff and targeted customers. They are also useful for communicating last minute program changes.
    - Recommendation: One interviewee recommended that a technical person who is familiar with the load control devices be present at the spring agricultural customer workshops. The technical person could answer specific questions about the systems and how the equipment might affect the customers' irrigation process. This would help manage the customers' expectations regarding equipment installation and operation.
- As mentioned, half the interviewees noted that the timing of the IPUC decision made it hard to conduct marketing and outreach activities in a timely manner. Interviewees cited problems deploying information and short timelines to enroll customers and install equipment as needed. Program growth will likely exacerbate the problems with short lead times.
    - Recommendation: Unless program changes are critical for operations, take a full year to submit changes to stakeholders and the IPUC for approval. This would allow program staff to fully inform customers of any program changes prior to enrolling in the program and would not compromise timelines.
- The marketing materials available to the public are consistent with interviewees understanding of the program. The marketing materials are well written and clear.
    - Recommendation: while communication can always be improved, the program marketing materials and supporting documents are well written and consistent. Idaho Power staff have done an excellent job of communicating program details to all stakeholders. The program should continue to give communication a high level of attention to maintain this level of understanding.

Data System and Reporting (CIS information integration)

Program and customer information originates from three main locations: the Customer Information System (CIS+), CLRIS, and M2M's load control system.

- The CIS+ is Idaho Power's billing system which stores information on active service locations. Data includes customer names, contact information, and other billing information.
- CLRIS is a web-based database that pulls information from CIS+ and houses additional customer information to support Idaho Power's DSM programs. The web-based system accesses data from CIS+ and also allows users to upload and post documents, track program participation and conduct program-related calculations.
- M2M's web-based system controls devices, directs the load control events and tracks event data for each pump (and corresponding device) in the program.

Each data system is used for different purposes throughout the program. The high level data processes for the 2011 program are shown in Figure 4.

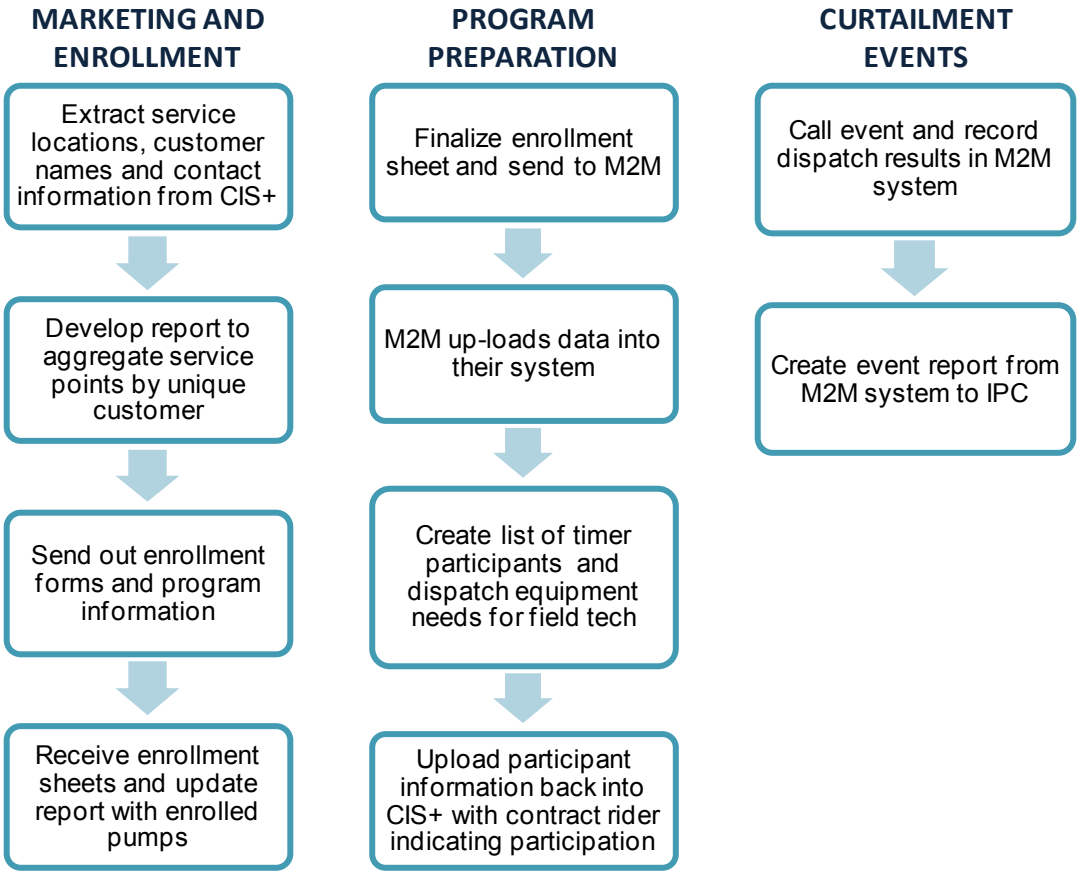
The CIS+ and CLRIS systems do not report information in the exact form needed by program staff. Thus, a contractor creates custom reports as an intermediary step necessary to create specialized reports from raw CIS+ extracts. The reports aggregate service points under unique customer names to ensure each customer receives only one program notification with all service points listed.

The customer completes customized enrollment forms by hand and mails them back to Idaho Power. When program staff receive the enrollment notification forms, a staff member enters the information into a spreadsheet and double-checks the entry. Program staff then sends the final participant list to M2M as well as pushes information back to CIS+, which initiates an automated process to attach a rider to the customers' billing information noting program participation and trigger the incentive payments.

Though 2011 did not have any events, information on events is typically recorded within M2M's system. After the conclusion of an event, M2M provides Idaho Power a report that summarizes event details. This information is used to provide initial feedback on the curtailment event as well as indicate opt outs or if any equipment failures had occurred.

Participation and load drop are verified by using Idaho Power's total system load data. More detailed evaluation is done using internal meters and M2M equipment logs.

Figure 4. Data Systems and Processes



Data System and Reporting Findings

Key findings related to data systems and reporting include:

- Program staff noted that M2M event reports do not always contain all information needed in the first version and reports are sometimes generated in iterations to access the right information. Multiple requests consume unnecessary time for both M2M and program staff.
    - Recommendation: Before the curtailment season begins, program and contractor staff should identify necessary indicators and statistics required by Idaho Power after an event. The report format and the timelines should also be discussed and clearly defined. This report can then be produced after each event and cut down on iterations and additional information requests.
- Enrollment is a manual process. Agricultural customers enroll via a paper form and data is then manually entered back into a report. This process, while manual, seems to work for the program currently. However, if the program grows in size, an automated enrollment system should be developed to manage the service point enrollment. This would increase efficiency and likely improve the quality control process.
    - Recommendation: The program resource currently exceeds 10 percent of system load, which by industry standards could be considered mature. Idaho Power should forecast future program growth potential and assess the need and/or feasibility of automating all or part the enrollment process

Equipment Installation and Operation

Once customers enroll their pumps in the program, Idaho Power assesses program equipment needs for any new service points enrolled or revisits existing program participants to repair hardware or adjust equipment settings. The timer and dispatch options have different equipment requirements, which are detailed below.

Timer Option

Idaho Power uses electronic timers manufactured by Grasslin Controls Corporation to turn off power to customers' pumps during the specified interruption period (e.g. 4-8 p.m.) on the selected number of days. Idaho Power sends staff to check and program all timer devices currently participating in the timer option before June 15. Only 5 percent of service points (128 in total) participated in the timer option in 2011. Customers experiencing problems with their timer devices contact the program staff or their customer service representative.

Equipment installed for the dispatch option can also be utilized in the timer option. If an agricultural customer has previously participated in the dispatch option and wishes to participate in the timer option, no new equipment need be installed.

Dispatch Option

Nearly 95 percent of participants were enrolled in the dispatch option in 2011 (2,214 service points). M2M is the equipment provider for most of the service points controlled under the dispatch option. Idaho Power selected M2M in 2009 because they offered the best equipment for the lowest price compared to similar providers at the time. Currently, Idaho Power buys the equipment from M2M and pays to have it installed on Idaho Power customers' pump panels. M2M provides installation and equipment maintenance service for Idaho Power.

In 2010, Idaho Power chose 16 service locations to test their existing AMI system using Aclara load control devices to control smaller pumps. Only locations where the customer chose dispatch Option 1, were on a feeder that supports Idaho Power's AMI, and were smaller (under 50 hp) were selected. Currently, Aclara does not manufacture a 480 volt device. Idaho Power contracts with local electricians to install the 240 volt device along with a transformer at these service points. In 2011, 57 service points were controlled using this equipment configuration.

A web-to-wireless remote control system, developed by M2M, utilizes the Loadstar® Model M101 control device installed in the customer's pump motor control circuit to turn off or prevent the pump from running during an interruption event. This equipment utilizes remote cellular communication or remote satellite communication. The web service allows Idaho Power to dispatch interruption events on the days determined to be system peak days. Two-way communication from the device provides the feedback used by Idaho Power to determine the status of the customers' equipment surrounding an interruption event. Customers receive a detailed user's guide and also have the option of using the equipment for their own management purposes outside of interruption events (dispatch option 2).

Idaho Power organizes participants into different dispatch groups using M2M's system. The dispatch groups are set up geographically and by control window (e.g. 4-8 p.m.). The program team takes special care to examine the natural aggregation of pumps to ensure owners of multiple pumps or pumps belonging to the same irrigation districts are placed in the same dispatch group. The 2011 dispatch groups were distributed among four time slots: 2-6 p.m., 3-7 p.m., 4-8 p.m., and 5-9 p.m.

Previous to the 2011 program, Idaho Power did not plan to significantly expand the program and did not order additional devices. The regulatory process dictated that Idaho Power continue to keep the program open to all irrigation customers. Several additional service points enrolled and Idaho Power and its equipment subcontractors had to manufacture and install additional devices on substantially reduced deadlines.

Previous Equipment Issues

In 2009, the dispatch load control system experienced a number of issues that affected Idaho Power's ability to fully realize its load-shedding potential. The program traced the problems to the satellite company that was used for devices that could not operate on a cellular signal. The program also identified problems with some of the cellular modems when approximately a quarter of the devices did not communicate properly. These problems were resolved by reprogramming cellular devices, adding antennas, and/or switching the satellite service provider. As of 2011, these issues appear to have been largely resolved.

Equipment Installation and Operation Findings

- The dispatch and timer equipment appear to be working well and problems with satellite and cell communication in 2009 appear to have been addressed. This indicates a useful flexibility among participants to adjust the system to fix problems that were noted in previous years.
    - Recommendation: Although the equipment appears to be working, prior to the 2012 control season Idaho Power and its contractors should perform a more thorough testing of the system since no events were called during the 2011 season. Additionally in subsequent years, Idaho Power should consider calling a minimum number of events to identify any equipment issues.
- There was no evidence of miscommunication or problems with the equipment installation and maintenance process. The chain of command to initiate an equipment maintenance case is long but the cases appear to get assigned to a contractor and addressed in a timely fashion.
    - Recommendations: If any significant program changes are made, care should be taken not to upset this process. Program staff should ensure adequate lead time to program timers and install and fix devices before the program start date.
- Agricultural installations have more varied and unique problems than in other demand response applications (e.g. farm animals damaging equipment, electrical storms).
    - Recommendations: Because of this, speed and flexibility are required to respond to untimely equipment failures. The processes as they exist do enable timely customer response. Any contract changes as well as processes created to maintain and repair equipment should continue to recognize and accommodate this unique need.

- As noted, half the interviewees reported the timing of the IPUC approval was difficult to navigate. Because the program operates year to year, program changes must be approved by the IPUC. The process is normally predictable however; any unforeseen delays in this process can impact the program's ability to deploy the program — including manufacture and install equipment — in a timely manner. Interviewees understood that the approval process was necessary but would like more time to conduct outreach, enrollment, and equipment installation activities.
    - Recommendation: Unless program changes are critical for operations, take a full year to submit changes to stakeholders and the IPUC for approval.

Load Curtailment Process

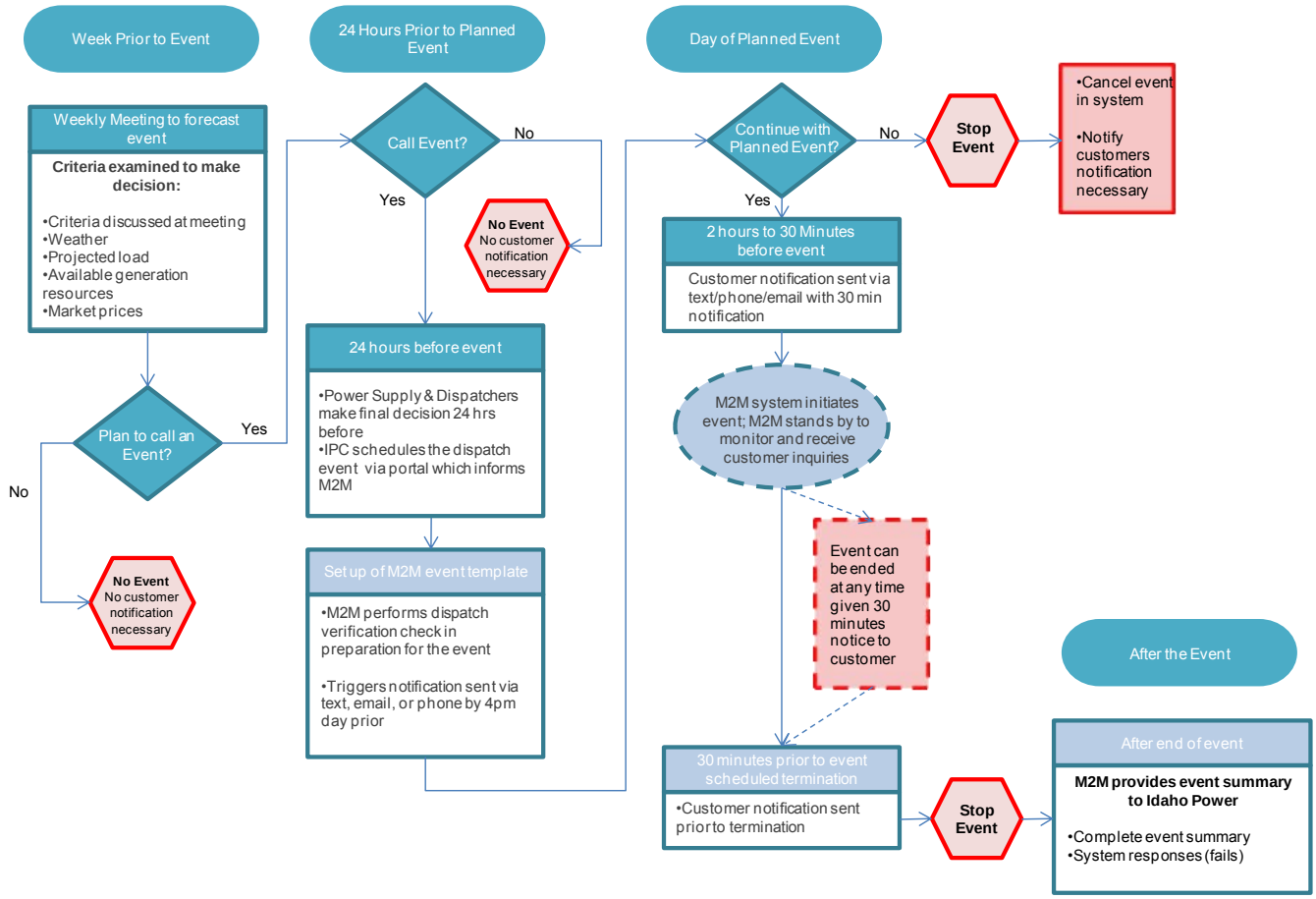
The process of calling load curtailment events is a multi-step process that involved multiple Idaho Power staff from different departments. Figure 5 details the Irrigation Peak Rewards process for calling load curtailment events.

When the program operation period begins on June 15, a team including representatives from the program, dispatch, generation supply, and load forecasting staff meet every Thursday to review the weather, generation availability and load forecast for the following week. The team discusses whether curtailment events would be needed and on which days they would likely call them. The decision to call events is influenced by expected interplay between weather, demand, market prices, and available generation resources.

Where Idaho Power calls events, the dispatch group fills out a web-based event template in M2M's system. M2M completes event preparation to check communication and ensure the service desk is aware of scheduled events to handle any incoming support calls related to the curtailment event. The M2M system then sends out messages the day before an event to notify customers. Customers receive notifications via text, email or phone. M2M Communication's system automatically sends out the event notification messages to customers and allows up to ten contact addresses (email or phone numbers) per customer. The messages are recorded; and the system records the result of the call (e.g. whether a person or voice messaging system answered). Follow up calls are sent to participants again 30 minutes prior to the event.

Once the event is in progress, the team (both Idaho Power and M2M) monitors the event through M2M Communications' system. The system sends out a notification 30 minutes prior to the conclusion of the event to notify participants. Some participants need to deploy personnel to pumps as they come back on line and the notifications help them plan for this.

Figure 5. Single Load Curtailment Event Process



Cancelling Events

The program can cancel events prior to or during an event. If an event is cancelled prior to commencement, the system sends notification messages to participants explaining the event cancellation. If the team needs to cancel the event after it has already started, the cancellation notification is sent out with a lead time of 30 minutes before the system switches devices back on. The lead time allows participants to make arrangements for systems coming back online. Program staff noted that ending during an event is likely to be a rare occurrence.

Load Curtailment Process Findings

- The process for deciding whether to call a curtailment event is collaborative and appears to involve the correct stakeholders/departments at Idaho Power Company. Interviewees involved in this process noted that, after honing the process over the past two years, they are satisfied with the process and the system appears to be effective for involved parties.

- Two interviewees noted that different viewpoints emerge when deciding to call events. There is a tension between maintaining customer satisfaction and addressing company needs. It appears the different point-of-views balance how many events are called as well as balances both Idaho Power and customer interests. One interviewee noted that resolving this tension might make meetings and discussions more streamlined.

    - Recommendation: The creative tension created by the differing points of view positively balances customer and company interests. The balance of interests is important to preserve if Idaho Power implements policy guidance aimed at reducing the creative tension.

- The program as designed relies heavily on a highly specialized third party service provider. Reliance on a single source introduces risk to the programs long term program success.
    - Recommendation: While, there are few options for service providers, Idaho Power should recognize and mitigate this risk through investing time and effort into the existing relationship. In the course of this evaluation, the contractual relationships were not examined. Risks introduced by single provider relationships can be minimized by investing time and effort in strengthening the partnership. Idaho Power can achieve this by clearly documenting contract performance expectations, clearly identifying lines of communication (company to company as well as priorities for responding to agricultural customer trouble calls) and relationship management for day to day operations.
    - Recommendation: Continue to investigate using existing AMI resources as a part of the program delivery. The two approaches can be complimentary and reduce risks such as: communication failures, company shutdowns or contractual disagreements, associated with a single delivery channel for the program.

Customer Incentives

The Irrigation Peak Rewards program pays a fixed incentive for enrolling in the program and a variable incentive for each curtailment event for participants in the dispatch option. The timer options offered a demand credit and energy credit for the one, two, or three day options. Program incentive options are summarized in Table 3.

A customer's fixed incentive appears as a bill credit — the sum of the demand and energy credit — in the customer's June, July, and August utility bill. The demand credit is calculated by multiplying the monthly billing kW by the demand-related incentive amount for the interruption option selected by the customer. The energy credit is calculated by multiplying the monthly billing kWh usage by the energy-related incentive amount for the interruption option selected by the customer. If curtailment events had been called, a separate check would have been issued to participants for all curtailment events at the end of the season for the event-based variable incentive.

Table 3. 2011 Program Incentive Options

Option	Demand Credit ($ per billing kW)	Energy Credit ($ per billing kWh)
Dispatch		
Fixed Incentive	$5.00	$0.019
Variable Event Incentive (4 hours between 1-8PM)		$0.159
Variable Event Incentive (4 hours between 1-9PM)		$0.209
Timer		
One day	$3.15	
Two Day	$4.65	$0.002
Three Day	$4.65	$0.007

All customer participation incentives for the Timer or Dispatch options were calculated using Idaho Power meter billing data. Idaho Power's Customer Information System (CIS) calculates the bill credits and applies them to customer bills. Installation and opt-out fees are done as manual adjustments in CIS. Incentives for service points

classified as Large Service Locations were completed through calculations in CLRIS using interval meter data. However, staff manually inspects the calculations to ensure meter multipliers or other inputs were correct.

Findings

- IPC staff thought customers understood incentives; results from the participant survey confirm that participants seem to have a thorough understanding of the program benefit and cost to their agricultural operation.
- IPC staff likes the new incentive structure but some noted including events in the fixed cost portion of the incentive would provide more program flexibility. In this scenario, IPC would pay variable incentives only after the events in the fixed costs have been used. Idaho Power is currently considering adding some events within the fixed costs for future program cycles. Participant feedback indicated that a majority of participants (94 percent) were either likely or highly likely to continue enrolling in the program if Idaho Power always called three to four events per season.
- A majority of staff interviewees thought the incentives were the strongest aspect of the program. Participants also confirmed this sentiment, as 86 percent of respondents said they participated in the program due to the incentive. The 2011 program incentive changes did not negatively affect the program as the program grew in size and nearly all surveyed participants would recommend the program to another agricultural customer.

Customer and Program Support

Customer Support

Contact information for both program staff and agricultural representatives were included in program outreach materials. When customers had questions, they generally contacted their agricultural representative. Emergencies or detailed program questions were sometimes routed directly to program staff. Agricultural representatives were able to field the majority of questions but did need to pass some questions on to the correct program staff.

M2M managed equipment related requests or problems. Troubleshooting calls came from three main sources: program staff, agricultural representatives, or customer calls direct to M2M's service desk. Requests coming through the program or representatives were passed directly to M2M, who then routed the request to appropriate field staff. M2M maintained a field operations database and once a case was created, the system assigned it to a particular contractor (organized by region). If the case was high priority, M2M made a phone call to the manager of service crew and dispatched someone to go directly to the customer.

Opting Out

Customers could change program participation options prior to June 15. Options to add a service point were limited to whether an electrician could install a device on the pump. If a customer wanted to terminate their enrollment for the season at a service point before June 15, there was no fee. However, if the termination occurred after June 15 there was a $100 penalty fee for timer option participants and a $500 penalty fee for dispatch option participants. Additional fees were assessed if the program installed a device that was never used for the program to cover the equipment installation fee. For the program year 2011, only two sites terminated enrollment and were charged the penalty fee. One additional participant terminated participation after the June 15 deadline, but the error belonged to Idaho Power and the customer was not charged. There were an additional 15 sites prior to the June 15 deadline where participants decided not to participate after they had signed up. In these instances, no fee was charged, either because this was not their first year participating, or because a device had not been installed and therefore Idaho Power did not incur installations costs.

Dispatch participants were also allowed to opt out of events. The program assessed a fee of $1.00 per kW per event based on the current months billing kW. Because no events occurred in 2011, the program did not assess any event opt-out fees.

Customer and Program Support Findings

- Feedback on the support and competency of the program staff was generally enthusiastic and positive. All interviewees felt program staff was organized, knowledgeable, and supportive in implementing the program and answering questions. One interviewee noted “They are supportive. [The program staff] are all over it if there is a question we need answered. There is nobody quite like [them] when it comes to understanding how all this comes together.” Another interviewee observed, “Their knowledge and understanding is good [as well as their] ability to speak to a crowd [at the regional workshops].”

6. Key Observations and Recommendations

Idaho Power's Irrigation Peak Rewards Program is a well run program that consistently delivers on its intended objective of securing load reduction resources to be used during summer peak times.

There are several key strengths of the program:

- The program operates with a consistent program delivery framework. There is an established and well documented routine to the program. This results in multiple benefits, including consistent messaging to customers, coordination ease among vendors and program staff, and smooth delivery between customer representatives and program staff.
- Because of the consistent framework, internal stakeholders and third party vendors responsible for program delivery have a clear and consistent understanding of the program and how it operates. Everyone is aligned on the program purpose and intent which is key for efficient program delivery.
- The program staff responsible for delivering the program are knowledgeable and generally well respected by parties delivering the program. The program delivery staff members were recognized by all interviewees as very knowledgeable about the program and the industry. There is a high level of trust and respect for the staff.
- Internal stakeholders and third party implementers agree the incentive is clearly a program strength. This is reinforced by the results of the customer survey. The agricultural customers appreciate the incentive and specifically value how it reduces their operating costs.

There are also some program limitations:

- The manual process for creating the enrollment forms as well as updating Idaho Power's database currently works well to capture the changing ownership as well as crop rotations that make participating in the program. However, this process is not scalable and is highly dependent on the knowledge of the staff involved in the program.
- Many elements of the program depend on staff knowledge. The program implementation manual does a good job of documenting the programs processes; however, there is still a great deal of implementation that relies on the institutional knowledge of internal program staff.
- Historically program changes have been made almost every year. The timeframe to identify program adjustments, inform stakeholders and seek IPUC approval between curtailment seasons is insufficient.

Recommendations

The following are ways Idaho Power can preserve program strengths:

- Revisit and update program documentation frequently. The existing program documentation is very good; however, much of the excellence in program delivery relies on the institutional knowledge of a few key staff. Program documentation should capture as much institutional knowledge as possible. While this will never fully replace the knowledge of staff it can be useful in the event of long or unforeseen staff absences (e.g. maternity leave, military leave or injury)
- Ensure any new staff has comparable skill sets in the event personnel ever change. As an active part of succession planning, Idaho Power needs to ensure the future program staff applies the same skills, knowledge, and attention to detail.
- Take care not to upset the process for initiating and assigning trouble calls if any significant program changes are made. Ensure adequate lead time to program timers and install and fix devices before program start date.

- While communication can always be improved, the program marketing materials and supporting documents are well written and consistent. Idaho Power staff have done an excellent job of communicating program details to all stakeholders. The program should continue to give communication a high level of attention to maintain this level of understanding.

Idaho Power can reduce limiting factors in the following way:

- The program resource currently exceeds 10 percent of system load which by industry standards could be considered mature. Idaho Power should forecast future program growth potential and assess the need and/or feasibility of automating all or part the enrollment process
- Unless program changes are critical for operations, take a full year to submit changes to stakeholders and the IPUC for approval. This would allow program staff to fully inform customers of any program changes prior to enrolling in the program and would not compromise timelines.

PECI staff noted several recommendations that may help Idaho Power's program delivery in 2012. These items of note represented neither strengths nor limiting factors.

- Although the equipment appears to be working and previous communications have been addressed, prior to the 2012 control season, Idaho Power and its contractors should perform a thorough testing of the system since no events were called during the 2011 season. Additionally, in subsequent years, Idaho Power should consider calling a minimum number of events to identify any equipment issues and keep the process fresh in the minds of the agricultural customers participating in the program.
- One interviewee recommended that a technical person who is familiar with the load control devices be present at the spring agricultural customer workshops. The technical person could answer specific questions about the systems and how the equipment might affect the customers' irrigation process. This would help manage the customers' expectations regarding equipment installation and operation.
- The decision making process for calling curtailments is a collaborative process and the creative tension created by the differing points of view positively balances customer and company interests. The balance of interests is important to preserve if Idaho Power implements policy guidance aimed at reducing the creative tension. Adding a financial element to curtailment events enhances the decision making without impairing the collaborative process.

Idaho Power has a strong and knowledgeable third party vendor contracted to implement this program. Their experience and knowledge are valuable to continued program success. PECI staff noted several recommendations regarding this relationship.

- Idaho Power relies on its vendor to provide event performance data immediately following curtailment events. Prior to the start of the curtailment season, program and contractor staff should identify necessary indicators and statistics required by Idaho Power after an event. The report format and the timelines should also be discussed and clearly defined. This report can then be quickly produced after each event, reducing iterative report and additional information requests.
- Because agricultural installations have more varied and unique problems than in other DR applications (e.g. farm animals damaging equipment, electrical storms), speed and flexibility are required to respond to equipment failures. The processes as they exist do enable timely customer response. Any contract changes as well as processes created to maintain and repair equipment should continue to recognize and accommodate this unique need.

- There are risks associated with having a single vendor deliver a program. While, there are few options for service providers, Idaho Power should recognize and mitigate this risk through investing time and effort into the existing relationship. In the course of the evaluation, the contractual relationships were not examined, however, Idaho Power should clearly document contract performance expectations, lines of communication (company to company as well as priorities for responding to agricultural customer trouble calls) and vendor relationship management.
- Idaho Power should also continue to investigate using existing AMI resources as a part of the program delivery. The two approaches can be complimentary and reduce the risks associated with a single delivery channel for the program such as: communication failures, company shutdowns or contractual disagreements.

Appendix A: Interview Guide

The staff interview guide included questions on a variety of topics. However, we did not ask all questions of each interviewee. For example, customer agricultural representatives spoke more to marketing and customer outreach while system operator staff spoke more to curtailment event processes.

Staff Interview Questions

Communication and Organizational Structure

1. Can you briefly describe your role or relationship with the Irrigation Peak Rewards Program?
2. How frequently do you communicate with the program managers about program related topics? Is this by emails, meetings, phone calls, etc.?
3. Do you receive sufficient support from the program staff to meet the needs of your customers? (Or vice versa, do program staff receive clear communication from outreach/account management staff?)

Marketing and Customer Outreach

4. Do you speak directly with customers/participants? If so, when do customers contact you?
5. If they have a question about the Peak Rewards program how do you address it?
6. In your experience, what program aspects are customers interested or satisfied with?
7. What kind of feedback, questions or issues have you received regarding the Peak Rewards Program?
    a. If there were issues, how did you resolve the issues?
8. Do you ever go on customer site visits? When someone is doing program work at the site do you have specific communication or site visit requirements? Do you accompany the equipment installer to the site when they are installing or uninstalling a load control device?
9. What marketing and enrollment activities are you involved with? (to the target customers) How are customers enrolled?
10. Any plans to change the way the program notifies them about the program or spread the word?

Incentive Structure

11. From your point of view, how is the new incentive structure working out?
12. Do participants seem to understand the structure?
13. Have you received any feedback on the new incentive structure? If so, what was the feedback.

Database & Tracking (CIS information integration)

14. How about record keeping and reporting? Can you describe what your record keeping and reporting requirements are regarding your interactions with customers for the Peak Rewards program?

Load Curtailment Process (Pre, during and post)

15. How are customers notified of an event?
16. What happens on the day of an event to trigger the different types of participant load reduction?
17. At the end of the event, what is the sequence of events to notify participants or turn pumps back on?
18. What happens at the end of the curtailment season? Is there any follow up with participants?
19. How does the decision to call an event work?

   a. Do you find this process satisfactory?
20. [For System Operators] Are you able to detect a decrease in load when the events are called? Is the program a reliable source of load reduction?

Equipment Installation

21. How does the equipment installation process work? What is the standard routine?
22. How long does it take at each site?
23. Does it require time from the participant to accompany you to different pumps?
24. How often do you have to head out to the site after installation to fix devices or complete other equipment adjustments?
25. What issues do you usually run into with equipment? How were these issues resolved?
26. What is the lead time for new device order?
27. Have previous cell and satellite coverage issues been resolved?
28. How do you trouble shoot equipment problems (communication chain with IPC)?
29. How easy is it to make communication changes?
30. How does event cancelation work?
31. What if any constraints are there in the system design? For example, if IPC did _____ with the program it would be hard to accommodate.
32. What issues do you run into with this program? Do they differ by region?

Closing

33. What would you say are the program's strongest points?
34. What are its weakest points?
35. Other than what we've discussed above, what would you change about the program?

2010 - 2011 Irrigation Peak Rewards Program Report

December 31, 2011

Idaho Power 2011

Table of Contents

Table of Contents i
List of Tables ii
List of Figures iii
Executive Summary 1
Summary of Program Results 2
Program Details 2
Timer Option 2
Dispatch Option 3
Program Incentives 4
Program Opt-out 5
Review of Program Results 5
Participation 5
Operations 10
Equipment and Monitoring 10
Timer Option 10
Dispatch Option 10
Program Analysis 11
Load Reduction Analysis 11
Load Research Analysis—Timer Option 11
Load Research Analysis—Large Service Option 13
Load Research Analysis—Automatic Dispatch Option 14
M2M Communications Device Analysis—Automatic Dispatch Option 16
Substation Data Analysis 17
System Load Data Analysis 18
Load Reduction Achieved 20
Cost-Effectiveness 23
Program Costs 23

Benefit-Cost Analysis 24
Conclusions.....25

List of Tables

Table 1. Timer incentives.....4
Table 2. Dispatch incentives. 4
Table 3. 2010 Service point enrollment by area. 9
Table 4. 2011 Service point enrollment by area.. 8
Table 5. 2010 Service point distribution by area and program option.....9
Table 6. 2011 Service point distribution by area and program option.....9
Table 7. Realization rates by period for Timer Option participants 12
Table 8. Communication status of automatic devices during dispatch events.....17
Table 9. Enrolled billing demand by region (kW) 2010. 21
Table 10. Enrolled billing demand by region (kW) 2011. 21
Table 11. Realization rates used for program options. 22
Table 12. Total program daily MW reduction using realization rates for 2010. 23
Table 13. Total program daily MW reduction using realization rates for 2011. 23
Table 14. Annual program costs 2010. 24
Table 15. Annual program costs 2011. 24
Table 16. Benefit-cost model inputs 2010. 25
Table 17. Benefit-cost model inputs 2011. 25

List of Figures

Figure 1. Idaho Power service areas. 6

Figure 2. Distribution of participants 2010. 7

Figure 3. Distribution of participants 2011. 7

Figure 4. Average metered demand (kW) Timer Option in 2010. 12

Figure 5. Average metered demand (kW) Manual Dispatch Option in 2010 13

Figure 6. Average metered demand (kW) Manual Dispatch Option in 2011 14

Figure 7. Average metered demand (kW) Dispatch Option for 2010. 15

Figure 8. Average metered demand (kW) Dispatch Option for 2011. 16

Figure 9. Load data from a particular substation in the Eastern area on July 16. 18

Figure 10. Demand response impact on Idaho Power system load July 16. 19

Figure 11. Demand response program impacts on system load in 2010 20

This page left blank intentionally.

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 is designed to reduce peak load by turning off participating irrigation pumps during peak demand hours through the irrigation season in return for a financial incentive. Through this program, Idaho Power has been successful in reducing load during the summer afternoon hours, which are the hours that are driving Idaho Power's need for new power supply resources.

A major change in the demand response program occurred in 2009. This change expanded the dispatch capability of Idaho Power to reduce system demand during critical summer peak load events. The Irrigation Peak Rewards program, originally identified as a resource in 2004, was transitioned to act primarily as a direct load control or dispatch program. The Irrigation Peak Rewards program, which included the dispatch demand response option, was filed with the IPUC on November 10, 2008, and approved by the IPUC on January 14, 2009. The program was approved in Oregon by the Public Utility Commission of Oregon (OPUC) on February 25, 2009. In prior years, demand reduction through the program was controlled only with pre-programmed timers that provided demand reduction from irrigation pumping systems from 4:00 p.m. to 8:00 p.m. on weekdays in June, July, and August. Options added to the program in 2009 allowed direct load control or dispatch capabilities to match demand response resources with actual system peaks. The change in the program has increased the programs peaking resource capacity from its previous range of approximately 40 megawatts (MW) to 320 MW's in 2011. This report provides a review of the program's performance and operational results for 2010 and 2011, and is a supplement to the 2011 DSM Annual Report.

Following the 2010 program season, Idaho Power met with the Idaho Irrigation Pumpers Association (IIPA) participants and Commission staff, to propose changes to the program that would better align the program with the needs of the company. The changes included having an incentive structure that included a 'Fixed' and 'Variable' payment, extending the program hours to 9 PM with increased incentive for participation in this extended hour, and changing the opt out penalty per event making it easier for participants to understand the cost to opt out. The redesigned Irrigation Peak Rewards program was introduced at the October 26, 2010, Energy Efficiency Advisory Group (EEAG) meeting. Members of EEAG represent a cross-section of customer interests, including residential, industrial, commercial, and agricultural. IPUC staff are also members of the EEAG. Based on the success of the current Irrigation Peak Rewards program and the potential for substantially increased cost-effective, peak-demand reduction, the EEAG recommended that Idaho Power make the changes to the program. Idaho Power filed an application requesting approval of these changes to the program December 10, 2010 and were approved by the IPUC March 9, 2011. The program changes were approved by the OPUC on March 22, 2011. Idaho Power offered the revised program to all agricultural customers receiving service under Irrigation Rate Schedule 24 in both 2010 and 2011.

Throughout 2011, Idaho Power continued to share program information and progress with EEAG members through program updates. Details on the approved Irrigation Peak Rewards program changes are listed as part of Case No. IPC-E-10-46 on the IPUC Web site and as Advice No. 11-01 on the OPUC website, and are identified as Schedule 23 in both Idaho and Oregon.

Summary of Program Results

The following items summarize the key results of the program on a system-wide basis:

- In 2010, the program achieved a maximum peak load reduction of 249.7 MW and in 2011 had an estimated 320 MW maximum peak load reduction potential.
- Five hundred eight (508) customers, or 7.8% of the 6,521 eligible customers, chose to participate in the program in 2010. Five hundred forty seven (547) customers, or 8.5% of the 6,417 eligible customers, chose to participate in 2011.
- Two thousand thirty eight (2,038) or 11.3% of the eligible metered service points were enrolled in the program in 2010. Two thousand three hundred forty two (2,342) or 12.9% of the eligible metered service points were enrolled in 2011.
- Of the 2,038 enrolled service points for 2010, 279 were enrolled in the Timer Option, and 1,759 were enrolled in the Dispatch Option. Of the 2,342 enrolled service points for 2011, 128 were enrolled in the Timer Option, and 2,177 were enrolled in the Dispatch Option.
- The program achieved a total billing demand enrollment of 369,368 kilowatts (kW), of which 43,024 kW were enrolled in the Timer Option and 326,344 kW were enrolled in the Dispatch Option in 2010. The total billing demand enrollment for 2011 was 410,774 kW, of which 20,184 kW were enrolled in the Timer Option and 390,590 kW were enrolled in the Dispatch option.
- The program costs for 2010 were $13,330,826 and for 2011 were $12,086,222.
- Results show a 20-year average Total Resource benefit cost (B/C) ratio of 1.64.

Program Details

Timer Option

The pre-programmed Timer Option, offered previously, was made available to all irrigation customers. Installation fees between $250 and $500 were applied to participating service locations less than 75 Hp.

- Customers could choose to have all irrigation pumps on a single metered service point turned off on one, two, or three weekdays per week.
- Idaho Power determined the specific weekday or weekdays to schedule the interruption of all pumps at each service point.
- Interruptions occurred from 4 p.m. to 8 p.m.

Dispatch Option

The Dispatch Option allowed Idaho Power to initiate load control events that prevented pumps from operating at participating metered service points. Installation fees between $500 and $1,000 applied to participating service points less than 50 Hp. Customers could participate in one of three ways:

- Have a one-way communication device installed that allowed Idaho Power to control all the customer's pumps at a single metered service point.
- Have a two-way communication device installed that allowed both Idaho Power and the customer to control all the pumps at a single service point.
- Service points with multiple pumps and over 1,000 cumulative Hp were eligible to participate as a Large Service Location. Customers under this classification could choose to manually control which pumps were controlled during a load control event. The changes to the program in 2011 required that Large Service Locations nominate the amount of kilowatts (kW) available to dispatch during load control events.

The parameters of the Dispatch Option, which limits the impact on customers, include the following:

- Idaho Power will initiate control (dispatch) events on a customized M2M Communications Web site.
- Dispatch load control events can occur any weekday, excluding July 4, between the hours of 2 p.m. and 8 p.m. Changes to the program in 2011 extended the period in which load control events can occur to between the hours of 1 p.m. and 9 p.m.
- Load control events can 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 will give notice by 4 p.m. the day prior to the initiation of a control event.
- In 2010, if prior notice of a load control event had been sent, Idaho Power could choose to cancel the event by 1:30 p.m. on the scheduled day of the event. Due to the extension of program hours in 2011, notification by Idaho Power to cancel a load control event prior to starting occurs by 12:30 p.m. on the scheduled day of the event.
- Idaho Power gives 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 do not apply for any time Idaho Power interrupts the customer's load for a system emergency or any other time that a customer's service is interrupted by events outside the control of Idaho Power.

Program Incentives

A customer's incentive appears 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 for the interruption option selected by the customer. The energy credit is calculated by multiplying the monthly billing kilowatt-hour (kWh) usage by the energy-related incentive amount for the interruption option selected by the customer. For the June and August bill, the credit is prorated to the 15th of the month. In 2011, the incentive structure changed to include a 'Fixed' and 'Variable' payment, with an increased credit amount for service points that voluntarily participated in the 'Extended' 9 p.m. late interruption period. Incentives offered for 2010 and 2011 are listed in Tables 1 and 2.

Table 1. 2010 Option incentives.

Option	Demand Credit ($ per billing kW)		Energy Credit ($ per billing kWh)
Timer Option Incentives			
One Weekday	$3.15		
Two Weekdays	$4.65	plus	$0.002
Three Weekdays	$4.65	plus	$0.007
Dispatch Option Incentives			
	$4.65	plus	$0.031

Table 2. 2011 Option Incentives.

Dispatchable Interruption Option Incentives

Dispatchable Option	Fixed Incentive Payment			Variable Incentive Payment		
	Demand Credit ($ per billing kilowatt)		Energy Credit ($ per billing kilowatt-hour)	Standard Interruption Variable Energy Credit - 4 hours between 1 - 8 pm ($ per event kilowatt-hour)		Extended Interruption Variable Energy Credit - 4 hours between 1 - 9 pm ($ per event kilowatt-hour)
Options 1,2 and 3	$5.00	and	$0.019	plus $0.159	or	$0.209

Electronic Timer Option Incentives

	Demand Credit ($ per billing kW)		Energy Credit ($ per billing kWh)
Timer Options			
One Weekday	$3.15		
Two Weekdays	$4.65	plus	$0.002
Three Weekdays	$4.65	plus	$0.007

All customer incentives in the Timer or Dispatch options are calculated using Idaho Power metered billing data. Idaho Power's Customer Information System (CIS) calculates the bill credits and applies it to the bill. The change in the incentive structure in 2011 provided for the 'Fixed' portion of the incentive as a bill credit. The 'Variable' portion of the credit is paid to the customer in the form of a check within 45 days of the end of the program season. Installation fees are completed through manual adjustments. Incentives for service points classified as Large Service Locations are calculated using interval meter data and also are paid out in the form of a check.

Program Opt-out

During the 2010 irrigation season, two service point participants in the Timer Option requested to be removed from the program. Both requests occurred after June 15th. Under the program, if a service point is taken out of the Program after June 15th, the participant is assessed a fee. The fee for each service point removed is $100 for the Timer Option and $500 for the Dispatch Option. This resulted in a total of $200, credited to the Energy Efficiency Rider (Rider) funding account to offset the initial program costs.

In 2011, one service point participant in the Timer Option and one service point participant in the Dispatch Option requested removal from the program resulting in $600 in fees being credited back to the Rider. Request from the Timer Option service point participant occurred after June 15th and was assessed a $100 fee. Request for removal of the Dispatch Option service point participant occurred prior to June 15th, however the load control device had already been installed resulting in an assessed fee of $500. One additional Dispatch Option service point participant requested to be removed from the program after June 15th, but the error belonged to Idaho Power and therefore no fee was charged.

Under the rules of the Dispatch Option, participants have the ability to opt-out of dispatch events five times per service point. Each opt-out incurs a fee. In 2010 an opt-out fee was assessed in the amount of $0.005 per kWh based in the current month's billing kWh. In 2011 the opt-out fee was changed to be $1.00 per kW based on the current month's billing demand (kW). The opt-out penalty fee is prorated to correspond with the dates of program operation. Beginning in 2011, Large Service Locations are charged opt-out penalty fees based on the nominated kW that is not turned off during a load control event. During the 2010 irrigation season, 43 services points opted out 54 times. The opt out penalties were also credited to the Rider account. There were no load control events in the 2011 season.

Review of Program Results

Participation

Marketing strategies included presenting the program details at irrigation workshops in both 2010 and 2011 across Idaho Power's service area, and each year Idaho Power staff participated

in four agriculture shows. Program changes were presented, and demonstrations of the program equipment was provided.

In the beginning of each year, customer mailings were sent to all eligible Idaho Power irrigation customers who had pumps at least 30 horsepower in size. This mailing includes a program explanation, a program application, the program's incentive structure, a 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. Additionally, Idaho Power agriculture representatives answer specific customer's questions which help familiarize customers with the new technology and program details.

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.

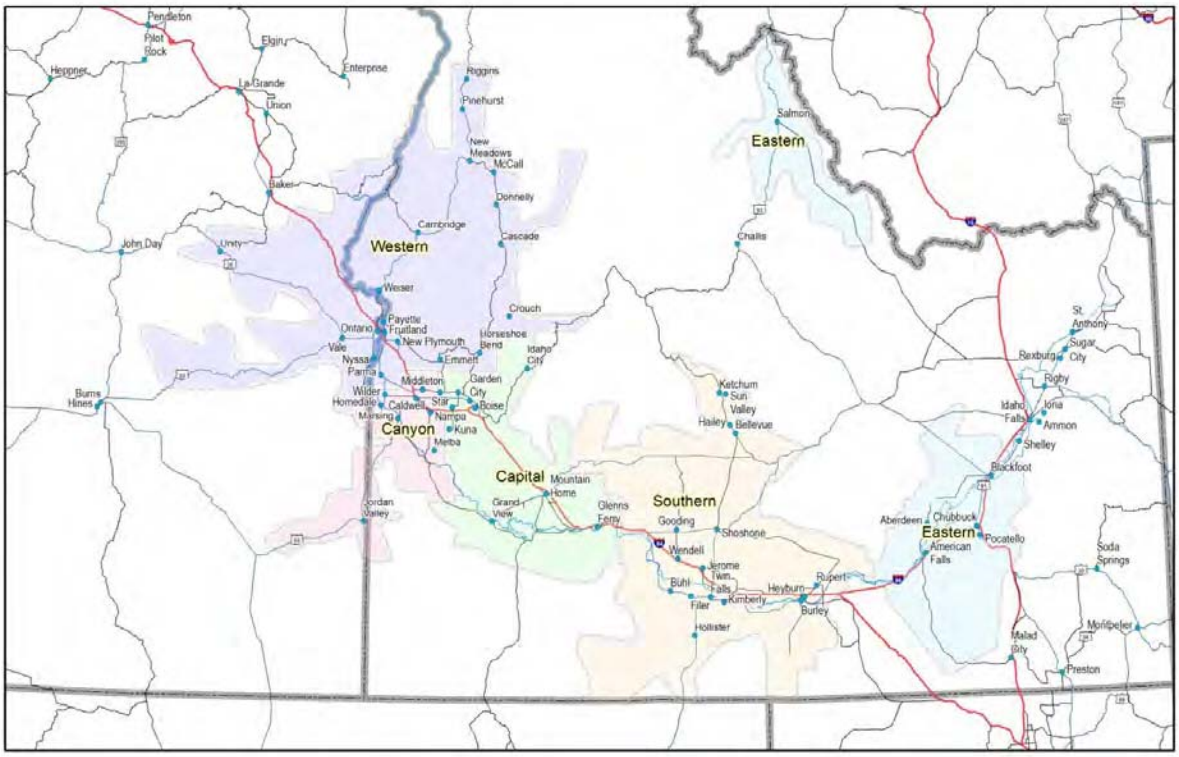


Figure 2 represents the 2,038 irrigation service points that participated in the program in 2010 and their distribution by Idaho Power's regional service areas.

Figure 2. Distribution of participants 2010.

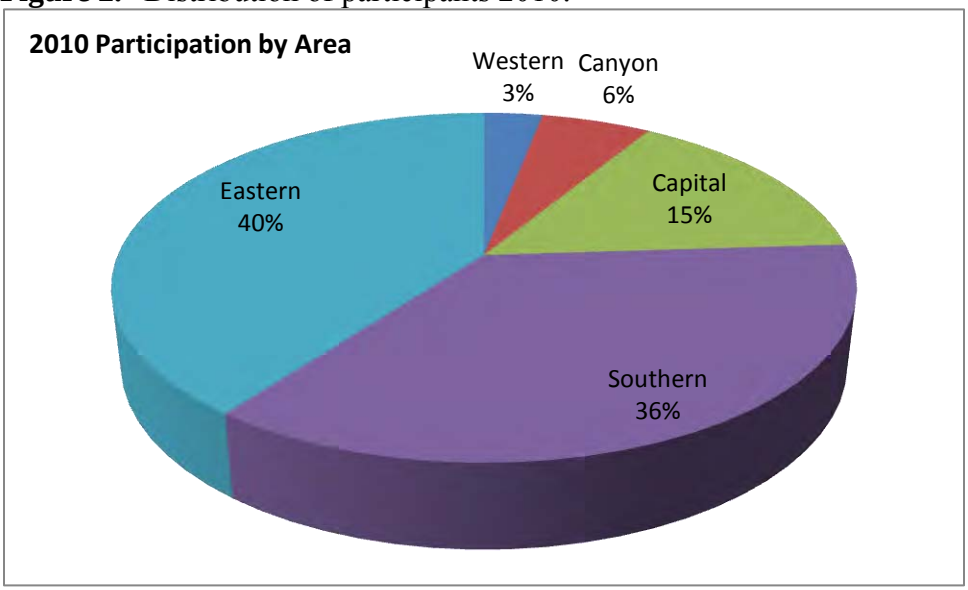
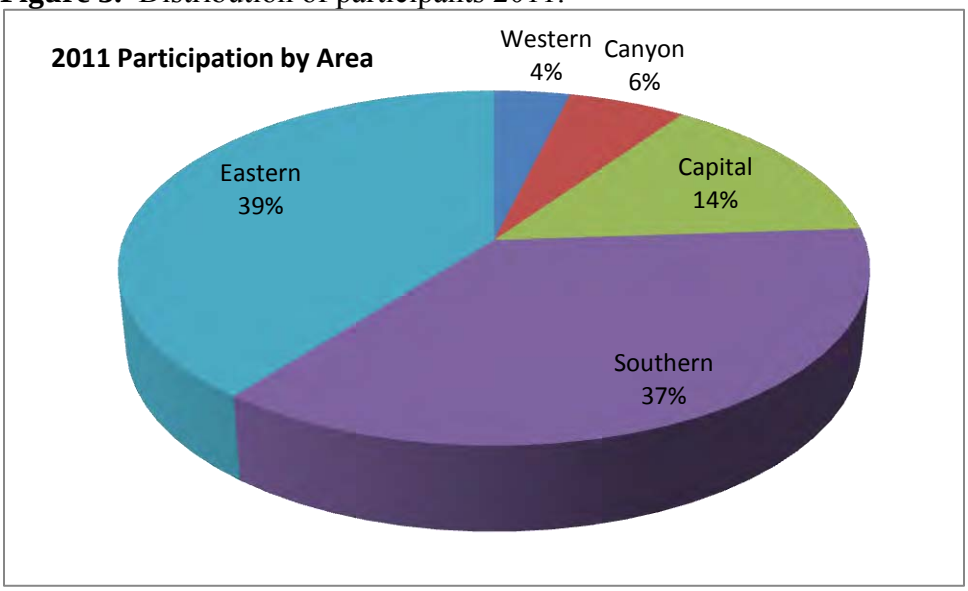


Figure 3 represents the 2,342 irrigation service points that participated in the program in 2011 and their distribution by Idaho Power's regional service areas.

Figure 3. Distribution of participants 2011.



Tables 3 and 4 lists the total number of eligible service points and the participation levels for each area by year. Eligible service points shown in this report represent service points that had been active within the prior year. However, whether a service point was active or not in the past, did not affect a customer's ability to participate in the program.

Table 3. 2010 Service point enrollment by area.

2010-Idaho Power Area		Eligible Service Points	Service Points Enrolled	Dispatch Option	Timer Option	Enrolled Percentage by Area
Western	Idaho	1,810	34	32	2	1.9%
	Oregon	1,511	28	20	8	1.9%
Canyon	Idaho	2,291	111	108	3	4.8%
	Oregon	79	5	3	2	6.3%
Capital		1,612	311	301	10	19.3%
Southern	Twin Falls	5,117	349	314	35	6.8%
	Mini-Cassia	2,262	390	353	37	17.2%
Eastern		3,311	810	628	182	24.5%
	Total Service Points	**17,993**	**2,038**	**1,759**	**279**	**11.3%**

Table 4. 2011 Service point enrollment by area.

2011-Idaho Power Area		Eligible Service Points	Service Points Enrolled	Dispatch Option	Timer Option	Enrolled Percentage by Area
Western	Idaho	1,825	47	46	1	2.6%
	Oregon	1,526	42	36	6	2.8%
Canyon	Idaho	2,317	134	132	2	5.8%
	Oregon	82	4	4		4.9%
Capital		1,619	333	331	2	20.6%
Southern	Twin Falls	5,182	452	439	13	8.7%
	Mini-Cassia	2,266	405	395	10	17.9%
Eastern		3,325	925	831	94	27.8%
	Total Service Points	**18,142**	**2,342**	**2,214**	**128**	**12.9%**

Tables 5 & 6 compare how the 2,038 participating service points in 2010 and the 2,342 participating service points in 2011 were distributed among the different program options across Idaho Power's service area.

Table 5. 2010 Service point distribution by area and program option.

		Dispatch Option			Timer Option			
					Interrupt Option 1	Interrupt Option 2	Interrupt Option 3	
2010-Idaho Power Area		**Automatic Device**	**Large Service**	**Total Dispatch**	**1 Days/Week**	**2 Days/Week**	**3 Days/Week**	**Total Timers**
Western	Idaho	32	0	32	0	0	2	2
	Oregon	20	0	20	1	0	7	8
Canyon	Idaho	102	6	108	0	1	2	3
	Oregon	3	0	3	0	2	0	2
Capital		281	20	301	6	3	1	10
Southern	Twin Falls	310	4	314	12	15	8	35
	Mini-Cassia	353	0	353	28	2	7	37
Eastern		628	0	628	99	59	24	182
	Total Service Points	**1,729**	**30**	**1,759**	**146**	**82**	**51**	**279**

Table 6. 2011 Service point distribution by area and program option.

		Dispatch Option			Timer Option			
					Interrupt Option 1	Interrupt Option 2	Interrupt Option 3	
2011-Idaho Power Area		**Automatic Device**	**Large Service**	**Total Dispatch**	**1 Days/Week**	**2 Days/Week**	**3 Days/Week**	**Total Timers**
Western	Idaho	46	0	46	0	0	1	1
	Oregon	35	1	36	1	0	5	6
Canyon	Idaho	124	8	132	0	0	2	2
	Oregon	4	0	4	0	0	0	0
Capital		308	23	331	1	1	0	2
Southern	Twin Falls	434	5	439	4	0	9	13
	Mini-Cassia	395	0	395	2	3	5	10
Eastern		831	0	831	64	22	8	94
	Total Service Points	**2,177**	**37**	**2,214**	**72**	**26**	**30**	**128**

Operations

Equipment and Monitoring

Timer Option

Electronic timers manufactured by Grasslin Controls Corp. (Model GMX-891-0-24) were used to interrupt power to customers' pumps during the interruption period. The timers were installed in the pump motor control circuit to prevent the pump from running during the interruption period.

Problems with timers are identified during the reprogramming of the devices in the spring and 17 (6%) service points with timers required a visit by a contract electricians to resolve a problem prior to the program start date on June 15, 2010. In 2011, nine (7%) service points using electronic timers needed a follow-up visit to resolve a problem prior to June 15th. All service points participating in the Timer Option were checked and re-programmed for the 2010 and 2011 irrigation seasons. While each known timer problem was resolved, a review of Idaho Power's load research data shows some issues went undetected and unreported by customers. These failures were due to mechanical and electrical problems.

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 which requested a modification to the existing contract to change the name on the contract to M2M Communications. Idaho Power granted this request and in 2011, Idaho Power contracted solely with M2M Communications 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 M2M Communications' Web site. The Web-to-wireless remote control system, developed by M2M Communications utilizes the Loadstar® Model M101control device installed in customers' pump motor control circuit to turn off or prevent the pump from running during an interruption event. This equipment provides remote cellular communication or remote satellite communication. The Web service allows Idaho Power to dispatch schedule and carry-out interruption events. Two-way communication from the device can provide feedback to determine the status of the customers' equipment surrounding an interruption event. Customers also have the option of using the equipment for their own remote control purposes outside of interruption events.

Program Analysis

Load Reduction Analysis

While total load reductions from the program are impactful, determining exact amounts for each day is challenging. Load reduction impacts have been determined by reviewing four different sets of data and past information contained in an impact analysis done by Summit Blue Consulting, LLC, in 2004. The four data sets reviewed and summarized in this section are Idaho Power Load Research data, M2M Communication data, Idaho Power sample substation data, and Idaho Power total system load data. This information was used to determine realization rates to estimate load reduction achievement.

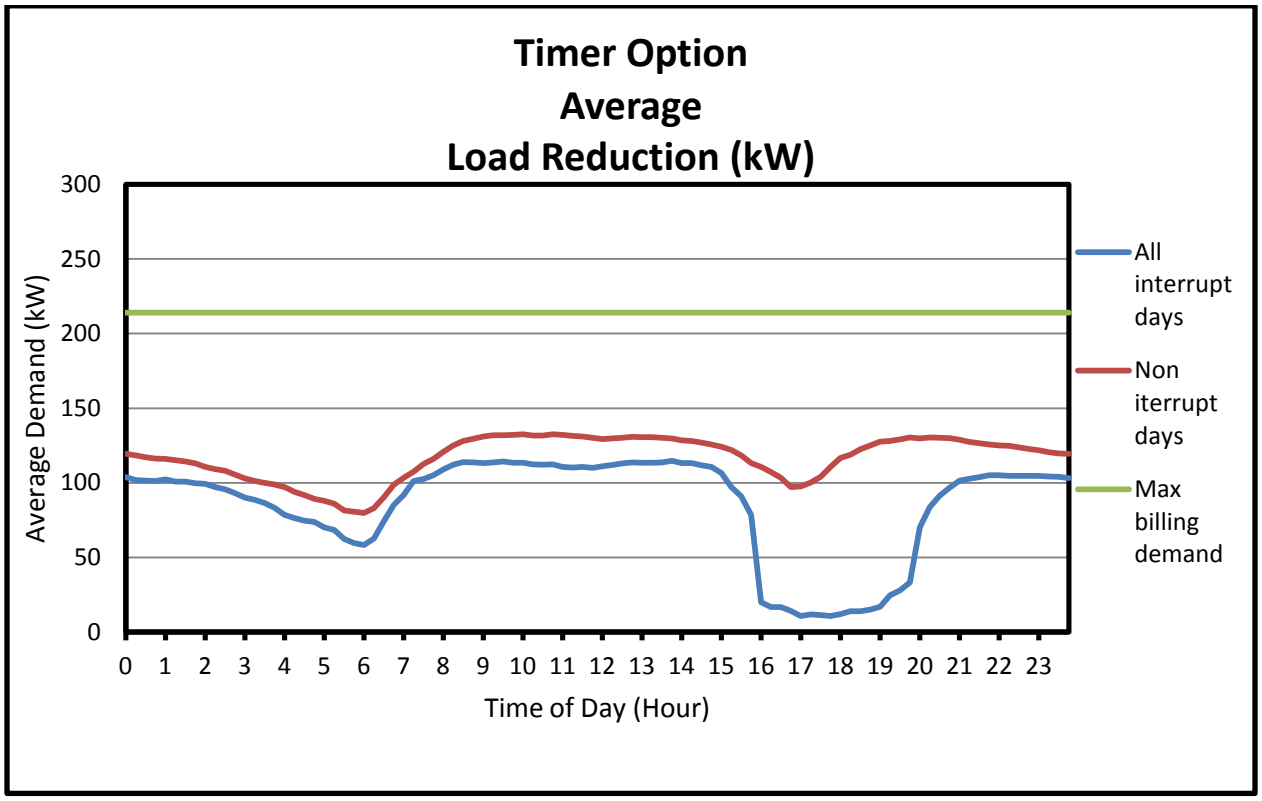
For the purposes of this report, realization rate is defined as the likelihood an irrigation service point is operating during the interrupt period and includes program equipment failures, and is used to determine program impacts. The realization rate can be characterized as the percentage of monthly 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.

Load Research Analysis—Timer Option

Each year Idaho Power reviews the realization rates, from the impact evaluation prepared by Summit Blue Consulting, LLC for the timer program, through analysis of current load research data. In 2010, Idaho Power had sixteen 15-minute interval load research service points in the Timer Option. In 2011, Idaho Power removed 15 minute interval meters and replaced them with automated hourly interval meters. Due to a reduction in timer option participants, there were only 6 service points left in the load research sample. Idaho Power did review the data from the six sites, however did not feel it was a large enough sample to rely on the results.

Figure 4 shows the average hourly kW for all days during the program season and shows the average load reduction per participating metered service point under the Timer Option within the load research sample. The graphed data represents the average demand (kW) for all interrupt days in 2010.

Figure 4. Average metered demand (kW) Timer Option in 2010.



Analysis of the data used to create this graph results in an average load of 112 kW before the events and 12 kW during the events. When compared to the average billing demand of 214 kW for these service points, the analysis yields an estimated 47% average realization rate across all events during the program season. The same analysis yielded the following realization rates for each time period: 2nd half of June; 48%; 1st half of July 53%; 2nd half of July 46 %; and the 1st half of August 42%. The results were impacted by the cooler than normal temperatures and higher precipitation that occurred across Idaho Power's service area in June of 2010. Even though this analysis shows results are approximately 10 % off the original realization rates, Idaho Power believes the realization rates from the impact evaluation are still reasonable to estimate the program's load reduction for Timer Option participants. Table 7 shows the program evaluation results from Summit Blue Consulting, LLC's impact evaluation for each two-week period of the program season.

Table 7. Realization rates by period for Timer Option participants.

Period	Idaho Power Realization Rate
2nd half of June	64%
1st half of July	60%
2nd half of July	53%
1st half of August	49%
Average	**57%**

Load Research Analysis—Large Service Option

For the Large Service Level Option, Idaho Power used interval data from each of the participants to determine the amount of load reduced. Figures 4 & 5 display the average hourly kW for all days in the program season for both 2010 & 2011. The 2010 graph shows the average load reduction per participating metered service point under the Large Service Option. The graphed data in both figures also represents the average demand (kW) for all non-interrupt days as well as the average Large Service participant's maximum billing demand in 2010 & 2011.

Figure 5. Average metered demand (kW) Large Service Option in 2010.

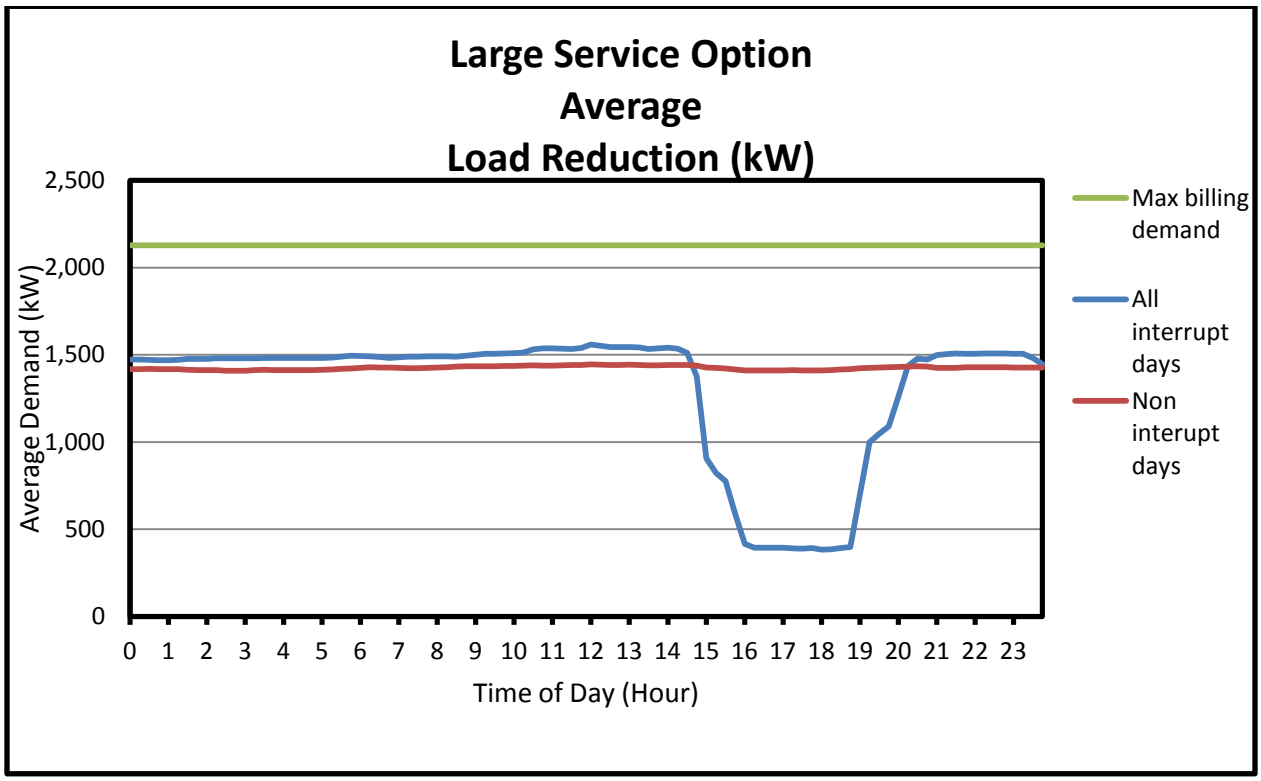
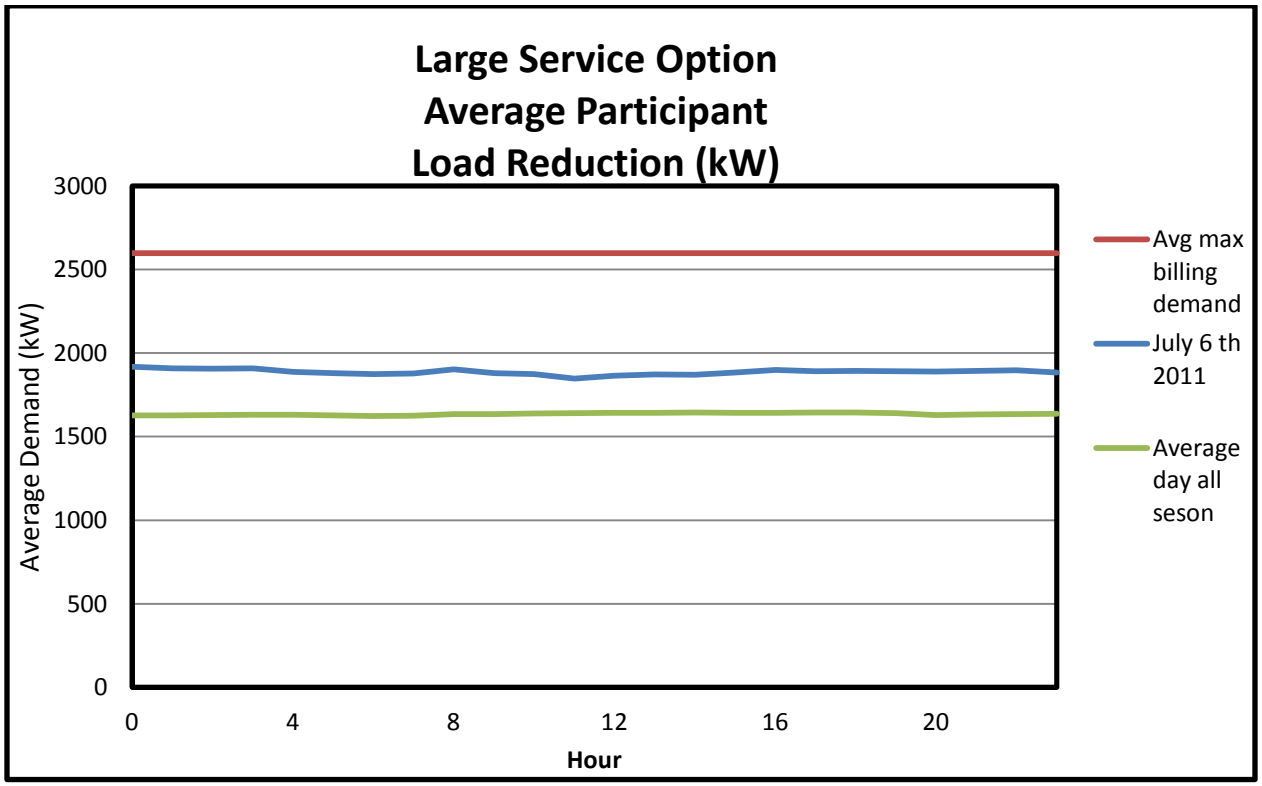


Figure 6. Average metered demand (kW) Large Service Option in 2011.



Analysis of the data used to create the 2010 graph which represents all actual interrupt days in 2010 results in an average of 1560 kW before the events and 404 kW during the events. When compared to average billing demand of 2,115 kW, the analysis results in an estimated 54% reduction by this group of customers for all events in 2010. The 54% is an expected number for this group because they are able to leave pumps on during events. Further analysis yielded the following realization rates for each interrupt day: 33 % for June 29th; 73 % for July 16th; and 57% for August 5th. Because this data represents all service locations in this group, the load reduction calculation for this group is definite.

In 2011, Idaho Power expected the percentage of load reduction would have been similar to 2010, if there had been a need for load control events in 2011. Figure 6 shows that on July 6th 2011, which was the system peak day for 2011, this group of customers were running at approximately 76 % of their maximum billing demand.

Load Research Analysis—Automatic Dispatch Option

The Automatic Dispatch Option represents the remainder of total program participation. This was the largest participation group with 1,729 & 2,177 service points enrolled respectively for 2010 and 2011. Idaho Power had 15-minute load research meters on 67 service points throughout this group in 2010. In 2011 the sites were converted to hourly data and Idaho Power tracked 66 service locations with hourly data for the 2011 season.

Figure 7 shows the average hourly demand (kW) for all days in the program season in 2010 and shows the average load reduction per participating metered service point under the Automatic Dispatch option. Both Figures 7 & 8, also show the maximum average billing demand for each year.

Figure 7. Average metered demand (kW) Dispatch Option for 2010.

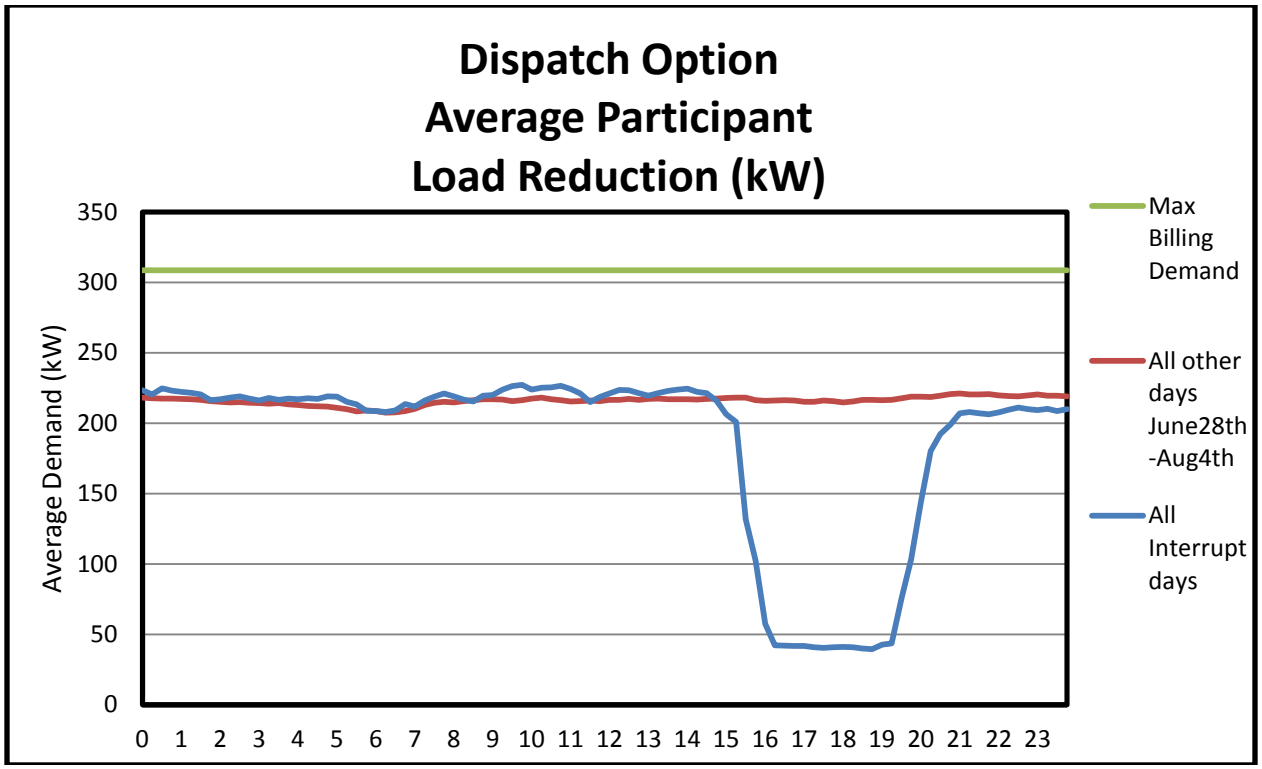
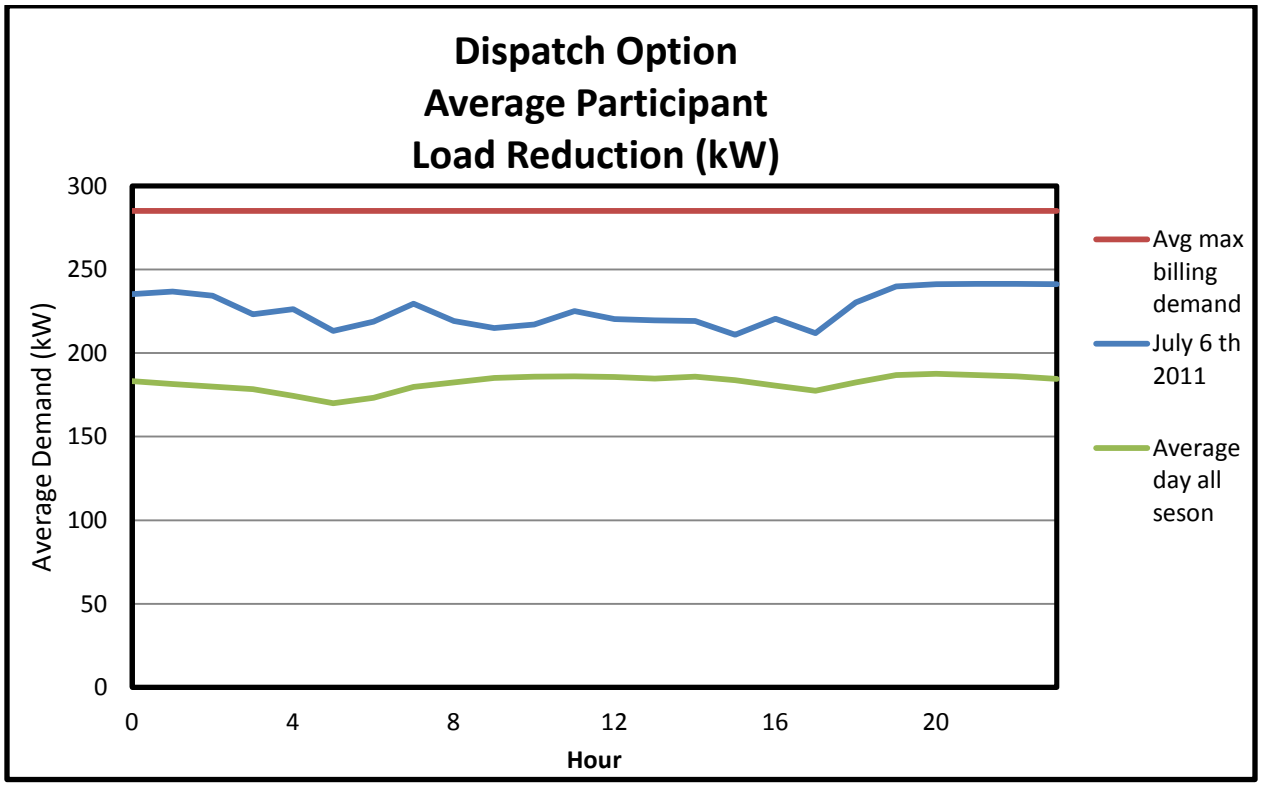


Figure 8 shows the average hourly demand (kW) per participating metered service point for all days in the program season in 2011 and shows the average load on July 6th 2011 for the Automatic Dispatch Option load research sample.

Figure 8. Average metered demand (kW) Dispatch Option for 2011.



Analysis of the data used to create the 2010 graph in figure 7 results in an average of 222 kW before the events and 41 kW during the events. When compared to average billing demand of 309 kW, the analysis results in an estimated average of 59% realized reduction by this group of customers for all events in 2010. Further analysis yielded the following realization rates for each interrupt day: 67 % for June 29th; 61 % for July 16th; and 48 % for August 5th.

Analysis of the 2011 data used to create the graph in figure 8 for July 6th indicates a potential realization rate of 79 % if all devices worked and there were no opt outs. However, the program has never achieved that high of realization rate in the past.

M2M Communications Device Analysis—Automatic Dispatch Option

For the Automatic Dispatch Option, Idaho Power also used device communication data from M2M Communications. A complete log of the operational data for each automatic device was analyzed for each day a dispatch event occurred. This data does not lead to a definite realization rate because we have determined in the past that there were devices responding even though the data showed they were not. However, due to improvements in communication with the devices we believe that the data quality in the last two years has continually improved.

The realization rates determined in Table 8 show the number of control devices that were turned off during each dispatch event in 2010 and the potential for July 6, 2011. The analysis of this

data resulted in an average realization rate of 50% for all events in 2011 and 68% for a potential event in 2011.

In 2009, the analysis of the same type of data yielded an average realization rate for the Automatic Dispatch Ooption of 40%. This was due to failure of the embedded firmware, weak cellular signal strength, and incorrect wiring. Throughout 2010, each device was revisited by electrical contractors who updated the firmware, installed high gain antennas where they determined necessary, and corrected wiring issues resulting in better communication for the 2011 season. The event status and corresponding realization rates in the table 8 below indicate the progress of M2M Communications in improving communication and maintaining the devices to be effective when dispatchable load control events are needed.

Table 8. Communication status of automatic devices during dispatch events.

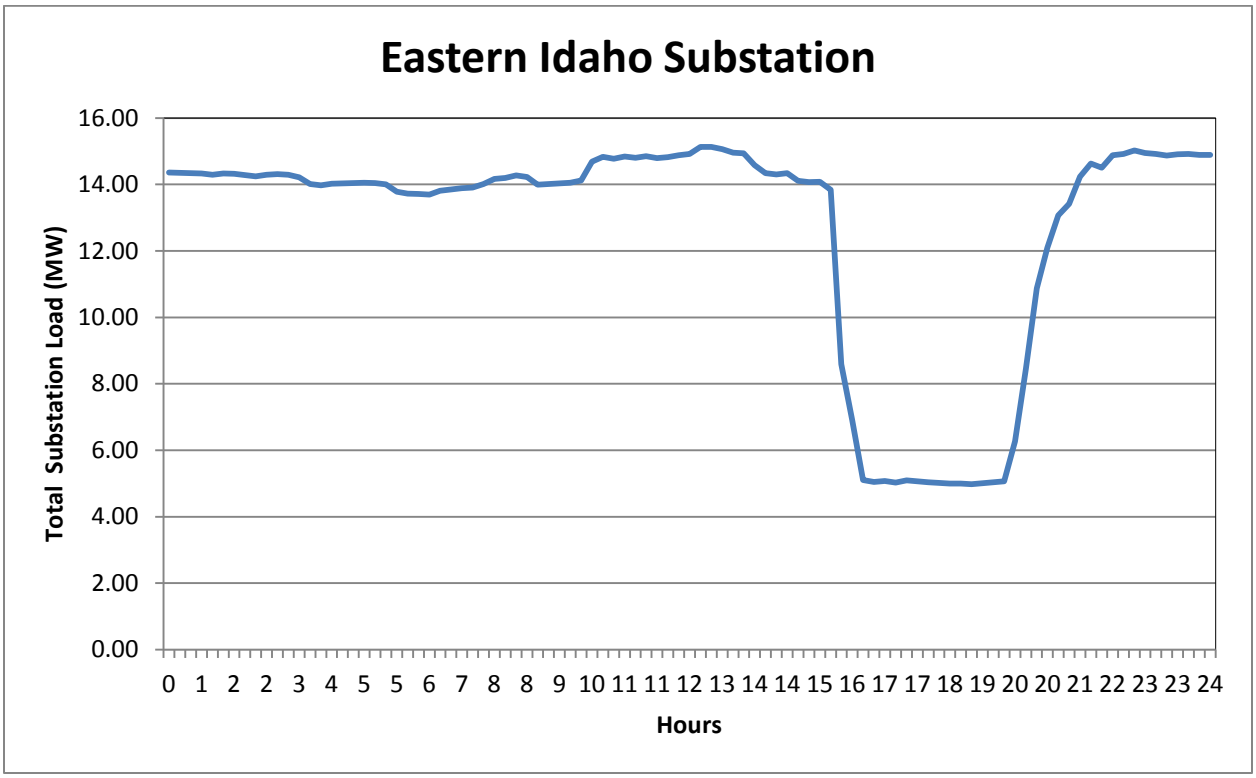
Status of automatic devices at the time of the dispatch event	**Date of 2010 Load Control Events**			**2011 Load Control Event Potential(a)**
	6/29/2010	7/16/2010	8/5/2010	7/6/2011
Number of devices that described pumps at service point as already off	492	433	894	614
Number of devices that did not work correctly	513	404	227	239
Number of devices that were opted out of the control event	35	26	18	N/A
Number of devices that turned pumps off	997	1,164	932	1,832
Total Number of Devices	**2,037**	**2,027**	**2,071**	**2,685**
Realization Rate	**49%**	**57%**	**45%**	**68%**

[(a)]No Load Control Events occurred during the 2011 season. Data is a result of status query July 6, 2011.

Substation Data Analysis

An additional way in which Idaho Power chose to evaluate load reduction from the program was to analyze specific substation data for those substations where there were substantial numbers of participants in the program. As an example, Figure 9 displays the load data on the event day of July 16, 2010, from a particular substation in the Eastern area in which there were 41 service locations with a total billing demand of 13.4 MW.

Figure 9. Load data from a particular substation in the Eastern area on July 16.



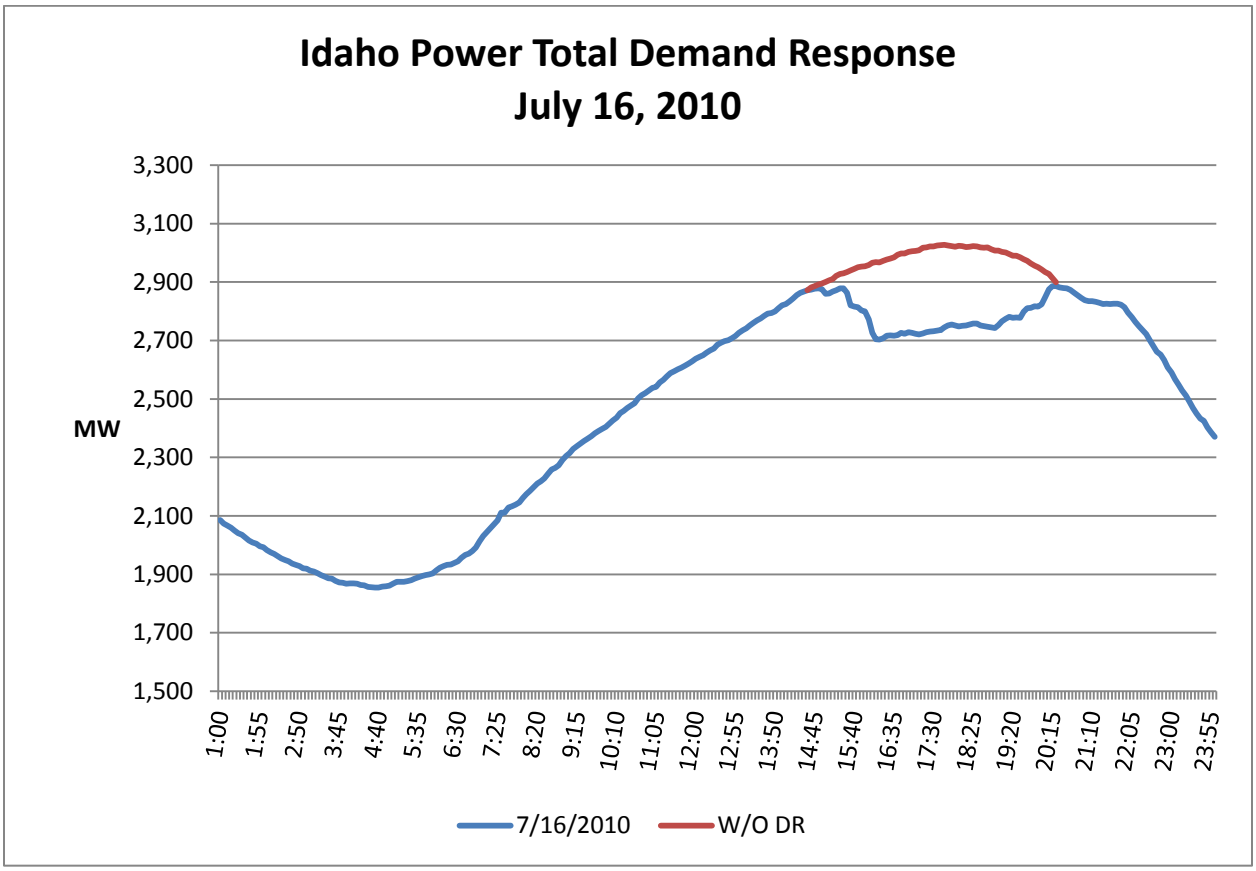
The data represents 14.4 MW of load before the event and 5 MW during the event, which equates to a total load reduction of 9.4 MW. When compared to the total billing demand of 13.4 MW from program participants on this particular substation, Idaho Power calculated a realization rate of 70%.

System Load Data Analysis

Another way to view the total program impact is to look at total system firm load data. The system firm load during the summer months has the greatest electrical demand of the year. The highest peak load historically occurs in late June or July during the afternoon.

Figure 10 represents demand response impact to the entire Idaho Power system firm load on July 16, 2010. On this date, load control events were initiated using the Irrigation Peak Rewards, Flex Peak Management, and A/C Cool Credit programs. Interruptions occurred from 3:00 p.m. through 8:00 p.m. at participating service locations in all regions under the irrigation Dispatch Option, 4 p.m. through 8:00 p.m under the Timer Option, and the 4 p.m. through 8:00 p.m under the Flex Peak Management program. The A/C Cool Credit program interruptions occurred from 4:00 p.m. through 7:00 p.m. Based on the current day forecast for July 16, 2010, it was estimated that loads would have reached approximately 320 MW higher than the actual loads at peak hour. Using this information and estimates of AC Cycling and Flex Peak, the calculated load reduction attributable to Irrigation Peak Rewards was estimated to be 249 MW, which results in a program realization rate of 65% when system losses are taken into account

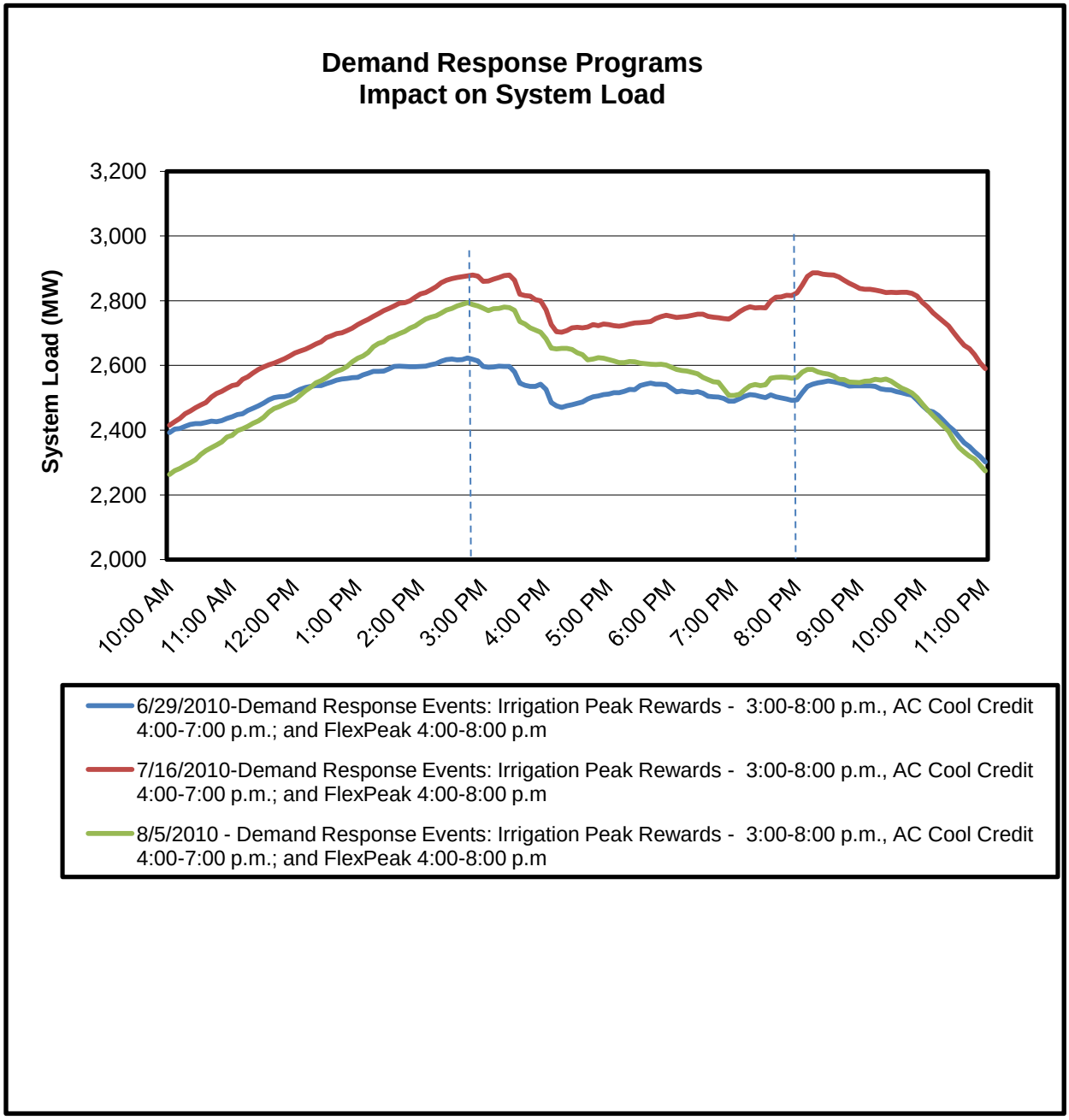
Figure 10. Total system load on July 16.



[(a)]Estimated system load with no demand response.

Figure 11 demonstrates the program's impact on system firm load for all demand response events initiated in 2010.

Figure 11. Demand response programs impact on system load in 2010.



Load Reduction Achieved

Idaho Power uses prior year's peak billing demand data from the months of June and July to estimate the amount of load enrolled in the program each year. The total billing demand enrolled in the program was 369,368 kW for 2010 and 410,774 kW for 2011. Idaho Power attempts to distribute the Timer Option participating service points evenly throughout each weekday, based on cumulative load reduction potential. However, due to service point size variability, enrollment

requests by customers, the load is not be exactly balanced . All participants in the Dispatch Option were grouped into five areas to be dispatched on each scheduled event day. Table 9 & 10 show how the enrolled load was distributed by area.

Table 9. Enrolled billing demand by region (kW) 2010.

		Dispatch Option[a]		Timer Option[a]			
				Interrupt Option 1	Interrupt Option 2	Interrupt Option 3	
2010-Idaho Power Area		**Automatic Device**	**Manual**	**1 Days/Week**	**2 Days/Week**	**3 Days/Week**	**Total All Options**
Western	Idaho	1,788	0	0	0	97	1,885
	Oregon	5,003	0	79	0	7	5,089
Canyon	Idaho	11,348	16,191	0	20	182	27,741
	Oregon	231	0	0	217	0	448
Capital		39,990	47,616	1,583	383	81	89,653
Southern	Twin Falls	32,323	2,929	2,229	2,271	343	40,095
	Mini-Cassia	80,999	0	5,648	428	991	88,066
Eastern		87,926	0	17,056	8,405	3,004	116,391
	Total Billing KW	**259,608**	**66,736**	**26,595**	**11,724**	**4,705**	**369,368**

[a]It is important to note that this billing demand level would be achieved only if 100% of the pumps enrolled in the program were all running at the scheduled interruption time.

Table 10. Enrolled billing demand by region (kW) 2011.

		Dispatch Option[a]		Timer Option[a]			
				Interrupt Option 1	Interrupt Option 2	Interrupt Option 3	
2011-Idaho Power Area		**Automatic Device**	**Manual**	**1 Days/Week**	**2 Days/Week**	**3 Days/Week**	**Total All Options**
Western	Idaho	3,349	0	0	0	44	3,393
	Oregon	5,410	4,656	84	0	170	10,320
Canyon	Idaho	15,541	18,117	0	0	175	33,833
	Oregon	284	0	0	0	0	284
Capital		40,339	49,609	130	128	0	90,206
Southern	Twin Falls	45,206	3,029	523	0	533	49,291
	Mini-Cassia	88,391	0	378	671	770	90,210
Eastern		116,659	0	10,738	4,207	1,633	133,237
	Total Billing KW	**315,179**	**75,411**	**11,853**	**5,006**	**3,325**	**410,774**

[a]It is important to note that this billing demand level would be achieved only if 100% of the pumps enrolled in the program were all running at the scheduled interruption time and if all the equipment worked flawlessly (i.e. 100 % realization rate). (b) The Totals for the Timer option cannot be added together due to the fact that on any one day only a portion of the participants are being interrupted based on the preprogrammed Timer schedule.

After reviewing the results from each of the different methods used to analyze load reduction, Idaho Power concluded that the substation data, load research data, and system load data all resulted in fairly similar realization rates for both summers. The dispatch option realization rates were estimated by combining the weighted average of participants in the Large Service Option with consideration of the realization rates evaluated from M2M data, system load, load research data and substation data for the Automatic Dispatch Option. Table 11 shows the realization rates Idaho Power used to determine program load reductions for each day of the summer for 2010 and 2011. For the Timer Option, Idaho Power used the realization rates from Summit Blue Consulting, LLC, except in June and August of 2010 and for the first program week in 2011. Idaho Power used lower realization rates these time periods to better reflect the weather conditions during those times.

Table 11. Realization rates used for program options.

Period	2010 Timer Option	2011 Timer Option	2010 Dispatch Option	2011 Dispatch Option Potential[(a)]
2nd half of June	6%	(60%)64%	60%	70%
1st half of July	60%	60%	70%	71%
2nd half of July	53%	53%	65%	61%
1st half of August	30%	49%	57%	57%

Table 12&13 show the MW reduction achieved daily on a week-by-week basis for both 2010 and 2011. These tables show resulting load reduction with system losses included.

Table 12. Total program daily MW reduction using realization rates for 2010.

	Monday	Tuesday	Wednesday	Thursday	Friday
June 15–18	n/a	1.0	1.0	.9	.8
June 21–25	.8	1.0	1.0	.9	.8
June 28–July 2	7.9	217.0[a]	10.0	8.5	8.2
July 5–10	7.9	9.6	10.0	8.5	8.2
July 12–16	7.9	9.6	10.0	8.5	249.7
July 18–22	7.0	8.5	8.9	7.5	7.3
July 26–30	7.0	8.5	8.9	7.5	7.3
August 2–6	3.9	4.8	5.0	161.6	4.1
August 9–13	3.9	4.8	5.0	4.3	4.1

[a] Shaded cells are days when dispatch events occurred.

Table 13. Total program daily MW reduction using realization rates for 2011.

	Monday	Tuesday	Wednesday	Thursday	Friday
June 15–17	n/a	n/a	6.0	3.8	2.6
June 20–24	3.7	3.5	6.4	4.0	2.8
June 27–July 1	3.7	3.5	6.4	4.0	2.8
July 4–8	3.5	3.3	320.0[a]	3.8	2.6
July 11–15	3.5	3.3	6.0	3.8	2.6
July 18–22	3.1	2.9	5.3	3.3	2.3
July 25–29	3.1	2.9	5.3	3.3	2.3
August 1–5	2.8	2.7	4.9	3.1	2.1
August 8–1	2.8	2.7	4.9	3.1	2.1
August 15	2.8	n/a	n/a	n/a	n/a

[a] Shaded cell was determined to be Idaho Power's peak load day and reflects the estimated MW load reduction that would have been achieved had a load control event be scheduled.

Cost-Effectiveness

Program Costs

This program had a total cost of $13.3 million, in 2010 and $12.1 million in 2011 with customer incentives and device installation being the largest two expenditures in both years. Customer incentives were 86 % of the total costs in both years. In future years, when the program is not growing as it has in the past three years, and new installations will likely be reduced, the customer incentive will make up an even larger percentage of the overall costs.

Customers participating in the Irrigation Peak Rewards program realized an average annual bill savings of 26% in 2010 and 23 % in 2011 on each service point enrolled. Customers enrolled in the Timer Option realized an average annual bill savings of 8% in 2010 and 10 % in 2011, and Dispatch Option customers realized a 28% savings in 2010 and 24 % savings in 2011. The average incentive on a per-Hp basis across all options was $24 in 2010 and $19 in 2011. Tables 14 & 15 display the annual program costs for each year.

Table 14. Annual program costs 2010.

Item	2010 Program Costs
Materials and Equipment	$ 560,711
Installation and Contract Services	$1,162,105
Incentive payments	$11,482,102
Marketing and Administration	$125,978
Total	**$13,330,826**

Table 15. Annual program costs 2011.

Item	2011 Program Costs
Materials and Equipment	$476,110
Installation and Contract Services	$1,111,372
Incentive payments	$10,364,043
Marketing and Administration	$134,697
Total	**$12,086,222**

Benefit-Cost Analysis

The B/C analysis for the Irrigation Peak Rewards program is based on a 20-year model that uses financial and demand-side management (DSM) alternative costs assumptions from the *2011 Integrated Resource Plan* (IRP). As published in the 2011 IRP, for peaking alternatives such as demand response programs, a 170 MW simple cycle combustion turbine is used as a cost basis. The levelized capacity cost factors applied are $94 kW/yr. The benefit for shifted energy use in the Irrigation Peak Rewards program is calculated using (DSM) alternative energy costs as determined by Idaho Power's Power Supply model, AURORAxmp® and published in the 2011 IRP. Idaho Power's cost-effectiveness model for the Irrigation Peak Rewards program is updated annually with actual benefits and costs. For demand response programs, the benefits are based on peak reduction and shifted energy use.

The updated cost-effectiveness model resulted in a one year utility B/C ratio of 1.14 and 2.32 in 2010 and 2011 respectively.

Tables 16 & 17 summarize the inputs that were used in the cost-effectiveness model. The most current analysis results in a overall 20-year program life B/C ratio from the total resource cost perspective of 1.64.

Table 16. Benefit-cost model inputs 2010.

Description	Input
Number of metered service points	2038
Overall Program realization rate in July	67%
Average service point, billing kW (peak month)	190
Enrolled peak (kW)	369,368
July peak reduction (MW)[(a)]	249
Actual Program Cost Total)	**$13,330,826**

[(a)]Dispatch days only.

Table 17. Benefit-cost model inputs 2011.

Description	Input
Number of metered service points	2,342
Program realization rate in July	78%
Average service point, billing kW (peak month)	176
Enrolled peak (kW)	410,774
July peak reduction (MW)[(a)]	320
Actual Program Cost Total	**$12,086,222**

Conclusions

- The Irrigation Peak Rewards program, increased participation in both 2010 and 2011 by 34.8 % and 14.9 % respectively.
- Idaho Power plans to continue the program because it is a cost-effective way to reduce peak demand on Idaho Power's electrical system.
- The combined Timer and Dispatch Options of the program achieved a maximum peak load reduction of 249 MW in 2010, and had a potential to reduce peak demand by 320 MW in 2011, at the generation level.
- The cost of the having this resource available was $53 per kW in 2010 and $38 per kW in 2011.
- The changes to the program in 2011 reduced potential costs significantly and did not have an adverse affect on participation.
- Irrigation customers make significant contributions to Idaho Power's demand response programs. The Irrigation Peak Rewards program currently contributes approximately 80 % of Idaho Powers overall demand response portfolio.

FlexPeak Management
2010 & 2011 Program Report

December 11, 2011

Table of Contents

Program Summary 3
2010 Demand Reduction Event Results 4
2011 Demand Reduction Event Results 5
Customer Recruitment 6
Metering 7
Event Initiation 8
Event Monitoring 8
Customer Satisfaction 10
Idaho Power Participation 12
Payment Reconciliation 12
Cost-Effectiveness 13
Conclusion 13

Program Summary

FlexPeak Management is a voluntary demand response program targeting Idaho Power's industrial and large commercial customers that are capable of reducing their electrical energy loads for short periods during summer peak days. The program became available to the company's Idaho customers in May 2009 and became available to Oregon customers in May 2010. The program objective is to reduce the demand on Idaho Power's system during peak times through customers' voluntary electrical use reduction. The program is active June 1 to August 31, between the hours of 2:00 p.m. to 8:00 p.m. on non-holiday weekdays. Customers receive notification of a demand reduction event two hours prior to the start of the event, and events last anywhere between two and four hours, with a maximum of 60 hours per summer.

In November 2008, Idaho Power selected EnerNOC, Inc. through a competitive Request for Proposal (RFP) process, to implement the program. Idaho Power entered into a five-year agreement with EnerNOC in February 2009, pending the Idaho Public Utilities Commission (IPUC) approval. In May 2009, the IPUC approved the contract in Order No. 30805.

In February 2010, Idaho Power filed a petition requesting the IPUC to approve an amendment to the agreement between Idaho Power and EnerNOC. The contract changes accomplished clarification of language regarding accrual of energy payments, adjustment of language regarding baseline calculations, correction of an error in EnerNOC penalty calculations, and the addition of a non-solicitation clause. On June 2, 2010, under Order No. 31098, the IPUC granted the company's Petition for Approval of the Amendment to the Agreement. In March 2010, Idaho Power filed an application with the OPUC to approve the FlexPeak Management program to be made available to Idaho Power Oregon customers, which was approved on June 2, 2010 in Order No. 10-206.

EnerNOC is responsible for developing and implementing all marketing plans, securing all participants, installing and maintaining all equipment downstream of Idaho Power's meter, tracking participation, and reporting results to Idaho Power. Idaho Power initiates demand response events by notifying EnerNOC, who then supplies the requested load reduction to the Idaho Power system.

EnerNOC meets with prospective customers to identify their potential to reduce electrical energy load during active program hours without negative impact to their business operations. Customers enroll in the program by entering into a contract with EnerNOC. EnerNOC then installs energy monitoring equipment at the customer site, simulates a demand response event to ensure customer satisfaction and performance, and officially enrolls the facility in the program.

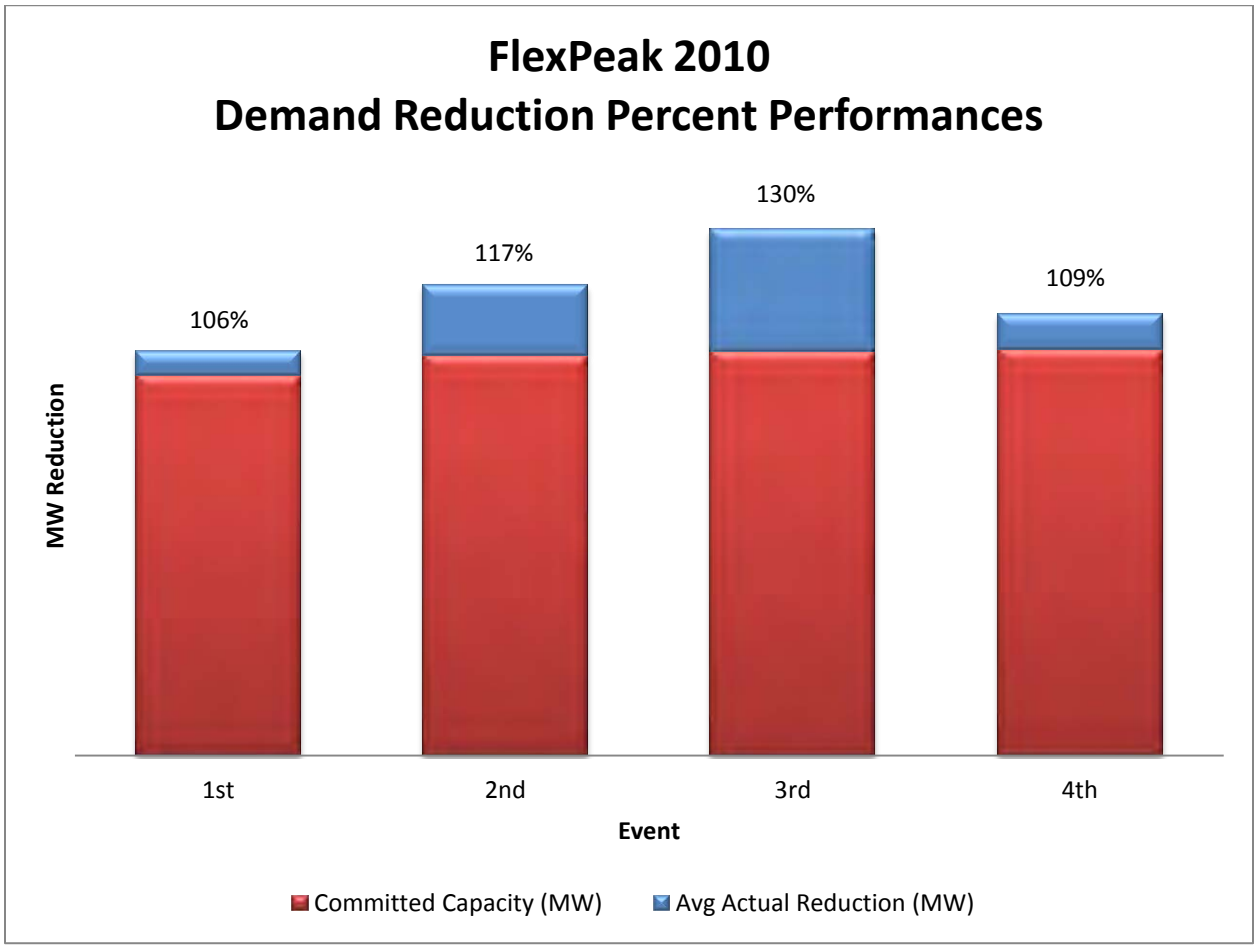
Contractually, EnerNOC has agreed to a target annual demand reduction amount for the five year contract length. Each week of the active season, EnerNOC commits a demand reduction level in megawatts (MWs) to Idaho Power that EnerNOC is obligated to meet in a demand reduction event. When Idaho Power anticipates the need for capacity, it schedules the date and time of the event and notifies EnerNOC.

Idaho Power has access to an EnerNOC web site that shows near real-time energy usage data of the aggregated load, and can continually monitor the success of the demand reduction during an event. Customers can also continuously monitor their demand reduction performance using their individual near real-time energy usage data available to them through the EnerNOC web site.

2010 Demand Reduction Event Results

EnerNOC's contractual obligation to Idaho Power in 2010 was 25 MW. The first week of the 2010 season, EnerNOC committed to provide a reduction of 27.0 MW. This weekly commitment or "nomination" was comprised of 49 facility sites, of which 30 participated in the program in 2009 and 19 were added in 2010. The reduction commitment at the end of the season was 30.8 MW, comprised of 64 facility sites. The commitment peaked in July at 34.2 MW.

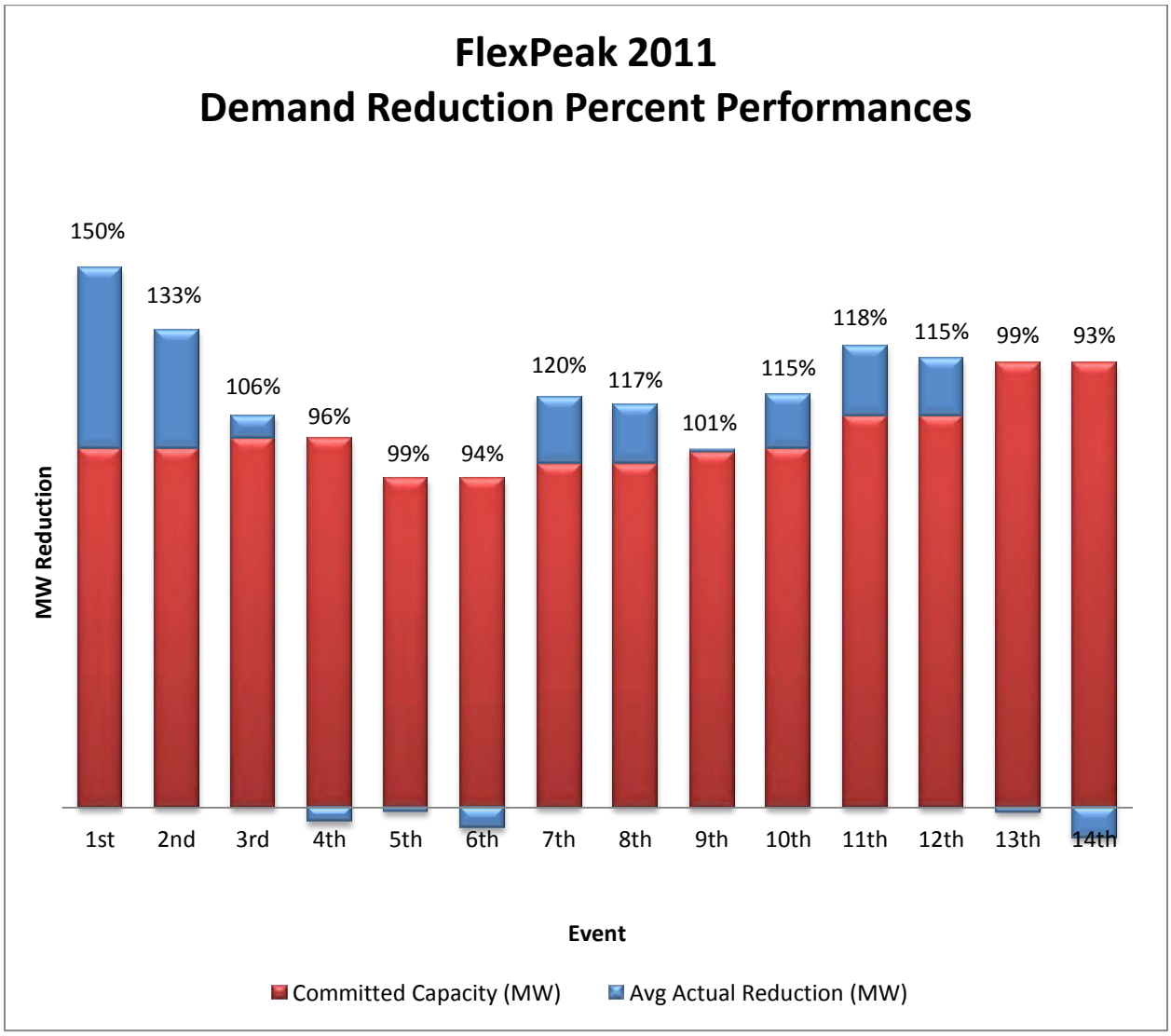
Idaho Power initiated four demand response events in 2010. One event occurred in June, two in July, and one in August. The highest hourly reduction achieved was in July, at 47.5 MW (meter-level). In each case, EnerNOC successfully exceeded the committed MW reduction by the percentages shown in the table below.



2011 Demand Reduction Event Results

EnerNOC's contractual obligation to Idaho Power in 2011 was 35 MW. The first week of the 2011 season, EnerNOC committed to provide a reduction of 33.0 MW. This weekly commitment or "nomination" was comprised of 78 facility sites, of which 33 participated in the program in 2009, 31 were added in 2010 and 14 were added in 2011. The reduction commitment at the end of the season was 41.4 MW, comprised of 103 facility sites. The commitment peaked in August at 41.9 MW. Part of the increase in facility sites in 2011 was due to the way customer sites were reported at the beginning of the season versus the end. In July, EnerNOC began reporting individual sites by meter rather than location, at Idaho Power's request, in order to have the ability to report performance by rate schedules. Therefore, though the number of sites nominated started at 64, it was increased by 11 due to the way sites were reported. The actual number of customer sites added in 2011 was 37. The number of sites removed was nine.

Idaho Power initiated 14 demand response events in 2011. Eight events occurred in July and six in August. The highest hourly reduction achieved was in July, at 50.8 MW (meter-level). EnerNOC performed to the committed MW reductions by the percentages shown in the table below.

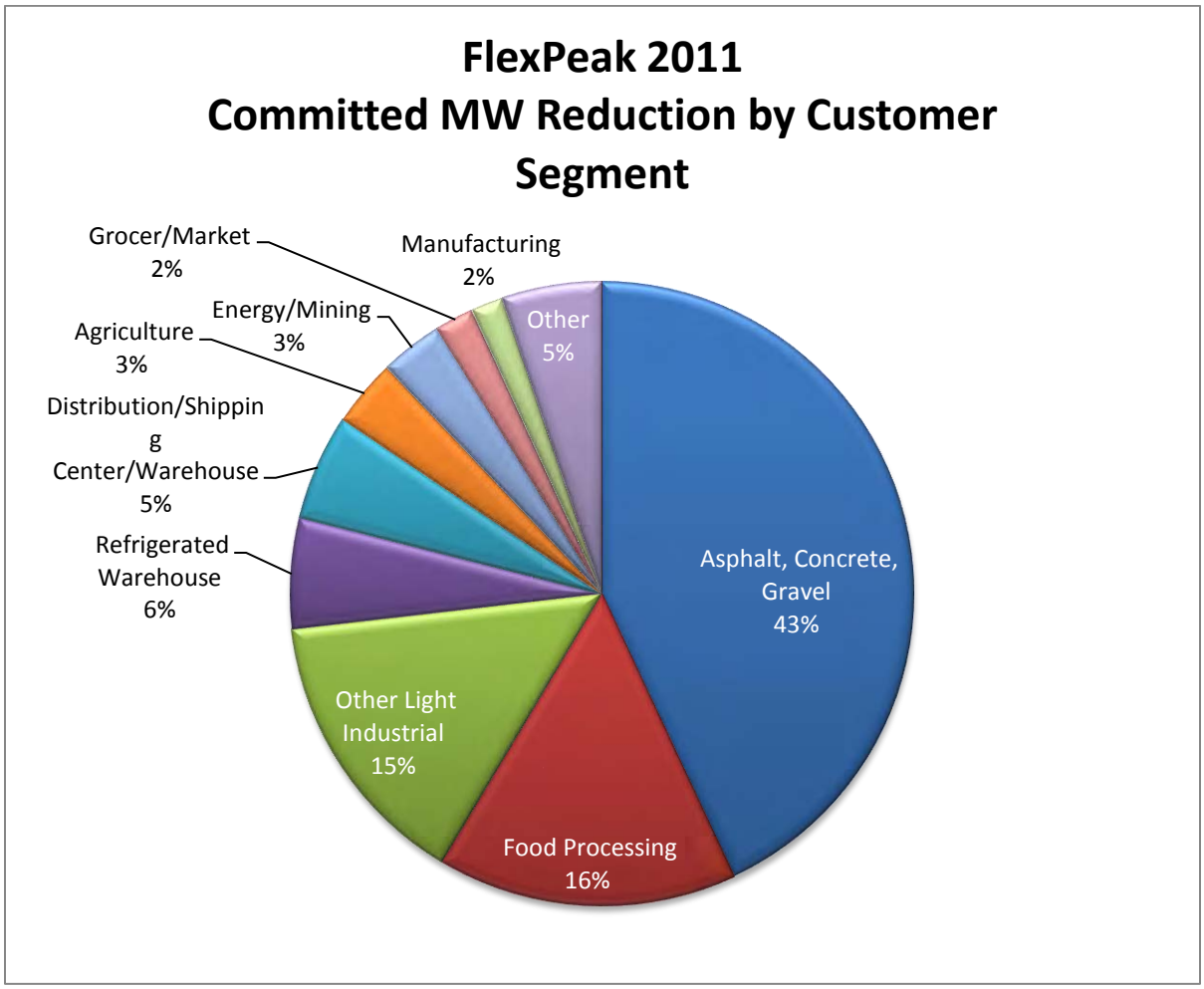


Customer Recruitment

EnerNOC began the recruitment process in 2009 by partnering with Idaho Power Customer Representatives to engage customers with a demand of 500 kW and above. They then included customers with a demand between 200 to 500 kW. Much of 2010 and 2011 was been spent revisiting those customers whose operations or demand may have changed to make them eligible since the initial marketing campaign. EnerNOC and Idaho Power Customer Representatives also worked with existing participants to increase nominations where appropriate.

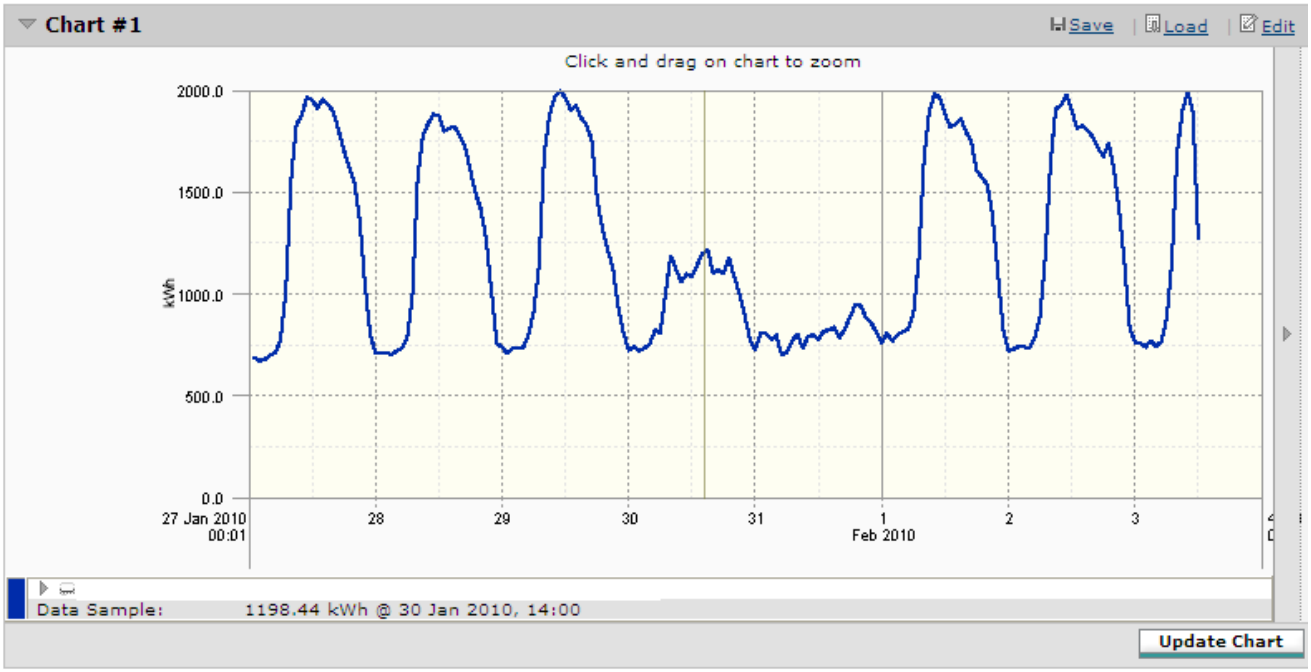
Once potentially eligible customers were identified, EnerNOC worked with them to develop a demand reduction plan that could be implemented at the site without negatively impacting the customer's business operations. Customers were then invited to sign a contract with EnerNOC to enroll in the program.

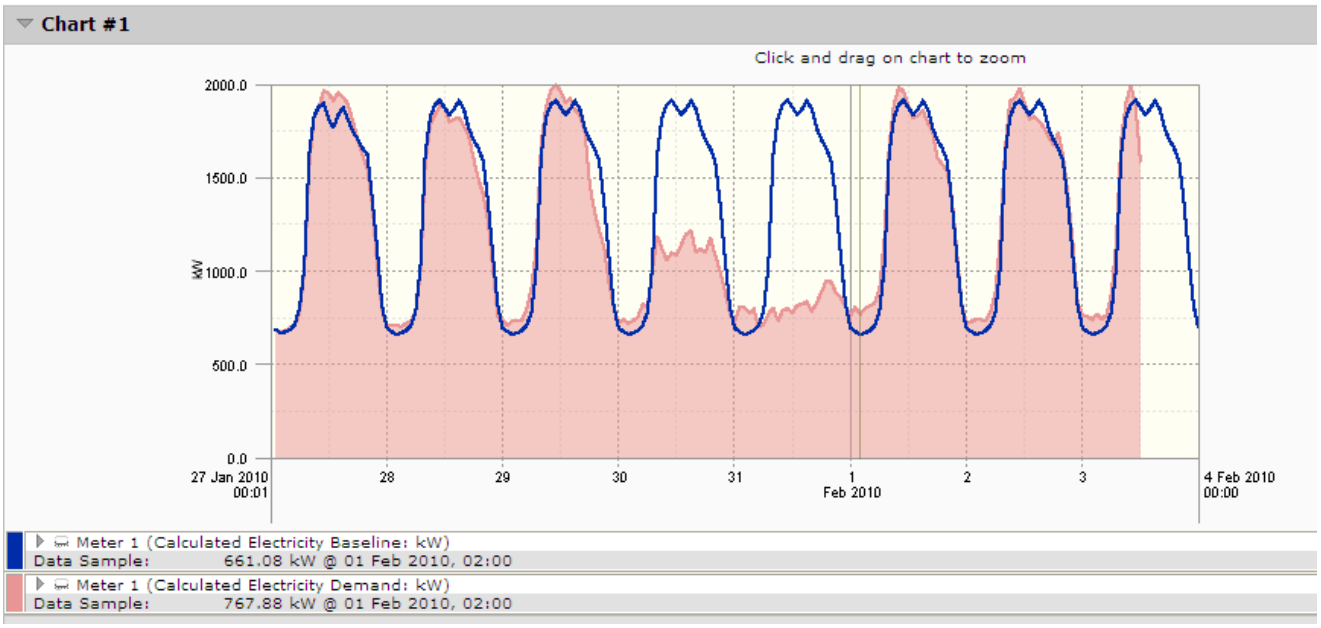
The most recent breakdown of MW reduction committed by customer segment is shown below.



Metering

Customers enroll in the program by signing a contract with EnerNOC. EnerNOC then submits requests to Idaho Power to enable the customers' electric meters to transmit KYZ-pulse outputs. Some customer's meters are already enabled for pulse outputs. For each customer not receiving pulse outputs, Idaho Power metering technicians enable the meters to transmit these outputs, and EnerNOC reimburses Idaho Power for the associated costs. EnerNOC then installs monitoring equipment to obtain and transmit the pulse output to their servers. By using EnerNOC's proprietary software, EnergySmart, customers can then monitor their near real-time energy use on a continual basis. Below are examples of information participants can access at all times through the EnerNOC web site using their unique login and password. In these examples the reduction in energy use occurs on a Saturday and Sunday.





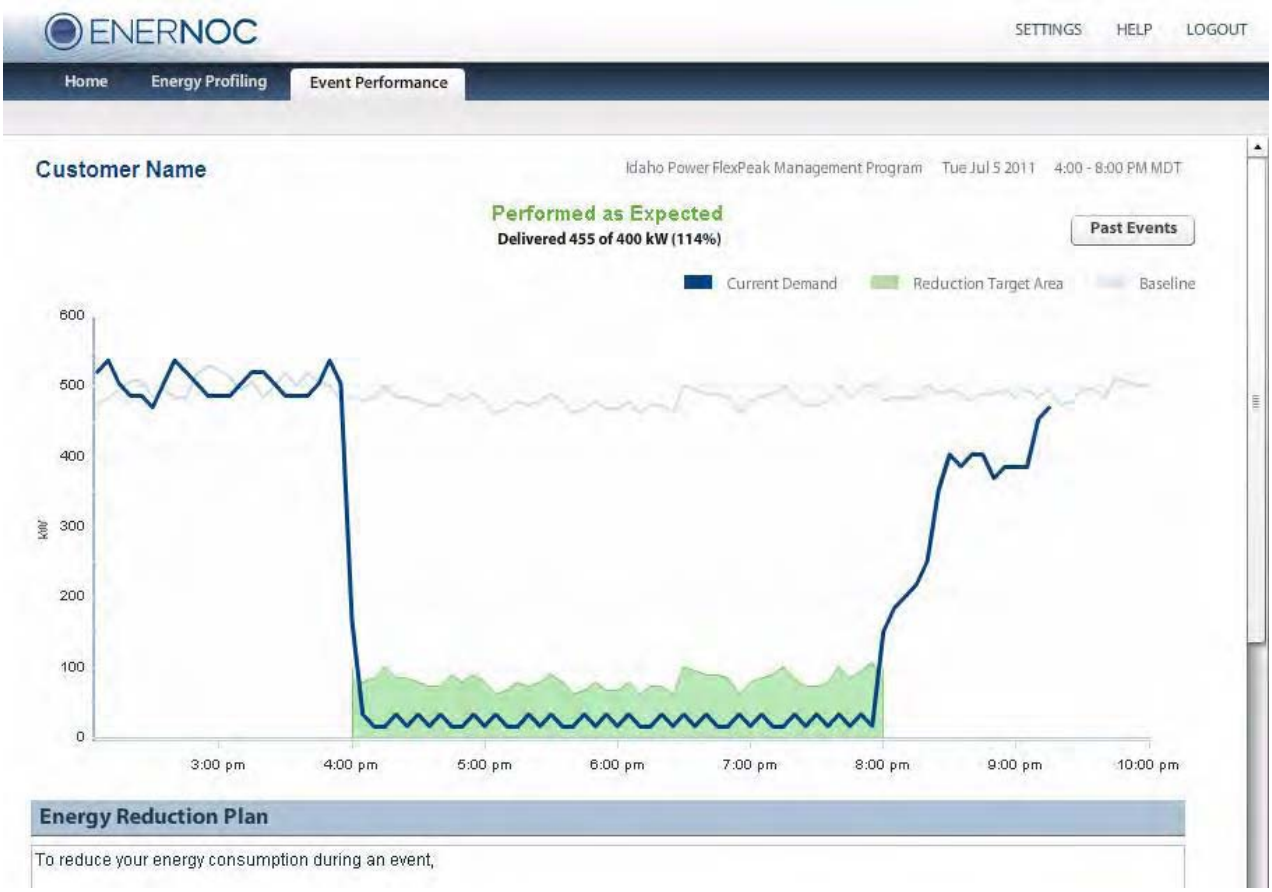
Event Initiation

In 2010, Idaho Power expanded the team responsible to identify which days were candidates for demand response events. The team met weekly through the active seasons in 2010 & 2011, and included representatives from groups such as Customer Relations and Energy Efficiency, Power Supply Planning, Power Supply Operations, Grid Operations and Generation Dispatch. Each week, the team reviewed system demand forecasts and evaluated up-to-date information, including weather predictions, transmission constraints and market conditions, to monitor the need to call demand reduction events.

Idaho Power initiated events in 2010 by sending an email to EnerNOC and in 2011 through a web portal, by phone and/or email. EnernNOC, in turn, notified customers two hours prior to each event. In 2010, all demand reduction was achieved manually by the participants at their sites, with EnerNOC retaining no automatic control of the reduction processes. By the end of 2011, 16 sites were voluntarily set up for remote reduction of their energy use, triggered directly by EnerNOC.

Event Monitoring

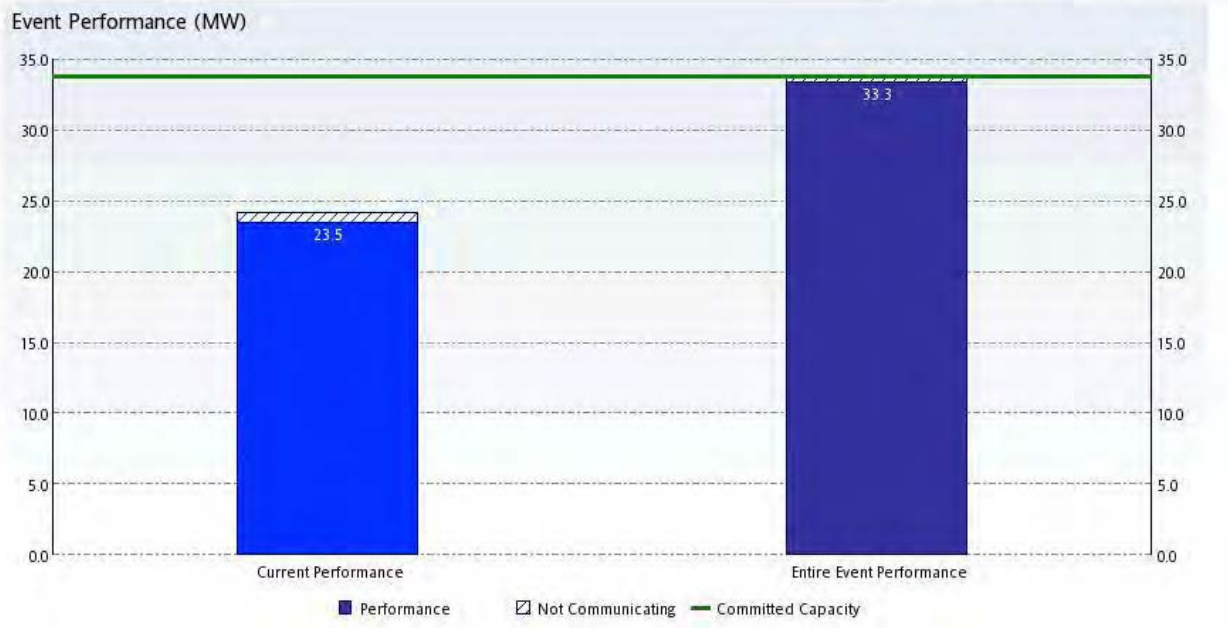
EnerNOC submitted weekly reduction commitments to Idaho Power by the Friday proceeding the event week. During each event, participants had access to near real-time electric use data, which displayed their baselines and reduction commitments through EnerNOC's web site. Below is an example of what a customer might see during a demand reduction event.



During each event Idaho Power had access to aggregate performance as shown below. The graph displays the current near real-time event performance, as well as the average performance throughout the event.

Tuesday, July 5, 2011 3:00 PM - 7:00 PM

Report Last Updated: Jul 5, 2011 7:21:14 PM



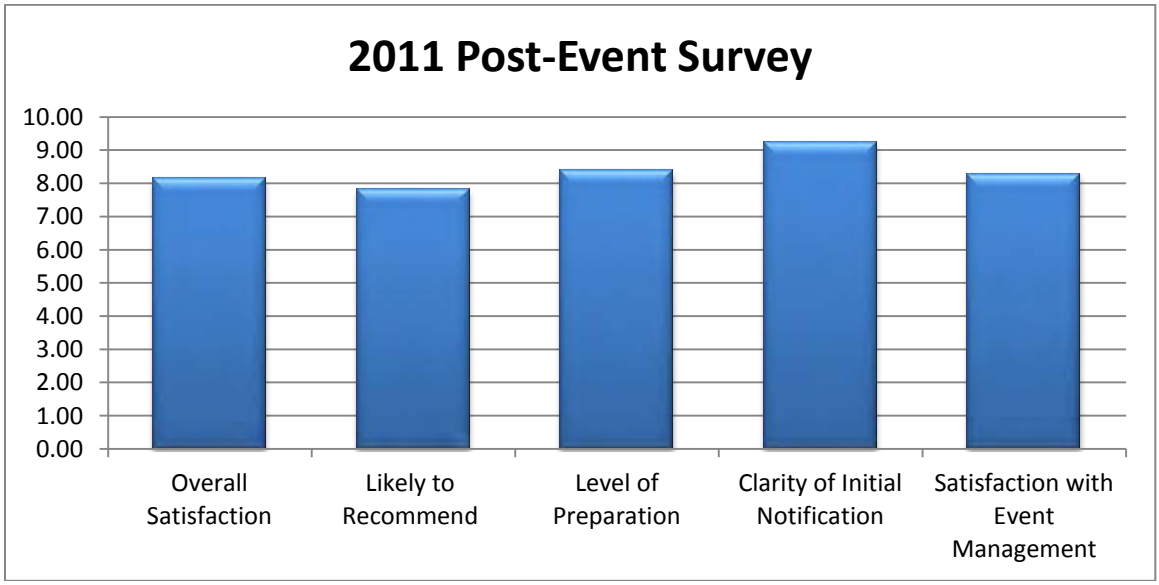
Committed Capacity: 33.8 MW

Performance	Known (MW)	Not Communicating (MW)	Percent Of Committed
Current	23.5	0.6	69.5% - 71.4%
Entire Event	33.3	0.4	98.6% - 99.8%

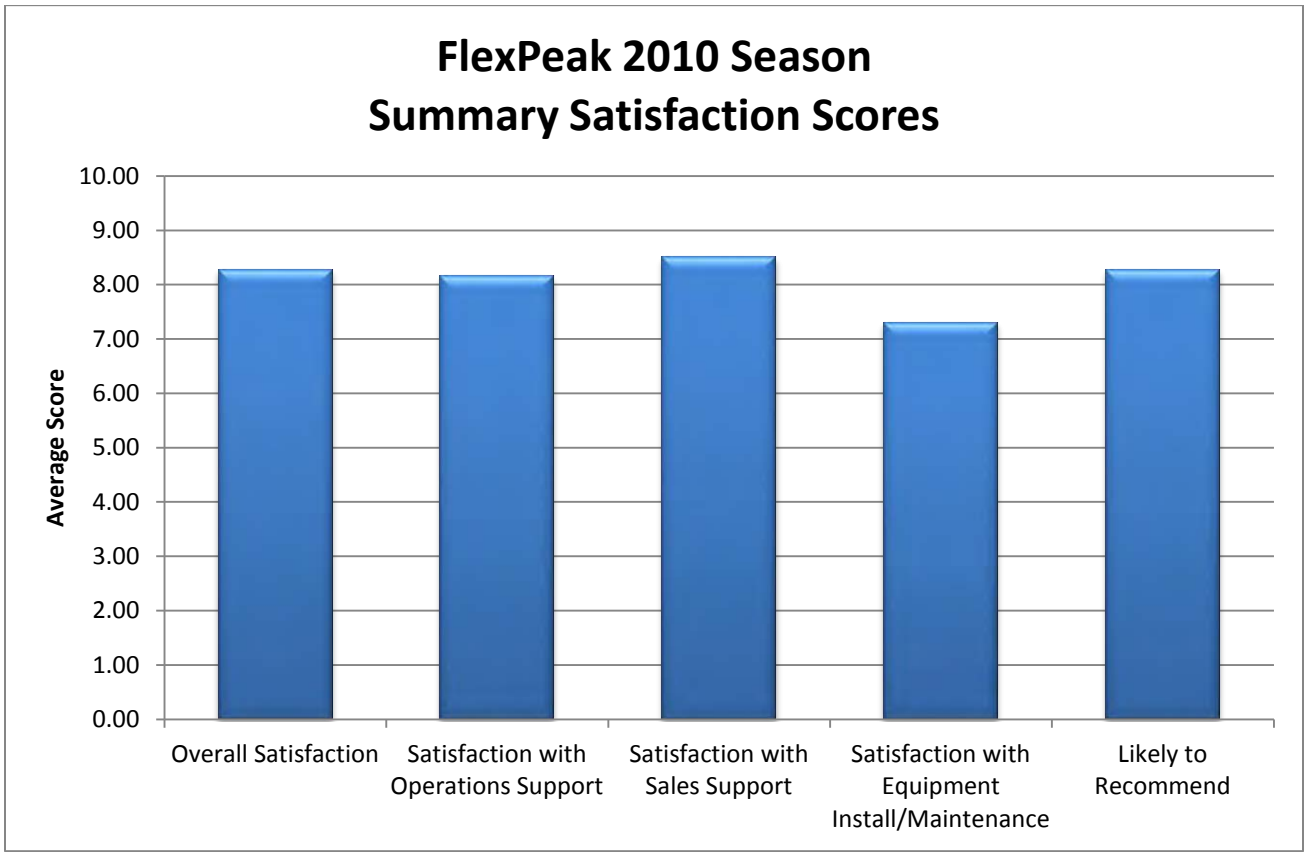
Customer Satisfaction

EnerNOC conducted a 2010 post-event survey for the June 29th event. Of the 125 customers surveyed, 10 responded. Customers were asked about their overall satisfaction with the program, how likely they were to recommend the program, how prepared they felt, the clarity of the initial notification and overall satisfaction with the way the event was managed. Responses were based on a 0-10 scale, 10 being very positive, and 0 being very negative. Overall average satisfaction with the program was 8.9. The average score for all questions was 9.2. Results are shown below.

The same post-event survey was conducted for the July 5, 6, 11 & 12 events in 2011. Of the 125 participants surveyed, 29 responded. Customers were again asked about their overall satisfaction with the program, how likely they were to recommend the program, how prepared they felt, the clarity of the initial notification and overall satisfaction with the way the event was managed. Responses were based on a 0-10 scale, 10 being very positive, and 0 being very negative. Overall average satisfaction with the program was 8.1. The average score for all questions was 8.4. Results are shown below.



EnerNOC conducted a post-season survey for the 2010 season during the first quarter of 2011. Of the 125 participants surveyed, 15 responded. Customers were asked about their overall satisfaction with the program, their satisfaction with operational support, their satisfaction with sales support, their satisfaction with equipment installation and maintenance and how likely they were to recommend the program. Responses were based on a 0-10 scale, 10 being very positive, and 0 being very negative. Overall average satisfaction with the program was 8.3. The average score for all questions was 8.1. Results are shown below.



EnerNOC plans to conduct a 2011 post-season survey within the first quarter of 2012. Results of the survey will be made available to Idaho Power.

In September, 2011 Idaho Power contracted with ADM Associates, Inc. to conduct a customer survey regarding the effectiveness of the FlexPeak Management program as a demand response program. The results of this survey indicated that the majority of respondents (88%) have participated in the program for two or more summers. Eighty percent of the customers estimated there were six or more events during the summer of 2011. The majority of respondents (74%) indicated there were more events called during 2011 than in 2010. Just over half (56%) of the respondents did not opt out of any events during the 2011 season. The majority of respondents (78%) indicated they are “very likely” to participate in the program in 2012. Half of the respondents (51%) participated in the program because of the financial incentive. Overall satisfaction with the program was high among respondents with 86% indicating they are “very satisfied” with the program. Nearly all (91%) of the respondents are “very likely” to recommend the FlexPeak Management program to others.

Idaho Power Participation

In 2010 Idaho Power identified the Idaho Power Corporate Headquarters (IPC CHQ) in downtown Boise as a candidate to participate in FlexPeak Management. In August of 2010 Idaho Power entered into an agreement with EnerNOC, similar to the agreement customers enter into to enroll in the program. Unlike other program participants, Idaho Power does not receive any financial incentives to participate. Idaho Power committed to reduce their electrical consumption by 100 kW during demand reduction events in 2011. The CHQ participated in all fourteen of the FlexPeak events initiated in July and August. The average reduction achieved by the facility across the fourteen events was 200 kW. The CHQ exceeded the committed reduction in all but one event, and which case they achieved an average reduction of 92 kW. The maximum reduction was 377 kW, achieved in July. Reductions were mostly obtained by turning off lights, adjusting chiller set-points, decreasing fan speeds and curtailing elevator use. Besides the benefit of experiencing first-hand what participants experience with the program, Idaho Power now has a facility reduction plan in place that could be executed at any time to reduce electricity use if necessary.

Payment Reconciliation

EnerNOC invoices Idaho Power on a monthly basis for the months of June through August each year. Invoices consist of both a capacity payment component, which is based on the amount of reduction available during active program times, and an energy payment component, which is based on measured reductions during each event. In the months where no demand reduction events occurred, charges were based on a simple capacity payment calculation using EnerNOC weekly reduction commitments. During months where demand reduction events were called, invoice amounts had an energy component and a capacity component which were both based on actual participant reductions.

The overall demand reduction was determined by totaling the demand reduction of each participating facility. The demand reduction of each participating facility was determined by subtracting their actual use from a calculated baseline. The baseline in a demand reduction program is used to measure response and establish appropriate compensation for program participants. It estimates what would have happened on an event day, absent the demand reduction event, which then allows Idaho Power to determine how much load was reduced as a result of the program. Specifically, a baseline is calculated by selecting the three highest load days of the preceding ten non-event business days.

EnerNOC provided customer baseline and reduction data to Idaho Power with the July invoice, and Idaho Power worked in parallel, using the actual five minute interval data received from EnerNOC to determine baselines and reductions independently. The companies worked together to identify and resolve all discrepancies. Discrepancies were typically due to things such as individual baseline day selections or customer notification times. At the end of the reconciliation process, both companies agree upon the individual reductions and composite reductions for each event.

Cost-Effectiveness

On December 30, 2011, the Idaho Public Utilities Commission acknowledged Idaho Power's 2011 IRP. As a result, the program's cost-effectiveness model has been updated to reflect the newly accepted financial inputs and DSM alternate costs. As published in the 2011 IRP, for peaking alternatives, such as demand response programs, a 170-MW simple-cycle combustion turbine (SCCT) is used as an avoided resource cost.

In addition to these updates, Idaho Power has reviewed it's methodology to analyze the cost effectiveness of its demand response programs. This analysis is updated annually with actual benefits and costs. For the FlexPeak Management program, the benefits are based on measured demand reduction at the participants' meter. The costs include the fees paid to EnerNOC and Idaho Power administration for the program. The 2010 & 2011 cost-effective results are in the table below.

FlexPeak Management Cost Effectiveness

	MW Reduction	TRC Ratio
2010	35.04	1.33
2011	38.66	1.93

Conclusion

FlexPeak Management continues to be a reliable resource to Idaho Power, as evidenced over the last two years, with an average event performance of 112%. Idaho Power planners are able to utilize commercial/industrial demand response alongside their stack of resources available each week, and the long-term forecast includes reduction capacity attributed to the program.

Idaho Power will continue to evaluate the best use of the program in order to meet the program objectives, maximize the benefit to Idaho Power's system and refine internal criteria to call demand reduction events. Results will continue to be reported annually in Idaho Power's Demand Side Management Annual Report.

See ya later, refrigerator® Program

Process Evaluation

2009-2011 Program Cycle

Prepared for:

Idaho Power

Prepared by:

ADM Associates, Inc.
3239 Ramos Circle
Sacramento, CA 95827
916.363.8383

Final Report, December 2011

Table of Contents

1. Executive Summary 1-1

2. Introduction 2-1

3. Process Evaluation Methodology 3-1

4. Overview of the See ya later, refrigerator® Program 4-1

5. Participant Survey Findings 5-1

6. Idaho Power and JACO Staff Interview Findings 6-1

7. Key Conclusions 7-1

Appendix A. Participant Survey Instrument A-1

1. Executive Summary

This report provides the process evaluation of Idaho Power's See ya later, refrigerator® Program during the 2009-2011 program cycle. The report focuses on participant and stakeholder perspectives from the 2011 program year, while summarizing findings and program activity for the full program cycle.

The purpose of the process evaluation is to examine program operations and results throughout the program operating cycle, and to identify potential program improvements. This process evaluation was designed to document the operations and delivery of the See ya later, refrigerator® Program during its first program cycle.

Key research questions to be addressed by this evaluation of program activity include:

- *How effective were the marketing efforts for the program? Which marketing methods were most effective?*
- *How well did Idaho Power staff and the implementation team work together?*
- *Were the program participants satisfied with their experience? What was the level of satisfaction with the incentive amount, the scheduling process, and the pickup process?*
- *What changes can be made to the program's design or delivery to improve its effectiveness in future program years?*

These questions are approached through a series of research activities, including the following:

1.1 Review of Program Documentation

ADM conducted a review of relevant program documents, reports, and other materials in order to gain a thorough understanding of the organizational structure and operational characteristics of the See ya later, refrigerator® Program. 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.

1.2 Interviews with Idaho Power and JACO Staff

Open-ended telephone interviews were conducted with Idaho Power program management staff, as well as with key implementation contractor staff at JACO Environmental (JACO). Specific research topics addressed through these interviews include:

- Program Design;
- Program Changes and Developments;

- Quality of Communication; and
- Potential Program Improvements.

1.3 Participant Survey

A telephone survey was conducted with customers who had recycled at least one unit through the See ya later, refrigerator® Program in 2011. The purpose of the participant survey is to evaluate customer perceptions of the program and gauge overall program satisfaction. The survey design focused on customer decision making and overall experience with the program, while gaining an understanding of how effectively the program is meeting customer needs. In total, 386 customers who participated in the 2011 program responded to the survey. Specific research topics covered within the survey instrument include:

- **Decision making process:** Respondents stated how they learned about the program, indicated which portion of the program provided them with the most value, and rated the appropriateness of the program rebate level.
- **Customer satisfaction:** Customer respondents conveyed their satisfaction levels with selected program elements including the program application process, the pickup process, and the program incentive. Respondents were also asked whether they would be likely to recommend the program to others.
- **Problem resolution:** Respondents were asked whether they experienced problems with any elements of the program and were asked to provide commentary describing any mentioned issues. These participants were also asked whether their problem had been resolved.

Appendix A provides a copy of the survey instrument that was administered to 2011 program participants.

1.4 Key Conclusions

The following is a summary of the key findings identified as a result of the process evaluation research activities:

1.4.1 High Program Satisfaction

Participants of the See ya later, refrigerator® Program provided very positive satisfaction ratings for numerous program elements including the application process, scheduling process, and JACO appliance recycling crew. There were very few instances of dissatisfaction, and the majority of these were anecdotal in nature. These results suggest that the program has developed into a reliable entity that is capable of meeting customer expectations and goal targets.

1.4.2 Effective Program Marketing

According to JACO staff, the See ya later, refrigerator® Program marketing strategy is an example of a comprehensive approach that continually increases program awareness. While it appears that utility bill inserts are the most effective form of direct marketing, the other marketing materials account for approximately half of the initial program awareness. Additionally, customers are likely hearing about the program from multiple sources, which provides a consistent messaging effect.

1.4.3 Positive Working Relationships

Each interviewed JACO and Idaho Power staff member provided positive comments related to the working relationships that have been developed while working with the See ya later, refrigerator® Program. It is likely that these relationships have been a strong asset for the success of the program. It appears that Idaho Power and JACO have adopted a collaborative communication style that is very effective at monitoring and modifying the program process.

1.5 Potential Areas of Research

In addition to the findings discussed above, there are areas of the program that may benefit from continued research. Participant survey results and stakeholder interviews pointed to aspects of the program that may be relevant to future program design.

1.5.1 Existing Retailer Involvement with Program

When JACO representatives asked how customers first heard about the program, 13% of the 2009-2011 participants indicated that they learned of the program through an appliance retailer. In the customer survey for 2011 participants, 6% reported that they had learned of the program through retailers. While Idaho Power has chosen not to engage retail channels in the promotion of the See ya later, refrigerator® Program, some retail stores may be using the program as a tool to increase sales.

1.5.2 Customer Understanding of Program Requirements

Several open-ended responses within the participant survey suggested that some customers may not fully understand the eligibility requirements or purpose of the See ya later, refrigerator® Program. For example, a few customers suggested that the program provide rebates for non-working appliances, and one customer did not appear to understand why the unit's cord was cut upon removal from the home. These responses suggest that some customers are likely focusing on the benefits that the program provides to them, and that they may not understand that the program is designed to actively reduce the total demand on the electrical grid.

2. Introduction

This report provides the process evaluation of Idaho Power's See ya later, refrigerator® Program for its first program cycle during years 2009-2011. The report focuses on participant and stakeholder perspectives from the 2011 program year, while summarizing findings and program activity for the full program cycle. An overview of the program process is provided, and is based upon a review of available program documentation as well as stakeholder interviews. Customer perspectives are obtained through the 2011 program participant survey, while the program operational perspective is based on interviews with key utility and implementation contractor staff. The report identifies key findings related to how the program is operating, strengths and weaknesses of the program, and opportunities for future program years.

3. Process Evaluation Methodology

The purpose of the process evaluation is to examine program operations and results throughout the program operating cycle, and to identify potential program improvements. This process evaluation was designed to document the operations and delivery of the See ya later, refrigerator® Program during its first program cycle.

Key research questions to be addressed by this evaluation of program activity include:

- *How effective were the marketing efforts for the program? Which marketing methods were most effective?*
- *How well did Idaho Power staff and the implementation team work together?*
- *Were the program participants satisfied with their experience? What was the level of satisfaction with the incentive amount, the scheduling process, and the pickup process?*
- *What changes can be made to the program's design or delivery to improve its effectiveness in future program years?*

Figure 3-1 illustrates the stages of the process evaluation, outlining key activities performed.

Figure 3-1 Process Evaluation Overview

3.1 Review of Program Documentation

ADM conducted a review of relevant program documents, reports, and other materials in order to gain a thorough understanding of the organizational structure and operational characteristics of the See ya later, refrigerator® Program. Documents reviewed included the program handbook, marketing materials, and progress reports for the full three-year program cycle. ADM also reviewed the program application form and program data records that are maintained by JACO Environmental, the implementation contractor. 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.

3.2 Interviews with Idaho Power and JACO Staff

Open-ended telephone interviews were conducted with Idaho Power program management staff, as well as with key implementation contractor staff at JACO Environmental (JACO). The interviewed JACO staff represented a wide range of program roles, including program management, marketing, data management, and recycling center coordination. Specific research topics addressed through these interviews include:

- **Program Design:** Interview participants were asked about the overall structure of the program including the appliance pickup process, data management tasks, marketing strategy, and program planning. Implementation contractor staff discussed the effectiveness of the See ya later, refrigerator® Program design as compared to other similar appliance recycling programs.
- **Program Changes and Developments:** Participants were asked about any changes that have been made to the program design since its initial implementation, as well as about any significant changes in the market environment that may have affected the operations of the program.
- **Quality of Communication:** Participants characterized how communication is structured between utility and implementation contractor staff, and were asked about the quality of this communication. JACO staff also evaluated communication among the appliance pickup crew, the recycling center, and other staff members.
- **Potential Program Improvements:** Interview participants were asked about any improvements that could be made to the program in terms of customer participation levels, operational efficiency, or overall effectiveness.

3.3 Participant Survey

A telephone survey was conducted with customers who had recycled at least one unit through the See ya later, refrigerator® Program in 2011. The purpose of the participant survey is to evaluate customer perceptions of the program and gauge overall program satisfaction. The survey design focused on customer decision making and overall experience with the program, while gaining an understanding of how effectively the program is meeting customer needs. In total, 386 customers who participated in the 2011 program responded to the survey. Specific research topics covered within the survey instrument include:

- **Decision making process:** Respondents stated how they learned about the program, indicated which portion of the program provided them with the most value, and rated the appropriateness of the program rebate level.

- **Customer satisfaction:** Customer respondents conveyed their satisfaction levels with selected program elements including the program application process, the pickup process, and the program incentive. Respondents were also asked whether they would be likely to recommend the program to others.
- **Problem resolution:** Respondents were asked whether they experienced problems with any elements of the program and were asked to provide commentary describing any mentioned issues. These participants were also asked whether their problem had been resolved.

Appendix A includes a copy of the survey instrument that was administered to 2011 program participants.

3.3.1 Participant Survey Sampling Strategy

Determining customer satisfaction with the See ya later, refrigerator® Program in 2011 was accomplished through telephone surveying of a randomly-selected sample of 386 participants.

This sample size allows for program impacts to be assessed at the 95% confidence level with ±5% relative precision. The sample size to meet 95/5 requirements is calculated based on the coefficient of variation of savings for program participants, assumed to be approximately 0.50, based on industry best practices. On this assumption, a sample size of at least 385 participants is required, as shown in the following formula:

Minimum Sample Size Formula for 95% Confidence

Coefficient of Variation (CV) is defined as:

$$CV(x) = \frac{Standard\ Deviation\ (x)}{Mean(x)}$$

Assuming a CV of 0.50, the minimum required sample size with 95% confidence and 5% relative precision is calculated as:

$$n_0 = \left(\frac{1.96 * CV}{RP}\right)^2 = \left(\frac{1.96 * 0.5}{0.05}\right)^2 = 385$$

where:

- n_0 = minimum sample size
- CV = Coefficient of Variation (assumed to be 0.5)
- RP = Relative Precision (0.05)

4. Overview of the See ya later, refrigerator® Program

Idaho Power's See ya later refrigerator Program is designed to help customers reduce their energy consumption by removing refrigerators and freezers from their homes to recycle them. Idaho Power benefits because the old appliances, which are generally more inefficient, will be permanently removed from the system. The environment also benefits from the recycling process through safe disposal of environmentally harmful materials.

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. Many areas in which spare units are placed are not space conditioned and most refrigerators used in that environment operate under a heavy thermal load during the summer. This is exacerbated by the fact that the units are usually quite old and inefficient. Previous studies by the Environmental Protection Agency (EPA), the Department of Energy (DOE) and other utilities have determined that removing these appliances, and properly recycling them, performs an energy saving service.[1]

The program is configured as a turnkey, stand-alone energy efficiency initiative. The program targets existing multi and single family households, renters and homeowners who have old, inefficient refrigerators and freezers. Marketing for the program consists of newspaper ads, bill stuffers, Customer Connection articles, website content, and community events. To be eligible for the program, units to be recycled must be in working condition at the time of pick-up. The customer receives pick-up and removal service in addition to a $30 rebate per recycled refrigerator or freezer.

Removing old, inefficient refrigerators and freezers prevents them from being resold or transferred to another Idaho Power customer. The program provides annual electric energy savings for the remaining life of the unit by permanently removing the unit from service. As an added environmental benefit, 95% of the materials from these units are able to be recycled (metals, plastic, glass, oil, etc.) and disposed of in an environmentally responsible manner, thus preventing the materials from reaching landfills and contaminating the environment.

4.1 Overall Program Process

Figure 4-1 presents a logic model outlining the main activities that occur from the time the program is promoted to customers to the time the appliance is removed from the electrical grid and recycled. The initial stages of the program involve operational design and structuring prior to implementation. These activities include setting program goals and developing the marketing strategy that will be used to promote the program to

[1] EPA information available at http://www.epa.gov/ozone/title6/608/disposal/household.html

customers. During program implementation, marketing materials such as bill inserts are distributed to customers in order to notify them of the rebate and haul away opportunity.

The customer initiates participation in the program by enrolling online or by telephoning the JACO call center whose number is provided with the See ya later, refrigerator® marketing materials. If the customer calls the call center, their eligibility to participate is reviewed through a series of screening questions. These questions include verifying that the customer is a residential customer within the appropriate service territory and confirming the size and functionality of refrigerators or freezers. The customer is also asked a series of questions such as how they heard about the program. During this initial call, JACO makes appointments with customers, generally within a two week time frame.

The updated enrollment data are sent daily to Idaho Power for verification, where program staff ensures that the customer is a current account holder and meets the general eligibility requirements. Once this process is complete, a full enrollment list containing all approved customers is sent back to JACO for confirmation. The length of time between the enrollment call and pickup date varies based on total participant load and location of customer. Rural areas are less commonly visited by the pickup crew, and appointments in these areas are generally scheduled to allow for one visit every few weeks.

The customer is reminded of their appointment and given a 4 hour pickup window on the day prior to the pickup. On the day of the appointment, the pickup crew enters the customer's residence and verifies that the refrigerator or freezer is plugged in and in working condition. The pickup crew asks the customer a series of questions regarding their appliance and records information such as unit age, make, and type. The pickup crew cuts the cord of the refrigerator or freezer onsite, rendering it non-functional before placing it in the recycling truck. At the end of the day of scheduled appointments, the pickup crew drops the units off at a central site, where they are consolidated onto a larger truck and transported to Salt Lake City, Utah for the recycling process.

During the recycling process, the appliances are broken down and hazardous waste materials are properly disposed of. The process ensures that impact on landfills is minimized, and that substances contained within the units, such as Freon, are prevented from being released into the atmosphere. After the appliance is picked up, the rebate check is mailed to the customer within four to six weeks.

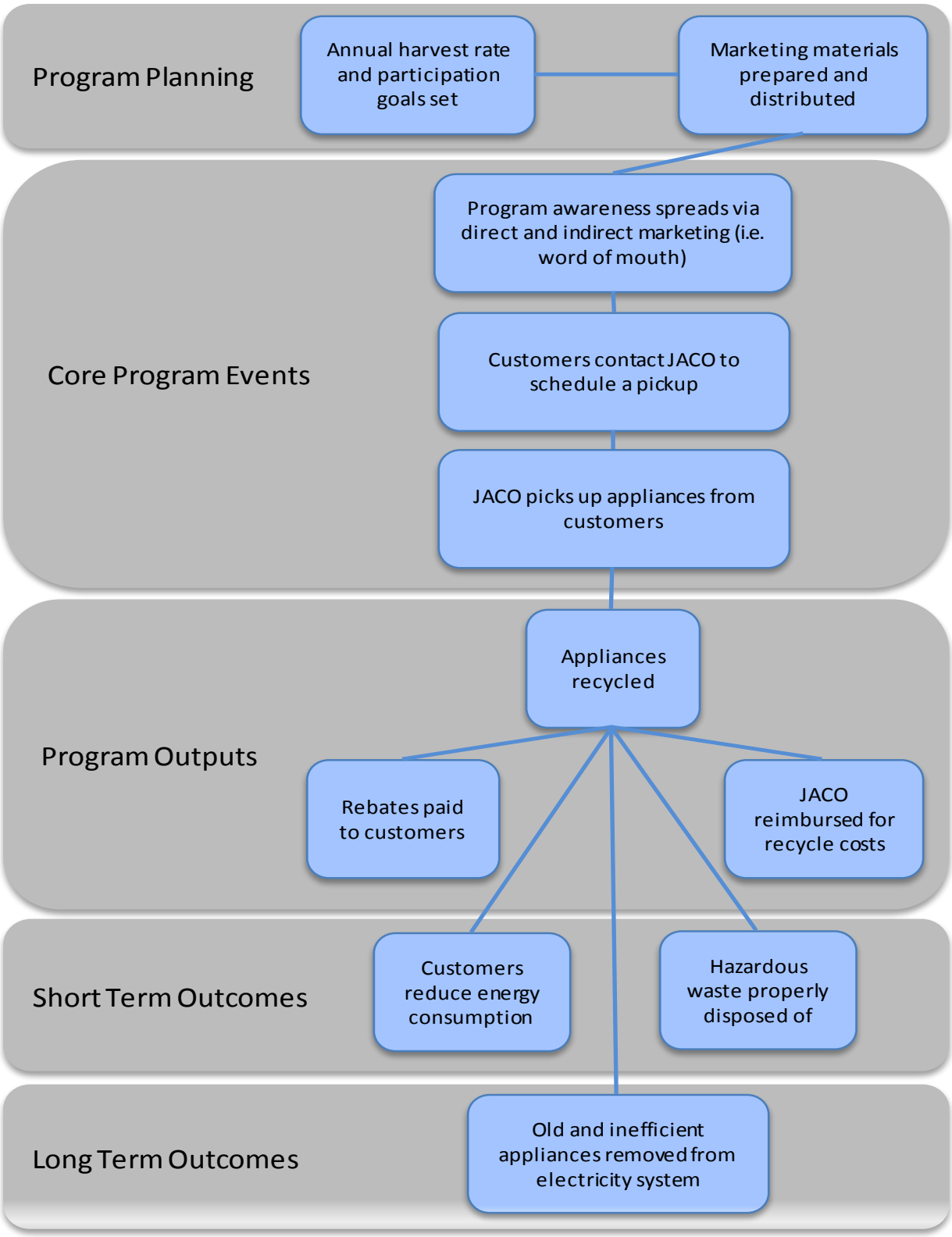


Figure 4-1 Logic Model of the See ya later, refrigerator® Program Process

4.2 Marketing the Program

In order to track the relative success of the various marketing efforts employed for the See ya later, refrigerator® Program, JACO tracks customer response data for how they heard about the program in its records database. Customers are asked how they learned of the program when they make their enrollment call or submit an online application. The results from these data have consistently shown that utility bill inserts are the most common source of initial program awareness. Figure 4-2 displays these findings for the entire program cycle from 2009-2011. Utility bill inserts accounted for nearly 50% of customer responses, while friends and neighbors were cited by 19% of participants. Thirteen percent of participants reported that they heard about the program from appliance retailers, which is notable considering the fact that the program is not actively promoted through retail channels. This suggests that retailers may be independently marketing the See ya later, refrigerator® Program in order to increase appliance sales.

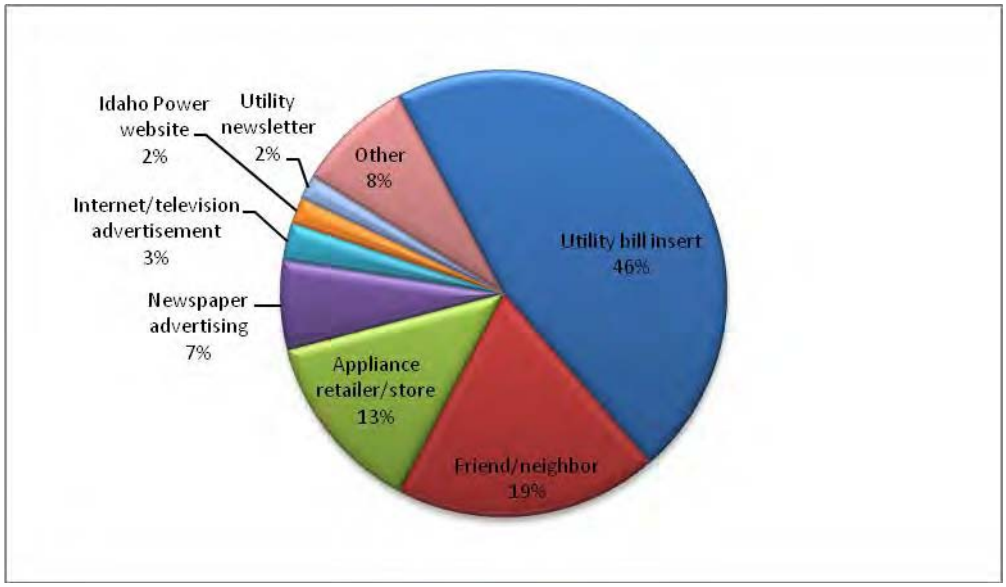


Figure 4-2 JACO Data for How Customers Heard of the Program, 2009-2011

1.1.1 Newspaper and Internet Advertising

One aspect related to program marketing involves the type of appliances that are emphasized in program marketing materials. Program management staff noted that the marketing message tends to focus on recycling secondary units. Although primary refrigerators and freezers are eligible for the program, program marketing is designed to minimize free ridership by encouraging customers to recycle the units that they likely did not have previous plans to replace. JACO asks participants whether their recycled units were used as primary or secondary appliances.

Table 4-1 compares the number of units for each usage type with the age of the units for the 2011 program year. In 2011, 774 participants reported that their appliance was a primary use unit. Nearly twice as many participants identified their refrigerators or freezers as secondary use units. In terms of appliance age, the majority of recycled primary units were less than 20 years old while the majority of secondary units were more than 20 years old. These findings suggest that the program is successfully encouraging a high percentage of customers to recycle their older, secondary use units. Additionally, the efficiency level of older refrigerators and freezers is typically lower than that of new units, which likely has an effect on the total electricity consumption removed from the electrical grid.

Table 4-1 Age of Recycled Units by Usage Category, 2011

Usage Category	*Age of Unit*				*N*
	Less than 5 years	*5 - 10 years*	*11 - 20 years*	*More than 20 years*	
Primary	0.8%	28%	39%	32%	774
Secondary	0.5%	11%	24%	64%	1,516

4.3 Seasonality of Program Participation

Due to the presence of rural areas such as mountain regions, and the weather conditions resulting from changing seasons, the See ya later, refrigerator® Program experiences a level of participation seasonality. This is partially related to the fact that customers tend to be more willing to have their refrigerator or freezer defrosted and picked up during warmer months. Additionally, the JACO appliance pickup crew limits its service to some regions during winter months in order to improve pickup efficiency and avoid transportation complications. Figure 4-3 displays the number of successful enrollment calls made by customers per month, starting in June of 2009 and ending in October of 2011. Each year, the number of enrollments drops significantly between November and February, with noticeable spikes in enrollment during July and August. Along with the seasonality of enrollment, the timing of program marketing appears to have had a significant effect on participation patterns. When bill inserts are sent to customers, the program experiences an accompanying increase in participation.

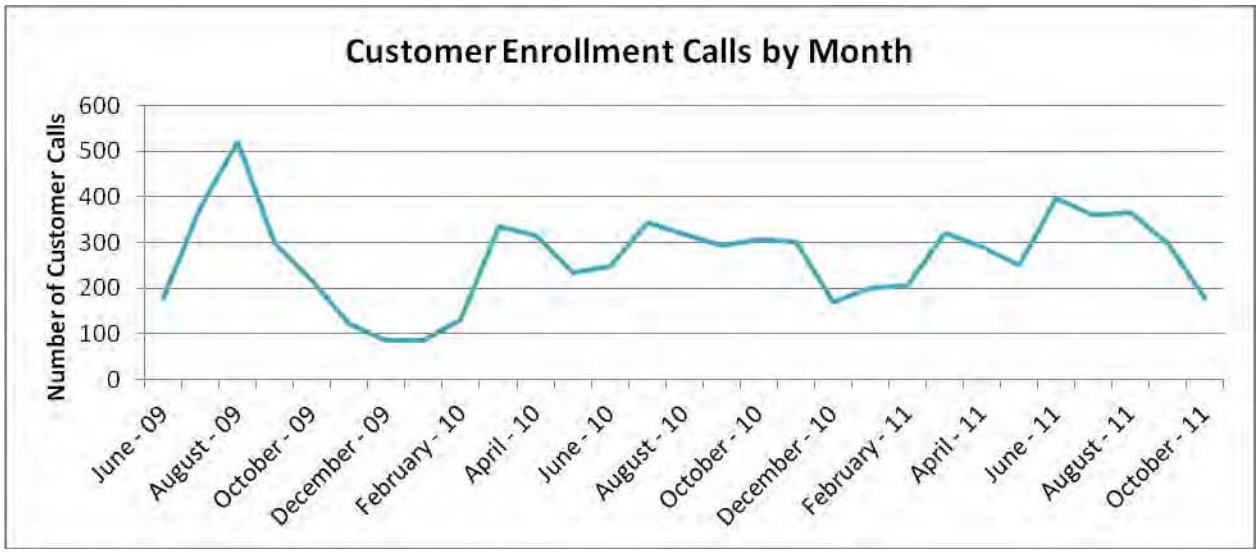


Figure 4-3 Customer Enrollment Calls by Month, 2009-2011

The fluctuation in enrollment throughout the program year has an effect on appointment scheduling and pickup availability. The average lead time between customer enrollment and appliance pickup ranges from approximately 7 to 26 days during the year. A comparison between this figure and Figure 4-4 finds a correlation between enrollment load and appointment lead time, with longer lead times occurring during the summer months. When total enrollment is low, such as in December of 2009, the average time between enrollment call and appliance pickup is fewer than ten days. The total average pickup lead time for 2009-2011 is approximately 13 days. In the customer survey, participants who expressed dissatisfaction with appointment scheduling generally mentioned lead times of more than two weeks; this suggests that the average time frame between enrollment call and pickup is satisfactory to most customers.

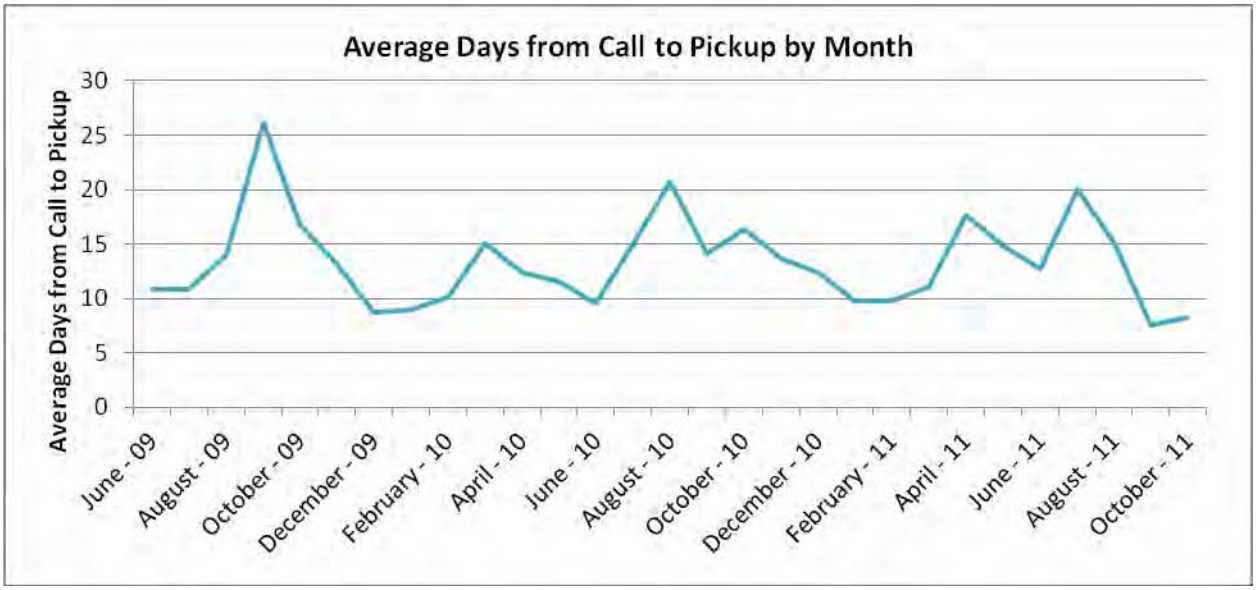


Figure 4-4 Days from Enrollment Call to Unit Pickup, 2009-2011

5. Participant Survey Findings

A telephone survey was conducted to collect data about customer decision-making, preferences, and opinions of the See ya later, refrigerator® Program. The survey focused on various aspects of the customer experience, including the program application process, the pickup process, and the program rebate. The customer survey was conducted in December of 2011 with customers who had participated in the 2011 See ya later, refrigerator® Program year. In total, 386 customers who had recycled at least one unit through the program responded to the survey.

5.1 Customer Awareness of the Program

Participants were first asked how they first learned about the See ya later, refrigerator® Program. As shown in Figure 5-1, respondents most commonly reported that they heard about the program through a bill insert from Idaho Power. This was followed by Idaho Power brochures with 19% of respondents citing this source. As it is unclear from customer responses whether these brochures were actually bill inserts, some of the respondents citing an Idaho Power brochure may have been referring to a utility bill insert. These results are consistent with the findings obtained from multiple customer inquiries conducted by JACO, where program participants commonly cited bill inserts as their initial source of program information.

Sixteen percent of respondents reported hearing about the See ya later, refrigerator® Program from friends or relatives, which suggests that many customers are recommending the program to others through word of mouth. It is likely that this word of mouth element has substantially increased over the course of the program, and that a high percentage of customers have heard about the program from friends or relatives who have participated.

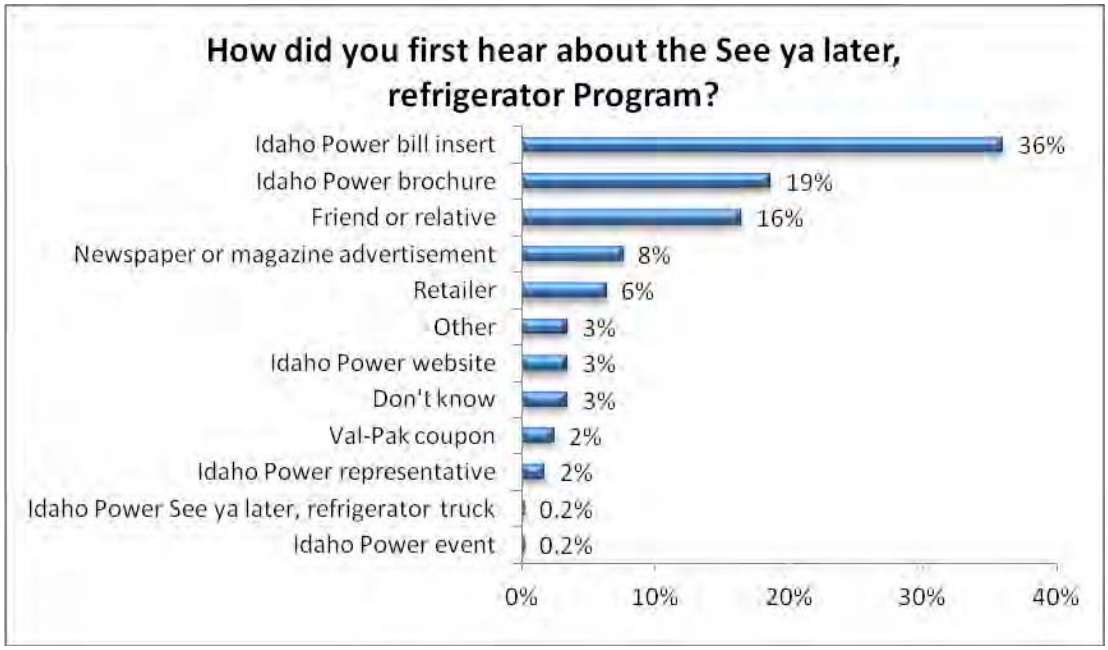


Figure 5-1 How Customers Learned about the Program

5.2 Customer Decision Making Characteristics

In order to understand customer values and potential motivations for participating in the program, survey respondents were asked which part of the program provided them with the most value. As shown in Figure 5-2, the majority of customers reported that they received the most value from the convenience of the program. This is likely related to the efficiency of the pickup process offered by the program, which allows customers to have their old appliances removed from their homes without having to pay a haul-away fee. One-quarter of respondents indicated that the incentive or rebate provided them with the most value.

The convenience of haul away and the program incentive are typically the two most common motivations for customers to participate in appliance recycling programs such as the See ya later, refrigerator® Program, and it is often unclear whether some customers would be interested in participating in the absence of a rebate. This question alone does not directly address these customer motivations, but suggests that a high percentage of customers received more value from the convenience of the program than from the offered rebate. Additionally, 23% of respondents provided other responses, including environmental impact and reduction of energy costs.

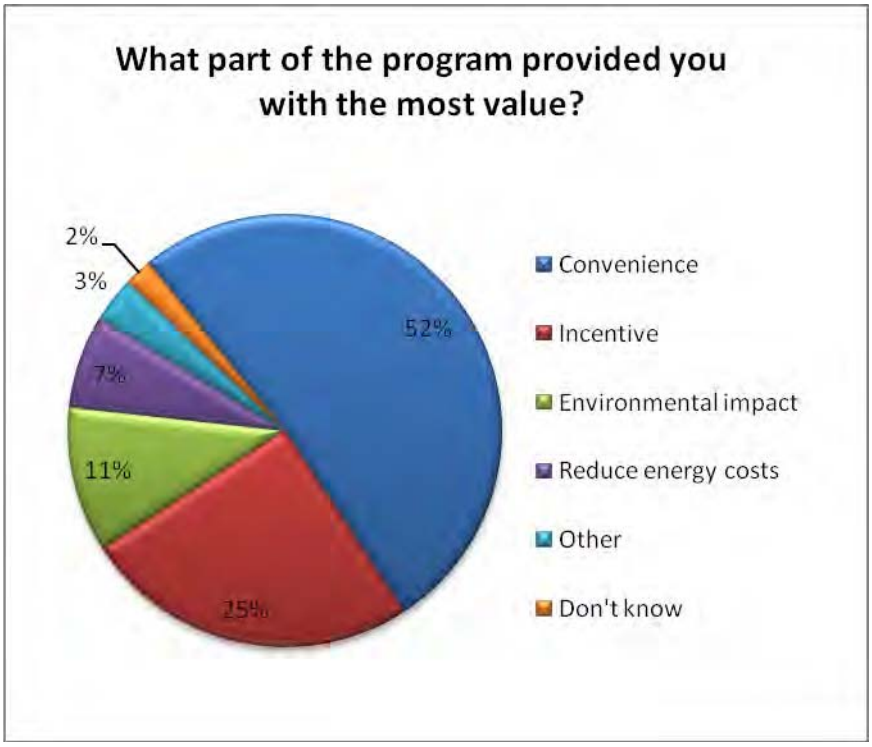


Figure 5-2 Value Provided to Customers through Program

Respondents were then asked to provide opinions related to the program rebate amount; Figure 5-3 displays the results. Ninety-five percent of respondents reported that they either agree or strongly agree that they rebate offered through the program was an adequate amount. Only 3% of respondents disagreed that the rebate amount was adequate, suggesting that a very high percentage of customers are satisfied with the rebate level. This is in agreement with commentary expressed during interviews with Idaho Power and JACO staff, where staff members noted that customers have been aware of other refrigerator recycling programs with $30 rebates and therefore would likely accept that rebate level as being appropriate for the See ya later, refrigerator® Program.

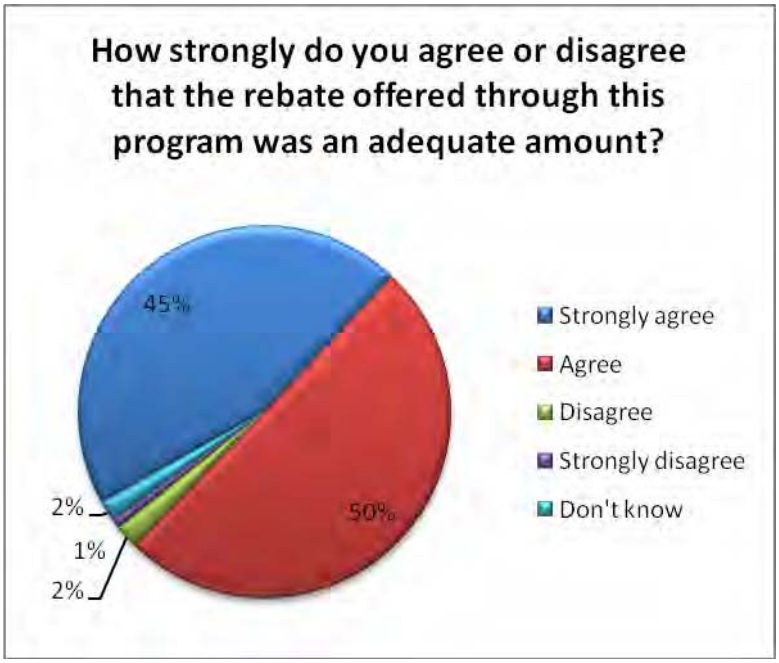


Figure 5-3 Customer Opinion of Program Rebate Amount

5.3 Customer Satisfaction with the Refrigerator Recycling Program

The participant survey also asked customers about their satisfaction with several elements of the program. These elements included:

- Satisfaction with the program application process;
- Satisfaction with the scheduling of pickup appointments;
- Satisfaction with the JACO appliance pickup team;
- Satisfaction with the time it took to receive the rebate after participating; and
- Satisfaction with the overall process of participating in the program.

Respondents were asked about their levels of satisfaction with these program elements, with the response options of “very satisfied”, “somewhat satisfied”, “somewhat dissatisfied”, and “very dissatisfied”. Figure 5-4 displays the distribution of participant satisfaction ratings for these aspects of the program. Overall, satisfaction ratings were very high, with few low scores reported by respondents.

Customer satisfaction with program application process: Ninety-seven percent of respondents indicated that they were at least somewhat satisfied with the application process for the program. Two percent of respondents expressed dissatisfaction with the application process, however the open-ended explanations for dissatisfaction were more closely related to aspects of the program other than the application itself.

One respondent commented that the general process of participating in the program had taken too long, while another respondent indicated that they had not yet received a rebate for participating. These comments suggest that the actual process of enrolling to participate in the program is very satisfactory for customers, but that some of them are likely dissatisfied with one or more of the remaining program elements addressed in the customer survey.

Customer satisfaction with pickup appointment scheduling: Seventy-eight percent of respondents reported being very satisfied with the process of scheduling their pickup appointment, and another 19% reported being somewhat satisfied with this aspect. Three percent of respondents indicated that they were dissatisfied with appointment scheduling; several of these respondents mentioned that they had to reschedule the pickup one or more times. Two respondents stated that the lead time for appointments was too long, while three respondents reported that they had called for a pickup in the winter but were required to wait until the spring for an appointment.

These findings reflect some of the challenges that exist with coordinating the haul away service for customers with busy schedules or uncertain availability. While these customers represent a small percentage of respondents, their concerns emphasize the importance of communicating with customers and ensuring that the pickup process is as straightforward as possible.

Customer satisfaction with JACO pickup team: When asked how satisfied they were with the team from JACO who had picked up the old appliance, 80% of respondents reported that they were very satisfied. Less than 2% of respondents indicated that they were dissatisfied with the JACO team. When asked about their dissatisfaction, one of these respondents explained that the pickup crew did not arrive when scheduled and asked the customer to reschedule their pickup time. Two respondents mentioned issues with the appliance removal process, with one stating that they did not like the fact that the refrigerator cord was severed while in the customer's home. The remaining respondent expressed dissatisfaction with the pickup crew itself.

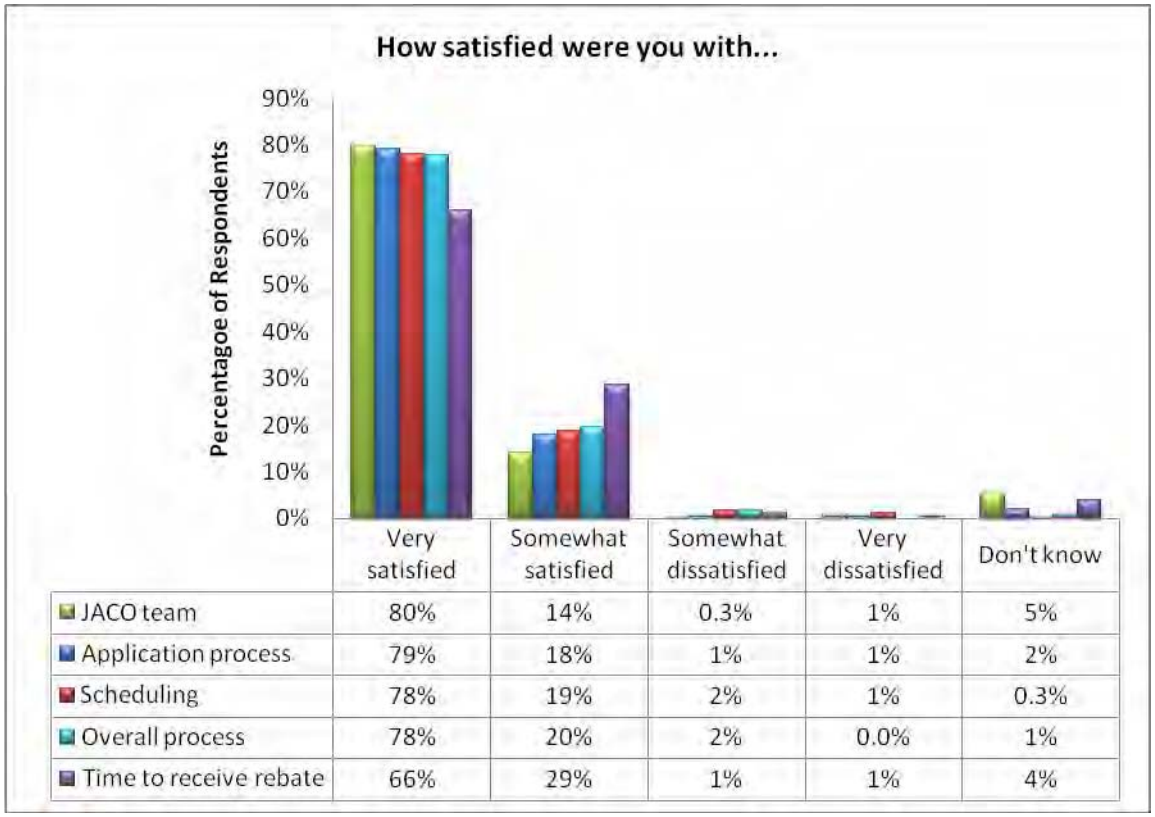
For programs that require entering customer homes for installation or removal of equipment, some customers typically view the process as burdensome or uncomfortable. However, respondent commentary for this program element primarily relates to the scheduling and appliance pickup process, while the full set of participant responses strongly suggests a high level of satisfaction with the JACO pickup team.

Customer satisfaction with time to receive program rebate: Two-thirds of respondents reported being very satisfied with the time it took to receive their rebate, while 29% of respondents indicated that they were somewhat satisfied with this aspect. While this program element received the fewest ratings of „very satisfied', these ratings reflect very high satisfaction levels for customers. Two percent of respondents rated the time to receive the rebate with either a „somewhat dissatisfied' or „very dissatisfied' response. All of these respondents indicated that the rebate seemed to take too long to

arrive, although records indicate that they received the rebate within the time frame that is specified within the program documentation.

Customer satisfaction with overall process of program experience: Ninety-eight percent of respondents were at least somewhat satisfied with the overall process of having their appliance recycled, from the time they called for a pickup to the time they received their rebate. Two percent of survey participants indicated that they were somewhat dissatisfied with this overall process. When explaining the reasons for their dissatisfaction, respondents mainly restated the issues that they had experienced with the previously discussed program elements. The most common issue related to the length of the full process, with one respondent remarking that a six to eight week process is too long.

It appears that respondents were either concerned that it took too long for the appliance to be picked up, or that the rebate did not arrive quickly enough after the pickup had been completed. These issues may be related to managing customer expectations, where some customers may anticipate very flexible appointment times or instant rebates. While these details are generally addressed within the customer-facing program documentation, unfulfilled expectations would likely be minimized by ensuring that participants understand the estimated timeframes of both the scheduling process and rebate delivery.



	Very satisfied	Somewhat satisfied	Somewhat dissatisfied	Very dissatisfied	Don't know
JACO team	80%	14%	0.3%	1%	5%
Application process	79%	18%	1%	1%	2%
Scheduling	78%	19%	2%	1%	0.3%
Overall process	78%	20%	2%	0.0%	1%
Time to receive rebate	66%	29%	1%	1%	4%

Figure 5-4 Customer Satisfaction with Selected Program Elements

In addition to satisfaction levels for specific program elements, survey respondents were asked whether they experienced any problems with the program. As displayed in Table 5-1, only 3% of respondents indicated that they had experienced a problem with the program. These problems were mainly related to appointment scheduling delays, and were primarily anecdotal in nature.

Table 5-1 Problems Experienced During Program Participation

Did you experience any problems with this program?	*Percent of respondents*
No	97%
Yes	3%
N	386

Finally, customers were asked about their likelihood of recommending the See ya later, refrigerator® Program to a friend or family member. Table 5-2 shows that 99% of respondents reported being at least somewhat likely to recommend the program to others, with less than 1% of respondents indicating that they would be unlikely to make this recommendation. This suggests that participants have significantly benefited from the program and believe that it would be valuable to others. It is likely that the observed

informal word of mouth method of marketing will continue to expand as these and other participants mention their experiences with the program to friends and family members.

Table 5-2 Customer Likelihood of Recommending Program

How likely would you be to recommend the See ya later, refrigerator® Program to a friend or family member?	*Percent of respondents*
Very likely	93.8%
Somewhat likely	5.4%
Somewhat unlikely	0.5%
Very unlikely	0.3%
N	386

6. Idaho Power and JACO Staff Interview Findings

Open-ended telephone interviews were conducted with Idaho Power program management staff, as well as with key implementation contractor staff at JACO Environmental (JACO). The interviewed JACO staff represented a wide range of program roles, including program management, marketing, data management, and recycling center coordination. The purpose of these interviews was to obtain operational perspectives of program performance and structure for the purposes of further understanding program functionality as well as key characteristics of the program as compared to other, similar programs.

6.1 Program Design

Interview participants described several characteristics of the See ya later, refrigerator® Program and its market environment that were considered when designing the structure of the program. JACO staff was able to compare the See ya later, refrigerator® Program with similar programs in terms of organization and performance.

6.1.1 Setting Program Goals

Program management staff explained that participation targets for the program were forecasted based on market research findings and collaborative discussions between Idaho Power and JACO Environmental. After performing this review, program management staff estimated that approximately 3,000 units could be recycled per year. This forecasting took into account the specific demographics of the Idaho Power customer base, as well as environmental factors such as winter months where participation would likely decline temporarily. Interview participants noted that the program participation estimate have been accurate, which is indicative of a proper and appropriate forecasting methodology.

6.1.2 Considering Customer Expectations

Several interview participants mentioned that Idaho Power and Rocky Mountain Power have overlapping areas of influence in terms of marketing and interactions with customers. Due to the fact that Rocky Mountain Power had already been advertising their refrigerator recycling program, many Idaho Power customers had seen these marketing messages and were familiar with various details of the program. These details included the “See ya later, refrigerator®” name, $30 program rebate, and the overall appliance recycling process. Interviewed staff explained that Idaho Power licensed the program name and designed the $30 program rebate in order to appeal to customers who were already familiar with these features. It is likely that these considerations promoted a smooth implementation process and may have caused the program to gain participation momentum more quickly.

6.1.3 Program Marketing Strategy

Utility and implementation contractor staff explained the marketing strategy for the See ya later, refrigerator® Program. The program involved a multimedia marketing campaign, utilizing methods such as radio, Internet, and print materials. Additionally, the recycling truck driven by the appliance pickup crew was equipped with advertising panels. Both JACO and Idaho Power staff mentioned that utility bill inserts continue to be the most reliable source of program awareness for customers, with noticeable increases in participation occurring after inserts are distributed. JACO staff mentioned that marketing methods for appliance recycling programs vary widely by utility, but that the Idaho Power strategy appears to be thorough and effective.

In terms of marketing messages, JACO marketing staff explained that there are three main messages that are incorporated into the majority of See ya later, refrigerator® marketing materials: the program rebate, the free haul away service, and the annual savings achieved once the appliance is removed. JACO staff noted that these three values are the highest priorities for program participants throughout the country, and that a multi-pronged approach of combining the three messages has worked very well in the past. As the order of perceived importance of the three messages varies by program, the marketing strategy tends to promote each of the three aspects as individual features of the See ya later, refrigerator® Program.

6.2 Program Changes and Developments

Interview participants discussed how the program has developed over its three-year cycle, addressing factors such as the economic environment and several factors that may have affected overall participation levels thus far.

6.2.1 Economic Environment

JACO management staff stated that the program kickoff in 2009 proceeded very smoothly and performed well. However, one participant explained that there was some economic hardship in the territory as a result of the national economic downturn, which may have had an effect on energy efficiency implementations in general. This may be most relevant for customers who were planning to replace their recycled units; in this case they may choose not to participate in the program in order to avoid the need to purchase a new primary refrigerator or freezer. JACO staff indicated that while the challenges facing the economic environment likely had an effect on program participation, the See ya later, refrigerator® Program has been fairly effective at maintaining its participation levels. Several JACO staff members attributed this success to the expanded and consistent marketing strategy, as well as to a recent market trend towards general energy efficiency. Additionally, customers who are becoming more concerned about spending money may be drawn towards programs that offer free haul away of energy-using appliances.

6.2.2 Factors Affecting Participation

Interview participants were asked about the customer base for the See ya later, refrigerator® Program, and how its characteristics may influence participation levels. Respondents from both JACO and Idaho Power program management staff mentioned that the Idaho Power service territory contains several rural areas that are significantly removed from commerce areas. According to program management staff, customers living in these rural areas tend to purchase groceries infrequently and bring home a surplus of items. These items are often stored in secondary refrigerators or freezers until needed, which makes these units more valuable to these rural customers. These customers may be less willing to have their secondary units removed. Additionally, interviewed staff explained that the Idaho Power region is popular for hunting, and that many customers likely store their game in these secondary units. JACO program management staff noted that while these factors are not necessarily barriers to the success of the program, they do assist in characterizing which market segments may be more likely to participate.

6.1 Program Communication

When asked about the quality and characteristics of program communication within and between JACO and Idaho Power, all of the interview participants reported that effective communication is one of the program's strongest features. JACO staff explained that Idaho Power and JACO are in very consistent and proactive communication with each other, providing updates regarding program planning and participation. Several members of JACO staff praised Idaho Power for its active involvement in the program implementation process, and mentioned that much of the program success has been related to Idaho Power program management. JACO call center staff reported that very few customer complaints have been received, but that both JACO and Idaho Power immediately address any customer issues that arise. JACO pickup scheduling staff noted that communication between scheduling managers and the pickup crew has been successful, with the pickup crew being very responsive to instructions or requests. In programs where customer satisfaction is a high priority, effective communication is essential in order to prevent problems from proceeding unnoticed. It appears that both Idaho Power and JACO have built successful working relationships that contribute to the overall success of the See ya later, refrigerator® Program.

6.2 Potential Program Improvements

In order to address any future changes that could be made to the program, interview participants were asked for their thoughts regarding how the program could be improved. For the most part, JACO staff responded that the See ya later, refrigerator® Program is running very smoothly as compared to similar appliance recycling programs. JACO program management staff indicated that continuing to use a consistent and

multi-pronged marketing approach will likely increase program awareness and help to maintain the participation levels that have been achieved thus far. Additionally, JACO staff mentioned that Idaho Power's continued interest in pursuing unique marketing techniques such as theatre advertisements and magnet mailers is an indicator of active program management staff who will be an asset to the future success of the program.

JACO scheduling management staff indicated that having the same pickup crew since the inception of the program has resulted in a very skilled pickup crew that understands the service territory and its customers. Although some customers expressed dissatisfaction regarding appointment availability, pickup and scheduling staff reported that they are able to handle the participation load and can add additional pickup teams if needed. Overall, interview participants indicated that the See ya later, refrigerator® Program is in a position to operate effectively and achieve its goals during the future program cycle.

6.3 Appliance Recycling Crew

Additionally, a telephone interview was conducted with the See ya later, refrigerator® recycling crew. This crew is responsible for following a schedule of appointments to visit customer homes and recycle program-qualifying refrigerators and freezers. The recycling crew reported that overall, the program is running very smoothly. According to the driver of the recycling crew truck, customers report being satisfied with the program and are fairly cooperative when the crew is in the home. The recycling crew mentioned that improved awareness of the program would be beneficial, as many people appear to be unaware of the incentive and haul away service. Specifically, the crew noted that neighbors of participating customers often mention being unaware of the program.

The crew suggested that the recycling truck be involved in public events such as parades in order to increase program awareness and potentially expand participation. The recycling truck is labeled with program advertising and may serve as an effective marketing tool when displayed in public or near customer homes. The number of homes visited per day varies between 10 and 30, which is a manageable number for the current two-person crew. The recycling crew noted that if program participation were to increase significantly, it may be necessary to add a second recycling crew in order to manage the number of customer appointments. It should be noted that increased participation during summer months has resulted in the need for an additional pickup crew; scheduling and pickup staff reported that adding these additional pickup crew members was a relatively straightforward process that successfully increased program capacity on a temporary basis.

7. Key Conclusions

This section summarizes a selection of overall findings from the See ya later, refrigerator® Program process evaluation. These findings are based on information obtained from the program documentation review, the participant survey, and the stakeholder interviews.

7.1 High Program Satisfaction

Participants of the See ya later, refrigerator® Program provided very positive satisfaction ratings for numerous program elements including the application process, scheduling process, and JACO appliance recycling crew. There were very few instances of dissatisfaction, and the majority of these were anecdotal in nature. Section 5.3 provides a detailed summary of customer satisfaction responses.

In addition to customer satisfaction, JACO and Idaho Power staff reported being very satisfied with the success of the program thus far, and pointed to very few issues with program operation. These results suggest that the program has developed into a reliable entity that is capable of meeting customer expectations and goal targets.

7.2 Effective Program Marketing

According to JACO staff, the See ya later, refrigerator® Program marketing strategy is an example of a comprehensive approach that continually increases program awareness. While it appears that utility bill inserts are the most effective form of direct marketing, the other marketing materials account for approximately half of the initial program awareness. Additionally, customers are likely hearing about the program from multiple sources, which provides a consistent messaging effect. As JACO has been tracking marketing effectiveness for the full program cycle, program management staff is able to learn how the customer base responds to various promotional efforts. This allows Idaho Power to plan future program activities that will likely appeal to the specific market environment of the See ya later, refrigerator® Program.

7.3 Positive Working Relationships

Each interviewed JACO and Idaho Power staff member provided positive comments related to the working relationships that have been developed while working with the See ya later, refrigerator® Program. It is likely that these relationships have been a strong asset for the success of the program. It appears that Idaho Power and JACO have adopted a collaborative communication style that is very effective at monitoring and modifying the program process. JACO staff indicated that active program management on the utility side is very useful, and that a proactive communication style makes the implementation process more straightforward for all parties. If new staff members are added to the program, it would likely be beneficial to encourage the

communication style and development of working relationships that have been reported by the existing stakeholders.

7.4 Potential Areas of Research

In addition to the findings discussed above, there are areas of the program that may benefit from continued research. Participant survey results and stakeholder interviews pointed to aspects of the program that may be relevant to future program design.

7.1.1 Existing Retailer Involvement with Program

When JACO representatives asked how customers first heard about the program, 13% of the 2009-2011 participants indicated that they learned of the program through an appliance retailer. In the customer survey for 2011 participants, 6% reported that they had learned of the program through retailers. While Idaho Power has chosen not to engage retail channels in the promotion of the See ya later, refrigerator® Program, some retail stores may be using the program as a tool to increase sales. Retailer involvement raises questions of customer motivations to participate, and may be related to the level of free ridership for the program. JACO staff indicated that retail activity within appliance recycling programs is often incorporated into the program design and does not necessarily have an effect on free ridership levels. However, an awareness of how the program is being promoted through retailers and other potential channels will likely contribute to effective program management and monitoring over time.

7.1.2 Customer Understanding of Program Requirements

Several open-ended responses within the participant survey suggested that some customers may not fully understand the eligibility requirements or purpose of the See ya later, refrigerator® Program. For example, a few customers suggested that the program provide rebates for non-working appliances, and one customer did not appear to understand why the unit's cord was cut upon removal from the home. These responses suggest that customers are likely focusing on the benefits that the program provides to them, and that they may not understand that the program is designed to actively reduce the total demand on the electrical grid. It should be noted that these responses represent less than 5% of respondents in the participant survey, although it is unclear how many participants may share these perspectives. Encouraging customers to understand the full program process may be useful in promoting overall energy efficiency and minimizing the number of customers who attempt to recycle non-working or not-in-use refrigerators and freezers.

Appendix A. Participant Survey Instrument

Idaho Power

See ya later, refrigerator® Program

Participant Survey Questionnaire

"Hello, my name is _____. I am with Research America, an independent research firm, and we are conducting an evaluation of Idaho Power's See ya later, refrigerator® Program. Our records indicate that you participated in the program in 2011 by having an appliance picked-up for recycling. We would like to include your opinions about the program in our evaluation. The interview will take approximately 10 minutes. May I ask you a few questions?"

IF REFUSAL: THANK AND TERMINATE

1. Do you recall having one or more of your old refrigerators or freezers picked up for recycling as part of the Idaho Power See ya later, refrigerator® program?
   a. Yes
   b. No (If No, Thank the respondent and terminate the survey)

2. Many of our questions focus on your experience and satisfaction with the See ya later, refrigerator® program, including interactions with the recycling company, JACO. Are you the best person to talk to regarding these topics?
   a. No (If No, Ask, "Is someone else there now who would be better for me to speak with?" If Yes, ask to speak with that person and continue the survey with the new person. If No, thank the participant and terminate the survey.)
   b. Yes (If Yes, Continue survey)

3. What type of unit was picked up? (Use the response for this question as the [EQUIPMENT TYPE] referenced throughout survey)
   a. Refrigerator
   b. Freezer
   c. Refrigerator and Freezer

4. How did you first hear about the Idaho Power Refrigerator Recycling Program? (DO NOT READ LIST. PROMPT IF NECESSARY)
   a. Retailer
   b. Newspaper or magazine ad/article

c. Friend or relative
d. Val-Pak coupon
e. Idaho Power event
f. Idaho Power representative
g. Idaho Power website
h. Idaho Power brochure
i. Idaho Power bill insert
j. Idaho Power See ya later, refrigerator® truck
k. Don't know/Don't remember
l. Other: _____

5. What part of the program provided you with the most value? (PROMPT CUSTOMER TO SELECT ONE. IF CUSTOMER DOES NOT SELECT ONE, MARK AS NONE/NO RESPONSE)

   a. Incentive
   b. Reduce energy cost
   c. Environmental impact
   d. Convenience
   e. Other

6. How strongly do you agree or disagree that the rebate offered through this program was an adequate amount?

   a. Strongly agree
   b. Agree
   c. Disagree
   d. Strongly disagree
   e. Don't know/Don't remember (DON'T READ)

7. How satisfied were you with the See ya later, refrigerator® program *application* process?

   a. Very satisfied
   b. Somewhat satisfied
   c. Somewhat dissatisfied
   d. Very dissatisfied

e. Don't know/Don't remember (DON'T READ)

8. (Ask If C or D in Q7) Why were you dissatisfied with the application process?

_____
_____
_____

9. How satisfied were you with the scheduling of the pick-up of your old [EQUIPMENT TYPE]?
   a. Very satisfied
   b. Somewhat satisfied
   c. Somewhat dissatisfied
   d. Very dissatisfied
   e. Don't know/Don't remember (DON'T READ)
10. (Ask If C or D in Q9) Why were you dissatisfied with the scheduling of the pick-up of your old [EQUIPMENT TYPE]?

_____
_____
_____

11. How satisfied were you with the team from JACO who picked up your old [EQUIPMENT TYPE] ?
   a. Very satisfied
   b. Somewhat satisfied
   c. Somewhat dissatisfied
   d. Very dissatisfied
   e. Don't know/Don't remember (DON'T READ)
12. (Ask If C or D in Q11) Why were you dissatisfied with the team from JACO?

_____
_____
_____

13. How satisfied were you with the length of time it took to receive the rebate for recycling your old [EQUIPMENT TYPE]?
   a. Very satisfied
   b. Somewhat satisfied
   c. Somewhat dissatisfied
   d. Very dissatisfied

e. Don't know/Don't remember (DON'T READ)

14. (Ask If C or D in Q13) Why were you dissatisfied with the length of time it took to receive the rebate?

_____
_____
_____

15. How satisfied were you with the overall process of having your [EQUIPMENT TYPE] recycled, from the time you called for a pick-up to the time you received your rebate?

a. Very satisfied

b. Somewhat satisfied

c. Somewhat dissatisfied

d. Very dissatisfied

e. Don't know/Don't remember (DON'T READ)

16. (Ask If C or D in Q15) Why were you dissatisfied with the overall process?

_____
_____
_____

17. Did you experience any problems with the program?

a. Yes (If Yes, Ask, "What was the nature of this problem?" and include customer's response below.)

_____
_____
_____

b. No

c. Don't know

18. (Ask If A in Q17) Did you contact Idaho Power about this problem?

a. Yes

b. No (If No, Ask, " Why did you choose to not contact Idaho Power about the problem?" and include customer's response below.)

_____
_____

19. (Ask If A in Q18) How satisfied were you with the resolution of your problem?

a. Very satisfied

b. Somewhat satisfied

c. Somewhat dissatisfied

d. Very dissatisfied

20. How likely would you be to recommend the See ya later, refrigerator® program to a friend or family member?

    a. Very likely

    b. Somewhat likely

    c. Somewhat unlikely

    d. Very unlikely

21. Do you have any other comments or concerns that you would like me to relay to Idaho Power? (DO NOT READ LIST. PROMPT IF NECESSARY): Recommendations on ways to improve the program, complaints, etc.)

    _____

    _____

    _____

Thanks for your help!
Idaho Power will use your input to improve its energy efficiency programs for its residential customers.

SURVEYS

Table 4. 2011 Surveys

Report Title	Program or Sector	Analysis Performed by	Study Manager	Study/Evaluation Type
Idaho Power Ductless Heat Pump Pilot Survey	Residential	Idaho Power	Idaho Power	Survey
2011 Easy Upgrades Program Customer Survey	Residential	Idaho Power	Idaho Power	Survey
2011 EnerNoc Post-Event Survey	Commercial/Industrial	EnerNoc	Idaho Power	Survey
2011 Green Expo Survey	All	Idaho Power	Idaho Power	Survey
Heating and Cooling Efficiency Evaporative Cooler Survey	Residential	Idaho Power	Idaho Power	Survey
Idaho Power Heating and Cooling Efficiency Survey	Residential	Idaho Power	Idaho Power	Survey
2011 Home Improvement Program Customer Survey	Residential	Idaho Power	Idaho Power	Survey
2011 Idaho Green Expo Attendee Survey	All	Idaho Power	Idaho Power	Survey
Irrigation Efficiency Program Customer Survey	Irrigation	Idaho Power	Idaho Power	Survey
2011 Women's Show Attendee Survey	All	Idaho Power	Idaho Power	Survey
Energy Efficiency Kits Lending Program Final Project Report	Residential	Idaho Power	Idaho Power	Survey
Idaho Power FlexPeak Management Survey Results	Commercial/Industrial	ADM Associates	Idaho Power	Survey
Idaho Power Irrigation Peak Rewards Survey Results	Irrigation	ADM Associates	Idaho Power	Survey
Boise City Home Audit Follow-up Survey	Residential	Idaho Power	Idaho Power	Survey
Boise City Home Audit Post-Audit Survey	Residential	Idaho Power	Idaho Power	Survey
Idaho Power A/C Cool Credit Survey Results	Residential	ADM Associates	Idaho Power	Survey

This page left blank intentionally.

Idaho Power Ductless Heat Pump Pilot Survey

1. Please enter the following information that will help us evaluate the overall program.

	Response Percent	Response Count
Name of company that installed your ductless heat pump:	**98.3%**	**116**
City you live in:	97.5%	115
	answered question	**118**
	skipped question	**2**

2. How did you hear about Idaho Power's Ductless Heat Pump Pilot Program? (check all that apply)

	Response Percent	Response Count
Heating and cooling contractor	30.3%	36
Idaho Power Web site	10.1%	12
Friend or relative	6.7%	8
Letter from Idaho Power	**48.7%**	**58**
Community event	4.2%	5
Idaho Power employee	4.2%	5
Other (please specify)	17.6%	21
	answered question	**119**
	skipped question	**1**

3. Were you aware of Idaho Power offering an incentive for the purchase of a ductless heat pump prior to your purchase?

	Response Percent	Response Count
Yes	**66.4%**	**79**
No	33.6%	40
	answered question	**119**
	skipped question	**1**

4. How much did the Idaho Power incentive influence your purchasing decision?

	Response Percent	Response Count
A lot	**65.0%**	**76**
Some	28.2%	33
Not at all	6.8%	8
	answered question	**117**
	skipped question	**3**

5. Why did you choose to install a ductless heat pump? (Check all that apply)

	Response Percent	Response Count
Contractor suggested it	18.6%	22
Reduce electric bill	**72.9%**	**86**
Receive incentive	46.6%	55
Best technology for the purpose	48.3%	57
No ducting available for other heating sources	64.4%	76
Other (please specify)	7.6%	9
	answered question	**118**
	skipped question	**2**

6. What factors influenced your decision to hire the contractor you did for this project: (Check all that apply)

	Response Percent	Response Count
Contractor on Idaho Power's list of participating companies	**58.1%**	**68**
Recommendation from friend or relative	22.2%	26
Familiarity	35.0%	41
Price	24.8%	29
Other (please specify)	27.4%	32
	answered question	**117**
	skipped question	**3**

7. Overall, how would you rate the contractor's knowledge of Idaho Power's Ductless Heat Pump Pilot Program?

	Response Percent	Response Count
Very knowledgeable	**89.8%**	**106**
Somewhat knowledgeable	7.6%	9
Neutral	0.8%	1
Not very knowledgeable	1.7%	2
Not knowledgeable at all	0.0%	0
answered question		**118**
skipped question		**2**

8. Please rate the contractor on the following questions using a scale of 1 to 5 where "1" means you Strongly Disagree with the statement and "5" means you Strongly Agree with the statement:

	Strongly Agree 5	4	Neutral 3	2	Strongly Disagree 1	N/A	Response Count
Contractor arrived at scheduled time	**84.2% (101)**	8.3% (10)	3.3% (4)	1.7% (2)	2.5% (3)	0.0% (0)	120
Contractor was courteous	**90.8% (109)**	6.7% (8)	0.8% (1)	0.0% (0)	1.7% (2)	0.0% (0)	120
Contractor was thorough	**84.9% (101)**	9.2% (11)	1.7% (2)	2.5% (3)	1.7% (2)	0.0% (0)	119
Contractor spent enough time explaining how to use the new equipment	**73.9% (88)**	17.6% (21)	3.4% (4)	2.5% (3)	2.5% (3)	0.0% (0)	119
						answered question	**120**
						skipped question	**0**

9. How likely would you be to recommend this contractor to a friend or relative?

	Response Percent	Response Count
Definitely would	**84.2%**	**101**
Probably would	11.7%	14
May or may not	0.8%	1
Probably would not	2.5%	3
Definitely would not	0.8%	1
	answered question	**120**
	skipped question	**0**

10. Overall, how satisfied are you with Idaho Power's Ductless Heat Pump Pilot Program?

	Response Percent	Response Count
Very satisfied	**88.2%**	**105**
Somewhat satisfied	10.1%	12
Neither satisfied nor dissatisfied	1.7%	2
Somewhat dissatisfied	0.0%	0
Very dissatisfied	0.0%	0
	answered question	**119**
	skipped question	**1**

11. How likely would you be to recommend Idaho Power's Ductless Heat Pump Pilot Program to a friend or relative?

	Response Percent	Response Count
Definitely would	**85.8%**	**103**
Probably would	12.5%	15
May or may not	1.7%	2
Probably would not	0.0%	0
Definitely would not	0.0%	0
answered question		**120**
skipped question		**0**

12. If you have other comments about the Ductless Heat Pump Pilot Program, please enter them below:

	Response Count
	30
answered question	**30**
skipped question	**90**

2011 Easy Upgrades Program Customer Survey

1. How did you first learn about the *Easy Upgrades* program?

	Response Percent	Response Count
Contractor, supplier or vendor	**65.3%**	**81**
Idaho Power employee	7.3%	9
Business associate	8.1%	10
Mailing from Idaho Power	4.0%	5
Participation in other Idaho Power energy efficiency program	11.3%	14
Easy Upgrade's web site	4.0%	5
Other (please specify)		3
answered question		**124**
skipped question		**3**

2. Overall how satisfied are you with the *Easy Upgrades* program?

	Response Percent	Response Count
Very satisfied	**90.5%**	**114**
Somewhat satisfied	7.1%	9
Somewhat dissatisfied	1.6%	2
Very dissatisfied	0.8%	1
answered question		**126**
skipped question		**1**

3. What is it about the program that is dissatisfying?

	Response Count
	3
answered question	**3**
skipped question	**124**

4. For each of the following statements please indicate the level to which you agree or disagree.

	Strongly Disagree 1	2	3	4	Strongly Agree 5	N/A	Response Count
Idaho Power staff provided you with accurate information about the program.	3.2% (4)	2.4% (3)	7.9% (10)	22.2% (28)	**50.0% (63)**	14.3% (18)	126
Idaho Power staff was helpful.	4.0% (5)	2.4% (3)	6.3% (8)	18.3% (23)	**54.8% (69)**	14.3% (18)	126
Idaho Power incentive application forms were easy to follow.	2.4% (3)	8.7% (11)	9.5% (12)	26.2% (33)	**42.1% (53)**	11.1% (14)	126
Your application was processed within the time frame you expected.	3.3% (4)	6.5% (8)	9.8% (12)	22.0% (27)	**52.8% (65)**	5.7% (7)	123
					answered question		**126**
					skipped question		**1**

5. What factors influenced your decision to hire the contractor you did for your *Easy Upgrades* project?
(Check all that apply)

	Response Percent	Response Count
Used for other projects	**49.6%**	**58**
Price	40.2%	47
Recommendation from others	33.3%	39
Availability	17.1%	20
Other (please specify)		10
answered question		**117**
skipped question		**10**

6. Please rate the contractor you used for your *Easy Upgrades* project in the following areas:

	Poor 1	2	3	4	Excellent 5	N/A	Response Count
Quality of work	0.0% (0)	1.6% (2)	7.3% (9)	16.9% (21)	**73.4% (91)**	0.8% (1)	124
Courteousness	0.8% (1)	1.6% (2)	2.4% (3)	16.8% (21)	**77.6% (97)**	0.8% (1)	125
Professionalism	0.8% (1)	0.8% (1)	4.8% (6)	17.7% (22)	**75.0% (93)**	0.8% (1)	124
Knowledge of equipment	0.0% (0)	1.6% (2)	4.0% (5)	16.9% (21)	**75.8% (94)**	1.6% (2)	124
Knowledge of Easy Upgrades program	0.0% (0)	1.6% (2)	5.6% (7)	17.6% (22)	**74.4% (93)**	0.8% (1)	125
Completing work in a timely manner	0.0% (0)	2.4% (3)	6.4% (8)	19.2% (24)	**71.2% (89)**	0.8% (1)	125
Explaining efficiency aspects of new equipment	0.8% (1)	1.6% (2)	8.0% (10)	20.8% (26)	**65.6% (82)**	3.2% (4)	125
						answered question	**125**
						skipped question	**2**

7. How likely would you be to recommend this contractor to a business associate?

	Response Percent	Response Count
Definitely would	**78.2%**	**97**
Probably would	19.4%	24
Probably would not	1.6%	2
Definitely would not	0.8%	1
	answered question	**124**
	skipped question	**3**

8. Please explain why you would not recommend this contractor.

	Response Count
	1
answered question	**1**
skipped question	**126**

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

	Response Percent	Response Count
Lighting/Controls	**83.7%**	**103**
HVAC/Controls	16.3%	20
Building Shell	6.5%	8
Plug Load/Office Equipment	0.0%	0
Motors/Controls	3.3%	4
Food Services Equipment	5.7%	7
	answered question	**123**
	skipped question	**4**

10. Overall, how satisfied are you with the energy efficiency equipment installed under the *Easy Upgrades* program?

	Response Percent	Response Count
Very satisfied	**88.6%**	**109**
Somewhat satisfied	11.4%	14
Somewhat dissatisfied	0.0%	0
Very dissatisfied	0.0%	0
	answered question	**123**
	skipped question	**4**

11. What is it about the equipment you installed that is dissatisfying?

	Response Count
	0
answered question	**0**
skipped question	**127**

12. How influential were the following elements in deciding whether or not to do this project?

	Not at all influential 1	2	3	4	Very influential 5	Response Count
Easy Upgrades incentive	0.8% (1)	3.2% (4)	4.8% (6)	21.0% (26)	**70.2% (87)**	124
Installation contractor	5.0% (6)	3.3% (4)	25.0% (30)	**33.3% (40)**	**33.3% (40)**	120
Payback period on new equipment	4.9% (6)	4.9% (6)	13.9% (17)	33.6% (41)	**42.6% (52)**	122
Amount of energy savings potential	0.8% (1)	4.1% (5)	10.7% (13)	29.5% (36)	**54.9% (67)**	122
Needed to replace failed equipment	22.1% (27)	19.7% (24)	13.9% (17)	18.0% (22)	**26.2% (32)**	122
					answered question	**124**
					skipped question	**3**

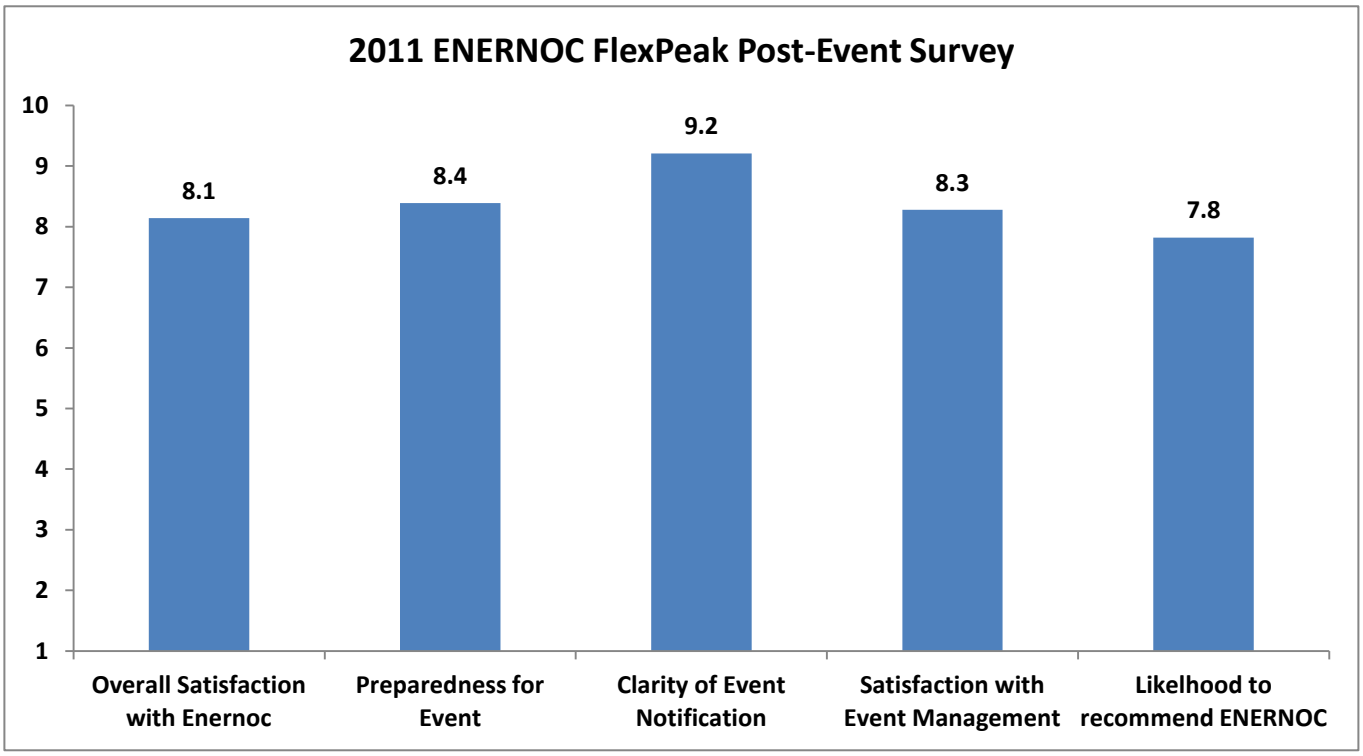
13. How likely would you be to recommend the *Easy Upgrades* program to a business associate?

	Response Percent	Response Count
Very likely	**91.7%**	**111**
Somewhat likely	8.3%	10
Somewhat unlikely	0.0%	0
Very unlikely	0.0%	0
	answered question	**121**
	skipped question	**6**

14. If you have other comments about the *Easy Upgrades* program, please enter them below.

	Response Count
	26
answered question	**26**
skipped question	**101**

2011 ENERNOC Post-Event Survey
Thank you for being part of EnerNOC's demand response event. Please help us improve the service we provide you and your company by completing the survey below.
Using a scale of 1 to 10 where 1 means “Very Dissatisfied” and 10 means “Very Satisfied”, how would you rate your overall satisfaction with EnerNOC?
How involved were you in the implementation of the energy reduction plan during the demand response event last week?
Using a scale of 1 to 10 where 1 means “Not at all Prepared” and 10 means “Fully Prepared”, how prepared did you feel for the demand response event last week?
Using a scale of 1 to 10 where 1 means “Very Confusing” and 10 means “Very Clear”, on the day of the event, how clear was the initial notification you received from EnerNOC?
What was confusing about the initial notification?
Did you contact EnerNOC with an inquiry during the event?
Was implementing your energy reduction plan easier or more difficult than you expected?
Using a scale of 1 to 10 where 1 means “Very Dissatisfied” and 10 means “Very Satisfied”, how satisfied are you with how we manage your demand response events?
Using a scale of 1 to 10 where 1 means “Definitely Will Not” and 10 means “Definitely Will”, how likely are you to recommend EnerNOC to a peer or business partner?
EnerNOC is committed to continuously improving our customer service. Please let us know how we can make event preparation, notification, and implementation of your energy reduction procedure easier for you and your company.
Thank you for your input!



2011 Green Expo Survey Results and other metrics

Denise Humphreys
CR&EE
Program Specialist

Final Report
June 30, 2011

Summary of Green Expo Overall Attendance

Expo volunteers counted attendees as they entered through the front doors of the Boise Centre. At any given time, a single individual was responsible for logging the count on a mechanical tally counter. The table below shows the number of attendees for the two years on record.

Expo Attendance

	Saturday	Sunday	Total
2011	4482	3105	7587
2010	5296	3280	8576

Summary of Idaho Power's 2011 Expo Activities

Bags

The Expo graphic image was designed by local artist, Ward Hooper, and supplied to Idaho Power in late January. We matched the look and feel and delivered artwork to the vendor (PromoShop) by the Feb 15 deadline. Dale Gibson worked with us to receive and store the bags at the Salvage Yard. They arrived on May 6, one week prior to the Expo.

Lessons Learned/Comments

- Attendees loved the bags. We ended up with 150 left. They will be used at select events later in the year.
- 4-color setup for 3 different "sides" was expensive, accounting for a little more than 10% of the overall cost. We should consider this decision carefully in upcoming years.

Program Ad

Ad specs were delivered to us on March 16 with an April 1 deadline. Susan delivered artwork on March 30.

- Size: Full Page Ad – Bleed: 8.75" x 11.25" - Trim: 8.5" x 11" – Live area: 8" x 10.5"
- Copy: Reduce your use for today and the next generation. Visit us at booth #105 to learn, play and win!

Move-In/Move-Out/Setup

Brad Lords and Cody Howell assisted with transport and unloading at the Boise Centre on May 13. They brought a truck with sideboards, pallets and packing materials. They even hauled everything into the building and unloaded it for us. Additionally, they brought a regular-sized truck that we parked at the CHQ. We used the truck for move-out on Sunday and then left it in the parking lot (keys locked inside) Brad picked the truck up on Sunday and only billed us for 2 hours use. Awesome!!!

Lessons Learned/Comments

- Since this was a new booth, it hadn't been set up in its entirety. The logo banner for the top-right corner was missing the logo. If we use it again, we'll need to re-print/re-place that section.
- Not nearly enough extra Velcro for the many pieces. We had some panic shopping to get the amount needed. In the future, we need to find a source for the "hook" part and have a lot on-hand (not just the dots but strips) when we use this style of backdrop.
- Ladder or stool would help. Definitely needed more than two hands to put this backdrop together.

Booth

Susan Klein designed a new 20-ft backdrop using the Skyline black fabric panels. The images repeated elements of the bag design and the text game and included sample interval data charts. The main portion of the booth consisted of a small brochure table out front and 4 computer stations (2 on each side) for demonstrating Account Manager and interval data. A small CSR/CIS desk/laptop was set up in the back corner.

Booth focus:

- Demonstrating and signing customers up for Account Manager
- Encouraging attendees to participate in the texting game
- Instant-prize fulfillment

Booth staff were supplied with tally counters and asked to record their meaningful interactions with customers. All IPC staff recorded a number at the conclusion of the shift prior to leaving the Boise Centre.

Idaho Power Booth "Touches"

	Saturday	Sunday	Total
2011	131 (2.9%) by shift: 67/37/27	146 (4.7%) by shift: 107/39	277 (3.65%)
2010	325 (6.1%)	284 (8.6%)	609 (7%)

Account Manager Stats

	5/01/2011 To 5/13/2011	5/14/2011 To 5/29/2011	6/01/2011 To 6/14/2011	4/24/2010 To 5/07/2010	5/08/2010 To 5/23/2010	6/01/2010 To 6/14/2010
AMI Views - Aclara	38	52	49	98	137	54
AMI Views - IPC	619	776	655	461	432	296
Account Manager Sign Ups	824	1,099	924	1,132	1,328	1,131
Energy Tools Visits	30	59	43	32	42	36
Energy Tools Views	39	83	50	41	119	51
E-Bill Service Visits	1,142	1,312	1,271	1,066	1,227	1,134
E-Bill Service Views	1,569	1,788	1,731	1,484	1,708	1,590

Lessons Learned/Comments

- Have 30 Simple Things For Kids available at booth. Majority of people coming to the booth for instant prizes were kids.
- People are still asking for the Green Couch.

- Screen Saver was not blocked from computers so booth staff had to work hard to keep the Account Manager images visible. This created issues. It could have been fixed easily, but no one thought to call Denise/Deb and so we didn't find out about it until the final shift on Sunday. Deb had checked computers prior to setup and thought this had been taken care of.

Green Expo Text Scavenger Hunt

What

Twenty fill-in-the blank energy efficiency tips were placed in various locations around the Boise Centre and a bonus question was placed on the IPC website. Game players texted in the missing word and received an additional energy efficiency tip in response. Additionally, five of the tips indicated that players could receive an "instant prize" by going to the booth with the missing word. Kevin Winslow coordinated this effort from Corp Comm, working with I2SMS as the vendor.

At the conclusion of the Expo, one winner received an iPad 2 and all other participants were notified that they did not win.

Game Promotion

Two large posters advertising the game were placed in the lobby – one at the entrance to the lobby and one at the main entrance to the exhibit hall. Roughly 4000 instruction cards were distributed during the Expo. The instruction cards were available at the information table, at our booth, at the refreshment counter and on the GreenWorks table at the entrance to the exhibit hall. Additionally, 3-4 high school students from the Timberline Tree club, wearing Idaho Power t-shirts, worked each shift. They circulated through the building handing out instructions throughout the day. The Expo program ad also contained a teaser indicating that participants could "Learn, Play, Win" by visiting the IPC booth.

Expo Text Game Stats

We had 307 unique individuals participate in the texting game. This represents 4% of the total Expo attendees. On average, each participant returned 11 messages or 52% of the total number possible. The median number of texts was 12.

Instant Prizes redeemed: 37 LED night lights, 65 power switches, 71 lip balms, and an unaccounted for # of CFL coupons and seed packs.

	Saturday	Sunday	Total
# of Texts	1789	1561	3350

Stats by Boise Centre Location

# of Texts	Keyword	Location
214	Degree	Front Men's Room
202	Energy	Kids Room
194	Water	Behind Computers/Entrance
189	LED	Corner Workshop Hall/East
188	Moisture	Lobby Concierge
186	Oven	???
176	Value	End of Hall bet. Lobby/Workshops
173	Strip	Mid-way Workshop Hall
171	Shade	Volunteer Room
170	Peak	IPC Booth
167	Cooling	End of Hall bet. Lobby/Workshops w/ Modus Architecture Display
166	Star	Base of Stairs
166	Line	Workshop Hall/Entry to Main Hall
161	Fans	GreenWorks Booth/Lobby
160	Air	Floor - Under instructions
144	Heater	Drinking Fountain
144	Fridge	Green Room
141	Day	West Wall in Exhibit Hall
120	Thermostat	Above Refreshment Area/Lobby
76	CFL	Upstairs
42	Ducts	Online

Lessons Learned/Comments

- Need to have a complete list of the answers and clue locations at the booth.
- The box for Timberline Students wasn't easily located and noticed at the first shift…this impacted the metric gathering…….so we don't have good metrics for when the instruction cards were handed out.
- Response from the instant prizes wasn't awesome. And seed packets and CFL coupons were given for various types of interactions – not just text-game instant prizes.
- The CFL "tip" was inadvertently located in a difficult-to-find location at the top of the stairs. So we didn't capitalize on the effort required to get the CFL coupons.
- Placement matters….CFL poster upstairs got the least attention; poster by men's bathroom got the most. Put posters where people are going to be.
- Message matters. The scavenger hunt made you work a little and learn a lot. Quote from participant: "The text response was unexpected and….very informative. It was kind of a reward for participating and it prompted me to go to the next one. Toward the end of the day on Sunday, I deliberately walked through as much of the Expo as I could, looking for the signs."
- Takeaway: Make it fun, give participants something clever to remember, make them work a little (but not a lot) --- vendor says the more they've got to work, the less they'll participate.

Stampede Text Promotion Stats (for comparison)

There were 132 unique participants out of a total of 5643 for a 2.34% overall participation rate. Each player texted an average of 3.25 out of 4 messages for a 75% return rate.

	Friday Apr 15	Saturday Apr 16	Total
# of Texts	182	223	405

Workshops

We presented two workshops:

Simple Changes Make Cents: Tips, Tricks & Tools to Reduce Electricity Use

- Saturday, 5:00-6:00 p.m.
- Denise Humphreys & Michelle Glaze
- 6 attendees

Get Ready, Get Set, Go: Powering Homes With Alternative Energy

- Sunday, 3:00-4:00 p.m.
- Patti Best & Scott Gates
- 15 attendees

Lessons Learned/Comments

- Deadline for proposals is usually January with descriptions due in March. We should be looking at topics in the fall of the prior year.
- Saturday workshop had a belly-dancing/drumming class going on next door for the first 20 minutes. Make certain this doesn't happen again…….could hardly hear.
- If workshops are offered in upcoming years, consider using field staff – too much for CR&EE staff to do along with set-up and tear-down.
- Sunday attendance was boosted by John Weber physically going out to hall and exhibit area and pulling people in.

IPC Web Presence

- Facebook
- Expo Pod on Residential EE landing page……opened to additional details re: Expo and promotion of text game
- Expo weekend, "Up Close" on the home page linked to the info page above AND the 21st text game clue was posted. Both these items were removed prior to Monday morning.

Lessons Learned/Comments

- The text promotion keyword from the IPC website (DUCTS) was sent in 42 times. For comparison, the top keyword (DEGREE) was sent in 214 times.

Other

1. A/C Cool Credit sponsored an ad for GreenWorks Idaho's Green Page in Boise Weekly on the Wednesday prior to the Expo. This "bought" us the opportunity to write the educational article that day. We wanted to both capitalize on our Expo participation and expose the Expo-going audience to additional summer efficiency measures. The Ad was well-received by GreenWorks and Boise Weekly.

2. One week prior to the Expo, Lisa Young from the Snake River Alliance contacted us for assistance in providing some resources for the lobby "energy" display she was coordinating on behalf of the Idaho Energy Collaborative. She asked for an updated poster re: our Generation Resources and a couple of ppt slides re: Account Manager. This put is in a bit of a tailspin due to the wind campaign and the sensitivity around claims re: renewable AND the fact that we weren't involved in the display design. Although the bulk of the display matched our message and, in fact, directed attendees to our booth to sign up and learn about Account Manager, the final call to action was a petition calling for our legislature to act on the 2007 Idaho Energy Plan.

   At Theresa's request, we met with Greg Otero the week of the Expo. The outcomes of that meeting were as follows:

   - Greg contacted IEC to discuss the petition and signage. They agreed to display only the general petition, staff an IEC booth in the lobby, and place prominent signage near the petition indicating that it was an IEC initiative.
   - Greg agreed to work with the Board to discuss the development and implementation of a policy to prevent political activity at future Expos. If the board does not do this, Idaho Power may no longer be able to participate in a sponsorship role.

- Denise resolved the "poster issue" by distancing our brand from the info and including Rocky Mountain Power and Avista information in addition to the IPC Resource Mix.

Lessons Learned/Comments

- Need to follow up with GreenWorks re: the development and implementation of a policy to prevent political action. This needs to happen prior to committing our sponsorship for next year.

Survey

Denise worked with Becky to coordinate the Green Expo participant survey again this year. Because GreenWorks had a limited Survey Monkey license, Idaho Power placed the survey in our system and delivered both the survey link and the reporting link to Greg Otero. Greg worked with Mac Life to obtain an iPod as a prize to encourage survey completion. 5 computer stations were staffed with 2 volunteers to guide, encourage and help people either fill out the survey or sign up as GreenWorks members. A 2'x3' poster talked about the survey and its prize and a separate poster promoted Membership and the Green Pass. Links to both options were bookmarked on the computer's main screen providing for easy transition back and forth.

We received 402 survey response in 2011 compared to 328 in 2010.

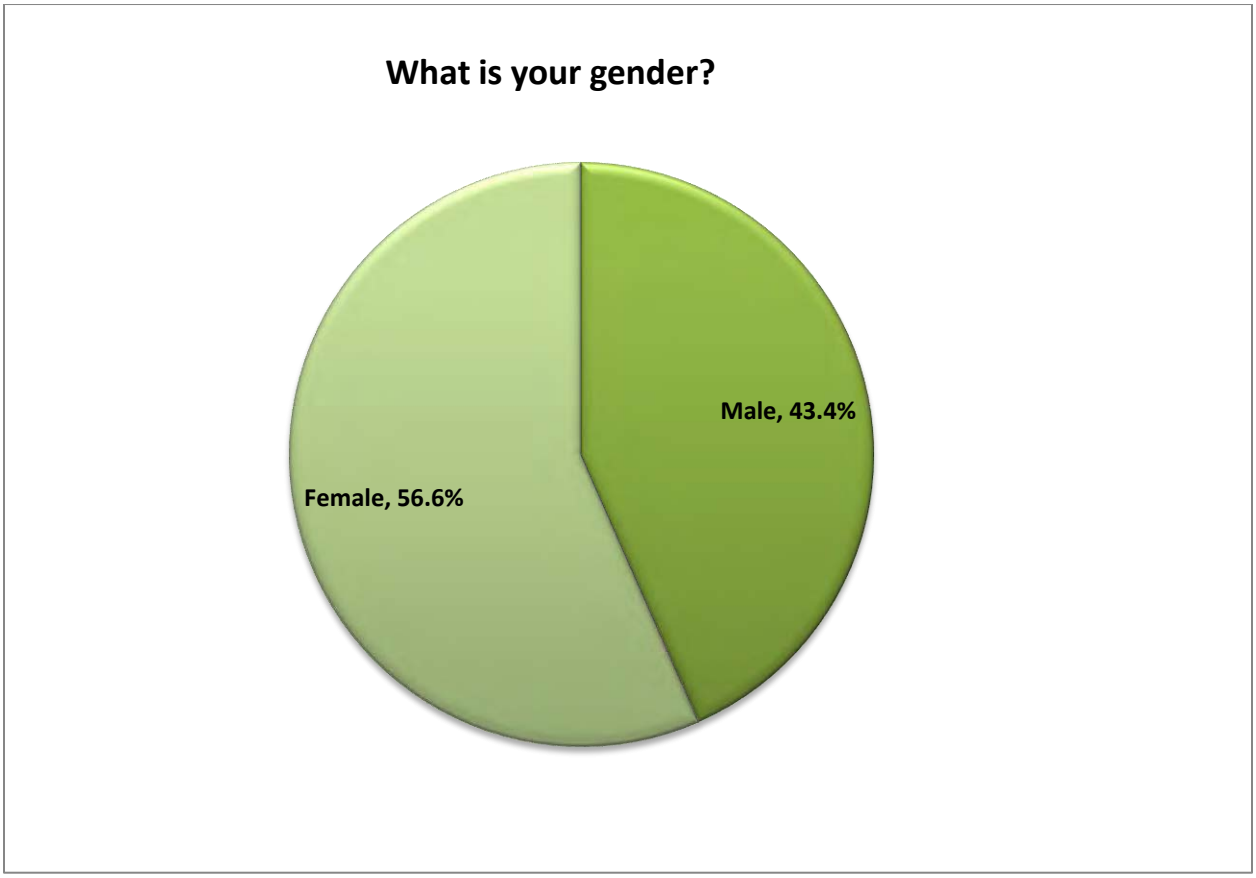
Lessons Learned/Comments

- Question #12, "Who did you bring with you today?" needs to be re-worded. The verbatim comments indicated confusion with the choices provided since a significant number of people selected "Other."

Survey results

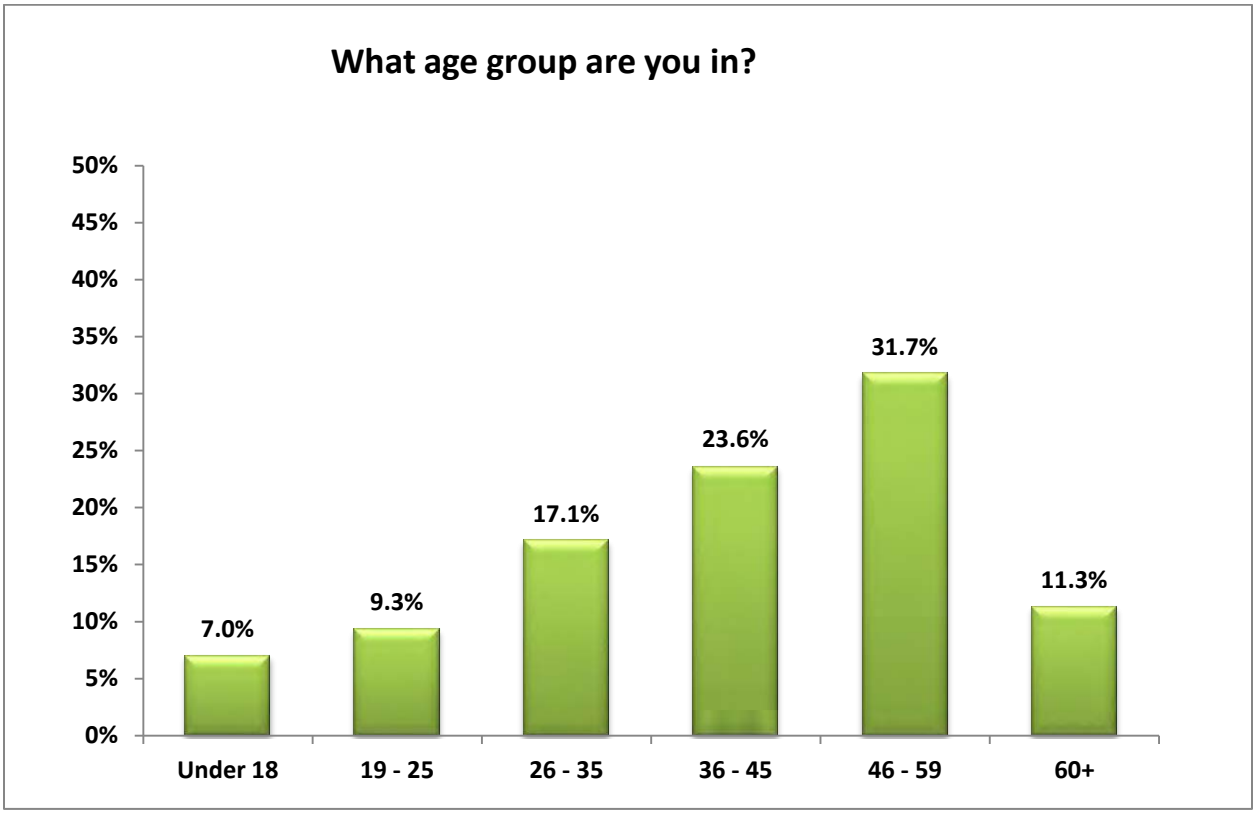
More women attended the 2011Expo than men, consistent with the 56% reported in 2010.

Exhibit 1: Gender of attendees



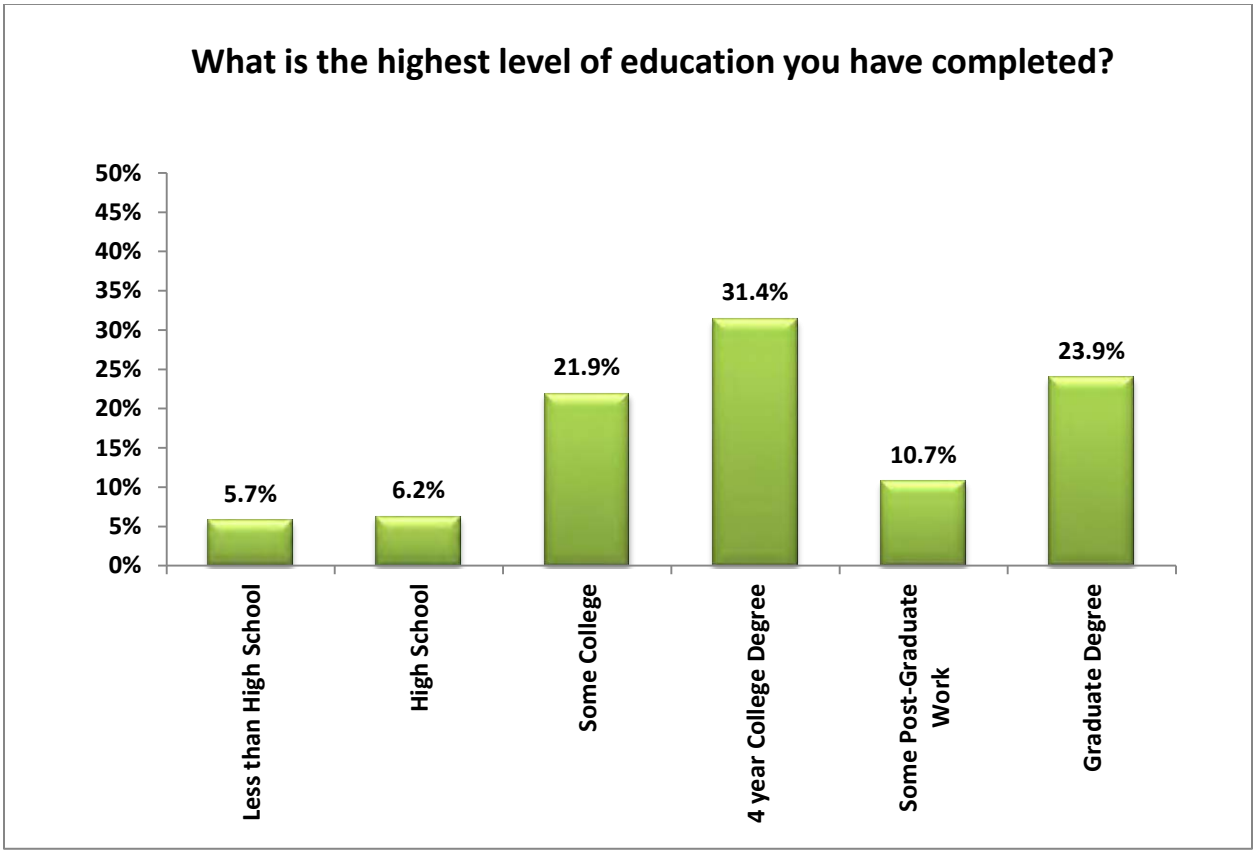
The largest age group represented at the 2011 Expo was 46-59, also consistent with 2010; however, fewer children attended this year than in 2010 (7% vs. 11.7%).

Exhibit 2: Age Grouping of Attendees



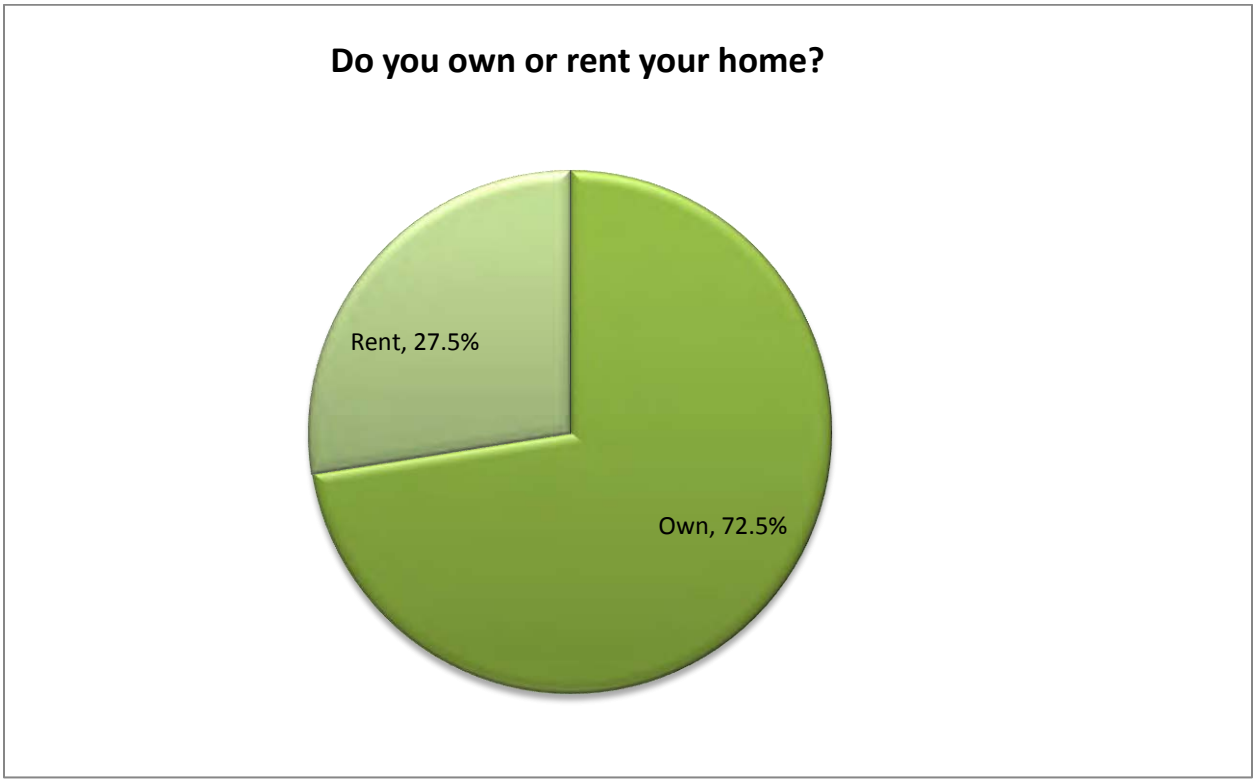
Attendees were asked to identify their education level which oftentimes can be correlated with income level. The % of attendees with some college and 4 yr degrees increased slightly whereas those with post-graduate and graduate degrees decreased slightly over 2010.

Exhibit 3: Education Level of Attendees



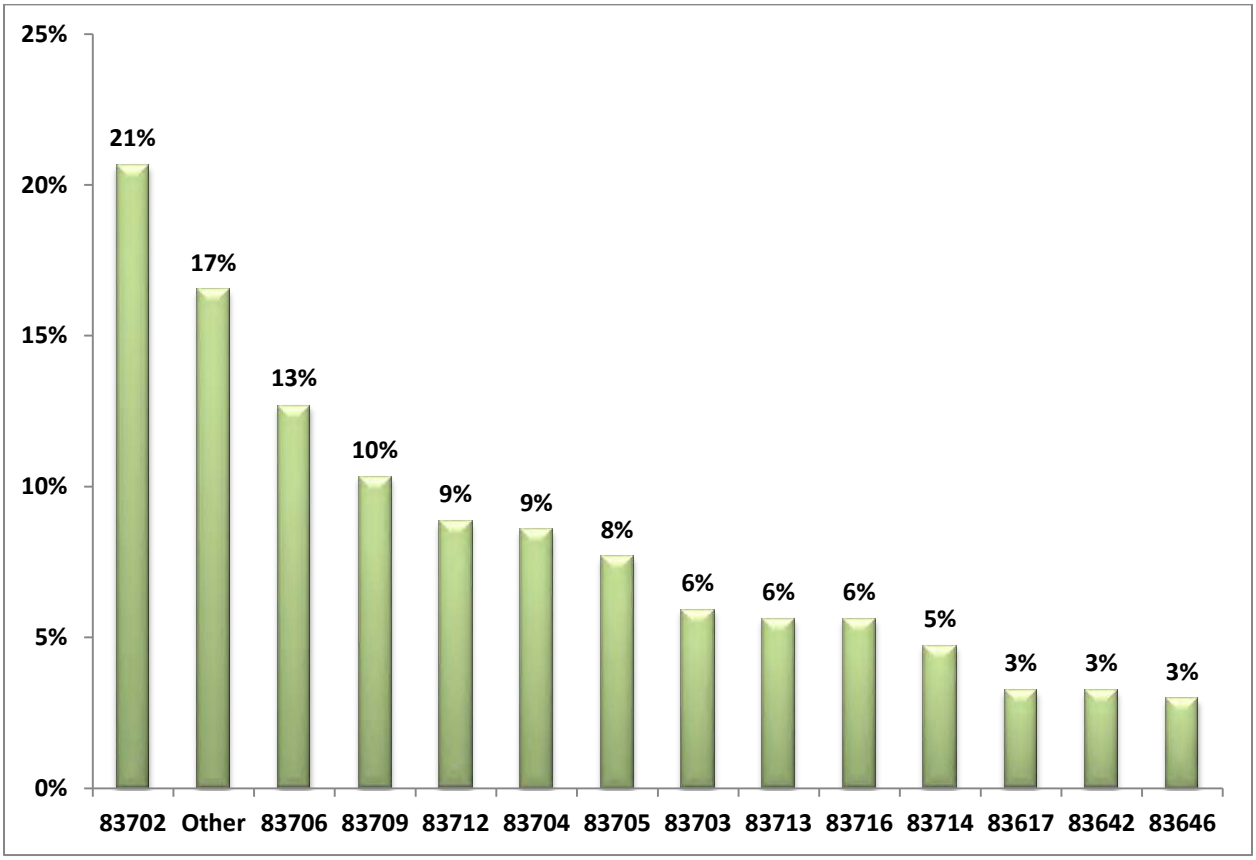
Attendees continued to be largely homeowners.

Exhibit 4: Home Ownership



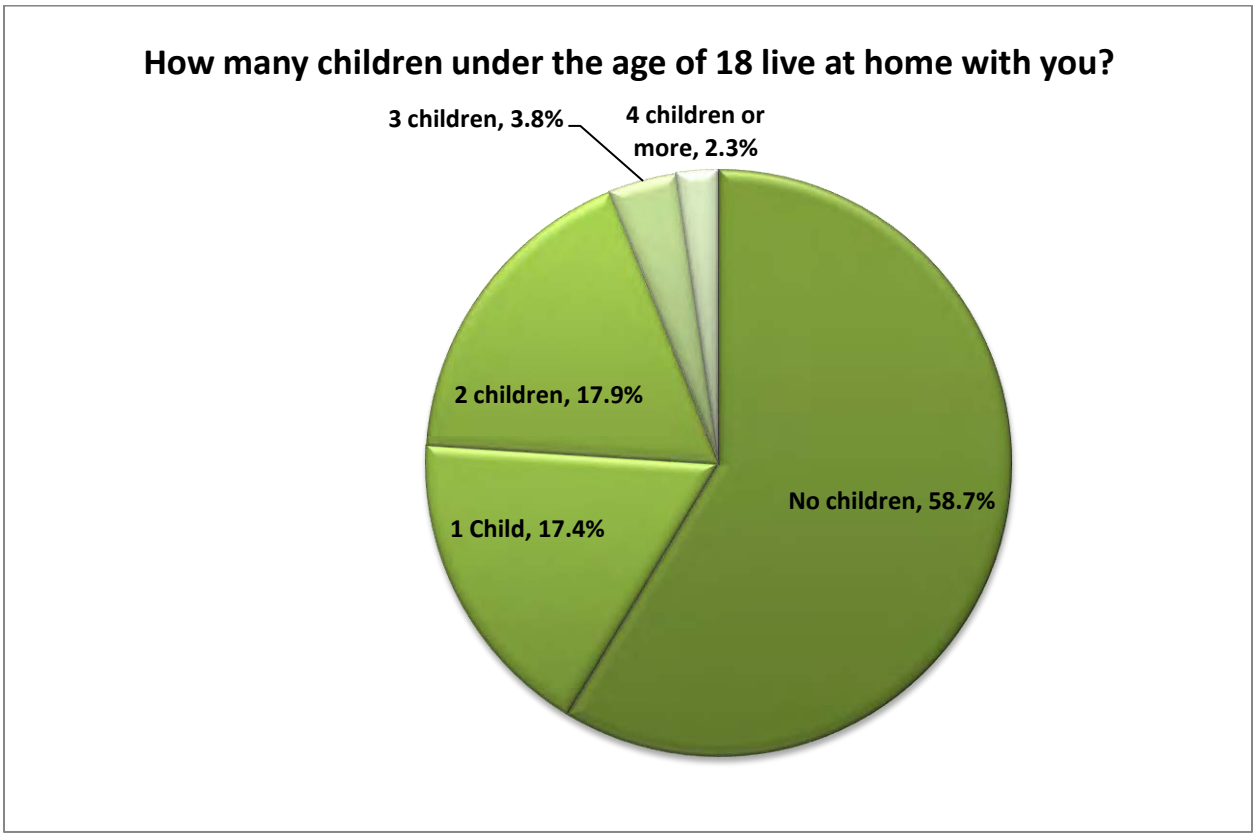
Forty-nine different zip codes were represented in our survey sample. The highest percentage of attendees was from Ada County, with the North End and West Boise highly represented.

Exhibit 5: Zip Codes relative to Attendees



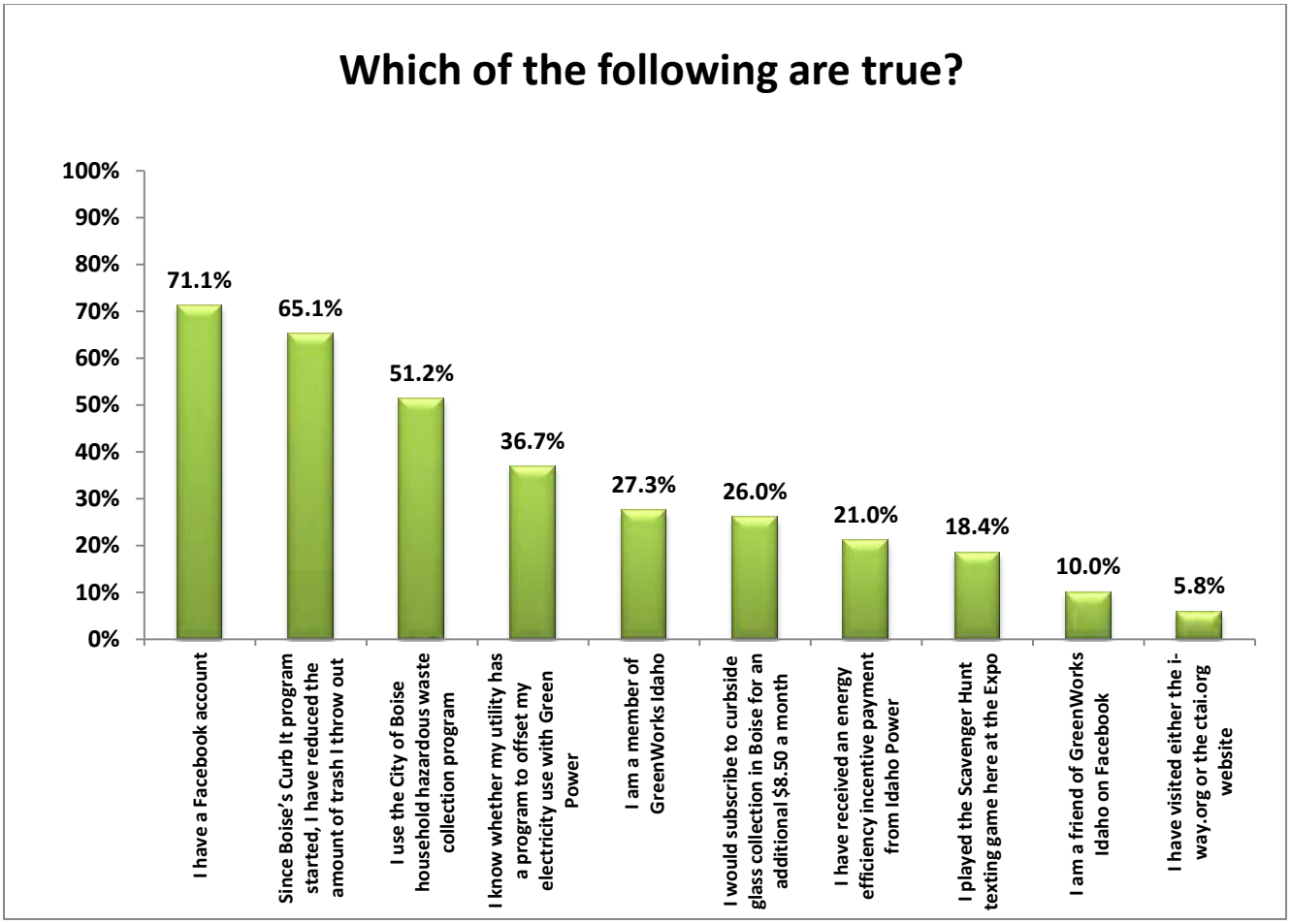
The majority of attendees had no under-age children living at home with them at the present time. This number was slightly higher than in 2010.

Exhibit 6: Number of Children Under Age 18 Living at Home



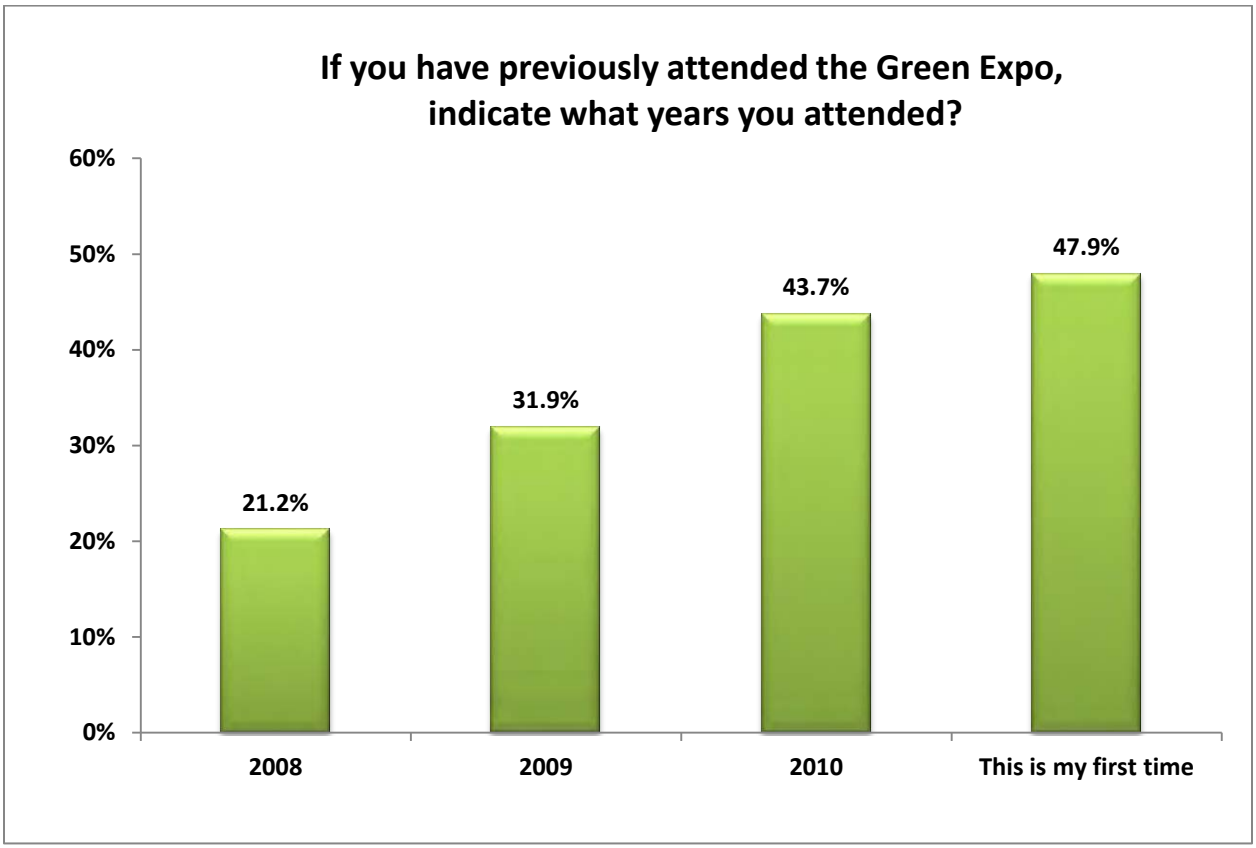
The respondents were asked a number of specific questions to determine their engagement in various sustainable practices and social media activities. 21% of respondents indicated that they'd received an incentive payment from Idaho Power and 36.7% were aware of their electric utility's Green Power Program. 18.4% of the respondents reported that they participated in the text promotion.

Exhibit 7: Level of Engagement in Sustainable Practices



Forty-eight percent of respondents reported that they attended the Green Expo for the first time in 2011.

Exhibit 8: Previous Expo Attendance

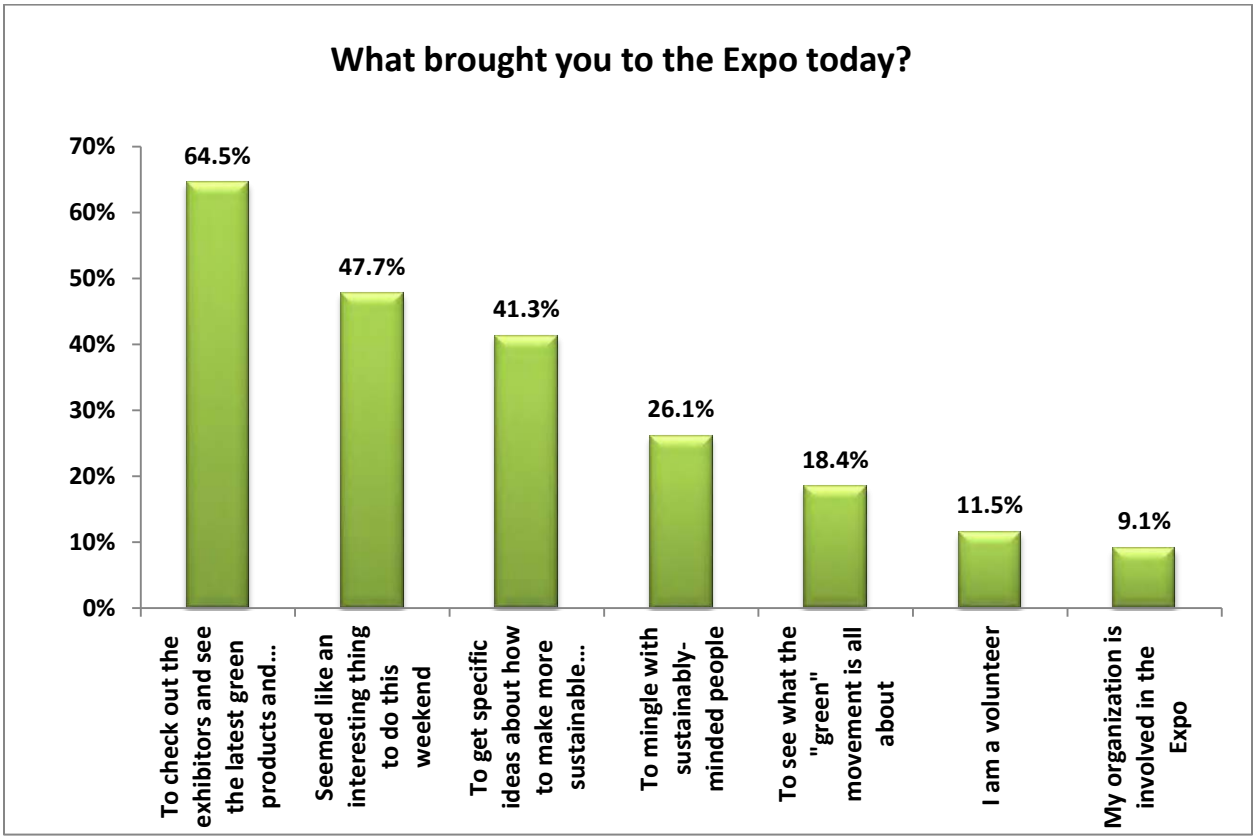


The top two reasons respondents gave for attending the Expo were:

- To check out the exhibitors and see the latest green products
- It seemed like an interesting thing to do over the weekend

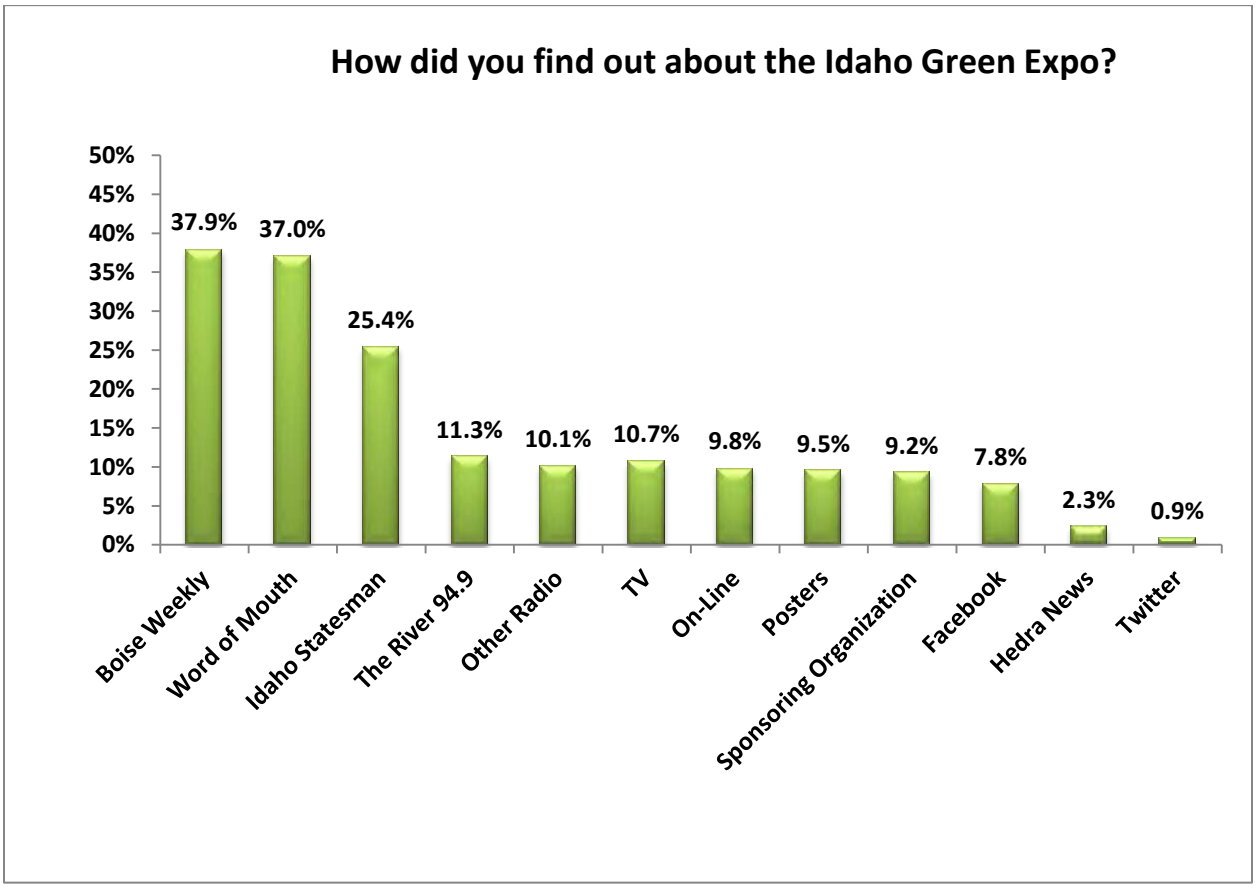
In 2010 the top two reasons for attending were "It seemed like an interesting thing to do" and "To get specific ideas about how to make more sustainable choices."

Exhibit 9: Why People Attended



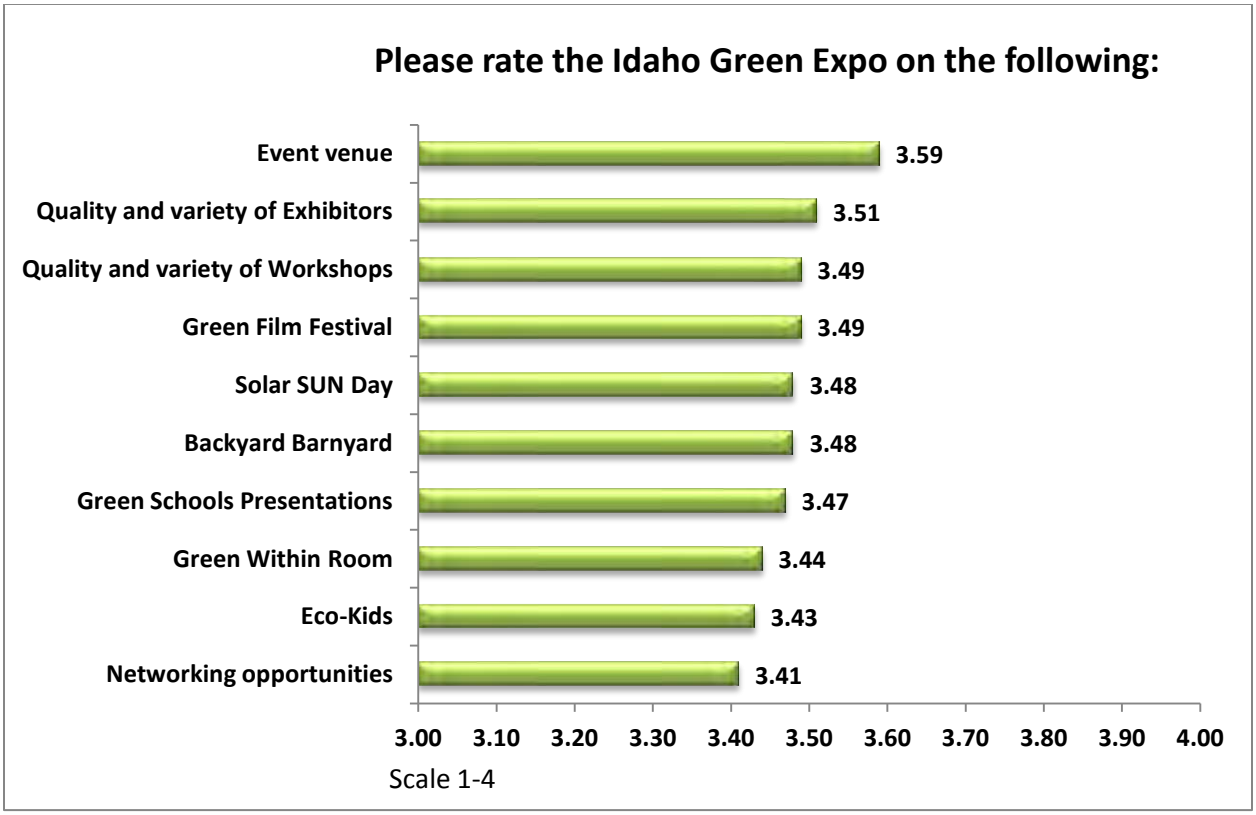
The top three marketing mechanisms for 2011 were consistent with the 2010 survey; however the effectiveness shifted slightly. Boise Weekly jumped to the number one position from third place. Word of mouth went from first place to second. And the Idaho Statesman dropped a notch to third place.

Exhibit 10: Expo Marketing



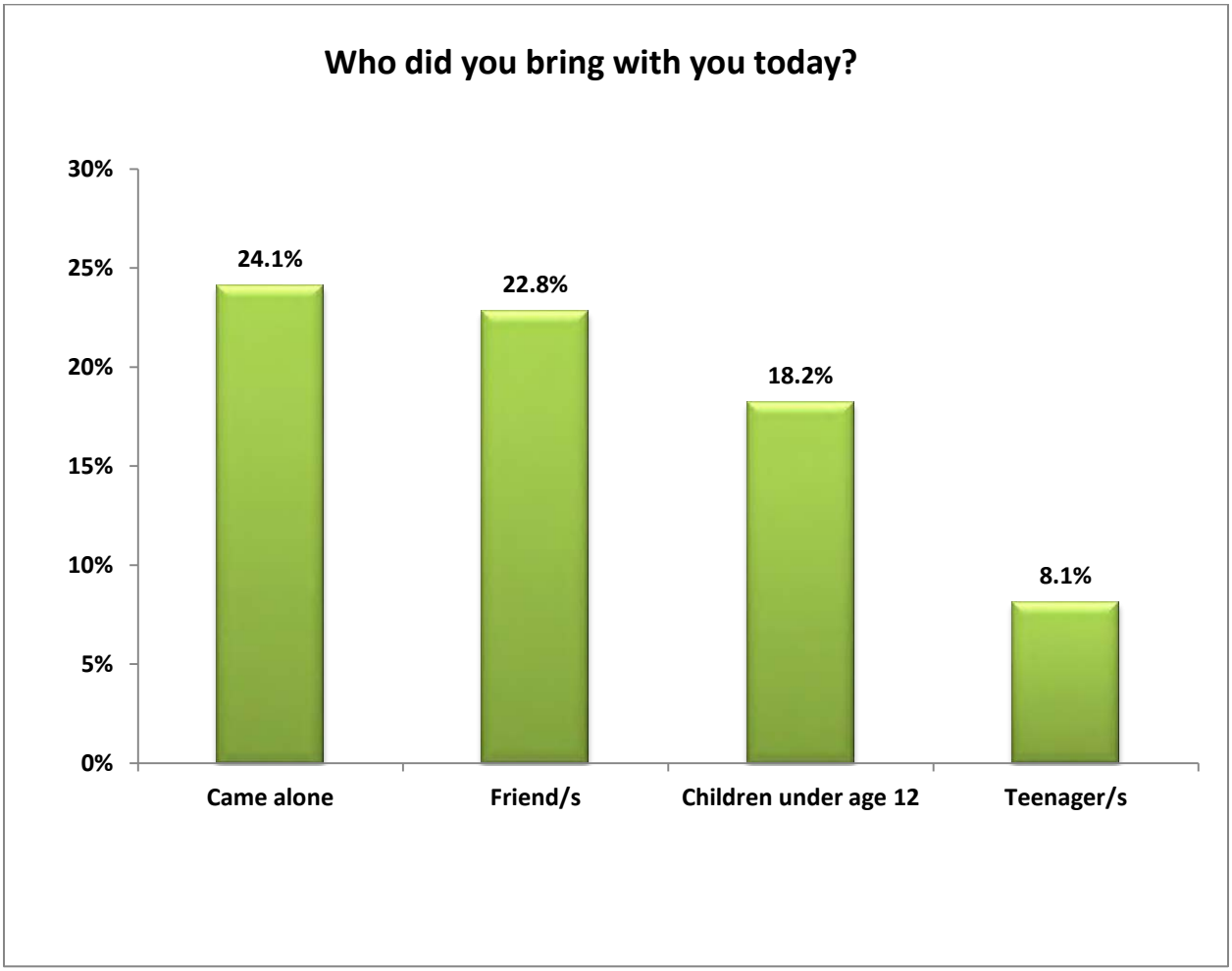
Respondents were asked to rate the various features of the Expo in which they participated on a 1-4 scale with 1 being Poor and 4 being Excellent. Of the items rated, the respondents were most pleased with the venue, the quality and variety of exhibitors and the "Green Film Festival". The film festival was a new addition and replaced the "Green Within" feature in a tie for 3rd place this year.

Exhibit 11: Participants' View of the 2011 Expo



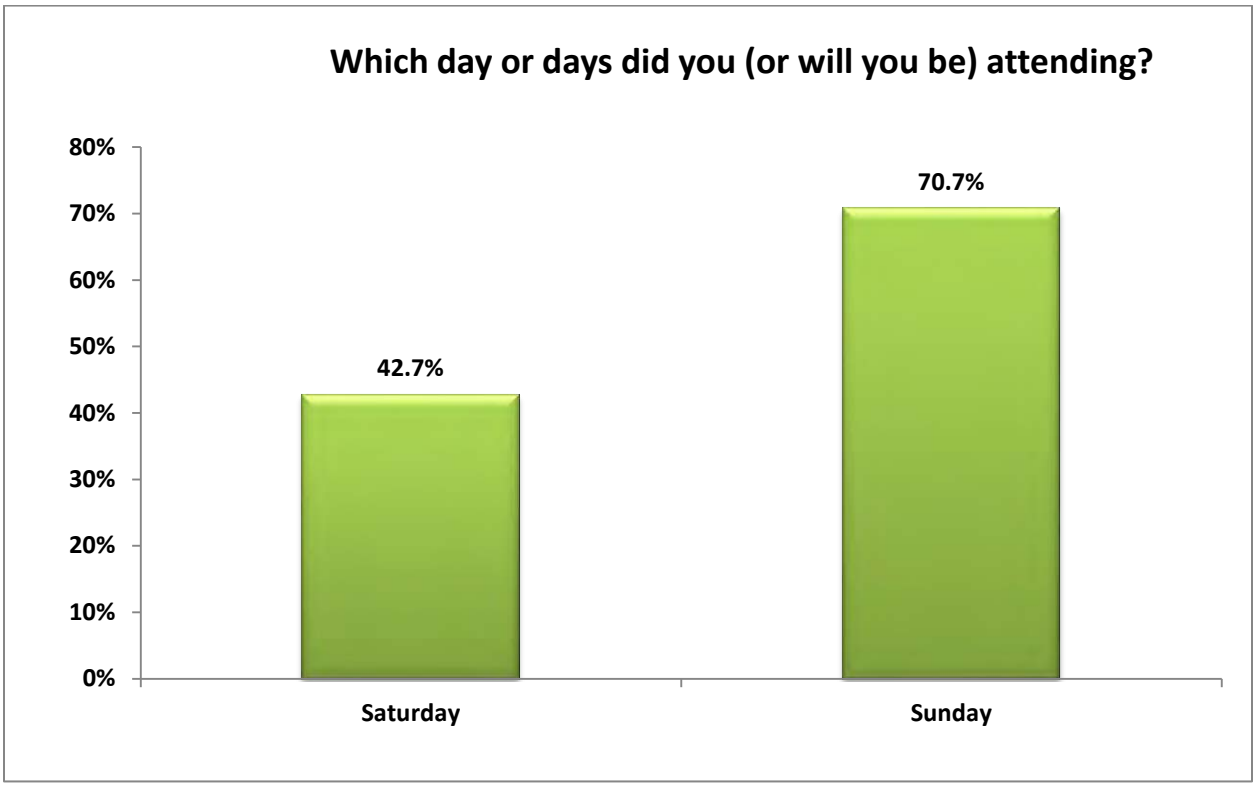
This question was worded differently than in 2010 and seemed to confuse respondents. A significant number came with spouses or other family members and they indicated this through verbatim comments.

Exhibit 12: Who Came With Attendees



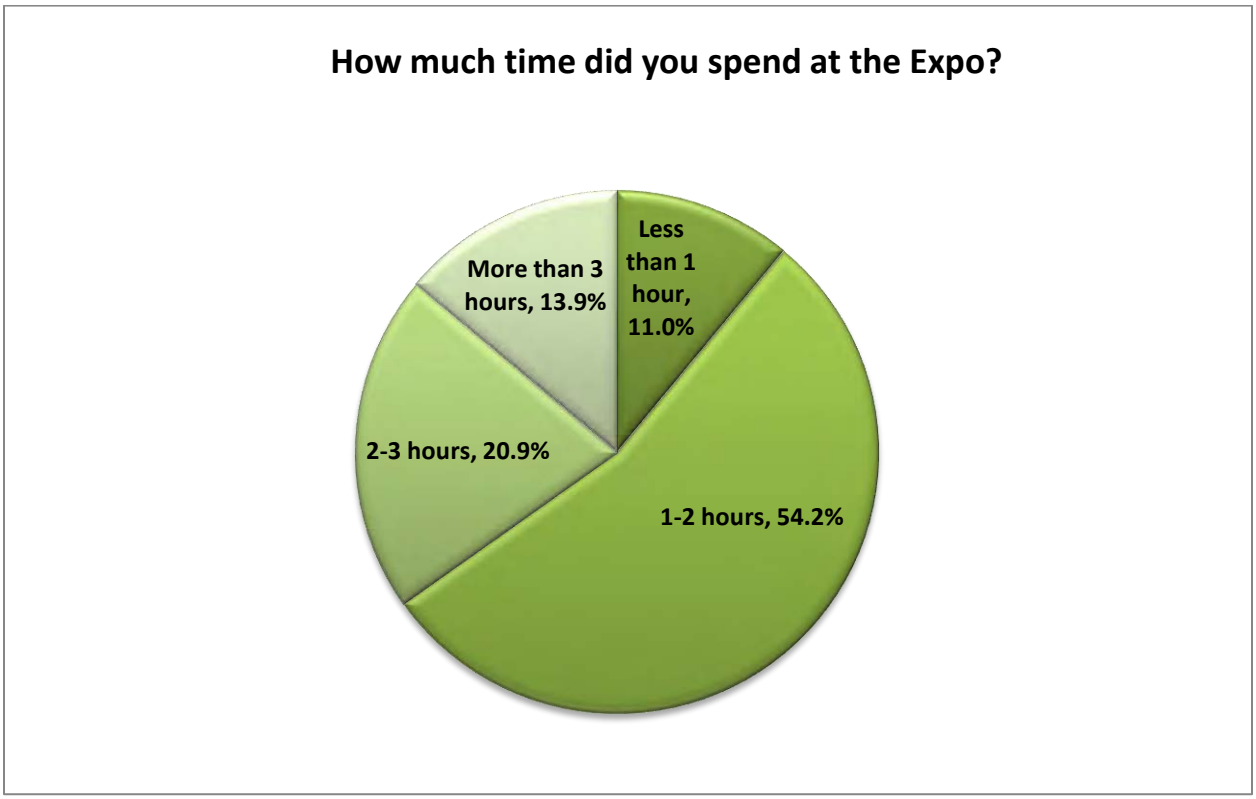
Forty-two percent of respondents attended on Saturday and 70.7% attended on Sunday.

Exhibit 13: Which Day Attendees Participated



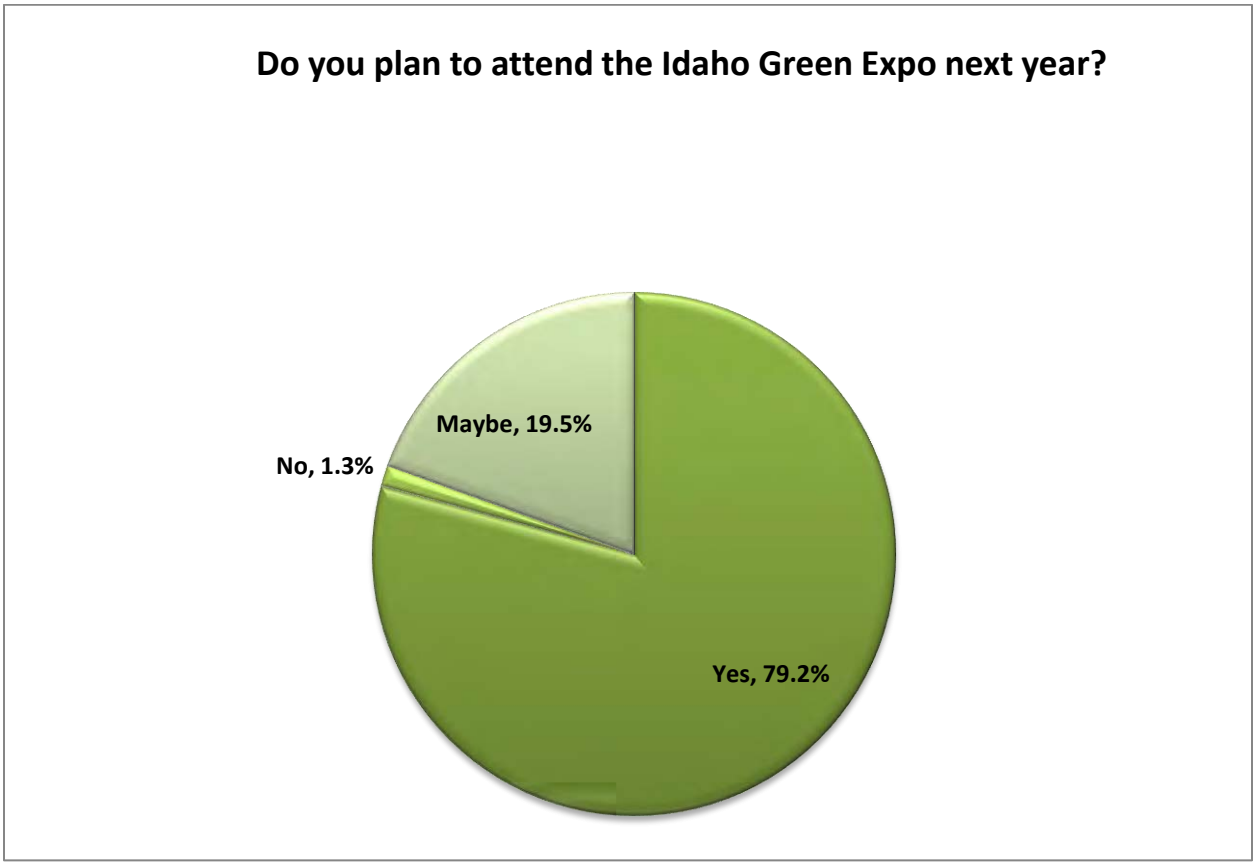
Most of the attendees spent between one and two hours at the Expo and a small portion (11%) spent less than an hour there. This was consistent with 2010.

Exhibit 14: Length of Time Spent at the Expo



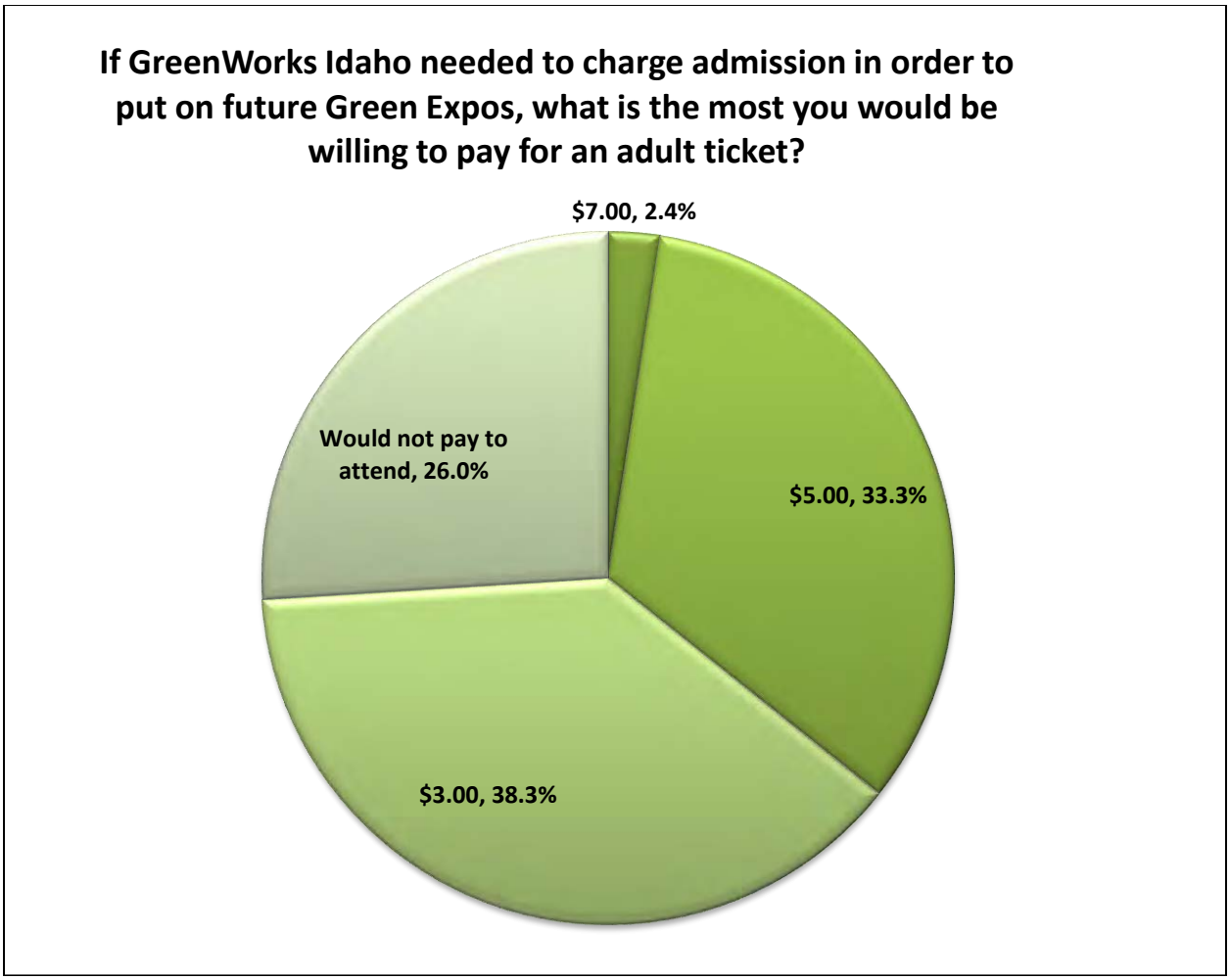
A significant number of attendees said they plan to attend the Expo again in 2012.

Exhibit 15: 2011 Attendance



26% of attendees reported that they would not be willing to pay an admission fee to attend the Green Expo. The majority of attendees indicated that they would be willing to pay in the neighborhood of $3-$5 to attend in future years.

Exhibit 16: Potential Effect of Charging Admission Fee



Verbatim Comments

When asked for suggestions for improving the Idaho Green Expo, these comments were offered:

there could be a keg, food or something for volunteers

keep it free

Appreciate that it is a no-charge event. This was my first time here, but I really enjoyed it . No improvement suggestions at this time.

keep it free please. Get even more exhibitors.

vermicuture

more info on wind generators

Hold the event in a less energy-draining venue. Have fewer greenwashing-style vendors (or potential for them, at least), or have some system of indicating sustainability quality (ratings for vendors, maybe?).

1st year had speaker re; Philodesign that was fantastic--have looked for this each year since... really disappointed that the filmed seminars haven't been made available to general public from Greenworks website (specifically last year's seminar re; local Idaho w/ several diff subjects: transpo, food, energy, etc)

good job .....keep it up!!!!!

Hold it at Expo Idaho so its more accessible & would have options for more vendors

Keep the event free to the public. The sponsors have much to gain and by charging for the event many people may decide to skip out on learning something very valuable.

Have the vendors start the conversation and talk about what they are all about. I shouldn't have to drag the information out of them.

Expand to 3 days

more information about what is going on with fun exhibits when you come in the door or a hand out....if there was one I was missed.

Sometimes people do not know what they need or want because the terminology is vague or the signage is just there to sell a product. I think it would be helpful to have more demonstrations of how some one can have a more green life.

keep it up!

include other colors

solar power exhibits.

Involve the Sustainability Club and Environmental Studies Club at Boise State University

More "Hands-On" workshops

no, it was excellent

Continue the green expo message beyond this weekend.

a suggestion. Make it easier to find businesses to support that are part of ID Green Works. Thanks

I would like to see more back to basics ideas. It's difficult to commercialize the green revolution and so the businesses can only take us so far. Maybe an extra, smaller event in the fall would be nice too.

Some of the vendors (like banks and universities) seem to take up space for other vendors that might be selling green products or services. I would prefer to see those take priority.

some of the exhibits provided information on how much energy you would save but didn't equate the savings in $$'s. You need to do that. If I'm going to save a certain # of gallons per day or kilowatt hours, I need to know how much that would cost or save me

maybe every other year

more green businesses

doing a great work
More green companies, less not associated with "green"
I'm sorry to have missed 3 workshops that ran Saturday and I couldn't come then.
I'd like to know more about lighting options.
I would have like to see more informational booths.
I loved it. It was great. I would like to hear more promotion about the event in advance.
I thought the individual venders were friendly and approachable. I git a great deal out of our exchanges. Thank you.
More kids games activities
I think if you start charging an admission fee, you will keep a lot of people away. NOT a good idea.
less or smaller paper handouts to be greener
Doing a great job
More outdoor activities, including local food, beverages and music
Keep it free
More booths on alternative energy, it had a lot but more is always better
Lot more exhibits for the average citizen. Environmentally friendly things that everyone can do around the home, with free or low cost options, as well.
more food
It is great to see how many operating green products, from cars to house parts to gardens, are shown on the GreenExpo floor. Great growth and expansion in 4 years.
green cleaning products and ideas of how to make your own
expand the eco kids with a live pet zoo
I can't think of anything that would need to be changed at this time.
Activities for older kids ages 10-14
I would not pay to attend because although a lot of the vendors are here to share info, many others are here to advertize for their businesses. Also, I would definitely come again for 'free admission', however, because I've now been here 2wice and it's not so different, I would not pay in the future to see something that i like but that charges to get in...

also, we thought that there was a beer garden in the past. where is that? That was a cool aspect and a neat way to mingle with people.

Another idea, is that I think this might be too early in the year to get as large a turnout as the other year I attended. [I missed the 2010 because we were out of the state traveling]... It is probably difficult to find a happy medium.

One cool thing is that ALL the garden info was very relevant right now at the beginning of spring when we can all go home and utilize the info right away or try to follow through with new ideas...

Thanks. i know this is a ton of work and i really like the expo!
keep it free
Continue to use David ad your web developer
more workshops outside
maybe advertise on radio?
Please include psychic readers and more energy healers in the Green Within room, and make booth fees low enough that these vendors can participate. Pagans, psychics and spiritual healers are among some of the strongest proponents of green solutions for a healthy planet.

Success of events like this is dependent upon having LOTs of people attend. Charging admission will drastically reduce attendance.
more interactive booths
Great job, awesome expo! :D
No because it was amazing! The candy is good.
I LOVVVED IT! loved the candy
more free stuff
Maybe more inclusion of local initiatives - still lots of energy efficiency, but there could be more (broader) and still green pieces.
Keep up the good work!
more interesting exhibits
Do not charge over $2.00. I really was looking forward to outside events associated with autos and scooters. I would suggest including these next year. Individual built battery based cars, solar vehicles, electric scooters, etc., etc.. They were missed this year.
Direct mail to "tuned in" households.
more interactive type exhibits.
I would like there not to be an admission price if possible to allow more people the opportunity to learn about our planet
not really this is a fine establishment
better films

more workshops on environmental situation and nuclear energy
Would like to see targeted information on green jobs
Materials in Spanish. I am bilingual, however, I spoke with several persons from Cuba and Argentina.
some of the event outside
Bike parking!
air conditioning and/or fans!!!!!!

Heating and Cooling Efficiency Program
Evaporative Cooler Survey

1. 1. Please enter the following information that will help us evaluate the overall program.

	Response Percent	Response Count
City you live in:	50.0%	1
Retail store where you bought evaporative cooler:	**100.0%**	**2**
	answered question	**2**
	skipped question	**0**

2. 2. Were you aware of Idaho Power offering an incentive for the purchase of an evaporative cooler prior to your purchase?

	Response Percent	Response Count
Yes	**50.0%**	**1**
No	**50.0%**	**1**
	answered question	**2**
	skipped question	**0**

3. 3. How much did the Idaho Power incentive influence your purchasing decision?

	Response Percent	Response Count
A lot	**50.0%**	**1**
Some	**50.0%**	**1**
Not at all	0.0%	0
	answered question	**2**
	skipped question	**0**

4. 4. How would your purchase of an evaporative cooler have changed, if you had not received an incentive from Idaho Power?
Would you have.....

	Response Percent	Response Count
Postponed the purchase	**50.0%**	**1**
Repaired existing equipment	0.0%	0
Purchased less expensive equipment	0.0%	0
Installed less energy efficient equipment	0.0%	0
Purchase decision would not have changed at all	**50.0%**	**1**
	answered question	**2**
	skipped question	**0**

5. 5. How did you hear about Idaho Power's Heating and Cooling Efficiency program? (please check all that apply)

	Response Percent	Response Count
Bill insert	0.0%	0
Community event	0.0%	0
Retail store	**50.0%**	**1**
Friend or relative	**50.0%**	**1**
Idaho Power Web site	0.0%	0
Idaho Power employee	0.0%	0
	Other (please specify)	0
	answered question	**2**
	skipped question	**0**

6. 6. Overall, how easy was it for you to participate in Idaho Power's Heating and Cooling Efficiency Program?

	Response Percent	Response Count
Very easy	**100.0%**	**2**
Somewhat easy	0.0%	0
Neutral	0.0%	0
Somewhat difficult	0.0%	0
Very difficult	0.0%	0
	answered question	**2**
	skipped question	**0**

7. 7. Overall, how satisfied are you with Idaho Power's Heating and Cooling Efficiency program?

	Response Percent	Response Count
Very satisfied	**100.0%**	**2**
Somewhat satisfied	0.0%	0
Neither satisfied nor dissatisfied	0.0%	0
Somewhat dissatisfied	0.0%	0
Very dissatisfied	0.0%	0
	answered question	**2**
	skipped question	**0**

8. 8. How likely would you be to recommend Idaho Power's Heating and Cooling Efficiency program to a friend or relative?

	Response Percent	Response Count
Definitely would	**50.0%**	**1**
Probably would	**50.0%**	**1**
May or may not	0.0%	0
Probably would not	0.0%	0
Definitely would not	0.0%	0
	answered question	**2**
	skipped question	**0**

9. Entering the following information is optional:

	Response Percent	Response Count
Name:	0.0%	0
Address	0.0%	0
Phone #:	0.0%	0
	answered question	**0**
	skipped question	**2**

10. If you have other comments about the Heating and Cooling Efficiency Program, please enter them below:

	Response Count
	0
answered question	**0**
skipped question	**2**

Idaho Power Heating and Cooling Efficiency Program Survey

1. 1. Please enter the following information that will help us evaluate the overall program.

	Response Percent	Response Count
Name of heating and cooling company you used:	**100.0%**	**86**
City you live in:	98.8%	85
	answered question	**86**
	skipped question	**0**

2. 2. Please indicate which of the following describes the new equipment you installed:

	Response Percent	Response Count
Air source heat pump	**82.9%**	**68**
Open loop water source heat pump	17.1%	14
	answered question	**82**
	skipped question	**4**

3. 3. Were you aware of Idaho Power offering an incentive for the purchase of a heat pump prior to your purchase?

	Response Percent	Response Count
Yes	**82.4%**	**70**
No	17.6%	15
	answered question	**85**
	skipped question	**1**

4. 4. How much did the Idaho Power incentive influence your purchasing decision?

	Response Percent	Response Count
A lot	21.7%	18
Some	**50.6%**	**42**
Not at all	27.7%	23
	answered question	**83**
	skipped question	**3**

5. 5. What were your reasons for participating in Idaho Power's Heating and Cooling Efficiency Program? (Check all that apply)

	Response Percent	Response Count
Ensure heat pump sized and installed to best practices	38.8%	33
Contractor suggested participation	49.4%	42
Optimize energy efficiency of equipment	56.5%	48
Reduce electric bill	**58.8%**	**50**
Receive incentive	43.5%	37
Other (please specify)	18.8%	16
	answered question	**85**
	skipped question	**1**

6. 6. How did you hear about Idaho Power's Heating and Cooling Efficiency program? (check all that apply)

	Response Percent	Response Count
Heating and cooling contractor	**77.4%**	**65**
Idaho Power Web site	15.5%	13
Friend or relative	14.3%	12
Bill insert	17.9%	15
Community event	1.2%	1
Idaho Power employee	1.2%	1
Other (please specify)	10.7%	9
	answered question	**84**
	skipped question	**2**

7. 7. What factors influenced your decision to hire the contractor you did for this project: (Check all that apply)

	Response Percent	Response Count
Contractor on Idaho Power's list of participating companies	18.8%	16
Recommendation from friend or relative	29.4%	25
Familiarity	**44.7%**	**38**
Price	20.0%	17
Other (please specify)	25.9%	22
	answered question	**85**
	skipped question	**1**

8. 8. Overall, how would you rate the contractor's knowledge of Idaho Power's Heating and Cooling Efficiency Program?

	Response Percent	Response Count
Very knowledgeable	**79.5%**	**66**
Somewhat knowledgeable	15.7%	13
Neutral	1.2%	1
Not very knowledgeable	2.4%	2
Not knowledgeable at all	1.2%	1
	answered question	**83**
	skipped question	**3**

9. 9. Please rate the contractor on the following questions using a scale of 1 to 5 where "1" means you Strongly Disagree with the statement and "5" means you Strongly Agree with the statement:

	Strongly Agree 5	4	Neutral 3	2	Strongly Disagree 1	N/A	Response Count
Contractor arrived at scheduled time	**83.3% (70)**	11.9% (10)	1.2% (1)	3.6% (3)	0.0% (0)	0.0% (0)	84
Contractor was courteous	**89.2% (74)**	8.4% (7)	0.0% (0)	1.2% (1)	1.2% (1)	0.0% (0)	83
Contractor was thorough	**81.7% (67)**	11.0% (9)	4.9% (4)	0.0% (0)	2.4% (2)	0.0% (0)	82
Contractor explained how to get the most efficiency out of new equipment	**73.8% (62)**	16.7% (14)	4.8% (4)	1.2% (1)	3.6% (3)	0.0% (0)	84
Contractor offered options to help in making purchase decision of new equipment	**73.5% (61)**	18.1% (15)	3.6% (3)	2.4% (2)	2.4% (2)	0.0% (0)	83
						answered question	**84**
						skipped question	**2**

10. 10. How likely would you be to recommend this contractor to a friend or relative?

	Response Percent	Response Count
Definitely would	**80.7%**	**67**
Probably would	14.5%	12
May or may not	2.4%	2
Probably would not	1.2%	1
Definitely would not	1.2%	1
answered question		**83**
skipped question		**3**

11. 11. Please explain why you would OR would not recommend the contractor you used.

	Response Count
	26
answered question	**26**
skipped question	**60**

12. 12. Overall, how easy was it for you to participate in Idaho Power's Heating and Cooling Efficiency Program?

	Response Percent	Response Count
Very easy	**85.9%**	**73**
Somewhat easy	8.2%	7
Neutral	2.4%	2
Somewhat difficult	1.2%	1
Very difficult	2.4%	2
	answered question	**85**
	skipped question	**1**

13. 13. Overall, how satisfied are you with Idaho Power's Heating and Cooling Efficiency program?

	Response Percent	Response Count
Very satisfied	**78.8%**	**67**
Somewhat satisfied	15.3%	13
Neither satisfied nor dissatisfied	3.5%	3
Somewhat dissatisfied	0.0%	0
Very dissatisfied	2.4%	2
	answered question	**85**
	skipped question	**1**

14. 14. How likely would you be to recommend Idaho Power's Heating and Cooling Efficiency program to a friend or relative?

	Response Percent	Response Count
Definitely would	**75.9%**	**63**
Probably would	18.1%	15
May or may not	4.8%	4
Probably would not	1.2%	1
Definitely would not	0.0%	0
answered question		**83**
skipped question		**3**

15. 15. If you have other comments about the Heating and Cooling Efficiency Program, please enter them below:

	Response Count
	12
answered question	**12**
skipped question	**74**

16. The following information is optional:

	Response Percent	Response Count
Name:	**100.0%**	**2**
Address:	**100.0%**	**2**
Phone #:	50.0%	1
	answered question	**2**
	skipped question	**84**

2011 Home Improvement Program Customer Survey

SurveyMonkey

1. Please enter your five-digit personal identification number (PIN) located on the back of the paper survey you received.

	Response Percent	Response Count
PIN:	**100.0%**	**533**
	answered question	**533**
	skipped question	**0**

2. How did you hear about Idaho Power's Home Improvement Program? (Check all that apply)

	Response Percent	Response Count
Insulation contractor	**35.3%**	**188**
Idaho Power website	6.0%	32
Friend or relative	27.4%	146
Information with Idaho Power bill	33.0%	176
Community event	3.6%	19
Idaho Power employee	7.3%	39
Val-pak coupon	2.3%	12
Other (please specify)	11.1%	59
	answered question	**533**
	skipped question	**0**

3. What were your reasons for participating in Idaho Power's Home Improvement Program?
(Check all that apply)

	Response Percent	Response Count
Contractor suggested participation	19.3%	103
Reduce energy costs	**91.0%**	**485**
Receive incentive	43.9%	234
Improve comfort	47.7%	254
Other (please specify)	3.2%	17
	answered question	**533**
	skipped question	**0**

4. What was the single greatest factor that influenced your decision to hire the contractor you did for this project:

	Response Percent	Response Count
Recommendation from friend or relative	**34.8%**	**185**
Prior experience with contractor	16.2%	86
Price	19.8%	105
Received direct-mail communication from contractor	2.1%	11
Other (please specify)	27.1%	144
	answered question	**531**
	skipped question	**2**

5. Overall, how would you rate the contractor's knowledge of Idaho Power's Home Improvement Program?

		Response Percent	Response Count
Very knowledgeable		**81.1%**	**425**
Somewhat knowledgeable		17.2%	90
Not very knowledgeable		1.7%	9
Not knowledgeable at all		0.0%	0
		answered question	**524**
		skipped question	**9**

6. Please rate the contractor on the following questions using a scale of 1 to 5 where "1" means you Strongly Disagree with the statement and "5" means you Strongly Agree with the statement:

	Strongly Disagree 1	2	3	4	Strongly Agree 5	N/A	Response Count
Contractor arrived at scheduled time	5.9% (31)	2.5% (13)	2.6% (14)	8.9% (47)	**80.0% (423)**	0.2% (1)	529
Contractor was courteous	6.0% (32)	0.8% (4)	2.3% (12)	7.2% (38)	**83.1% (441)**	0.8% (4)	531
Contractor was thorough	6.5% (34)	1.5% (8)	3.4% (18)	10.3% (54)	**78.0% (407)**	0.2% (1)	522
Contractor left your property clean of any debris from their work	5.6% (30)	2.6% (14)	4.7% (25)	14.1% (75)	**72.6% (386)**	0.4% (2)	532
						answered question	**532**
						skipped question	**1**

7. How likely would you be to recommend this contractor to a friend or relative?

	Response Percent	Response Count
Definitely would	**73.3%**	**390**
Probably would	21.8%	116
Probably would not	3.4%	18
Definitely would not	1.5%	8
answered question		**532**
skipped question		**1**

8. Please explain why you would recommend the contractor you used.

	Response Count
	329
answered question	**329**
skipped question	**204**

9. Please explain why you would not recommend the contractor you used.

	Response Count
	24
answered question	**24**
skipped question	**509**

10. Overall, how easy was it for you to participate in Idaho Power's Home Improvement Program?

	Response Percent	Response Count
Very easy	**83.6%**	**443**
Somewhat easy	14.2%	75
Somewhat difficult	1.9%	10
Very difficult	0.4%	2
	answered question	**530**
	skipped question	**3**

11. How much would you agree that you received your payment for the Home Improvement Program in the time frame you expected?

	Response Percent	Response Count
Strongly agree	**67.1%**	**349**
Somewhat agree	27.9%	145
Somewhat disagree	3.5%	18
Strongly disagree	1.5%	8
	answered question	**520**
	skipped question	**13**

12. Overall, how satisfied are you with Idaho Power's Home Improvement Program?

	Response Percent	Response Count
Very satisfied	**87.0%**	**460**
Somewhat satisfied	10.6%	56
Somewhat dissatisfied	1.7%	9
Very dissatisfied	0.8%	4
answered question		**529**
skipped question		**4**

13. What is it about the program did you find satisfying?

	Response Count
	303
answered question	**303**
skipped question	**230**

14. What about the program did you find dissatisfying?

	Response Count
	12
answered question	**12**
skipped question	**521**

15. How likely would you be to recommend Idaho Power's Home Improvement Program to a friend or relative?

	Response Percent	Response Count
Definitely would	**83.7%**	**437**
Probably would	15.3%	80
Probably would not	0.6%	3
Definitely would not	0.4%	2
answered question		**522**
skipped question		**11**

16. Please indicate how familiar you are with the following Idaho Power programs:

	Never heard of	Aware of	Participated in	Response Count
A/C Cool Credit *(air conditioner cycling)*	18.1% (93)	**54.2% (278)**	27.7% (142)	513
Heating & Cooling Efficiency *(Heat pump rebate)*	39.4% (195)	**54.1% (268)**	6.5% (32)	495
Home Products *(ENERGY STAR Appliance rebates)*	17.0% (85)	**63.5% (317)**	19.4% (97)	499
ENERGY STAR Homes *(Inspected and labeled energy efficient new home)*	23.3% (114)	**74.5% (365)**	2.2% (11)	490
Energy House Calls *(Free duct sealing for electrically-heated manufactured homes)*	**63.7% (310)**	34.5% (168)	1.8% (9)	487
See ya later, refrigerator *($30 rebate when Idaho Power picks up and recycles your old refrigerator)*	28.9% (147)	**60.7% (309)**	10.4% (53)	509
			answered question	**524**
			skipped question	**9**

17. What one fuel is used most often to heat this residence?

	Response Percent	Response Count
Electricity	28.3%	144
Natural gas	**64.0%**	**325**
Propane	3.1%	16
Fuel Oil	1.4%	7
Wood	3.1%	16
	Other (please specify)	25
	answered question	**508**
	skipped question	**25**

18. What is your gender?

	Response Percent	Response Count
Female	47.1%	243
Male	**52.9%**	**273**
	answered question	**516**
	skipped question	**17**

19. Which of the following best describes your age?

	Response Percent	Response Count
Under 18	0.0%	0
18-24	0.0%	0
25-34	5.9%	31
35-44	7.8%	41
45-60	30.7%	161
Over 60	**55.6%**	**292**
	answered question	**525**
	skipped question	**8**

20. What is the highest level of education you have completed?

	Response Percent	Response Count
Less than high school	1.0%	5
High school or equivalent	16.0%	83
Some college/technical school	**35.9%**	**186**
4-year college degree	20.8%	108
Some graduate courses	6.9%	36
Graduate degree	19.3%	100
	answered question	**518**
	skipped question	**15**

2011 Idaho Green Expo Attendee Survey

1. What is your gender?

	Response Percent	Response Count
Male	43.4%	173
Female	**56.6%**	**226**
	answered question	**399**
	skipped question	**3**

2. What age group are you in?

	Response Percent	Response Count
Under 18	7.0%	28
19 - 25	9.3%	37
26 - 35	17.1%	68
36 - 45	23.6%	94
46 - 59	**31.7%**	**126**
60+	11.3%	45
	answered question	**398**
	skipped question	**4**

3. What is the highest level of education you have completed?

	Response Percent	Response Count
Less than High School	5.7%	23
High School	6.2%	25
Some College	21.9%	88
4 year College Degree	**31.4%**	**126**
Some Post-Graduate Work	10.7%	43
Graduate Degree	23.9%	96
	answered question	**401**
	skipped question	**1**

4. Do you own or rent your home?

	Response Percent	Response Count
Own	**72.5%**	**287**
Rent	27.5%	109
	answered question	**396**
	skipped question	**6**

5. What is your zip code?

	Response Count
	396
answered question	**396**
skipped question	**6**

6. Who did you bring with you today? (Check all that apply.)

	Response Percent	Response Count
Came alone	24.1%	89
Spouse / Significant Other	**49.9%**	**184**
Children under age 12	18.2%	67
Teenager/s	8.1%	30
Friend/s	22.8%	84
Other (please specify)		46
answered question		**369**
skipped question		**33**

7. How many children under the age of 18 live at home with you?

	Response Percent	Response Count
0	**58.7%**	**233**
1	17.4%	69
2	17.9%	71
3	3.8%	15
4 or more	2.3%	9
answered question		**397**
skipped question		**5**

8. Which of the following are true? (Check all that apply)

	Response Percent	Response Count
I have a Facebook account	**71.1%**	**271**
I am a friend of GreenWorks Idaho on Facebook	10.0%	38
Since Boise's Curb It program (no-sort recycling) started, I have reduced the amount of trash I throw out	65.1%	248
I would subscribe to curbside glass collection in Boise for an additional $8.50 a month	26.0%	99
I use the City of Boise household hazardous waste collection program	51.2%	195
I know whether my utility has a program to offset my electricity use with Green Power	36.7%	140
I have received an energy efficiency incentive payment from Idaho Power	21.0%	80
I played the Scavenger Hunt texting game here at the Expo	18.4%	70
I have visited either the i-way.org or the ctai.org website	5.8%	22
I am a member of GreenWorks Idaho	27.3%	104
	answered question	**381**
	skipped question	**21**

9. How did you find out about the Idaho Green Expo? (Check all that apply)

	Response Percent	Response Count
The River 94.9	11.3%	39
Other Radio	10.1%	35
TV	10.7%	37
Idaho Statesman	25.4%	88
Boise Weekly	**37.9%**	**131**
Posters	9.5%	33
Facebook	7.8%	27
Twitter	0.9%	3
Hedra News	2.3%	8
Word of Mouth	37.0%	128
On-Line	9.8%	34
Sponsoring Organization	9.2%	32
	Other (please specify)	55
	answered question	**346**
	skipped question	**56**

10. What brought you to the Expo today? (Check all that apply)

	Response Percent	Response Count
To see what the "green" movement is all about	18.4%	69
To get specific ideas about how to make more sustainable choices	41.3%	155
To attend a specific workshop	6.4%	24
To mingle with sustainably-minded people	26.1%	98
Seemed like an interesting thing to do this weekend	47.7%	179
I am a volunteer	11.5%	43
My organization is involved in the Expo	9.1%	34
To check out the exhibitors and see the latest green products and services	**64.5%**	**242**
	Other (please specify)	18
	answered question	**375**
	skipped question	**27**

11. Please rate the Idaho Green Expo on the following:

	Excellent	Good	Fair	Poor	N/A	Rating Average	Response Count
Quality and variety of Exhibitors	**54.2% (205)**	42.6% (161)	2.9% (11)	0.3% (1)	0.0% (0)	3.51	378
Quality and variety of Workshops	33.9% (123)	22.9% (83)	4.1% (15)	0.0% (0)	**39.1% (142)**	3.49	363
Eco-Kids	28.5% (101)	20.9% (74)	4.0% (14)	0.6% (2)	**46.0% (163)**	3.43	354
Green Film Festival	23.5% (83)	15.9% (56)	2.8% (10)	0.0% (0)	**57.8% (204)**	3.49	353
Green Schools Presentations	24.5% (86)	17.4% (61)	3.1% (11)	0.0% (0)	**55.0% (193)**	3.47	351
Green Within Room	28.9% (100)	24.9% (86)	3.2% (11)	0.3% (1)	**42.8% (148)**	3.44	346
Backyard Barnyard	27.1% (95)	17.9% (63)	3.7% (13)	0.0% (0)	**51.3% (180)**	3.48	351
Solar SUN Day	26.6% (92)	18.2% (63)	2.3% (8)	0.6% (2)	**52.3% (181)**	3.48	346
Networking opportunities	**39.1% (138)**	28.3% (100)	6.2% (22)	1.1% (4)	25.2% (89)	3.41	353
Event venue	**59.0% (214)**	32.2% (117)	3.0% (11)	0.3% (1)	5.5% (20)	3.59	363
						answered question	**378**
						skipped question	**24**

12. If you have previously attended the Green Expo, indicate what years you attended? (check all that apply)

	Response Percent	Response Count
2008	21.2%	81
2009	31.9%	122
2010	43.7%	167
This is my first time	**47.9%**	**183**
	answered question	**382**
	skipped question	**20**

13. Which day or days did you (or will you be) attending? (check all that apply)

	Response Percent	Response Count
Saturday	42.7%	163
Sunday	**70.7%**	**270**
	answered question	**382**
	skipped question	**20**

14. How much time did you spend at the Expo?

	Response Percent	Response Count
Less than 1 hour	11.0%	42
1-2 hours	**54.2%**	**207**
2-3 hours	20.9%	80
More than 3 hours	13.9%	53
	answered question	**382**
	skipped question	**20**

15. Do you plan to attend the Idaho Green Expo next year?

	Response Percent	Response Count
Yes	**79.2%**	**301**
No	1.3%	5
Maybe	19.5%	74
	answered question	**380**
	skipped question	**22**

16. If GreenWorks Idaho needed to charge admission in order to put on future Green Expos, what is the most you would be willing to pay for an adult ticket?

	Response Percent	Response Count
$7.00	2.4%	9
$5.00	33.3%	127
$3.00	**38.3%**	**146**
Would not pay to attend	26.0%	99
	answered question	**381**
	skipped question	**21**

17. Do you have any suggestions for improving the Idaho Green Expo?

	Response Count
	83
answered question	**83**
skipped question	**319**

18. If you want a chance to win an iPod please enter your email address below so we may contact you.

	Response Count
	328
answered question	**328**
skipped question	**74**

Irrigation Efficiency Program Customer Survey

1. How did you learn about the Irrigation Efficiency Program?

	Response Percent	Response Count
Idaho Power irrigation workshop	28.2%	111
Idaho Power advertisement	16.8%	66
Direct mailing from Idaho Power	29.0%	114
Irrigation dealer	**43.8%**	**172**
Another farmer	13.0%	51
Idaho Power website	1.3%	5
	Other (please specify)	32
	answered question	**393**
	skipped question	**24**

2. Which program option did you participate in?

	Response Percent	Response Count
Menu (Repair and replacement of specific irrigation system components)	**58.2%**	**238**
Custom (Extensive retrofit or installation of an irrigation system)	18.8%	77
Both	17.8%	73
Don't know	5.1%	21
	answered question	**409**
	skipped question	**8**

3. Overall, how satisfied are you with the Irrigation Efficiency Program?

	Response Percent	Response Count
Very satisfied *(Skip to Q5)*	**68.9%**	**284**
Somewhat satisfied *(Skip to Q5)*	26.7%	110
Somewhat dissatisfied	2.2%	9
Very dissatisfied	2.2%	9
	answered question	**412**
	skipped question	**5**

4. What is it about the program that is dissatisfying?

	Response Count
	25
answered question	**25**
skipped question	**392**

5. For each of the following statements please indicate the level to which you agree or disagree.

	Strongly Disagree 1	2	3	4	Strongly Agree 5	N/A	Response Count
Idaho Power staff provided you with accurate information about the program	6.1% (24)	3.8% (15)	7.4% (29)	22.2% (87)	**53.8% (211)**	6.6% (26)	392
Idaho Power staff was helpful	5.7% (22)	3.3% (13)	6.7% (26)	18.0% (70)	**58.4% (227)**	8.0% (31)	389
Idaho Power incentive application forms were easy to follow	5.2% (20)	5.2% (20)	10.9% (42)	29.7% (115)	**46.8% (181)**	2.3% (9)	387
Your application was processed within the time frame you expected	7.5% (29)	3.6% (14)	8.0% (31)	24.2% (94)	**55.2% (214)**	1.5% (6)	388
Irrigation equipment dealer was helpful	7.3% (28)	3.1% (12)	8.5% (33)	23.6% (91)	**47.7% (184)**	9.8% (38)	386
						answered question	**402**
						skipped question	**15**

6. Rank the top three reasons for making your system changes and applying for participation in the Irrigation Efficiency program.

	First	Second	Third	Rating Average	Response Count
Incentive helped offset costs	**61.9% (234)**	30.4% (115)	7.7% (29)	1.46	378
Components were worn out	40.8% (108)	**42.3% (112)**	17.0% (45)	1.76	265
Irrigation dealer recommendation	11.2% (24)	29.9% (64)	**58.9% (126)**	2.48	214
I determined I needed to make changes after reviewing the program material.	16.4% (18)	27.3% (30)	**56.4% (62)**	2.40	110
			Other (please specify)		151
			answered question		**399**
			skipped question		**18**

7. How much would you agree or disagree that the Idaho Power Irrigation Efficiency program was a motivating factor in making your irrgation system(s) more energy efficient?

		Response Percent	Response Count
Strongly agree		**51.8%**	**206**
Somewhat agree		42.2%	168
Somewhat disagree		3.5%	14
Strongly disagree		2.5%	10
		answered question	**398**
		skipped question	**19**

8. How much would you agree or disagree that the Irrigation Efficiency program incentive has influenced how frequently you conduct maintenance on your irrigation system? (Eg:changed nozzles, sprinkler heads, pivot packages, etc.)

	Response Percent	Response Count
Strongly agree	40.5%	166
Somewhat agree	**52.2%**	**214**
Somewhat disagree	6.3%	26
Strongly disagree	1.0%	4
	answered question	**410**
	skipped question	**7**

9. Have you attended any of Idaho Power's irrigation workshops in the past?

	Response Percent	Response Count
Yes	**49.9%**	**205**
No	47.7%	196
Not sure	2.4%	10
	answered question	**411**
	skipped question	**6**

10. Based on your past experience with the program, which of the following would prevent you from participating in the future? (Check all that apply)

	Response Percent	Response Count
Incentives were too small	32.8%	131
It was inconvenient to make the changes to my system	8.0%	32
The changes I made to my system were not beneficial	13.5%	54
I would participate again if I determined my system needed an upgrade	**77.7%**	**310**
I've made all the changes I can on my system	10.3%	41
	Other (please specify)	12
	answered question	**399**
	skipped question	**18**

11. How likely would you be to recommend Idaho Power's Irrigation Efficiency program to someone in the agricultural community?

	Response Percent	Response Count
Definitely would	**62.7%**	**260**
Probably would	35.2%	146
Probably would not	1.4%	6
Definitely would not	0.7%	3
	answered question	**415**
	skipped question	**2**

12. Additional Comments:

	Response Count
	32
answered question	**32**
skipped question	**385**

2011 Women's Show Attendee Survey

1. How did you hear about the Women's Show? (check all that apply)

	Response Percent	Response Count
Radio	15.9%	102
TV	29.2%	187
Idaho Statesman	15.6%	100
Boise Weekly	4.8%	31
Poster	5.1%	33
Facebook	6.2%	40
Word-of-Mouth	**37.1%**	**238**
Billboard	5.1%	33
Web site	6.2%	40
Email	17.5%	112
Sponsoring Organization	15.3%	98
	Other (please specify)	200
	answered question	**641**
	skipped question	**136**

2. If you have attended the Women's Show in previous years, what years did you attend? (check all that apply)

	Response Percent	Response Count
2008 or prior	**55.0%**	**421**
2009	41.7%	319
2010	48.1%	368
This is my first year attending	23.5%	180
	answered question	**765**
	skipped question	**12**

3. Did you come to the Women's Show alone or did you come with someone else? (check all that apply)

	Response Percent	Response Count
Came alone	19.9%	152
Came with spouse/significant other	9.6%	73
Came with teenage child/children	10.9%	83
Came with child/children under 12	12.1%	92
Came with friend(s)	**54.0%**	**412**
Came with co-worker(s)	8.0%	61
	answered question	**763**
	skipped question	**14**

4. How much time do you plan to spend at the Women's Show?

	Response Percent	Response Count
Less than 1 hour	6.5%	50
1-2 hours	**51.6%**	**396**
2-3 hours	26.5%	203
More than 3 hours	15.4%	118
	answered question	**767**
	skipped question	**10**

5. What motivated you to stop at the Idaho Power booth? (check all that apply)

	Response Percent	Response Count
To learn about energy efficiency	13.5%	101
To learn about Idaho Power's programs	8.6%	64
To ask a question	5.0%	37
To get the lip balm they were giving away	33.1%	247
To register to win the iPad2	**82.3%**	**614**
Friendly people working at the booth	35.3%	263
	Other (please specify)	15
	answered question	**746**
	skipped question	**31**

6. Is Idaho Power your electric utility?

	Response Percent	Response Count
Yes	**93.6%**	**719**
No	4.8%	37
Don't know	1.6%	12
	answered question	**768**
	skipped question	**9**

7. Please indicate how familiar you are with the following Idaho Power programs:

	Never heard of	Aware of	Participated in	Response Count
A/C Cool Credit *(air conditioner cycling)*	24.1% (169)	**53.6% (376)**	22.3% (156)	701
Heating & Cooling Efficiency *(Heat pump rebates)*	35.8% (248)	**57.9% (401)**	6.2% (43)	692
Home Products *(ENERGY STAR Appliance rebates)*	22.5% (156)	**57.2% (397)**	20.3% (141)	694
ENERGY STAR Lighting *(In-store promotional pricing for CFL light bulbs)*	24.3% (165)	**62.8% (427)**	12.9% (88)	680
ENERGY STAR Homes *(Inspected and labeled energy efficient new homes)*	18.7% (129)	**75.2% (518)**	6.1% (42)	689
Energy House Calls *(Free duct sealing for electrically-heated manufactured homes)*	**61.2% (421)**	36.6% (252)	2.2% (15)	688
See Ya Later Refrigerator *($30 rebate when Idaho Power picks up and recycles your old refrigerator)*	41.8% (287)	**51.0% (350)**	7.1% (49)	686
Home Improvement *(15 cent per sq. ft. rebate for attic insulation)*	41.7% (287)	**50.9% (350)**	7.4% (51)	688
Green Power Program *Voluntary renewable energy purchase)*	43.5% (297)	**52.9% (361)**	3.7% (25)	683
			answered question	**714**
			skipped question	**63**

8. Are you the person that pays the electricity bill for your home?

	Response Percent	Response Count
Yes	**78.5%**	**563**
No	15.6%	112
Sometimes	5.9%	42
	answered question	**717**
	skipped question	**60**

9. Do you own or rent the home you live in?

	Response Percent	Response Count
Own	**78.6%**	**562**
Rent	21.4%	153
	answered question	**715**
	skipped question	**62**

10. Which of the following best describes your role when making purchase or upgrade decisions for your home?

	Response Percent	Response Count
Influencer	7.0%	39
Primary decision maker	32.9%	183
Co-decision maker	**57.3%**	**319**
Bystander	2.9%	16
	answered question	**557**
	skipped question	**220**

11. Have you visited www.idahopower.com?

	Response Percent	Response Count
Yes	**57.0%**	**407**
No	41.3%	295
Don't know	1.7%	12
	answered question	**714**
	skipped question	**63**

12. What did you go to www.idahopower.com for? (check all that apply)

	Response Percent	Response Count
Energy efficiency information	29.6%	114
Pay your bill	**64.7%**	**249**
Billing or usage information	43.1%	166
Parks information	3.9%	15
	Other (please specify)	27
	answered question	**385**
	skipped question	**392**

13. What is your zip code?

	Response Count
	760
answered question	**760**
skipped question	**17**

14. What is your gender?

	Response Percent	Response Count
Female	**93.7%**	**716**
Male	6.3%	48
	answered question	**764**
	skipped question	**13**

15. Which of the following best describes your age?

	Response Percent	Response Count
Under 18	2.2%	17
19-25	7.8%	60
26-35	20.6%	158
36-45	21.0%	161
46-60	**33.7%**	**258**
Over 60	14.6%	112
	answered question	**766**
	skipped question	**11**

16. What is the highest level of education you have completed?

	Response Percent	Response Count
Less than High School	1.7%	13
High School or Equivalent	10.8%	82
Some College/Technical School	**35.1%**	**267**
4 year College Degree	29.8%	227
Some Graduate courses	7.5%	57
Graduate Degree	15.1%	115
	answered question	**761**
	skipped question	**16**

17. For a chance to win the iPad2, please enter your email address below.

	Response Count
	754
answered question	**754**
skipped question	**23**

18. Would you like to be contacted via email when time variant pricing (aka Time Of Use rates) becomes available in the future?

	Response Percent	Response Count
Yes	48.3%	366
No	**51.7%**	**392**
	answered question	**758**
	skipped question	**19**

Energy Efficiency Kits Lending Program
Final Project Report

Purpose:
To make it possible for Idahoans to monitor energy usage and determine potential energy efficiencies in their homes by making available an energy measuring device through local public libraries.

Desired Results:
- Idahoans will have increased awareness of energy use in their homes.
- Idahoans will have increased awareness of methods of saving energy.
- Idahoans recognize the library as a source for consumer information.

Project Summary:
The Idaho Commission for Libraries (ICfL) partnered with Idaho Power Company, Avista Utilities, and Rocky Mountain Power Company to create and distribute energy efficiency kits for use in public libraries. All parties contributed to the successful implementation of the program.

Usage:

Total Annual Circulation: 1,139

Percentage of total Circulation to date by partner region:

Partner Region	Circulation Reported[1]	Percentage of Total Circulation	Percentage of Libraries by Service Area
Avista Utilities	152	13%	23%
Idaho Power Company	909	80%	60%
Rocky Mountain Power	49	4%	17%
Other	29	3%	

User Satisfaction:
Library staff members were asked by survey to estimate the satisfaction of their customers. An overwhelming majority of responses were positive with 19% indicating "Very Satisfied" and 74% indicating "Satisfied." Only 3 survey respondents indicated their customers were either "Dissatisfied" or "Very Dissatisfied" with the service.

[1] Usage reports were not received by 100% of the participating libraries. As a result, actual circulation could be higher than reported.

Positive Comments

- It served the purpose for which it was designed.
- They find it interesting.
- They found it interesting to see the difference in the power usage of their different appliances.
- "Patrons have been excited to have them available from LCLD, the only place that they are available." "Easy to use and easy for us to check out." "Some patrons have checked them out more than once." "Three patrons--each reported that they thought it was useful." "All stated that it was easy to use." Only one said he had trouble "figuring it out", but confessed he did not read the directions.
- It helped determine which electronics are high energy consumers.
- "Good to know"
- They were surprised that we had any type of energy efficiency kits to have people check out.
- Very positive feedback. Limited, but positive
- One customer in particular told me that she had saved $36.00 per month on her power bill because of what she had learned by using the meter. She was pretty excited.
- Those patrons who have used the kits have been appreciative that they were available to them.
- They liked checking the appliances with their children to see what energy was used.
- "Interesting" to know how we use power
- We had several patrons remark how cool the kits are.
- Interesting results
- Seemed happy it was available to them. Used them to decide if they would buy a new appliance.
- Very useful in learning energy usage on different appliances.
- Just that it is interesting
- Interesting, informative, cool idea
- We really haven't heard any feedback but they are checked out most of the time.
- Very interested in finding out how many watts they're using.

Negative or Neutral Comments

- Not much. They have not received much use.
- No one wanted one at all. I finally took them home as they were cluttering up the library. I would like to return them to whomever.
- None - Not much interest.
- One of our kits was taken from the library. The other kit has not been used
- We did not have much interest in the kits.
- We have only had a couple of people check them out.
- The 2 kits were checked out 4 times total.

It is expected that the needs of local users vary from community to community. Demonstrating that diversity were comments ranging from "excited to have them available" to "no one wanted one at all." There were some noticeable differences by geographic region and utility service area with 80% of all circulation taking place in the Idaho Power service area. The three libraries with the highest circulation of the energy kits are located in Ada County. These figures may be attributed to both the higher service populations and to considerable promotion carried out by Idaho Power Company direct to their customers.

Top Circulation in Idaho Library Systems

Ada Community Library	130
Boise Public Library	102
Meridian District Library	84
Cooperative Information Network (North Idaho)	76
Twin Falls Public Library	74
Latah County Library District	56
Boise Basin Library District (Idaho City)	52
Eagle Public Library	50
The Community Library – Ketchum	49
Nampa Public Library	43

Project Budget Explanation

Funds Received	
Idaho Power	$4,821.00
Avista Utilities	1,848.00
Rocky Mountain Power	1,366.00
	$8,035.00
Expenses:	
Kill-A-Watt Meters	$4,350.39
Brochure printing	468.45
Logo Design	227.00
Tote Bags	1,495.00
Meter Distribution Mailing Boxes	165.00
Meter Distribution Postage	314.18
Poster Design	- 0 -
Poster Printing	40.95
Table Top Easels	461.45
Table Top Poster mailing Supplies	80.88
Table Top Poster Distribution Postage	377.88
Total Expenditures	$8,081.08
Remaining Funds	$ (46.08)[2]

Lessons Learned

The Energy Efficiency kit project was a unique opportunity for the Idaho Commission for Libraries to partner with the electrical utility companies serving the residents of Idaho. Library staff were asked if they would recommend the Commission pursue similar partnerships with these or other organizations if

[2] Excess costs were paid from the Networking budget (T10108-00) with Library Services and Technology Act (LSTA) grant funds.

the opportunity were presented in the future. Of the survey respondents, 76% indicated the Commission should pursue similar programs in the future. Where respondents did not agree with pursuing similar programs or were unsure, the following comments were provided:

- There hasn't been much interest in these kits.
- What kind of information do they want from this partnership? How much more work will it put on librarians to participate?
- This seemed to not be very useful to people.
- If the partnership was useful. I would like to see us partner with Zamzow's or D & B for gardening information. Or perhaps with the extension service agents in each county. People really need home garden, home chickens, home canning information!!
- If it's something that would be helpful to a larger number of people, then yes.
- Without knowing how the partnership impacts the ICfL and what the future ones would look like I don't feel informed enough to make a yes or no answer.

In the spirit of continuous improvement, Idaho library staff were asked to offer their feedback on the Energy Efficiency Kit Lending Program or future programs that could arise. Only 15 respondents provided a response to the request, but responses are useful for informing future projects.

- I'm the one and only staff member. I thought the EEK was a great idea and would like to see future projects occur.
- Good partnership. Energy use is a common individual and community concern.
- We would like to see more of these projects. With the right marketing, it will be a useful tool for our community.
- Interesting project. Good idea.
- We love the ICfL, but this project fell a little flat.
- Any opportunity for the library to serve the public is welcome. We are about more than books.
- Ask me first if I want to participate. I didn't think this would go over with my community and I certainly did nothing to promote it. I had it available at the adult table.
- This is something I would not have thought of but it is a nice service to give to the community.
- I wish there had been more publicity. We only had a couple people ask about it.
- It was great that ICfL had a site that patrons could go to for more information. It certainly made it easier for our library staff. We definitely would be interested in any future projects.
- We would keep them in a different place the next time.
- It would depend on what type of kit or project. We don't have a lot of enthusiasm for this type of thing here.
- The Bruneau Library doesn't have many people checking out the Energy Efficiency Kit, but even one is worth the time.
- Nice to have projects like this
- I think it is a great idea and would like to participate in similar programs.

Due to restrictions for collecting personal information about Energy Kit users from public libraries, it was not possible to gather specific information on how consumers used the meters, how they adjusted their home energy use, or the amount of energy savings experienced by residential customers of the partner power utilities. It is known, however, that energy kits were circulated to Idahoans 1,139 times during the first year of the project. Considering the retail cost of a Kill A Watt™ meter at $16.44[3], the retail value of

[3] Amazon.com

the equipment used for 1,139 households would amount to approximately $18,725. This demonstrates a good value for the $8,081.08 invested in the Energy Efficiency Kit Lending Program by the partners. Staff time at the power companies and the Commission for Libraries is not accounted for in the funds invested.

The success of the program is not limited to the good value and positive feedback. There are constructive lessons to be learned from the feedback provided by the library community – both activities to continue and opportunities to improve for the future.

What worked well?	What would work better next time?
Good value for the funds expended.	Provide more direction for promotional ideas to libraries early in the project.
Simplifying the instructions for using the meter midway into program in response to feedback.	Higher response rate for circulation reporting and surveys.
Promotion at Idaho Green Expo and direct customer communication by Idaho Power Company	Coordinated statewide promotion.
Experience working with new partners outside traditional library field.	Longer implementation period to provide more information to libraries.

Next Steps

The lending program will carry on as long as kits remain in circulation in Idaho's public libraries. Libraries wishing to cease circulation will have the opportunity to return them to the Idaho Commission for Libraries. Commission staff will continue to replace kits for libraries that need them for as long as current supplies are available.

In summary, the Energy Efficiency Kits Lending Program was a successful endeavor. The Idaho Commission for Libraries had the notable opportunity to work with new community partners. Additionally, the project is an example of a non-traditional way in which the Commission achieves its mission to "build the capacity of libraries to better serve their clientele." The Energy Efficiency Kits Lending Program allowed libraries to provide a tool for Idahoans to identify potential savings during a bleak economic period.

It is recommended that similar programs be pursued if opportunities are presented that both fall within the agency's mission and can be carried out with the resources available at ICfL and within the library community.

3239 Ramos Circle
Sacramento, CA 95827-2501
(916) 363-8383
Fax (916) 363-1788

Idaho Power
FlexPeak Management Survey Results

September 29, 2011

This memorandum presents results and findings of a telephone survey conducted by ADM Associates under contract with Idaho Power. FlexPeak Management participants were surveyed in order to determine program satisfaction levels, incentive level impacts and feedback on program design. A total of 88 surveys were conducted between Sept 19th, 2011 to Sept 26th, 2011. The survey responses are provided in an Excel file embedded at the end of this memorandum.

1. Findings from Fixed Response Questions

- Nearly 90% (88%) of participants have been a part of the program for 2 or more summers
- Four-fifths (80%) of participants estimated there were 6 or more events this past summer
- Just under three-fourths (74%) of respondents thought there were more events called in 2011 than in 2010. Only 2% stated they thought fewer events were called this summer.
- Over half (56%) of the respondents did not opt out of any events.
- Over three-fourths (78%) of participants indicated that they were very likely to participate in the program next year. Figure 1 shows the likelihood of participation for next year based on this year's experience.

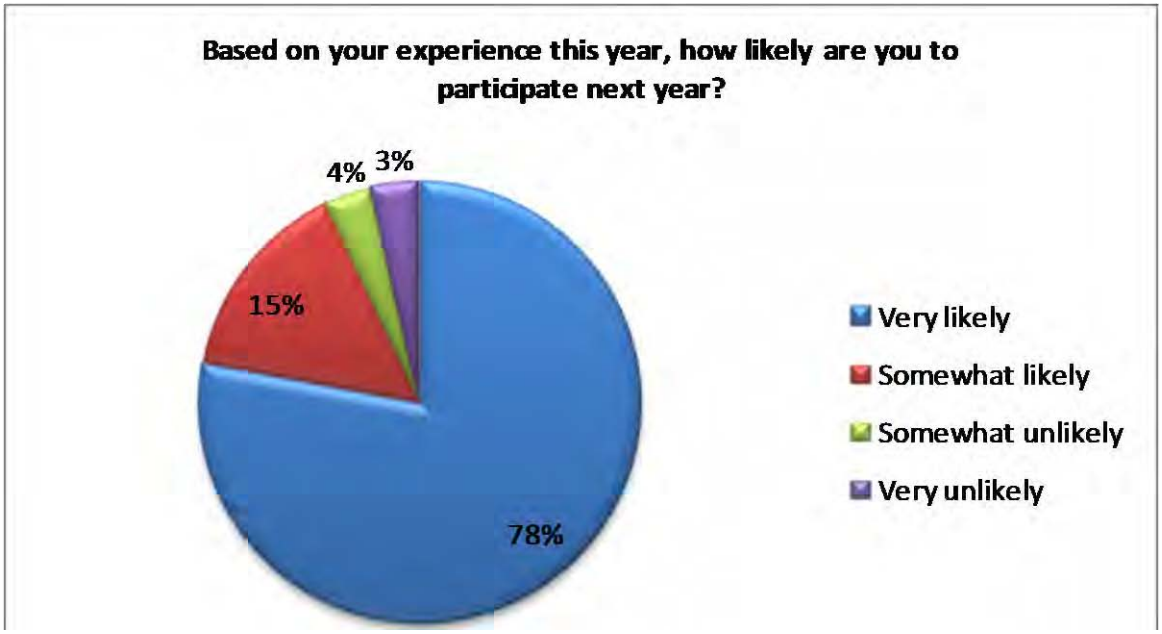


Figure 1. Likelihood of participation in 2012

Figure 2 details each customer's main reason for participating in the program. Just over half (51%) of respondents to the survey stated that the financial incentive was their main motivation for participating in the program.

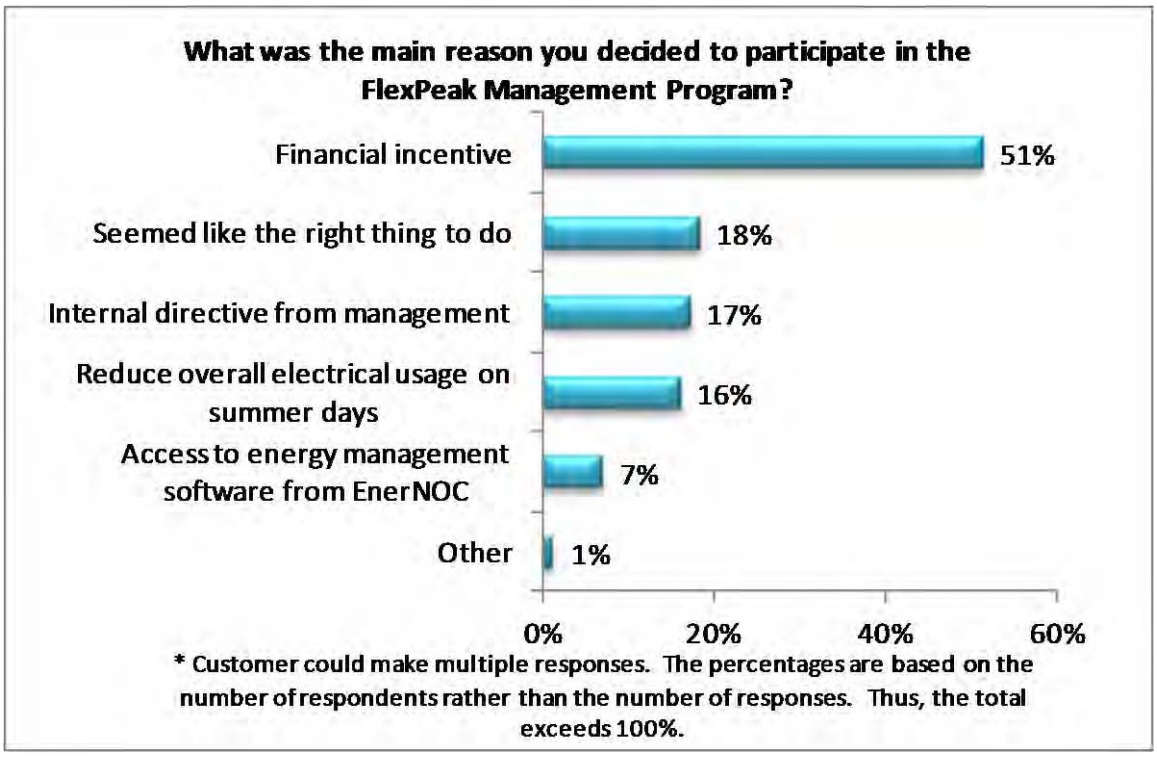


Figure 2. Main reason participants decided to participate in the program

- Overall satisfaction with the program was high, with 86% of respondents stating that they were very satisfied. Reasons why customers were dissatisfied with the program are listed below:
  - Respondents were concerned that last year's usage was used as the baseline for calculating this year's demand reduction
  - Too time consuming to start up and stop equipment
  - Excessive amounts of phone calls before and after events from EnerNOC, with complaints that their tone was demanding and making it seem that participation was mandatory rather than voluntary
  - Problems reading power consumption on the website
  - Insufficient incentive amount to supplement lost production time.
- Nearly all (91%) respondents are very likely to recommend the FlexPeak Management program to a business colleague.

2. Findings from Open Ended Questions

Responses to the open ended questions have been summarized by distilling each response down to its main point and categorizing it. The number of responses in each category is listed in parenthesis.

Open Ended Question #1 (Reasons for Opting out of Events) N=39

1. **Production Requirements– (28)**
    - Production demands too critical to shut down operation.
2. **Equipment Problems – (6)**
    - Metering solution from EnerNOC broken or broken equipment at facility.
3. **Miscellaneous – (5)**
    - General concerns.

Open Ended Question #2 (Impact on Business due to Events called this Summer) N=33

1. **Loss of production – (15)**
    - Production slow-down.
2. **Process to shut down equipment – (8)**
    - Respondents noted that the loss of man hours having to start up and stop equipment, additional personnel needed, and reorganizing production schedules to ensure customers were serviced was very time consuming.
3. **Inconvenience– (10)**
    - These respondents complained of slightly warmer temperatures due to longer events during business hours and the excessive amount of phone calls from EnerNOC.

Open Ended Question #3 (Reasons for Satisfaction with the Program) N=63

1. **Incentive Amount– (18)**
    - Participants would like a higher incentive amount.
2. **Saving Energy – (24)**
    - Conserving energy, helping the community, and reducing environmental impact.
3. **Program design and implementation – (18)**
    - Program was very well organized and easy to follow. Participants commented on great communication between their company and Idaho Power. Access to actual data and portal information was helpful in understanding how much the company is saving.
4. **Notification Process – (3)**
    - Notification process is very good.

Open Ended Question #3 (Comments about the Program) N=25

1. **Great Program– (2)**
    - Participants hope that the program continues.
2. **Events and Timing– (4)**
    - Participants noticed more events and longer events this summer compared to prior summers.
3. **Program explanation and communication– (1)**
    - Program was very well organized and easy to follow. Participants commented on great communication between their company and Idaho Power. Access to actual data and portal information was helpful in understanding how much the company is saving.
4. **Incentive Amount – (1)**
    - Participants would like a higher incentive amount.
5. **Recommendations– (8)**
    - Participants would like to be made aware of an event as much in advance as possible. Participants would like to know where the power is going when the need for an event takes place and the overall help/savings it creates.
6. **Problem with the Program—(6)**
    - Some participants received no advance notice of events. The payment rate and penalty for not participating are confusing.
7. **Miscellaneous—(3)**
    - General concerns.

Flex Peak ADM Results.xlsx

3239 Ramos Circle
Sacramento, CA 95827-2501
(916) 363-8383
Fax (916) 363-1788

Idaho Power
Irrigation Peak Rewards Survey Results

September 30, 2011

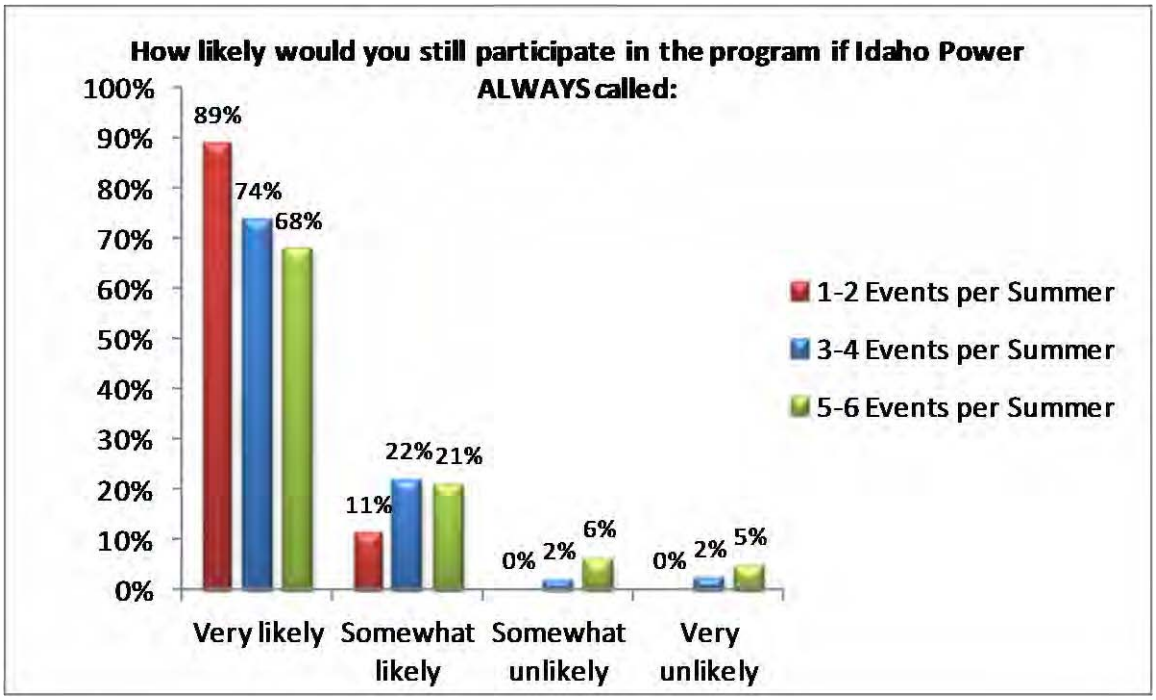
This memorandum presents results and findings of a telephone survey conducted by ADM Associates under contract with Idaho Power. Irrigation Peak participants were surveyed in order to determine program satisfaction levels, incentive level impacts and feedback on program design and implementation. A total of 205 surveys were conducted between Sept 19th, 2011 to Sept 29th, 2011.

1. Findings from Fixed Response Questions

- Just over five-sixths (86%) of participants participated in the program due to the financial incentive offered.
- Just over three-fourths (81%) of participants have been a part of the program for 2 or more summers.
- Nearly 90% (87%) of participants responded that the change in the incentive level this year did not influence their decision to participate in the program.
- For participants who were influenced by the change in the financial incentive structure, 46% enrolled more pumps, 14% enrolled in program who not enrolled in previously, 3% enrolled fewer pumps, and 11% said other. Participants who responded "other" said that the incentive change led them to apply for additional rebate programs offered by Idaho Power or consider not participating in the program entirely.
- 91% of respondents were very satisfied that no events were called this summer.
- Overall program satisfaction was high, with 85% of respondents stating that they were very satisfied. Participants who responded somewhat dissatisfied (13.5%) and very dissatisfied (1.5%) complained of no events being called this year and the start up process for program needing to be changed.
- Nearly all (97%) respondents are very likely or somewhat likely to recommend the Irrigation Peak Rewards program to another member of the agriculture community.
- All participants responded that they will very likely or somewhat likely participate in the program next year.

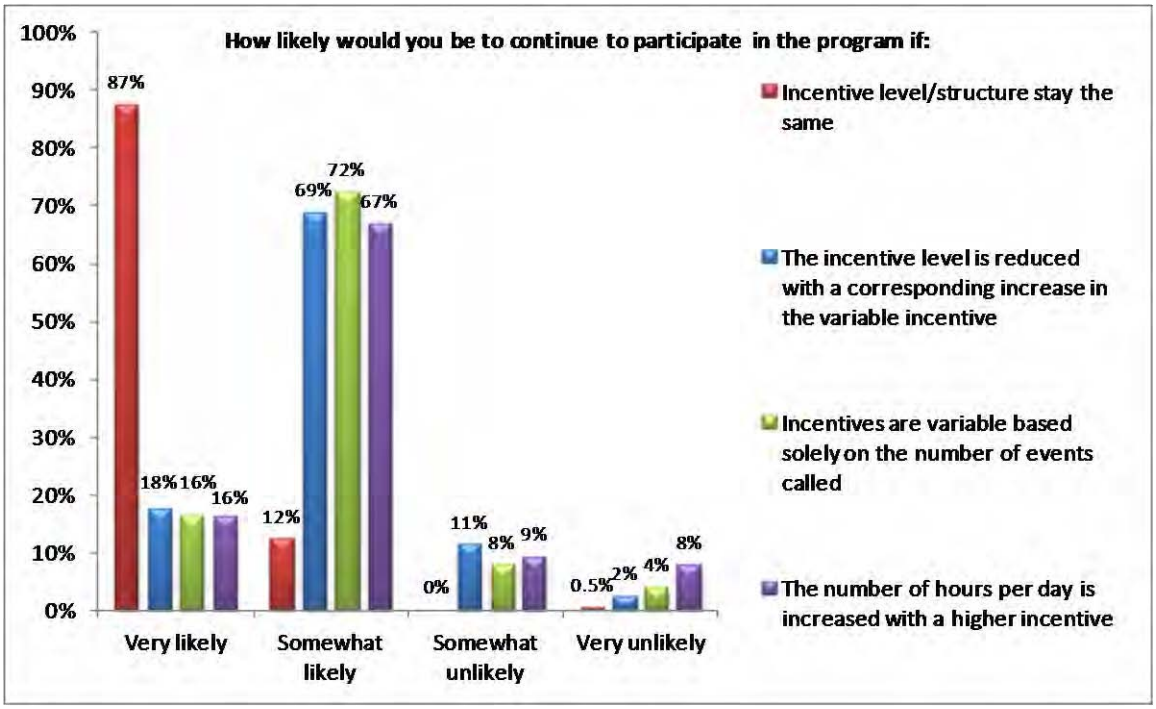
- Figure 1 shows the likelihood of participation based on the number of events included in the fixed billing credit. There appears to be no significant difference to the customer if there are just 1-2, 3-4, or 5-6 days per summer included in the fixed bill credit. While some customers shift over to somewhat likely from very likely, the move is not dramatic.

Figure 1. Likelihood of participation based on number of events



- Customers do appear to prefer the current incentive level and program structure, with 87% saying they would be very likely to continue participation if the program stayed the same. The proposed combined fixed and variable incentive structure has 87% of respondents as somewhat likely or very likely to participate. Even the switch to an entirely variable incentive structure retains 72% of customers as at least somewhat likely to participate. The option of number of hours per day being increased with a higher incentive has 83% of participants saying that they would very likely or somewhat likely participate in the program. Figure 2 details the participants' feelings towards proposed program changes.

Figure 2. Likelihood of participation for a given program incentive structure



2. Findings from Open Ended Questions

Responses to the open ended questions have been summarized by distilling each response down to its fundamental point and categorizing it. The number of responses in each category is listed in parenthesis.

Open Ended Question #1 (Problems with Program) N=10

1. **Equipment Problems– (8)**
    - Equipment malfunctions including controllers, wiring, and pumps not working correctly.
2. **Equipment Process – (1)**
    - Difficulty restarting the pumps.
3. **Program Communication – (1)**
    - Lack of communication between the participants and Idaho Power.

Open Ended Question #2 (Program Satisfaction) N=82

1. **Incentive Amount – (51)**
    - Participants liked the money that they received.
2. **Energy Savings – (10)**
    - Conserving energy on peak demand days, helping the community, and reducing environmental impact.
3. **Program Design and Communication– (11)**
    - Respondents liked the timely manner in which everything was set up at their facilities and the convenience of turning equipment on or off manually.
4. **No Events – (4)**
    - No shutdowns took place because no events were called.
5. **Notification Process– (6)**
    - These respondents were very satisfied with the timing of the calls to notify them of an event.

Open Ended Question #3 (Comments) N=38

1. **Incentive Amount – (3)**
    - Participants would like a higher incentive amount.
2. **No Change Needed to Program – (8)**
    - Respondents like the program as is. If changes are made that make the program less financially viable, they will not participate.
3. **Great Program– (8)**
    - Participants hope that the program continues, and are very complementary of the program as is.
4. **Changes Need to Program – (4)**
    - Participants complained of the procedure necessary to start-up pumps, electrical box for restarting, M2M commuters, and the rotation-restart button on pumps are not working as intented.
5. **Program design– (2)**
    - These respondents enjoyed the seminar in the spring about the program and the notice before shutoff.
6. **Recommendations – (9)**
    - Participants would like the billing process to be more transparent, for the program to run through September, they would like additional explanation on how to operate the remotes, for more skilled electricians to be installing the equipment, to go back to the 2010 incentive level, and for Idaho Power to build more windmills.
7. **Survey – (2)**
    - General concerns.
8. **Miscellaneous – (2)**
    - No more rate hikes.

Irrigation Peak
Rewards Telephone F

Boise City Home Audit Follow-up Survey

1. 1. How easy was it for you to apply for the Boise City Home Audit Program?

	Response Percent	Response Count
Very easy	**78.6%**	**231**
Somewhat easy	19.4%	57
Somewhat difficult	1.7%	5
Very difficult	0.3%	1
	answered question	**294**
	skipped question	**2**

2. 1(a). If the application process was difficult what was it about that process that made it difficult?

	Response Count
	6
answered question	**6**
skipped question	**290**

3. 2. How satisfied were you with the ability to schedule a time and day for your audit that was convenient for you?

	Response Percent	Response Count
Very satisfied	**79.2%**	**232**
Somewhat satisfied	16.4%	48
Somewhat dissatisfied	3.1%	9
Very dissatisfied	1.4%	4
answered question		**293**
skipped question		**3**

4. 2(a). If the appointment scheduling process was dissatisying for you, what was it about the process that was dissatisfying

	Response Count
	9
answered question	**9**
skipped question	**287**

5. 3. Please identify the auditor you used for your home audit.

	Response Percent	Response Count
Kevin Abbott, *Western Heating and Air Conditioning*	22.5%	61
Chris Callor, *Affordable Energy Improvements*	**38.7%**	**105**
Tad Duby, *On Point, LLC with Western Heating and Air Conditioning*	15.1%	41
	answered question	**271**
	skipped question	**25**

6. 4. Please rate your home auditor on each of the following:

	Excellent	Good	Fair	Poor	Response Count
Courteousness	**80.9% (229)**	18.0% (51)	0.7% (2)	0.4% (1)	283
Professionalism	**76.2% (215)**	18.4% (52)	3.9% (11)	1.4% (4)	282
Explanation of work/measurements to be performed as part of audit	**64.8% (182)**	28.5% (80)	6.0% (17)	0.7% (2)	281
Explanation of recommendations resulting from audit	**54.8% (154)**	32.0% (90)	10.0% (28)	3.2% (9)	281
Overall experience with auditor *(from scheduling an appointment to follow-up after the audit)*	**60.9% (171)**	29.2% (82)	7.1% (20)	2.8% (8)	281
				answered question	**283**
				skipped question	**13**

7. 5. If you have additional comments you would like to offer about your home auditor, please enter them in the space below.

	Response Count
	104
answered question	**104**
skipped question	**192**

8. 6. How much did the audit increase your understanding of ways to reduce energy usage?

	Response Percent	Response Count
A lot	40.9%	114
Some	**54.8%**	**153**
None at all	4.3%	12
answered question		**279**
skipped question		**17**

9. 7. Overall, how would you rate the Boise City Home Audit Program?

	Response Percent	Response Count
Excellent	**54.1%**	**153**
Good	32.9%	93
Fair	9.9%	28
Poor	3.2%	9
answered question		**283**
skipped question		**13**

10. 7(a). What, if anything, about the Boise City Home Audit Program was most satisfying to you?

	Response Count
	161
answered question	**161**
skipped question	**135**

11. 7(b). What, if anything, about the Boise City Home Audit Program was most dissatisfying to you?

	Response Count
	34
answered question	**34**
skipped question	**262**

12. 8. How likely would you be to recommend the Boise City Home Audit Program to a friend or relative?

		Response Percent	Response Count
Very likely		**66.5%**	**187**
Somewhat likely		21.4%	60
Somewhat unlikely		6.4%	18
Very unlikely		5.7%	16
		answered question	**281**
		skipped question	**15**

13. 9. If you have other comments about the Boise City Home Audit Program, please enter them below:

	Response Count
	43
answered question	**43**
skipped question	**253**

14. 10. Please identify your age in the ranges below:

		Response Percent	Response Count
Under 25		0.0%	0
26-35		11.8%	33
36-50		31.2%	87
51-65		**41.9%**	**117**
Over 65		15.1%	42
		answered question	**279**
		skipped question	**17**

15. 11. What is the highest level of education you completed?

	Response Percent	Response Count
Less than high school	0.0%	0
Some high school	0.0%	0
High school graduate or equivalent	3.2%	9
Some college	18.3%	51
Two year Associate degree or Trade/Technical school	8.2%	23
Four year college degree	24.7%	69
Some graduate courses	11.1%	31
Advanced degree	**34.4%**	**96**
	answered question	**279**
	skipped question	**17**

Boise City Home Audit Post-Audit Survey

1. 1. How much did the audit influence you to reduce the amount of electricity you consume?

	Response Percent	Response Count
Influenced me a lot	19.9%	56
Influenced me some	**56.4%**	**159**
Didn't influence me much	16.7%	47
Didn't influence me at all	7.1%	20
	answered question	**282**
	skipped question	**1**

2. 2. As a result of the Boise City Home Audit program, please indicate how strongly you agree or disagree with the following statements.

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	N/A	Response Count
I am more informed about energy usage in my home	**47.3% (131)**	44.0% (122)	5.4% (15)	2.9% (8)	0.4% (1)	277
Other members of my household are more informed about our household energy usage	26.1% (71)	**44.1% (120)**	7.0% (19)	4.0% (11)	18.8% (51)	272
I am more informed about energy efficiency programs that are available to me	31.3% (85)	**43.4% (118)**	18.8% (51)	5.9% (16)	0.7% (2)	272
					answered question	**279**
					skipped question	**4**

3. 3. After receiving your audit through the Boise City Home Audit program, please indicate if you have taken any of the following actions:

	Yes	No	Not sure	N/A	Response Count
I visited the Idaho Power website	47.6% (130)	**48.0% (131)**	3.3% (9)	1.1% (3)	273
I unplug appliances when not in use	**52.7% (144)**	43.6% (119)	0.7% (2)	2.9% (8)	273
I wash my clothes in cold water	**60.6% (166)**	32.1% (88)	1.8% (5)	5.5% (15)	274
I adjust the temperature on my thermostat (higher in summer, lower in winter)	**81.6% (222)**	13.2% (36)	0.7% (2)	4.4% (12)	272
I reduced the temperature of my water heater	32.5% (88)	**63.1% (171)**	1.8% (5)	2.6% (7)	271
I shared my energy audit experience with relatives and/or friends	**73.0% (200)**	26.3% (72)	0.0% (0)	0.7% (2)	274
Other	**49.5% (55)**	12.6% (14)	0.9% (1)	36.9% (41)	111
If you selected "other", please specify what other actions you have taken:					65
				answered question	**277**
				skipped question	**6**

4. 4. Since receiving your audit through the Boise City Home Audit program, please indicate when, or if, you will complete any of the following improvements:

	Already completed	Plan to in next 6 months	Plan to in 6-12 months	Want to but not sure when	Do not plan to at all	Response Count
Increase attic insulation	24.0% (65)	13.7% (37)	11.4% (31)	**26.6% (72)**	24.4% (66)	271
Increase wall insulation	4.4% (12)	1.8% (5)	3.7% (10)	20.7% (56)	**69.4% (188)**	271
Increase underfloor insulation	9.3% (25)	4.4% (12)	3.3% (9)	30.7% (83)	**52.2% (141)**	270
Seal air leaks	**40.4% (110)**	21.0% (57)	4.8% (13)	21.0% (57)	12.9% (35)	272
Seal duct work	**35.4% (97)**	12.8% (35)	6.9% (19)	24.1% (66)	20.8% (57)	274
Service heating equipment	**44.5% (121)**	21.0% (57)	7.4% (20)	13.2% (36)	14.0% (38)	272
Service cooling equipment	**43.2% (117)**	11.8% (32)	10.0% (27)	13.3% (36)	21.8% (59)	271
Replace an older, inefficient appliance with a new Energy Star model	27.9% (76)	3.7% (10)	4.0% (11)	**35.3% (96)**	29.0% (79)	272
Recycle an extra refrigerator or freezer	15.0% (39)	4.2% (11)	2.3% (6)	14.6% (38)	**63.8% (166)**	260
Replace additional showerheads with low-flow models	**52.2% (141)**	4.4% (12)	1.1% (3)	5.9% (16)	36.3% (98)	270
Replace additional incandescent lights with compact fluorescent lights (CFLs)	**71.0% (193)**	5.9% (16)	4.0% (11)	2.9% (8)	16.2% (44)	272
					answered question	**276**
					skipped question	**7**

5. For any improvements you indicated you do not plan to do, please tell us why.

	Response Count
	147
answered question	**147**
skipped question	**136**

6. 5. What were the top two benefits you experienced from the Boise City Home Audit program?

	First	Second	Response Count
Cost savings	**58.4% (59)**	41.6% (42)	101
Personal satisfaction	**51.4% (36)**	48.6% (34)	70
Raised awareness	**68.5% (85)**	31.5% (39)	124
Benefit to the environment	30.9% (17)	**69.1% (38)**	55
Home improvement	45.1% (51)	**54.9% (62)**	113
Comfort	38.5% (15)	**61.5% (24)**	39
		Other (please specify)	13
		answered question	**264**
		skipped question	**19**

7. 6. What is the greatest barrier you encounter in making energy savings changes in your home?

	Response Percent	Response Count
Cost	**74.9%**	**206**
Time	6.2%	17
Convenience	3.6%	10
Lack of necessity	8.4%	23
Other (please specify)	6.9%	19
	answered question	**275**
	skipped question	**8**

8. 7. The most effective method for Idaho Power to provide information about efficient energy use is to:

	Response Percent	Response Count
Offer classes in convenient locations	4.1%	11
Communicate information in local newspapers	4.4%	12
Communicate information on the Idaho Power website	4.1%	11
Offer a minimal cost home audit service	**35.9%**	**97**
Send newsletters or information directly to homeowners	28.5%	77
Send email communications to homeowners	18.1%	49
Other (please specify)	4.8%	13
	answered question	**270**
	skipped question	**13**

9. 8. How likely would you be to recommend an audit program like the Boise City Home Audit Program to a friend or relative?

	Response Percent	Response Count
Very likely	**63.9%**	**175**
Somewhat likely	21.2%	58
Somewhat unlikely	7.3%	20
Very unlikely	7.7%	21
	answered question	**274**
	skipped question	**9**

10. 10. Please identify your age in the ranges below:

	Response Percent	Response Count
Under 25	0.0%	0
26-35	12.9%	35
36-50	28.4%	77
51-65	**42.4%**	**115**
Over 65	16.2%	44
	answered question	**271**
	skipped question	**12**

11. 11. What is the highest level of education you completed?

	Response Percent	Response Count
Less than high school	0.0%	0
Some high school	0.4%	1
High school graduate or equivalent	4.5%	12
Some college	13.0%	35
Two year Associate degree or Trade/Technical school	6.3%	17
Four year college degree	27.1%	73
Some graduate courses	14.1%	38
Advanced degree	**34.6%**	**93**
	answered question	**269**
	skipped question	**14**

ADM Associates, Inc.

3239 Ramos Circle
Sacramento, CA 95827-2501
(916) 363-8383
Fax (916) 363-1788

Idaho Power
A/C Cool Credit Survey Results

September 29, 2011

This memorandum presents results and findings from a telephone survey of A/C Cool Credit participants that ADM conducted under contract with Idaho Power. A total of 525 surveys were conducted from Sept 16th, 2011 to Sept 26th, 2011.

1. Findings from Fixed Response Questions

- Just over three-fourths (76%) of participants have been a part of the program for 2 or more summers
- Just under two-thirds (65%)of participants estimated there were 5 or less cycling events this past summer
- Respondents thought the number of cycling events in 2011 was less than the number in 2010. 28% stated they thought less events were called this summer, while only 10% thought there were more events this summer.
- Three-fourths (75%) of the respondents stated that they were very satisfied with the number of times their air conditioning unit was cycled last summer.
- Customers do appear to prefer the fixed bill credit amount with 88% saying they would be very likely to continue participation if the credit stayed the same. The proposed combined fixed and variable incentive has 81% of respondents as somewhat likely or very likely to participate. Even the switch to an entirely variable incentive retains 73% of customers as at least somewhat likely to participate. Figure 1 shows the likelihood of participation for different incentive structures.

Figure 1. Likelihood of participation for a given program incentive structure

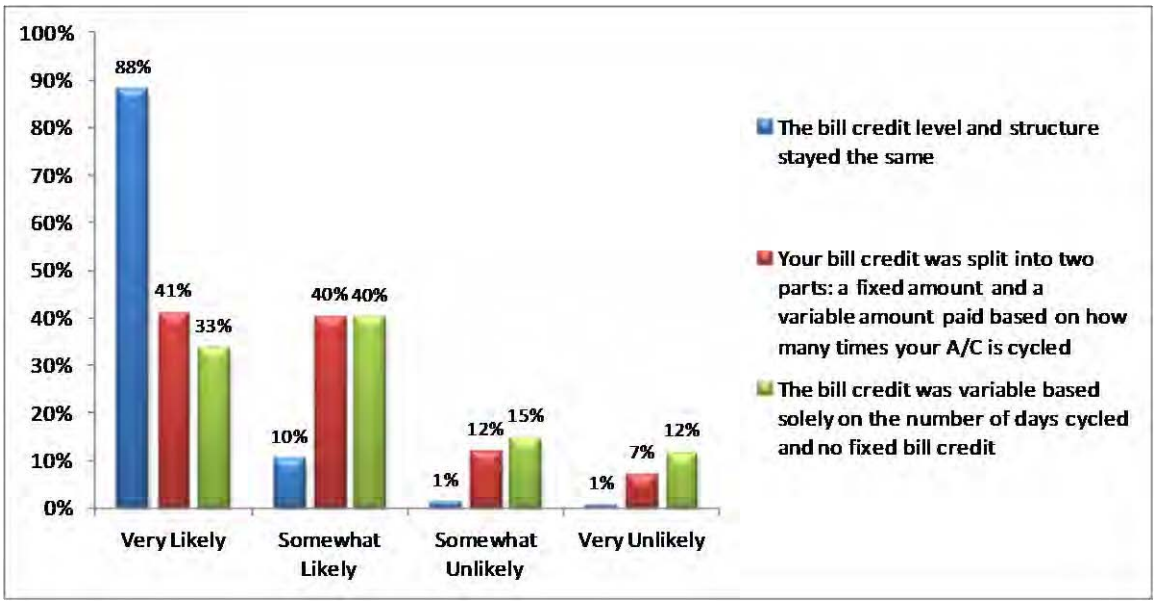
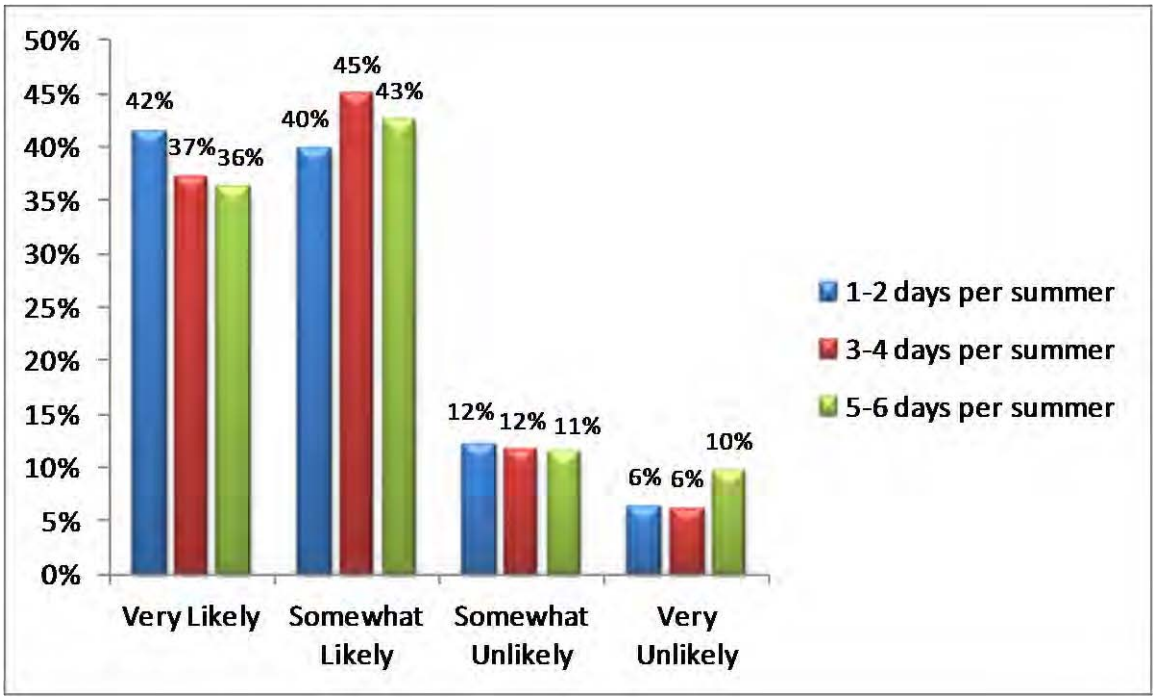


Figure 2 shows the likelihood of participation based on the number of days included in the fixed billing credit. There appears to be no significant difference to the customer if there are just 1-2 or 5-6 days per summer included in the fixed bill credit. While some customers shift over to somewhat likely from very likely, the move is not dramatic.

Figure 2. Likelihood of participation by the number of days included in the fixed billing credit



- Overall satisfaction with the program was high, with just over three-fourths (76%) of respondents stating that they were very satisfied. Just over two-thirds (68%) of respondents are very likely to recommend the A/C Cool Credit program to a friend or family member.

2. Findings from Open Ended Questions

Responses to the open ended questions have been summarized by distilling each response down to its main point and categorizing it. The number of responses in each category is listed in parenthesis.

Open Ended Question #1 (Reason for Satisfaction with the Program) N=397

1. **Bill Reduction – (183)**
    - Bill credits.
2. **Overall program satisfaction – (33)**
    - No complaints about the program, general satisfaction.
3. **Customer Service – (4)**
    - Responded quickly to problems, very easy to enroll.
4. **Saving energy – (70)**
    - Conserving energy, helping the community, reducing environmental impact, and ensuring no blackouts.
5. **Program design and implementation – (107)**

- Didn't notice impacts, not disrupted at all by the program. Customers were able to enroll and be left alone, and many didn't even notice a difference in comfort at their homes.

Open Ended Question #2 (Comments about the Program) N=86

1. **Customer Service Overall – (17)**
    - Customers appreciated the service and thought the company was very responsive to their requests for assistance.
2. **High Rates – (3)**
    - Participants complained that in general their electricity rates were too high. This does not directly relate to the program
3. **Low Rates – (10)**
    - Respondents noted that they would like the rates to stay low.
5. **Survey Confusing – (8)**
    - These respondents explained that the survey was somewhat hard to understand and that they would like the questions to be phrased in simpler language. Some didn't understand the questions about cycling.
6. **Recommendation for the Program – (3)**
    - Having a 1-800 number to call with questions or issues about the program would be beneficial. Offering a similar program for seniors or people on a fixed income. Trying to let people know about other programs they might be interested in that are offered by Idaho Power.
7. **Great Programs – (13)**
    - People hope that the program continues, and are very complementary of the program as is.
8. **Problems with the Program – (4)**
    - General Complaints
9. **Program explanation and communication – (16)**
    - Explain what is meant by cycling and how it operates. Include a graph to show savings, and publish the number of events and times the participant was cycled.
10. **Incentive Amount – (3)**
    - Participants would like a higher incentive amount.
11. **General concerns not related to the program – (9)**
    - Miscellaneous concerns.

SUCCESS STORIES

Table 5. 2011 Success Stories

Title	Program or Sector	Author
Idaho Ice World	Commercial	Idaho Power
Hansen Quick Stop & Go	Commercial	Idaho Power
Atkinsons' Market	Commercial	Idaho Power
Bellevue Wastewater	Industrial	Idaho Power
City of Hailey	Commercial	Idaho Power
University of Idaho Integrated Design Lab	Commercial	Idaho Power
Jefferson Place	Commercial	Idaho Power
SUPERVALU/Albertson's	Commercial	Idaho Power
Key Financial Center	Commercial/Industrial	Idaho Power
Heating & Cooling Efficiency Program— Knigge	Residential	Idaho Power
Heating & Cooling Efficiency Program—Quigley	Residential	Idaho Power
Ductless Heat Pump Pilot Program	Residential	Idaho Power

This page left blank intentionally.

Custom Efficiency

For Commercial and Industrial Projects

Chilling out more efficiently with Idaho Ice World

With 34,000 square feet of ice on two full-sized rinks, the city-owned Idaho Ice World in southeast Boise has to keep a lot of water very cold.

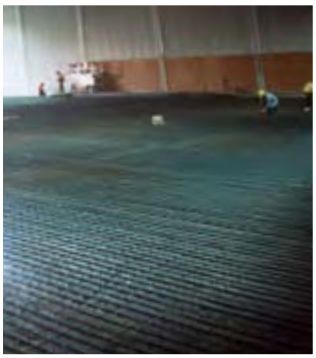
"We circulate a mixture of water and anti-freeze through 16 miles of pipe on each rink," says Idaho Ice World General Manager Tommy Scott. "We push it out at 14 degrees, and it comes back at 17 degrees, so we have to super-cool it again very quickly." In the ice-rink world, 17 degrees is warm enough to melt ice.

Replacing the old freezing technology

The Simplot Foundation built Idaho Ice World in 2000, then donated it to the City of Boise in 2005. Until recently, the facility used the original ice-making plant. "It was basically six big block motors that cooled the solution," Tommy explains. "It was starting to fail, so we had to do something quick. We came up with a new, highly energy-efficient system that uses less power, less water, less everything."

Idaho Ice World and Idaho Power worked together to get the system qualified for the utility's Custom Efficiency incentive program. "I told Jeff Rigby (the local Idaho Power customer representative) about the project and that it all had to happen really fast, and they were able to keep up. It was really great."

Idaho Power's contribution to the conversion went beyond helping with the paperwork. "Chris Pollow is an Idaho Power energy expert," Tommy says, "and he's very knowledgeable about industrial energy efficiency. He worked with our vendor to make sure the system was set up right."



Tweaking the new system

"There's an art and science to making ice," Tommy explains, "so our new system has to marry the two and, in the process, make it as energy efficient as possible." The new system is based on variable-frequency drives (VFDs) that regulate the amount of power the system's pumps use. When it's hot outside, we use more; when it's cold, we use less. Chris is helping us figure out the nuances of how to set those VFDs."

IDAHO POWER®
An IDACORP Company

www.idahopower.com/business

"Idaho Power has wonderful people to work with."

– Tommy Scott
General Manager
Idaho Ice World

The savings

Idaho Power estimates the project will save Idaho Ice World 189,000 kilowatt-hours (kWh) per year, an annual savings of $10,395 on their power bill and enough energy to serve 15 homes in Idaho Power's service area. The project also qualified for a $22,680 incentive through Idaho Power's Custom Efficiency program.

Cost	Idaho Power Rebate	Savings (kWh/year)	Annual Savings	Customer out-of-pocket*	Payback in Months
$32,400	$22,680	189,000	$10,395	$9,720	12

* Source: Idaho Power, City of Boise—Idaho Ice World Refrigeration System Upgrades IND0802

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

- The **Custom Efficiency** program offers substantial rebates to large commercial and industrial customers who invest energy-saving improvements in their facilities.
- **Easy Upgrades** provides incentives of up to $100,000 when companies retrofit their infrastructures with energy-saving upgrades.
- The **Building Efficiency** program pays up to $100,000 *per project* to mitigate the additional capital costs when companies upgrade their lighting, cooling, controls, and building shells to more efficient components.
- **FlexPeak Management** offers commercial and industrial customers incentives in the form of recurring payments for reducing their power consumption during times of overall peak demand.

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624. We'll show how you can join smart companies like Idaho Ice World, saving energy and money.

The above success story was produced in cooperation with, and approval from, Idaho Ice World.

A Zamboni is not an Italian sandwich

A Zamboni is the small truck that rolls across a rink and smoothes out the ice. It was invented in 1949 by Frank Zamboni, who grew up near Pocatello, Idaho. A Zamboni scrapes off the top one-eighth of an inch of the old, used, carved-up ice with a sharp blade. It then washes any tiny ice chips out of the grooves and gouges and lays down a thin, fresh sheet of water that freezes almost instantaneously. The result is a clean, fresh, smooth surface of ice and many happy skaters.

IDAHO POWER®
An IDACORP Company

Easy Upgrades

For Simple Retrofits

Hansen Quick Stop & Go—the little store built for big energy savings

On the outside, the Hansen Quick Stop & Go looks like a typical convenience store. Inside are aisles of food, snacks, and household items; beverage coolers; and pleasant people behind the counter. It's what you can't see that sets it apart.

"We completely gutted it and remodeled it," Stace Campbell, one of the new owners says. "And then we built energy efficiency into virtually every aspect of it."

We don't have nearly enough room here to describe every energy-efficient thing Stace and his partners included in the new store, but here are a few of the more interesting ideas:

- **Innovative heating and cooling**—They replaced the old 5-ton heating unit with a ½-horsepower (hp) pump that runs air through the walk-in cooler, dropping the temperature 8 degrees Fahrenheit (F) before it gets to the air conditioner.
- **Automatic controls in unusual places**—The Slurpee® machine turns off when the store closes, and then turns back on just before it opens the next morning, reducing "phantom" loads.
- **Lighting**—Old 450-watt (W) and 1,000-W exterior lights were replaced with new 14-W LEDs.
- **Gaskets**—The doors on the wall coolers weren't shutting properly, so Stace had a new gasket system designed and installed to let the doors shut air-tight.

A Boy Scout project becomes a city landmark

On the side of the Hansen Quick Stop & Go you'll see a mural of the trail system in the South Hills, a few miles, well, south of town. It was originally painted by the son of the first owners as a Boy Scout project in the 1950s. Almost immediately, it became a landmark in the community and a source of pride to the boy who painted it and his family. When the family sold the store, the new owner had the wall repainted and the mural was gone forever. But the Campbells knew what the mural meant to the town—and to the store—so they had a new version of the mural painted by local artist, Gary Stone. "It's nice to have it back, don't you think?" Stace asks, admiring it.

To which, we can only reply, "Yes, it is, Stace. Yes, it is."

IDAHO POWER®
An IDACORP Company

"We're at least 30 percent more efficient than your typical convenience store."

–Stace Campbell, Owner, Hansen Quick Stop & Go

The savings

"We're at least 30 percent more efficient than your typical convenience store," Stace says proudly. "Our friends in the business ask us, 'How do you do that? We want to do that.'"

The improvements reduced the store's power consumption approximately 64,950 kilowatt-hours (kWh) per year, representing an annual savings of $3,572.00. And while not all of the improvements fell within Idaho Power's Easy Upgrades incentive program, the utility covered $4,936 of the total costs.

"I've got years of experience with Idaho Power's energy-efficiency programs from the industrial, large customer side," Stace says. "So I knew they could help us get to the ROI [return on investment] we wanted."

Estimated savings from the Hansen Quick Stop & Go's energy efficiency improvements

kWh/Year Savings	Project Cost	$/Year Savings	Idaho Power Rebate	Customer Out-of-Pocket	Payback in Months
64,952	$22,854	$3,572	$4,936	$17,918	44

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy-efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

- The **Custom Efficiency** program offers substantial rebates to large commercial and industrial customers who invest in energy-saving improvements in their facilities.
- **Easy Upgrades** provides incentives of up to $100,000 when companies retrofit their infrastructures with energy-saving upgrades.
- The **Building Efficiency** program pays up to $100,000 *per project* to mitigate the additional capital costs when companies upgrade their lighting, cooling, controls, and building shells to more efficient components.
- **FlexPeak Management** offers commercial and industrial customers incentives in the form of recurring payments for reducing their power consumption during times of overall peak demand.

The above success story was produced in cooperation with, and approval from, Hansen Quick Stop & Go.

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624. We'll show how you can join smart companies like the Hansen Quick Stop & Go , saving energy and money.

IDAHO POWER®
An IDACORP Company

Custom Efficiency

For Commercial and Industrial Projects

Atkinsons' Market cuts energy use and keeps produce fresher with help from Idaho Power program

Whit Atkinson, owner of the three Atkinsons' grocery stores that serve the Wood River Valley, taps one of the light-emitting diode (LED) lights in the produce aisle of the Ketchum store. "We changed out the ceiling fixtures to T8 fluorescents four years ago," he said, explaining the multi-stage lighting retrofit Atkinsons' undertook through Idaho Power's Custom Efficiency program. "We put in the LEDs this year."

Custom Efficiency is just one of the many commercial and residential programs Idaho Power uses to help its customers reduce electricity consumption. For example, Atkinsons' Market saves enough electricity to power 73 average homes in Idaho Power's service area.

Turn down the heat

The T8 lights use 30 percent less energy than the T12 fluorescents they replaced. And the LEDs, which replaced the accent and case lights throughout the stores, reduce more than just power usage.

"Heat," Whit said. "We had 100-watt bulbs in the produce area, and the new ones are 16 watts with no heat. Less heat means the produce lasts longer and stays fresher. Same thing with the freezers. We don't have to turn up the refrigeration to compensate for the heat from the lighting, which means we use less electricity."

The savings

In 2007, when Atkinsons' replaced T12 fluorescent bulbs in all three stores with more efficient T8 bulbs, it saved an estimated 864,302 kilowatt-hours (kWh) per year. In 2010, during the second phase of the changeout,

The Custom Efficiency program makes saving energy easy

"We're definitely pleased with Idaho Power's incentive program," Whit Atkinson said. "I'd recommend it to anybody."

Idaho Power hears that from a lot of companies who take advantage of our Custom Efficiency program. And you don't even have to call Idaho Power to participate.

"There are a lot of ways companies can get into the program," said Todd Schultz, Idaho Power's commercial energy-efficiency program leader.

IDAHO POWER®
An IDACORP Company

"We're definitely pleased with Idaho Power's incentive program. I'd recommend it to anybody."

– Whit Atkinson,
Owner, Atkinsons' Market

Viridis Energy Solutions of Boise converted 204 halogen, incandescent, and fluorescent bulbs to LED lighting, which is 80 percent more efficient. "Going with the LEDs is a huge power savings," Whit said. "And the amount of light is tripled. So not only do we save energy, but the whole store looks better."

And Whit's not finished. "The new models of refrigerator cases are much more efficient, so we're switching those out, and Idaho Power has incentives for that, too."

Project Phase	kWh/Year Savings	Project Cost	$/Year Savings	Idaho Power Rebate	Customer Out-of-Pocket*	Payback in Months
2007 (T-8 conversion)	864,302	$139,814	$47,537	$91,614	$48,200 (approx.)	12
2010 (LEDs)	91,142	$29,711	$5,012	$10,937	$18,774 (approx.)	45
Total	**955,444**	**$169,525**	**$52,549**	**$102,551**	**$66,974**	**15**

*Source: Idaho Power Atkinsons' markets Lighting Retrofit project summaries IND0627 and IEIP-070416A

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

- The **Custom Efficiency** program offers substantial rebates to large commercial and industrial customers who invest energy-saving improvements in their facilities.
- **Easy Upgrades** provides incentives of up to $100,000 when companies retrofit their infrastructures with energy-saving upgrades.
- The **Building Efficiency** program pays up to $100,000 *per project* to mitigate the additional capital costs when companies upgrade their lighting, cooling, controls, and building shells to more efficient components.
- **FlexPeak Management** offers commercial and industrial customers incentives in the form of recurring payments for reducing their power consumption during times of overall peak demand.

The above success story was produced in cooperation with, and approval from, Atkinsons' Market.

The Custom Efficiency program makes saving energy easy (continued)

"Virtually all the lighting contractors in our service area know the program. They can do all the work for a company, including scoping the project, doing the paperwork, and submitting it to Idaho Power. So, if companies want to take advantage of our incentives," Todd added, "they can call us or call their own lighting contractor. They'll take it from there."

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624. We'll show how you can join smart companies like Atkinsons' Market, saving energy and money.

IDAHO POWER®
An IDACORP Company

Building Efficiency

For Commercial and Industrial Projects

The City of Bellevue saves money on its new wastewater treatment plant with help from Idaho Power

The growth of the Wood River Valley has been a boon to its southernmost community. The City of Bellevue's population has risen almost 20 percent since 2000, spurring the city to upgrade its infrastructure and city services, including its wastewater treatment plant.

Brandon Keller of Keller Associates, the Boise engineering firm that designed the new plant, knew Idaho Power's Building Efficiency incentive program could help the city save money on the project and on future electric bills. "We had previously worked with the program on a similar project," Brandon said, "and with the technology we were putting into the plant, we knew it could save Bellevue some money."

Building Efficiency is just one of the many commercial and residential programs Idaho Power offers to help its customers reduce electricity use. Such incentive programs help customers save money twice—first by helping offset the initial cost of energy-saving equipment, and later through ongoing reductions in energy usage.

Variable frequency drives drive savings

The City of Bellevue's new $5.9 million wastewater treatment plant will benefit from an updated heating, ventilating, and air conditioning (HVAC) system. "We installed a four-ton split system HVAC," Brandon explained. Split systems incorporate an indoor unit with a matching outdoor unit connected by refrigerant piping. "They offer a lot of advantages," Brandon said. "They're easier to install and maintain. They're quieter, more cost-effective, more efficient, and one system can heat and cool."

As part of Bellevue's wastewater treatment process, the mechanical plant uses multiple blowers and pumps, each with variable frequency drives (VFD).

Working with city hall

"From our standpoint, [the Idaho Power incentive program] is great," Brandon said. It helps us in our relationships with the cities we do business with." As Brandon pointed out, Idaho Power's Building Efficiency program benefits the city on three levels. "First, they get that immediate incentive, which helps them meet their budgets, and, as we all know, that's pretty important these days," Brandon says. "Second, they're being proactive in making sure their projects are energy efficient and sustainable, and third, they receive savings over the long-term through lower power consumption."

IDAHO POWER®
An IDACORP Company

"With the technology we were putting into the plant, we knew it could save Bellevue some money."

– Brandon Keller, Keller Associates

"A variable frequency drive can equal big energy savings," said Sheree Willhite, Idaho Power Building Efficiency Program Specialist. "It regulates the blower speed by reducing the amount of electricity each blower receives." In commercial applications, it can save a lot of energy and, in Bellevue's case, ease the stress on a stretched government budget.

The savings

Idaho Power paid the City of Bellevue a $14,203 incentive through the Building Efficiency program. The four new VFDs added 230 total horsepower (hp) of pumps and blowers and will reduce the City of Bellevue's energy usage by 187,686 kilowatt-hours (kWh) per year, helping to save the city—and taxpayers—$8,445 in annual electricity costs.

The city's role in the entire process was simple. "We coordinated with Idaho Power and filled out all the paperwork for the city and got it approved for them," Brandon explained. "The only thing they had to do was deposit the incentive check."

Savings are quite common

Saving energy is always a wise choice. The Building Efficiency program assisted the City of Bellevue in saving money for its taxpayers in the form of lower operating costs for the city's new wastewater treatment plant. Building Efficiency is just one part of Idaho Power's complete suite of energy efficiency programs.

Using Idaho Power's energy efficiency programs, customers saved enough electricity in 2010 to power more than 13,500 average-sized homes. That's an increase of 31 percent over the previous year, and Idaho Power anticipates even greater savings in 2011.

Using energy wisely benefits everyone by preserving natural resources and delaying the need for additional power facilities. It helps Idaho Power's customers save money and helps the company continue to provide reliable, responsible, fair-priced energy.

How can you participate?

A large and growing percentage of Idaho Power customers take part in at least one of our energy efficiency programs. To find programs to fit your needs, go to www.idahopower.com and select **Energy Efficiency**. We'll show you how you can reduce your energy use and trim your electric bills.

The above success story was produced in cooperation with, and approval from, the City of Bellevue and Keller Associates.

Working with city hall (continued)

Idaho Power's energy efficiency incentive programs have advantages for engineering and construction companies that participate in them as well. "We've had success with it on a number of projects," Brandon said. "So we'll be more likely to push for it with our clients—to be more proactive. With incentives through Idaho Power's Building Efficiency program, it's not a tough sell."

IDAHO POWER®
An IDACORP Company

Custom Efficiency

For Commercial and Industrial Projects

Hailey, Idaho, builds on a history of inspired energy ambitions

Hailey, Idaho, has a dream. "Based on our 2005 energy use," said Mariel Platt, the city's sustainability coordinator, "our goal is to achieve a 15-percent energy reduction by 2015."

Several municipalities in Idaho Power's service area are undertaking energy efficient practices, but few are as comprehensive as Hailey's efforts. But then, the city has a history of energy innovation. It was the first Idaho city to light the streets of its downtown business district with electricity (see sidebar).

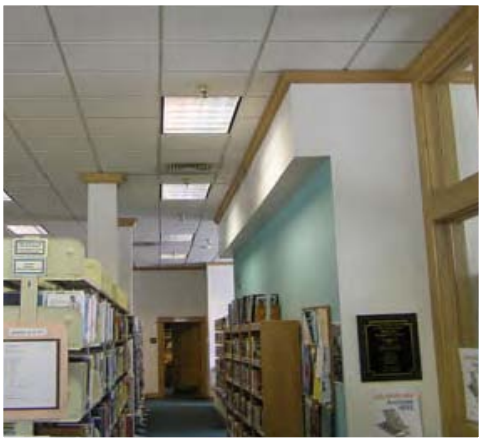
"We're looking at replacing HVAC systems and lights; constructing LEED-certified buildings; and doing anything within the city's area of operations we can to improve our energy efficiency and save money," said Mariel. In fact, since 2006, the city has reduced its electricity usage by more than 14 percent, or 334,000 kilowatt-hours (kWh), and much of that has been financed through Idaho Power's incentive programs.

The project

The city upgraded 209 T12 fluorescent and 29 metal halide lights in its city hall, library, streets, fire departments, and water-treatment center to more efficient T8 fluorescent technology. In addition, it replaced the facilities' incandescent fixtures with compact fluorescent lights (CFL) and, where it was feasible, installed motion sensors to ensure the lights are off when no one is present.

The savings

Lighting upgrades at the four facilities cost $39,083, of which Idaho Power's Custom Efficiency incentive program covered $13,684, or 35 percent. At the same time, the more efficient lighting systems are saving the city 114,032 kWhs per year, reducing Hailey's annual electric bill by $6,271. If the city can maintain these savings, the payback time period is just over four years.



A very special Christmas

Every hotel room in Hailey was filled on Christmas Eve 1885. Miners and sourdoughs jammed its 18 saloons, and civic leaders whooped in the streets in the sub-zero night.

The reason for such joy was not the arrival of Santa Claus, but something of much greater consequence: Idaho's first public electric-lighting system. That night, for the first time in the state, a town's entire business district was illuminated by electricity. The cost was $5.00 per light per

IDAHO POWER®
An IDACORP Company

www.idahopower.com/business

"Idaho Power has a great suite of financial incentives, that's for sure."

– Mariel Platt, Sustainability Coordinator, City of Hailey

Savings (kWh/year)	Project Cost	Savings ($/year)	Idaho Power Rebate	Customer out-of-pocket*	Payback (months)
114,032	$39,083	$6,271	$13,684	$25,399	49

*Source: Idaho Power City of Hailey Lighting Upgrade project summaries IND0101 and IND0155

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

- The **Custom Efficiency** program offers substantial rebates to large commercial and industrial customers who invest energy-saving improvements in their facilities.
- **Easy Upgrades** provides incentives of up to $100,000 when companies retrofit their infrastructures with energy-saving upgrades.
- The **Building Efficiency** program pays up to $100,000 *per project* to mitigate the additional capital costs when companies upgrade their lighting, cooling, controls, and building shells to more efficient components.
- **FlexPeak Management** offers commercial and industrial customers incentives in the form of recurring payments for reducing their power consumption during times of overall peak demand.

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624. We'll show how you can join smart cities like Hailey, Idaho, saving energy and money.

The above success story was produced in cooperation with, and approval from, the City of Hailey, Idaho.

A very special Christmas (continued)

month, a little steep considering the economies of the day and the fact the service was moody and unreliable. But that didn't dampen the spirit of the citizenry.

Soon, other Idaho communities were lighting up. Boise, Pocatello, American Falls, Twin Falls, Payette, Caldwell, Nampa, Meridian, and Emmett all shone under the glow of electric lights.

It was a bright future that got its start that joyous night in Hailey.

IDAHO POWER®
An IDACORP Company

Custom Efficiency

For Commercial and Industrial Projects

The University of Idaho's Integrated Design Lab:

An important partner in Idaho Power's energy-saving efforts

Chris Pollow, an Idaho Power Energy Efficiency Engineer for large and industrial customers, described the contributions the University of Idaho's (U of I) Integrated Design Lab (IDL) makes to the company's energy efficiency efforts. "The IDL plays a big part in making the Custom Efficiency program a success." The IDL works closely with Idaho Power and other regional stakeholders on commercial/industrial and residential programs.

"Idaho Power and its programs are driving factors behind our work," said Kevin Van Den Wymelenberg, Director of the IDL. "We do a lot of work with their commercial and industrial efficiency teams, helping them with evaluations, energy modeling, measurements, and verification."

Most companies would be happy with those services, but Idaho Power gets more out of the IDL. "We also ask them to do specific research," Chris added, "conduct customer surveys, deliver training and education programs, develop energy efficiency calculation tools, and perform other tasks to help support both our current and future energy efficiency programs."

Studying new ways to save energy comes naturally to the IDL

The IDL operates as a part of the U of I's College of Art and Architecture. In fact, most of its employees are U of I graduate students in architecture. They work with various entities throughout the state—both public and private—to help design buildings that are as energy efficient as possible.

"There's a synergy between academia and the professional world that benefits the consumer," said Kevin. "We bring an impartial, third-party perspective to the process that can be a little harder to achieve for a for-profit company." *Continued on back*

Building a valuable public/private partnership

One of the primary services the IDL provides is energy modeling, which consists of computer simulations demonstrating a building's energy efficiency under multiple scenarios.

"When we opened our doors in 2004," Kevin said, "very few firms did energy modeling." At the time, some might have thought the public university was competing with private business. Actually, the opposite was true.

IDAHO POWER®
An IDACORP Company

"Idaho Power and its programs are driving factors behind our work."

– Kevin Van Den Wymelenberg, Director, U of I's IDL

Studying new ways to save energy comes naturally to the IDL (continued)

One of the projects the IDL is working with Idaho Power on involves a system called an economizer.

"The concept of an economizer is simple," explained Kevin. "If the air outside is cool enough, we use it to cool the air inside a building that's getting warmed up by people, lights, and equipment instead of conditioning it. As long as it's the appropriate temperature, it can save a substantial amount of energy compared to re-cooling the interior air."

"In the long run," says Chris, "systems like the economizer will help our customers save megwatts of energy, and the IDL is helping us analyze and develop the right technologies for our service territory."

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

- The **Custom Efficiency** program offers substantial rebates to large commercial and industrial customers who invest energy-saving improvements in their facilities.
- **Easy Upgrades** provides incentives of up to $100,000 when companies retrofit their infrastructures with energy-saving upgrades.
- The **Building Efficiency** program pays up to $100,000 *per project* to mitigate the additional capital costs when companies upgrade their lighting, cooling, controls, and building shells to more efficient components.
- **FlexPeak Management** offers commercial and industrial customers incentives in the form of recurring payments for reducing their power consumption during times of overall peak demand.

The above success story was produced in cooperation with, and approval from, the IDL.

Building a valuable public/private partnership *(continued)*

"We offered professional courses on energy modeling," Kevin said. "We taught architects and engineers how to do energy modeling. We brought in outside experts to share their knowledge. Now several firms around the valley are doing them and getting paid for them."

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624. We'll show how you can join smart companies like the IDL, saving energy and money.

IDAHO POWER®
An IDACORP Company

Custom Efficiency

For Commercial and Industrial Projects

Jefferson Place: Classic architecture meets modern energy efficiency

Built in 1913 as the city's Elks Lodge, the Jefferson Place office plaza is an architectural landmark in downtown Boise, Idaho. "It's a beautiful building," proclaimed Jeff Jackson, vice president (VP) of real estate for the building's owner. "We take a lot of pride in it, and we like to take care of it."

In January 2011, Jeff oversaw the latest efforts in keeping the stately brick edifice elegantly classic on the outside and technologically modern on the inside.

Custom Efficiency incentives made it happen

"Erstad Architects helped us evaluate how to make the building more energy efficient," Jeff said, "and we quickly discovered that lighting was one of the low-hanging fruits.

"We had a hodgepodge of different light colors and fixtures," he explained. "It didn't look very good and it was horribly inefficient, so we retrofitted the entire building with more energy-efficient lighting."

Such a complete upgrade is not something you can dip into petty cash for. Fortunately, Idaho Power told Jeff about the Custom Efficiency incentive program. "It was a big project, and the tenants love what we did," Jeff noted, "but, without that incentive, we wouldn't have done it."

The savings

Working with Bright Ideas Lighting of Boise, 638 T12 lights in Jefferson Place were replaced with higher-efficiency T8 lights. Aging incandescent and mercury-vapor (MV) fixtures were also replaced with modern compact fluorescent lamps (CFL) and light-emitting diodes (LED), and 26 lights were removed altogether.

A long-term relationship with Idaho Power

Like most companies that participate in Idaho Power's Custom Efficiency program, Jefferson Place had leveraged Idaho Power's expertise many times before. "I've worked with a lot of folks at Idaho Power for a long time," Jeff said.

For example, five years ago, Jefferson Place had to upgrade its heating, ventilation, and air conditioning (HVAC) systems. "Of the 73 or 74 HVAC systems we have, more than 30 have been completely upgraded."

Continued on back.

IDAHO POWER®
An IDACORP Company

"Without that incentive, we wouldn't have done [the project]."

– Jeff Jackson
VP of Real Estate
Jefferson Place

The savings (continued)

The project reduced the building's annual power consumption from lighting by 250,802 kilowatt-hours (kWh), a savings of $13,794 per year and enough electricity for 20 average homes. And, because the new lights produce much less heat than the lights they replaced, the project also reduced air conditioning.

Project Cost	Savings	Savings (kWh/year)	Idaho Power Rebate	Customer out-of-pocket*	Payback (months)
$98,030	$13,794	250,802	$30,096	$67,934	59

* Source: Idaho Power Jefferson Place Lighting Retrofit project summary IND0678

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

- The **Custom Efficiency** program offers substantial rebates to large commercial and industrial customers who invest energy-saving improvements in their facilities.
- **Easy Upgrades** provides incentives of up to $100,000 when companies retrofit their infrastructures with energy-saving upgrades.
- The **Building Efficiency** program pays up to $100,000 *per project* to mitigate the additional capital costs when companies upgrade their lighting, cooling, controls, and building shells to more efficient components.
- **FlexPeak Management** offers commercial and industrial customers incentives in the form of recurring payments for reducing their power consumption during times of overall peak demand.

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624. We'll show how you can join smart companies like Jefferson Place, saving energy and money.

The above success story was produced in cooperation with, and approval from, Jefferson Place.

A long-term relationship with Idaho Power (continued)

"I approached Idaho Power when we first started thinking about the HVAC upgrade, and their input was invaluable. They set us up with the Integrated Design Lab, and those guys helped us design the most efficient systems for the building."

And Jeff's reliance on Idaho Power for the lighting upgrade was just as beneficial. "For this project, we worked closely with Chris Pollow, who's an Idaho Power energy-efficiency engineer. He helped us with the lighting design so we could maximize the energy savings on the project."

Like most of the long-term partnerships Idaho Power forges with its commercial and industrial customers, the one with Jefferson Place not only benefits the customer, but also Idaho Power and its ratepayers.

IDAHO POWER®
An IDACORP Company

Custom Efficiency

For Commercial and Industrial Projects

SUPERVALU/Albertson's takes a big step in reducing its carbon footprint

"Once we looked at the project's savings," said Pete Pearson, Director of Sustainability and National Accounts for the Albertson's division of SUPERVALU, the giant grocery and pharmacy company, "it was a no-brainer."

The project Pete refers to involved upgrading approximately 4,000 lights in the corporate offices of Alberston's Store Support Center in Boise. Under any circumstances, it's an ambitious undertaking and holds the promise of long-term cost benefits. "It's great for company goals," Pete explains, "and it saves us money." But there's another aspect of the project that appealed to SUPERVALU. "It's great for the environment," Pete adds.

An ambitious ethic of sustainability

SUPERVALU—and in turn Albertson's—stresses a culture of serious environmental responsibility. "It's not just public relations for us," Pete says. "It's almost a mission."

"SUPERVALU has set two sustainability goals for itself," adds Keith Tarver, the company's senior manager of technology. "By the end of 2012, we intend to reduce our carbon emissions by 10 percent and our landfill waste by 50 percent."

"Our over-arching theme is a commitment to zero waste. Zero waste to the landfill. Zero waste of water. Zero waste of energy," said Pete. Idaho Power's Custom Efficiency program is helping them meet that commitment.

Building a mindset for sustainability

"We're really trying to create an awareness within our employees of our efforts to reduce energy use," Pete Pearson says. In the Albertson's cafeteria, flat-screen monitors show real-time updates of how much energy the building is using and how much water it's consuming.

Pete also has some ideas that span the entire company. "I think it might be fun and effective to have a little competition between this building, our headquarters in Minneapolis, the Save-A-Lot offices in St. Louis, and so on."

Pete envisions a per-associate race to see who's using less energy. "Because we talk a lot about efficiency," Pete says, "but sustainability really is about reducing consumption."

IDAHO POWER®
An IDACORP Company

www.idahopower.com/business

"Our over-arching theme is a commitment to zero waste."

–Pete Pearson, Director of Sustainablity and National Accounts, Albertson's Food Stores

The savings

While large in scope, the lighting retrofit project was rather simple to execute. Four-thousand T12 lighting fixtures, spanning 200,000 square feet of office space in two buildings, were upgraded to more efficient T8 fixtures. This reduced the company's energy use by 1,354,441 kilowatt-hours (kWhs) per year—about the same amount of electricity as used by 100 homes—and cut its annual power bill by almost $75,000.

The Idaho Power incentive of $139,647 accounted for 70 percent of the $199,496 project cost, resulting in a payback of just 10 months.

Estimated savings from the SUPERVALU lighting upgrade project*

kWh/Year Savings	Project Cost	$/Year Savings	Idaho Power Rebate	Customer Out-of-Pocket*	Payback in Months
1,354,441	$199,496	$74,494	$139,647	$59,849	10

*Source: Idaho Power SUPERVALU Lighting Upgrade project summaries IND0705.

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

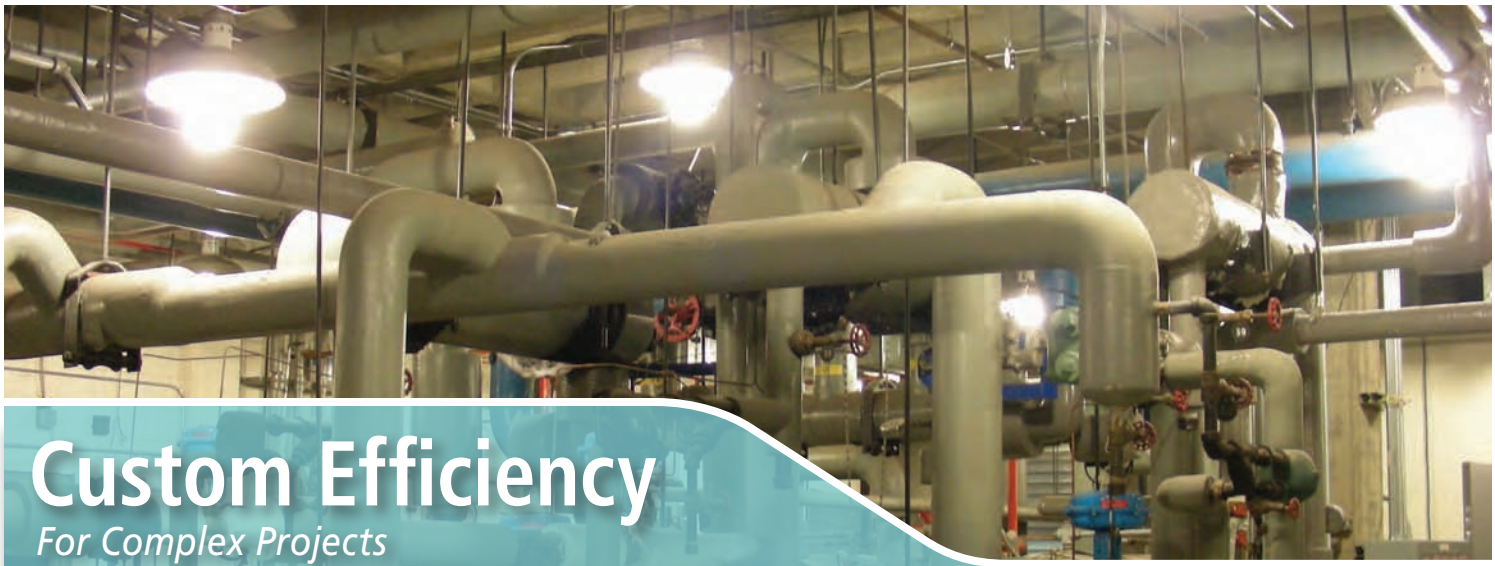
- The **Custom Efficiency** program offers substantial rebates to large commercial and industrial customers who invest energy-saving improvements in their facilities.
- **Easy Upgrades** provides incentives of up to $100,000 when companies retrofit their infrastructures with energy-saving upgrades.
- The **Building Efficiency** program pays up to $100,000 *per project* to mitigate the additional capital costs when companies upgrade their lighting, cooling, controls, and building shells to more efficient components.
- **FlexPeak Management** offers commercial and industrial customers incentives in the form of recurring payments for reducing their power consumption during times of overall peak demand.

The above success story was produced in cooperation with, and approval from, SUPERVALU/Albertson's.

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624. We'll show how you can join smart companies like SUPERVALU/Albertson's, saving energy and money.

IDAHO POWER®
An IDACORP Company



Custom Efficiency

For Complex Projects

Key Financial Center banks on Custom Efficiency program

Not many buildings run the air conditioning in the middle of November when the outside temperature barely nudges 50 degrees Farenheit (F). However, the Key Financial Center (KFC) did. "We had to do it to equalize the heat put out by our old lights," said Eric Fiolo, assistant property manager of the 14-story office building in downtown Boise.

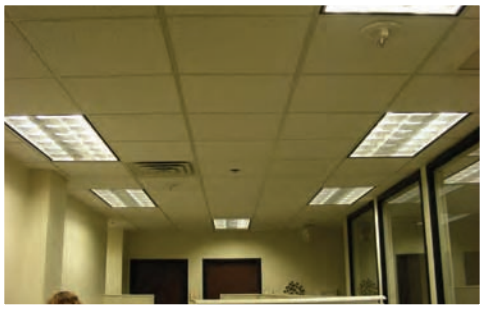
Making big changes while accomodating tenants

When the KFC was built as the Bank of Idaho building in 1962, it rose higher than any other building in Idaho at 174 feet. Almost 50 years later, it is still one of the ten tallest structures in the state. It is also a prestigious business address for law firms and financial planners, Key Bank's Idaho headquarters, and is now one of Idaho's most efficiently-lighted buildings.

"We're working towards qualifying for LEED certification," Eric explained. (See sidebar.) "And getting the lighting done was the first step, because we knew it was such a big problem." It was a big problem in more ways than one: the building had more that 1,600 outdated, inefficient fixtures to be replaced but with at least five important tenants, all occupying one or more floors, who were hesitant to have their business days interrupted by a lighting crew.

To meet both challenges, a team of three electricians from Enterprise Electric of Boise worked from 6:00 p.m. to 2:30 a.m to minimize the impact on the people who work in the building. "It was important to us," Eric explained, "that our tenants not be inconvenienced."

Working after hours also enabled the lighting crew to finish the project in just five weeks. In that time, they replaced 1,469 outdated T12 fluorescent bulbs with more efficient T8 fixtures, 106 incandescent fixtures with compact fluorescent lamps (CFL), and 44 emergency exit signs with high-efficiency light-emmitting diode (LED) signs. They also removed some fluorescent fixtures altogether and installed occupancy sensors.



What is LEED certification?

Leadership in energy and environmental design (LEED) certification is the recognized standard for demonstrating a building project is truly green. Developed and administered by the U.S. Green Building Council, it promotes design and construction practices that increase profitability, reduce the negative environmental impacts of buildings, and improve occupant health and well being.

LEED certification offers compelling proof to clients, peers, and the public that a building incorporates advanced environmental practices in site selection and management, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. *Continued on back.*

IDAHO POWER®
An IDACORP Company

"It was a good investment all the way around."

– Eric Fiolo
Assistant Property Manager
Key Financial Center

The savings

Enterprise Electric's final invoice was $82,422, of which Idaho Power reimbursed the KFC $57,695 as part of its Custom Efficiency program.

The building's annual electricity usage will decrease by more than 500,000 kilowatt-hours (kWh), enough energy to serve more than 30 homes in Idaho Power's service area for a year. As a result, the KFC will save more than $27,000 per year in lighting costs and an additional $2,276 in heating, ventilating, and air conditioning (HVAC) costs due to the reduced heat the new, more efficient bulbs produce. "When we factored it all out," Eric says, "the payback on the project worked out to 11 months. Add in the fact that it's a big step towards our LEED certification, and it was a good investment all the way around."

Cost	Idaho Power Rebate	Savings (kWh/year)	Annual Savings	Customer out-of-pocket*	Payback in Months
$82,422	$57,695	504,081	$27,724	$24,727	11

*Source: Idaho Power Key Financial Center Lighting Retrofit Project Summary IND0562, November 24, 2010

Uncommon savings are quite common

Saving energy has always been a smart business decision. Now, Idaho Power makes it attainable. Our complete suite of energy efficiency programs provides attractive incentives to commercial and industrial customers who want to reduce their utility costs.

- The **Custom Efficiency** program offers substantial rebates to large commercial and industrial customers who invest energy-saving improvements in their facilities.
- **Easy Upgrades** provides incentives of up to $100,000 when companies retrofit their infrastructures with energy-saving upgrades.
- The **Building Efficiency** program pays up to $100,000 *per project* to mitigate the additional capital costs when companies upgrade their lighting, cooling, controls, and building shells to more efficient components.
- **FlexPeak Management** offers commercial and industrial customers incentives in the form of recurring payments for reducing their power consumption during times of overall peak demand.

The above success story was produced in cooperation with, and approval from, the KFC.

What is LEED certification? (continued)

By meeting LEED standards, you can qualify for a growing number of state and local government incentives.

For more information about LEED certification, visit the U.S. Green Building Council's LEED website at www.usgbc.org/LEED.

How much can your company save?

For more information about Idaho Power's energy efficiency incentive programs, go to www.idahopower.com/business or call us at 208-388-5624. We'll show how you can join smart companies like the KFC, saving energy and money.

IDAHO POWER®
An IDACORP Company

Heating and Cooling Efficiency Program

For Residential Customers

Idaho Power offers incentives to homeowners for new heat pumps

In 1996, Dwain Knigge built a home near Hagerman, Idaho. It was unique in a couple of ways. First, it was rather large: 10,000 square feet that Dwain heated using heat pumps. Second was their power bill. "Our electric bill for a long time averaged about $148 a month," Dwain said with a playful grin. "That's heat, lights, water, the pool, the Jacuzzi, everything. In the winter."

"Idaho Power questioned our electricity use over and over and over again. They couldn't believe it could be so low."

The ideal climate for heat pumps

The secret to the suspiciously low power bills was the three heat pumps that heated and cooled the Knigge's home, pool, and Jacuzzi.

"We put three water-source geothermal heat pumps in Dwain's house," said Terry Green, a local heating, ventilating, and air conditioning (HVAC) contractor. "He was totally delighted."

"We loved it," Dwain agreed. "In the winter, you just set the temperature at about 68 or 69 degrees, and it's as comfortable as can be."

The advantage of heat pumps

Heat pumps are uniquely suited to southern Idaho for a number of reasons.

Fuel availablity and cost

Heat pumps are basically air conditioners that cool and heat your home. Because they are electricity based, they are not dependent on natural gas being available where you live, an important consideration in rural areas, like the Magic Valley.

Continued on back

The confrontation

Terry related what happened in a local hardware store. "We had just put Dwain Knigge's water-source heat pump in," Terry said, shaking his head. "And one day I'm walking through a local store, and I see him.

"He walks up to me, pointing his finger at me, with this funny look on his face, and he says to me, 'I want to talk to you.'

"I'm thinking, 'Oh, man, he must have gotten his power bill.' He had. 'Thank you for talking me into that heat pump,' he said with a grin. 'I got my first power bill, and it was just $125. And that was for everything.' I thought I was in deep trouble, but he was just totally delighted."

IDAHO POWER®
An IDACORP Company

"Typically, you're saving 30 to 50 percent on your heating bill with a heat pump."

– Terry Green
HVAC Contractor

The advantage of heat pumps (cont.)

"If you live in town, you have natural gas and other options for heat," said Terry, "but we have a huge rural service area where a lot of customers must rely on electricity, oil, or propane gas, and propane and oil are pretty expensive right now."

By comparison, Idaho Power customers enjoy some of the lowest electric rates in the nation.

Efficiency

Electric-resistance heating systems, like electric forced-air furnances, baseboards, radiant ceiling cables, and wall units have efficiencies approaching 100 percent. Heat pumps, on the other hand, can generate three times the amount of heat than the energy they consume depending on their size, efficiency ratings, and other factors.

"Typically, you're saving 30 to 50 percent on your heating bill with a heat pump," Terry said. Dwain added, "It has to be one of the greatest heating systems that I've ever run into."

Heat pumps make a lot of sense for southern Idaho

"The heat pump is a really, really good heating option for this part of the world," Terry said.

The nominal temperature in southern Idaho varies between 46 degrees in the eastern part of the state to 52 degrees in the west. Most heat pumps can heat at cost-effective efficiencies down to 30 degrees depending on the equipment's Heating Season Performance Factor (HSPF), the size of the home, and other factors.

Idaho Power incentives

Idaho Power offers its customers cash incentives of up to $400 for installing a new, qualified air-source heat pump and up to $1,000 for installing a new, qualified water-source heat pump.

Talk to your local heating contractor

Check Idaho Power's website for a participating heating contractor near you. They can take care of all the details of sizing a heat pump specifically for your home and applying the incentive.

The above success story was produced in cooperation with, and approval from, Dwain Knigge and Terry Green.

IDAHO POWER®
An IDACORP Company

Heating and Cooling Efficiency Program

For Residential Customers

It's cold outside—let's turn on the heat pump

The wonderful technology of heat transfer

It's a very chilly November out here on the Snake River plain west of Buhl, Idaho. Nonetheless, Robin, a prominent Magic Valley heating contractor; Scott, one of his customers; and a visitor are standing next to Scott's new heat pump that's running comfortably in the cold.

"We put it in about three months ago," said Scott, "and it's working great."

"Yeah, he replaced his old one," Robin added. "This time he went with an 8.5 HSPF where he was at 7.0 to 7.2 with the old one, so he's improved quite a bit on efficiency." (See the sidebar for more information on HSPF.)

Pulling heat out of cold air

In the winter, a heat pump absorbs heat from the outdoor air—yes, even cold outdoor air—then transfers it into the the house. Since the heat is already available in the air, there is no need to use energy to produce it. The heat pump only needs to absorb it and move it. Other heat pump types use ground water, or the ground itself, for the heat they transfer into the house.

In the summer, the heat pump reverses the process, absorbing heat from inside the house and transferring it outside, which cools the home.

This results in a high-efficiency heating and cooling system. In fact, many heat pump systems can provide several times more heat than electric baseboards or ceiling cables for the same cost.

Continued on back

What is an HSPF?

When Robin refers to HSPF, it's shorthand for Heating Season Performance Factor. HSPF is a heating efficiency rating that describes how much electric energy it takes to move heat from the air, ground water, or the ground into the house. The higher the number, the higher the efficiency. For example, at an HSPF of 8.5, Scott's new heat pump is more efficient than his old 7.2-HSPF pump.

Likewise, the Seasonal Energy Efficiency Ratio (SEER) refers to the heat pump's cooling efficiency rating in the summer.

IDAHO POWER®
An IDACORP Company

"We're very happy with the whole system."

– Scott
Heat pump owner

Thinking outside the living room

Robin kneels down next to the heat pump and pats it with his hand. "Scott's got a constant torque motor on this thing, which is both more powerful and more efficient than the permanent split capacitor motor on his old heat pump," he says.

"It doesn't run as long as the old one," Scott adds. "And it pushes a lot more air. We're very happy with the whole system. And the air conditioning felt really good, because the old heat pump went out during the heat of the summer."

Save energy. Get cash from Idaho Power.

Replace a qualified ducted heating system with a new high-efficiency heat pump (HSPF = 8.2 or higher), and Idaho Power will provide you with a cash incentive of up to $1,000, depending on the qualified system you're installing.

Check out Idaho Power's website for a participating contractor. Like Robin, they take care of all the details, including sizing the heat pump specifically for your home and applying for the incentive.

The above success story was produced in cooperation with, and approval from, Robin Quigley and Scott Horton.

The heat in cold air

"I love that about heat pumps," the visitor said, amazed at the seeming magical heat-pump technology, "that they cool as well as heat."

"Yeah, what's even crazier is an air-source heat pump like Scott's can even do it on a day like this," said Robin.

You may not realize it as you're bundled up in your parka and mittens, but there is still heat in the air even when there is snow on the ground.

"Heat pumps are the standard around here," Robin explains. "We do installs as far north as Gooding, which is probably one or two degrees colder as far as the HSPF chart goes. I think it's impressive that we can go with heat pumps in this area."

IDAHO POWER®
An IDACORP Company

Ductless Heat Pump Pilot Program

For Residential Customers

$750 from Idaho Power is just one benefit you'll enjoy with a ductless heat pump

Robert Jensen, owner of a heating, ventilation, and air conditioning (HVAC) company in Pocatello, is a big fan of ductless heat pumps. "We're selling quite a few," he said. "Most of them are replacing electric baseboards, ceiling cables, and wall cadet heaters, and the people who are buying them are taking advantage of the Idaho Power incentive."

More comfort, less energy, and $750 back

Ductless heat pumps quietly make homes more comfortable and use less energy than standard electric heating technologies. Idaho Power has also added an attractive benefit for customers who make the switch—cash!

More comfort. The indoor, wall-mounted unit of the ductless heat pump is installed in just one location, but its effects are felt in surprising places. "We put one in a gentleman's house," Robert recalled, "and he called me the next morning and said that the bedroom he sleeps in is the furthest room away from the heat pump, and it was the same temperature as the rest of the house when he got up the next morning."

Less energy. A ductless heat pump can reduce energy consumption as much as 40 percent over a standard electric heat system. "One customer read his meter every day," Robert said, "so he knew exactly what the difference between his old system and his new ductless heat pump was. He was totally impressed with it. I see him about every other week, and he always lets me know how good it's doing."

Idaho Power's $750 incentive. If an Idaho Power electric-heat customer has a qualified ductless heat pump installed by a participating contractor, Idaho Power will give them a $750 cash incentive.

Continued on back.

It's okay to be uncertain

How will it look? How much will it save? Will there be cold spots in my house? All are valid questions when considering a ductless heat pump.

Robert tells the story of one cautious customer. "About four years ago," he said, "I sold one to a gal who was really hesitant about buying it. She was nervous that she would need two of them."

"But I convinced her that just one would do the job, so she went ahead and bought it, and she's been very pleased, which kind of surprised me, because she was really, really skeptical."

IDAHO POWER®
An IDACORP Company

"Customers can get about $750 back from Idaho Power when they buy a ductless heat pump."

– Robert Jensen,
HVAC contractor,
Pocatello, Idaho

More comfort, less energy, and $750 back (continued)

"Most customers are already sold on the ductless heat pump just from its energy- and money-saving merits," Robert explained, "but the Idaho Power incentive seems to help make the decision to get one a lot easier."

You hardly know it's there. The ductless heat pump has two features that don't get a lot of publicity: the sound it doesn't make and how unobtrusive it looks on your wall.

"To me, one of its top selling points is its quietness," said Robert, "because noise is a big concern when people hang them on a wall in a room where they're always watching TV. The first thing I think of is how noisy window air conditioners are. We call them window shakers or wall rattlers. But ductless heat pumps are very, very quiet."

"Another big selling point is their appearance. Some customers are very concerned at first about how they look from a decorative standpoint. They don't want a big, bulky, ugly thing hanging on the wall. So I put an indoor unit in my showroom. Once they see how nice it looks, they don't mind it."

Talk to one of Idaho Power's participating contractors

Check out Idaho Power's website for a participating contractor near you. They'll take care of the details involved in sizing the heat pump specifically for your home and applying for your incentive.

You can also view a video about ductless heat pumps at www.idahopower.com/residential. See for yourself how good a ductless heat pump can look in your home, and learn about other benefits people have come to enjoy after having one installed.

The above success story was produced in cooperation with, and approval from, Robert Jensen.

IDAHO POWER®
An IDACORP Company

WEATHERIZATION ASSISTANCE FOR QUALIFIED CUSTOMERS 2010 ANNUAL REPORT

This page left blank intentionally.

IDAHO POWER®
An IDACORP Company

Weatherization Assistance
for Qualified Customers

2010 Annual Report
April 1, 2011

2010

Printed on recycled paper

TABLE OF CONTENTS

Table of Contents i
List of Tables i
List of Figures i
Description 1
Background 1
Review of Weatherized Homes and Non-Profit Buildings by County 2
Review of Measures Installed 5
Overall Cost-Effectiveness 7
Customer Education, Advocacy, and Satisfaction 9
Plans for 2011 9

LIST OF TABLES

Table 1
2010 WAQC weatherization activities and Idaho Power expenditures by agency and county 3

Table 2
2010 WAQC base and carryover funding 5

Table 3
2010 WAQC review of measures installed 6

LIST OF FIGURES

Figure 1
SIR frequency distribution 8

This page left blank intentionally.

DESCRIPTION

The Weatherization Assistance for Qualified Customers (WAQC) program provides financial assistance to regional Community Action Partnership (CAP) agencies in the Idaho Power service area. This assistance helps cover weatherization costs of electrically heated homes occupied by qualified customers with limited income. The WAQC program also provides a limited pool of funds for 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 qualifying applicants who own or rent their homes. These customers also receive educational materials and efficiency ideas for further reducing energy use in their homes. Local CAP agencies determine program eligibility according to federal and state guidelines.

BACKGROUND

In 1989, Idaho Power began offering weatherization assistance in conjunction with the State of Idaho Weatherization Assistance Program. Through the WAQC program, Idaho Power provides supplementary funding to state-designated CAP agencies for the weatherization of electrically heated homes occupied by qualified customers and buildings occupied by non-profit organizations that serve special-needs populations.

Idaho Power has a WAQC agreement with each CAP agency. The agreement specifies the funding allotment, billing requirements, and program guidelines. Currently, Idaho Power oversees the program in Idaho through five regional CAP agencies, including the Canyon County

Organization on 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 Baker County, Oregon, Community Connection of Northeast Oregon, Inc. (CCNO) serves Idaho Power customers. Community in Action (CinA) provides weatherization services for qualified customers in Malheur and Harney Counties.

The *Weatherization Assistance for Qualified Customers 2010 Annual Report* satisfies the reporting requirements set out in the Idaho Public Utilities Commission's (IPUC) Order No. 29505 with the inclusion of the following topics:

- Review of Weatherized Homes and Non-Profit Buildings by County
- Review of Measures Installed
- Overall Cost-Effectiveness
- Customer Education, Advocacy, and Satisfaction
- Plans for 2011

REVIEW OF WEATHERIZED HOMES AND NON-PROFIT BUILDINGS BY COUNTY

In 2010, Idaho Power provided a total of $1,162,534 to Idaho CAP agencies with $1,056,849 directly funding audits, energy-efficient measures, and health and safety measures for qualified customers' homes (production costs), and another $105,685 funding the administration costs incurred by the Idaho CAP agencies. The total number of Idaho homes weatherized during 2010 was 373. In Oregon, Idaho Power provided a total of $113,427 to CAP agencies, including

$103,115 in production costs for 27 homes and $10,312 funding administrative costs. Table 1 shows the number of homes weatherized, production costs, average cost-per-home, administration payments, and total payments per county made by Idaho Power.

Table 1
2010 WAQC weatherization activities and Idaho Power expenditures by agency and county

Agency	County	Number of Jobs	Production Costs	Average Cost	Administration Payment to Agency	Total Payment
Idaho						
CCOA						
	Adams	2	$3,982	$1,991	$398	$4,380
	Boise	2	$6,090	$3,045	$609	$6,699
	Canyon	88	$210,341	$2,390	$21,034	$231,375
	Gem	5	$9,921	$1,984	$992	$10,913
	Payette	8	$44,447	$5,556	$4,445	$48,892
EICAP						
	Lemhi	4	$11,625	$2,906	$1,163	$12,788
El-Ada						
	Ada	98	$374,814	$3,825	$37,481	$412,295
	Elmore	26	$117,093	$4,504	$11,709	$128,802
	Owyhee	5	$24,892	$4,978	$2,489	$27,382
SCCAP						
	Cassia	1	$1,020	$1,020	$102	$1,122
	Gooding	16	$35,738	$2,234	$3,574	$39,312
	Jerome	10	$19,279	$1,928	$1,928	$21,207
	Lincoln	3	$9,518	$3,173	$952	$10,470
	Minidoka	1	$1,134	$1,134	$113	$1,248
	Twin Falls	41	$85,497	$2,085	$8,550	$94,046
SEICCA						
	Bannock	40	$70,466	$1,762	$7,047	$77,513
	Bingham	17	$24,789	$1,458	$2,479	$27,268
	Power	6	$6,202	$1,034	$620	$6,822
Oregon						
CCNO	Baker	3	$11,800	$3,933	$1,180	$12,980
CinA	Malheur	24	$91,315	$3,805	$9,132	$100,447

All amounts are rounded to the nearest dollar.

In an effort to help CAP agencies provide funding to as many customers as possible under WAQC, Idaho Power's agreements with agencies includes a provision allowing a maximum annual average cost-per-home up to a dollar amount specified in the agreement between the agency and Idaho Power. The average cost-per-home served is calculated by dividing the total annual Idaho Power production cost of homes weatherized per agency by the total number of homes weatherized that the CAP agency billed to Idaho Power during the year. The maximum annual average cost-per-home the CAP agency allowed under the 2010 agreement was $4,500. Overall in 2010, Idaho CAP agencies had a combined average cost-per-home served of $2,833. Oregon CAP agencies averaged $3,819. A CAP agency may have an average by county of over $4,500; however, the maximum annual average is for the agency's entire service area.

Administration fees are based on 10 percent of Idaho Power's per-home production costs. The average administration cost-per-Idaho-home weatherized in 2010 was $283, and the average administration cost-per-Oregon-home weatherized during the same period was $382. Additionally, Idaho Power staff labor, marketing, and support costs for the WAQC program totaled $45,171 for the year. These expenses were paid in addition to the WAQC program funding requirements of $1,212,534 contained in IPUC Order No. 29505.

In compliance with Order No. 29505, WAQC program funds are tracked, with unspent funds carried over and made available to CAP agencies in the following year. In Idaho in 2010, $0.11 was carried forward from 2009. In Oregon, $80,365.61 was carried forward from 2009 to 2010. Table 2 details the funding base amount, carryover funding, and the total amount of annual funding.

Table 2
2010 WAQC base and carryover funding

	Base	Carryover From 2009	Total 2010 Allotment	2010 Spending
Idaho Agency				
CCOA	$302,259.00	$0.00	$302,259.00	$302,259.00
EICAP	$12,788.00	$0.00	$12,788.00	$12,788.00
El-Ada	$568,479.00	$0.00	$568,479.00	$568,479.00
SCCAP	$167,405.00	$0.00	$167,405.00	$167,405.00
SEICAA	$111,603.00	$0.00	$111,603.00	$111,603.00
Non-Profit Buildings	$50,000.00	$0.11	$50,000.11	$0.00
Idaho Total	**$1,212,534.00**	**$0.11**	**$1,212,534.11**	**$1,162,534.00**
Oregon Agency				
CCNO	$6,450.00	$6,530.20	$12,980.20	$12,980.20
CinA	$36,550.00	$65,835.41	$102,385.41	$100,446.79
Non-Profit Buildings	$2,000.00	$8,000.00	$10,000.00	$0.00
Oregon Total	**$45,000.00**	**$80,365.61**	**$125,365.61**	**$113,426.99**

REVIEW OF MEASURES INSTALLED

The WAQC program realized 3,741,652-kilowatt-hour (kWh) savings from weatherizing homes in Idaho and Oregon. There were no buildings housing non-profit agencies weatherized in either Idaho or Oregon during 2010.

Table 3 details home counts in which Idaho Power paid a portion of measure costs, and recognizes the corresponding kWh savings by individual measure during 2010. The table also shows the life of each measure as defined in the EA4 energy audit—the software program approved for use by the State of Idaho Weatherization Assistance Program. The home counts column represents the number of times any percentage of that measure was billed to Idaho Power during the year. In reality, measure counts are higher when considering each home because in some homes, the measure was actually installed and billed at 100 percent to the state weatherization program and not to Idaho Power. In this case, Idaho Power would claim no

savings for that measure. Consistent with the State of Idaho Weatherization Assistance Program, Idaho Power offers several measures that have costs, but do not necessarily save energy or the savings cannot be measured. Included in this category are elements, such as health and safety, vents, furnace repair, 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 household's existing indoor air quality. Other non-energy-saving measures are allowed under this program because of the interaction between the non-energy-saving measures and the energy saving measures. Examples of items included in the "other" measure category are solid metal crossover duct with spray-foam sealant, fire retardant, and tie wire. This example includes material costs, labor costs for installation, and agency support costs.

Table 3
2010 WAQC review of measures installed

	Idaho Power Portion				
	Home Counts	Production Costs	Annual kWh Savings	Measure Life: Years	Levelized Costs[1] ($/kWh)
Idaho Home Measures					
Windows	292	$445,726	1,551,874	15	$0.028
Doors	196	$123,530	522,162	15	$0.023
Wall insulation	12	$4,580	21,777	20	$0.018
Ceiling insulation	148	$76,508	206,810	20	$0.031
Vents	2	$623	n/a	n/a	n/a
Floor insulation	129	$83,452	174,037	20	$0.041
Infiltration	196	$56,961	189,470	15	$0.030
Ducts	63	$17,910	78,357	20	$0.019
Health & Safety	5	$852	n/a	n/a	n/a
Other	1	$1,700	n/a	n/a	n/a
Water heater	44	$1,167	11,327	10	$0.013
Pipes	7	$349	318	15	$0.109
Refrigerator replace	1	$754	1,750	20	$0.037
Furnace modify	1	$1,183	3,464	3	$0.117
Furnace repair	2	$3,169	n/a	15	n/a

Table 3 (Continued)
2010 WAQC review of measures installed

	Idaho Power Portion				
	Home Counts	Production Costs	Annual kWh Savings	Measure Life: Years	Levelized Costs[1] ($/kWh)
Idaho Home Measures (continued)					
Furnace replace	110	$221,214	642,064	20	$0.029
Compact Florescent Light (CFL) bulbs	324	$5,442	48,616	3	$0.038
Audit investment	172	$11,729	n/a	7	n/a
Oregon Home Measures					
Windows	10	$19,338	32,215	15	$0.059
Doors	9	$3,940	11,449	15	$0.034
Wall insulation	4	$5,480	33,844	20	$0.014
Ceiling insulation	19	$24,960	81,944	20	$0.026
Floor insulation	21	$28,756	74,311	20	$0.033
Infiltration	24	$9,142	28,814	15	$0.031
Ducts	12	$5,244	17,121	20	$0.026
Water heater	1	$275	370	10	$0.095
Furnace tune	1	$85	807	3	$0.036
Furnace replace	2	$5,895	8,752	20	$0.057

[1] Levelized Costs are calculated using the 2009 IRP after-tax weighted average cost-of-capital discount factor of 6.98% and include line loss adjusted energy savings.

OVERALL COST-EFFECTIVENESS

Idaho Power monitors overall cost-effectiveness by requiring each CAP agency to ensure that each project has a savings-to-investment ratio (SIR) equal to or greater than 1.0. The total project's SIR reflects all the measure costs associated with the project, including measure costs that have no kWh savings, and compares that total cost to the benefit of the total kWh savings of the project. There are many factors incorporated into the SIR cost-effectiveness calculation in the EA4 criteria. Heating degree days, audit and labor hours, material costs, support hours, and energy costs are built into the formula. Square footage, housing age and type, and exposure

factors are all considered in the program as well. Under this standard, projects with an SIR greater than 1.0 are considered to be cost-effective by the EA4 energy audit criteria.

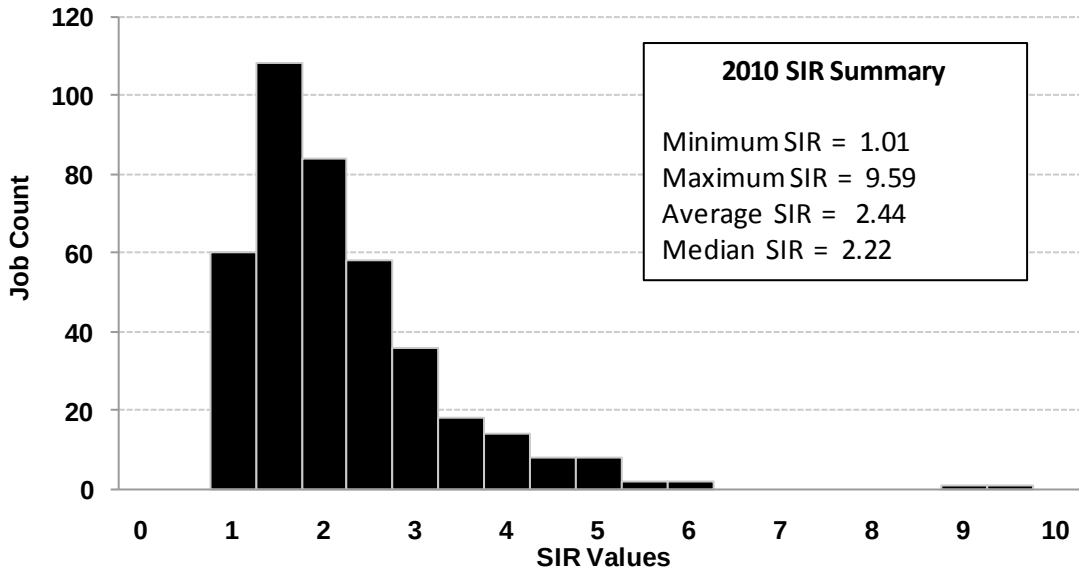


Figure 1
SIR frequency distribution

Figure 1 shows the SIR frequency distribution of the 2010 projects funded through WAQC. During 2010, SIR values ranged between 1.01 and a high project value of 9.59, with a mean SIR of 2.44. The levelized cost of saved energy in 2010 for the WAQC program is $0.027/kWh from a utility cost perspective and $0.035/kWh from a total resource cost perspective.

Annually, Idaho Power participates in the audits of 5 percent of the homes weatherized under the WAQC program. This includes Idaho Power personnel's participation in the Idaho state peer review process that reviews weatherized homes. The review involves representatives from CAP agencies, Community Action Partnership Association of Idaho, Inc. (CAPAI), and the Idaho State Department of Health and Welfare (IDHW) reviewing homes weatherized by each of the other CAP agencies. Results show that all CAP agency weatherization departments are weatherizing in accordance with federal guidelines. In addition to the peer-review process,

Idaho Power personnel visits weatherized homes with qualified customers as needed or requested by customers. The US Department of Energy (DOE) also audits state agencies each year. The DOE audits include fieldwork, as well as paperwork and billing audits.

CUSTOMER EDUCATION, ADVOCACY, AND SATISFACTION

Idaho Power provides materials to each CAP agency to help educate qualified customers who receive weatherization assistance. Included in the materials are copies of the Idaho Power brochures *Practical Ways to Manage Your Electricity Bill* and *Energy Saving Tips* that describe energy conservation tips appropriate for both the heating and cooling seasons, and a two-sided card that describes the energy-saving benefits of using compact fluorescent light (CFL) bulbs and helpful information about using the bulbs. In addition, Idaho Power provides each CAP agency copies of the book *30 Simple Things You Can Do To Save Energy*. Idaho Power also actively informs customers about weatherization assistance through energy, resource, and senior fairs.

To stay current with new programs and services, the Idaho Power program specialist overseeing WAQC attends state and federal energy assistance/weatherization meetings and other weatherization-specific conferences, such as the National Energy and Utility Affordability Conference. Idaho Power is also active in the Policy Advisory Council, helping advise and direct Idaho's state weatherization application to the DOE.

PLANS FOR 2011

Idaho Power will continue working in partnership with the IDHW, Oregon Housing and Community Services (OHCS), CAPAI, and individual CAP agency personnel to maintain the

targets, guidelines, and cost-effectiveness of the WAQC program. In so doing, Idaho Power will provide a valuable service to its qualified customers throughout the company's service area.

A new energy audit developed for the Idaho State Weatherization Assistance Program is Web-based and has mechanical and architectural measure interaction functionality.
This functionality will prioritize measures according to the interacted SIR. This new energy audit, called EA5, has interim approval from the DOE. Starting April 1, 2011, the new EA5 is scheduled to be used by weatherization managers.

Based on the required funding and the contracted annual average-per-home cost of $5,525, Idaho Power estimates 200 homes and eight non-profit buildings will be weatherized in Idaho in 2011. In Oregon, an estimate of eight homes and one non-profit building will be weatherized. In 2011, Idaho Power expects to fund $1,262,534 in weatherization measures and agency administration fees in Idaho, of which $100,000 will be used to weatherize buildings housing non-profit agencies that primarily serve qualified customers. Through the WAQC program, Oregon CAP agencies have an allotment of $56,939 to manage weatherization services for Idaho Power customers. Overall, Idaho Power will provide the WAQC program with over $1,319,473 in funding for weatherization of homes and buildings of housing agencies serving qualified customers. This amount includes unused funds carried over from the prior year.

Idaho Power plans to continually evaluate the need for additional program changes.
The company will continue to participate in the Idaho state peer review process, the review of weatherized homes, and the auditing of a minimum of 5 percent of the homes weatherized under the WAQC program for quality assurance.

Idaho Power plans to review the evaluations being conducted by Avista, Rocky Mountain Power, and Oak Ridge National Laboratory in 2011. As stated by the Oak Ridge National Laboratory, *Weatherization Assistance Program Technical Memorandum Background Data and Statistics*, March 2010[1]:

> Statistically valid answers to many of the questions surrounding Weatherization and its performance require comprehensive evaluation of the program. DOE is undertaking precisely this kind of independent evaluation in order to ascertain program effectiveness and to improve its performance. Results of this evaluation effort will begin to emerge in late 2010 and 2011, but they require substantial time and effort.

The review of these evaluations, when they are completed, will help guide Idaho Power in assessing the type and extent of the evaluations needed for the WAQC program as planned for 2012.

[1] http://weatherization.ornl.gov/pdfs/ORNL_TM-2010-66.pdf

This page left blank intentionally.