# IDAHO LOAD MANAGEMENT PILOT
# Final Report

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## Executive Summary

The Idaho Public Utilities Commission, in Order No. 30365 dated July 11, 2007, approved Avista's Schedule 96 "Energy Load Management Program – Pilot" that granted authority to offer residential and commercial demand response programs in portions of Sandpoint and Moscow, Idaho for a two-year period.

Avista (the Company) completed this two-year Energy Load Management pilot program on December 31st, 2009. Direct Load Control (DLC) devices were installed in volunteer households in portions of Sandpoint and Moscow, Idaho. A separate group within those communities participated in an In-Home-Display (IHD) device study as part of this pilot. The IHD program intent was to gain customer experience with "near-real time" energy usage feedback equipment.

The purpose of the pilot was to gain experience with customer acceptance, program design, operational components and cost effectiveness. This pilot was designed to be scalable. Given the multiple technology and program design options, the pilot program as approved, was to assist with determining future deployment. This project has provided experience with specific technologies that helped to examine cost-effectiveness and customer acceptance of demand response equipment. Technology was tested for functionality unique to Avista, thereby better defining system and hardware requirements, and assessing costs/benefits.

Control technology in each DLC participant's home enabled the Company to initiate curtailment signals to electric furnaces, air-conditioning units, heat-pumps and water heaters at times of high peak demand. The Company provided notification of these events to participants twenty-four hours prior to a "called event." Customers were allowed to opt-out at anytime.

For participating in the pilot, the DLC volunteer households were provided either a $10 per month bill credit for up to five months for appliances that qualified for an event, or a state-of-the art thermostat. Volunteers also were provided an opportunity to enter a drawing to win a high-efficiency washer and dryer set. The IHD group received a Blue Line PowerCost Monitor©.

As a product test, the pilot provided several findings: Equipment compatibility on Avista's system (from the customer's meter) through to Avista's "back office" operations was tested and improved. Avista initiated ten successful events by either cycling heating or air-conditioning units or shutting off water heater units for a period of two to four hours. These events took place over a range of morning, afternoon and evening peak demand time slots.

As a market test, the pilot indicated a strong customer willingness to participate. Five percent of those eligible volunteered to join this program. The override (or customer opt-out) rate averaged less than 2% overall during called events. Participants showed willingness to invest their time, work with the Company, re-arrange their daily schedules, and receive either less heat, less hot water or less air-conditioning.

The Energy Load Management program demonstrated conditions under which residential customers would accept load curtailment of home heating, air-conditioning or water heating. Also demonstrated is a method to which an active relationship between residential customers and Avista could be established. Due to low on-peak/off-peak cost differences on Avista's system, cost-effectiveness remains challenging under current power pricing.

Working with less than 100 customers allowed the Company to test the product and systems with the same benefits as if this were a larger scale project, however, in a controlled and customer-friendly manner.

## Background

The Company's prior experience with demand response[1] or load management was primarily during the 2001 Western Energy Crisis. Avista responded with an All-Customer Buy-Back program, an Irrigation Buy-Back program, bi-lateral agreements with large industrial customers, as well as commercial and residential enhanced energy efficiency programs. These methods were effective and enabled Avista to reduce its need for purchases in a very high cost Western energy market. In July 2006 a one day pricing spike required the Company to invoke immediate demand response options. Through a media request and a large customer reduction offer, the Company was able to reduce same day load by 50 MW.

In general, however, the Pacific Northwest has witnessed a low on-peak/off-peak price differential, averaging less than one cent/kWh. Going forward, peak prices are expected to be significantly higher than average prices. For example, the Company's Integrated Resource Plan (IRP) forecast shows average highest day prices are two to three times higher ($80 to $100/MWh) than average day prices. In addition, the highest prices can be an additional two to three times the average of those prices, consistent with the $200+ prices experienced during the summer of 2006. Those summer events of 2006 have emphasized localized cost impacts of the Western regional market. While this is not likely the beginning of an annual occurrence, it remains to be seen whether this was an anomaly or a five- or ten-year event.

With the potential for generally increasing differences between peak and off-peak prices and the existing and planned Company capacity[2] during extended critical peak periods, this pilot was initiated to examine customer and operational issues associated with demand response on Avista's system.

[1] Demand Response, as used in this report, is Avista actively managing customer consumption in response to supply conditions.

[2] Current capacity needs are accounted for, but Avista will need capacity resources in 2019.

## The Pilot Team

Demand response, by definition, cuts across several utility departments to provide customer programs with integration of many company operational functions. The following team approach is provided early in this report to highlight the coordination necessary to deliver demand response programs.

Led by Leona Doege, the team included Company personnel from several internal work groups, installation contractors and the equipment provider, Comverge™. Key members of the implementation and evaluation team included:

AVISTA:
DSM Group:
Jon Powell, Bruce Folsom, Tom Lienhard & Tyler Dornquast
Power Supply:
John Lyons, James Gall & Bill Johnson
Communications & Marketing:
Kelly Conley & Hugh Imhof
Distribution Engineering & IT/IS:
Heather Cummins, Curt Kirkeby, Greg Paulson, Ross Taylor, Rueben Arts, Mike Diedesch & Jon Seubert
Palouse Operations:
Tim Olson, Jenny Blaylock, Chris Schlothauer, Mark Magers & Thomas Haeder
Customer Service:
Jennifer Esch, Darrin Belgarde & Betsy Townsend
Contracts:
Ceil Orr
State & Federal Regulation:
Linda Gervais
Investor Relations:
Jason Lang

INSTALLATION CONTRACTORS:

| | |
|---|---|
| Gropp Heating, Air & Electric | Moscow, Idaho |
| McDonough Electric | Sandpoint, Idaho |

OTHER VENDORS:
ITRON™
Pass Word, Inc™ Paging
COMVERGE™

## Configuration

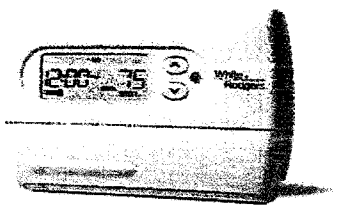
The Sandpoint and Moscow communities selected for the pilot are part of a larger project called the Distribution Reliability and Energy Efficient Project (DREEP). DREEP consists of distribution automation, conservation voltage reduction, optimal feeder balancing, outage validation improvement, power factor improvement, a security architecture test, along with power-flow simulation tests and advanced metering infrastructure. The DR program was designed to avoid potential redundancies or other conflicts with the Conservation Voltage Reduction (CVR) component of DREEP. These two communities had the existing Automated Metering Reading (AMR) system needed to perform the measurement of pilot curtailment events. ITRON's AMR meters, Fixed Network System (FNS) and Meter Data Management (MDM) systems were used for this purpose. Eligible customers were identified by feeder number.

Rate Schedules 1 (residential), 11 (small commercial), and 21(large commercial) customers were eligible for participation. Qualifying participants had to be homeowners or business owners occupying the premises for at least one year on a full-time basis. Initially, the targeted participants were all electric load. However, through the customer recruitment process, the target population was expanded to include customers with natural gas meters as well. Although no Direct Load Control (DLC) occurred on natural gas appliances, the opportunity to recruit potential participants with central Air-Conditioning came as a result.

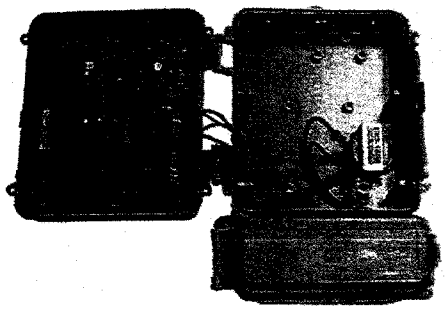
Participating customers were assessed no incremental costs. Customers opting in for a programmable controllable thermostat (PCT) received a thorough inspection of their HVAC system, and a state of the art PCT[3]. Participating customers with DLC switches also received an audit on all equipment controlled via the switch, plus a $10 a month credit for the months their appliance could be controlled. The control months were during July, August, December, January and February. For example, a water-heater participant received a total of $50 per year, while a participant with air-conditioning received $20 per year if the unit was controlled with a switch.

Figure 1: DLC Equipment

PCT



DLC Switch



[3] The inspection also served the intended purpose of confirming the customer equipment was in good working condition prior to installation of ancillary equipment through this program.

The following directly controllable appliances were targeted:

- Air – Conditioning
- Complete HVAC system (electric heat-pump w/air conditioning)
- Water Heater
- Pool Pump
- Electric Forced Air Heating System
- Electric Base Board Heating System
- Irrigation pump (if any)

Due to Avista system capacity issues and seasonal spot power prices, air conditioning load was given priority in customer selection. However, the Company explored the effects of demand response on both winter and summer peaks. Additionally, in order to gain knowledge and experience with a variety of demand response technologies, the Company installed DLC equipment in as many of the above listed applications as possible. All but irrigation pumps, pool pumps and baseboard heat were controlled.

As a cost mitigation method, one-way communications were chosen. Pass Word, Inc ™ paging service was contracted to communicate the Company's signal during a curtailment period.

After researching several DLC equipment providers, Comverge™ was selected. They provided the DLC equipment, training to the installation contractors and Avista, and supplied and hosted the Load Management Software (LMS) to control the DLC equipment. DLC events were executed by the Company utilizing Comverge's LMS. Customers with PCTs were given on-line access to program their thermostat through a web-portal hosted by Comverge™.

For the IHD study, equipment was selected based on the following criteria:

- Ability for customer to self-install,
- Ease of use,
- Nice display, and
- Programmable to Avista rates.

The products were narrowed to two selections, the PowerCost Monitor™ by Blue Line Innovations and the Aztech© display unit. Product delays prevented deployment of the Aztech© units in time to be considered in this pilot; however, they were tested outside the scope of this pilot. Forty of the PowerCost Monitors™ were randomly provided to twenty customers in each of the two communities, Sandpoint and Moscow, Idaho.

Figures 2 and 3 illustrate the DLC configuration and the Blue Line Innovations PowerCost Monitor™.

Figure 2: Direct Load Control System Configuration

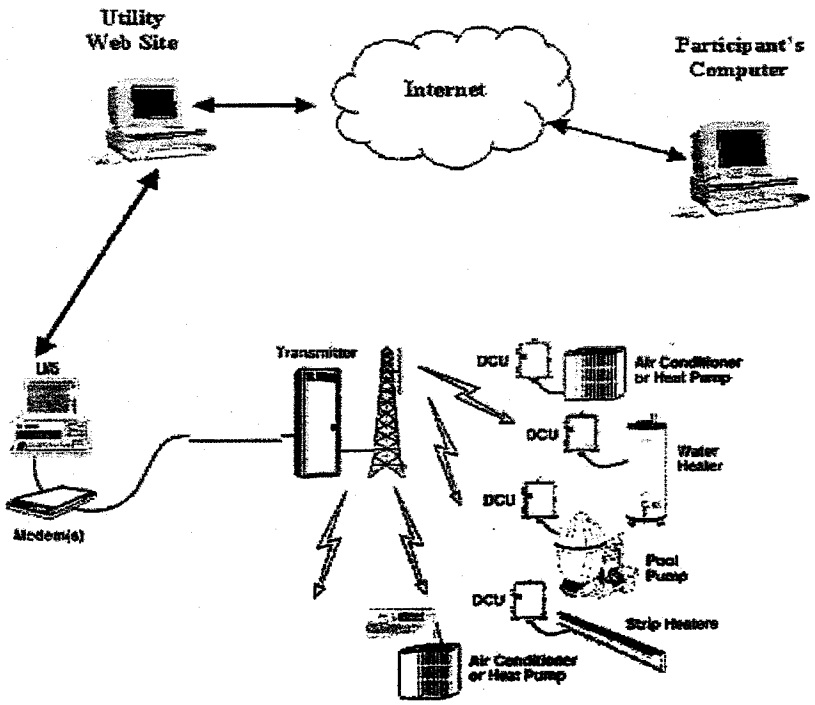
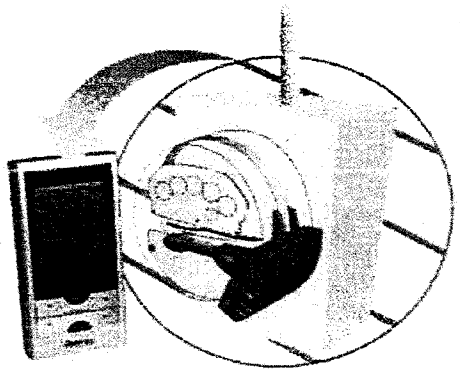



Figure 3: Blue Line Innovations PowerCost Monitor™ In-Home-Display Unit



## Participant Recruitment

The Company recruited participants by direct mail, and then followed up with telephone calls to those target households who responded to the mailing. In addition, telephone calls were made to customers living in a concentrated neighborhood in an effort to evaluate that system.

The Company's communications plan focused on the value propositions of saving money. It also highlighted programmable thermostats and how participating in energy efficiency is a "great way" to help the environment. Marketing material also stated that all participants would be entered into a random drawing to win a high-efficiency washer and dryer set. Five percent of the target group responded either to participate or gain more information. Shortly after the direct mailer was sent, it became clear that the recruiting efforts of commercial customers would be best performed by another method as no commercial customers responded to the direct mailer. This suggested that greater benefits would need to be apparent to commercial customers, and alternative communications should be considered for their recruitment. All respondents to the direct mailer were residential customers, which filled the need for the available DLC devices.

Strategies for future direct mailings were learned from this process. Self selection messages to help customers better understand program qualifications would be helpful in a direct mailer. For example, disclosure in program literature of the items that would prevent a customer from qualifying, e.g., no line-of-sight disconnect between the water heater and the breaker panel, not enough room to mount the switch, multi-stage furnace won't work with thermostat. In addition, there is no need to contact customers with low electric use (500 kWh/month or less) because most of their large load appliances appear to be non-electric. The direct mail material should also contain release information to allow Avista to pass on their information to a contracting agent of the Company for purposes of getting pilot-program equipment installed.

The recruitment process identified that customer education is perhaps the most important attribute of implementing DR programs. Customers expect a stronger relationship than through traditional energy efficiency programs. As a small scale pilot program, more opportunities to interact with our customers were available. For example, the initial phone calls to confirm the potential recruits' interest in the program and to discuss any questions these customers had about program details were made. Permission to release customer contact information was obtained which was to provided to the Company agent to install the pilot equipment, discussions regarding notification of upcoming load control events were made, and general questions customers had as the program was underway occurred throughout the pilot. A dynamic relationship was created that provide several learnings for the Company. This was intended on the Company's behalf to provide feedback to Avista and to maintain good customer relations. As a program such as this one moves to a larger-scale deployment, these customer education and relationship components will evolve into other information-delivery mechanisms.

Recruitment for the IHD units was done in a similar manner with a direct mailer. All customers within the communities of Sandpoint and Moscow with two standard-deviations (greater than or equal to 1300 kWhs per month on average) above average household electric usage were sent an opportunity letter, an initial survey for benchmarking and a product material hand-out about the Blue Line devices. 1156 direct mailers were sent for participant recruitment for an In-Home-Display device. Avista received 322 responses back for an uptake rate of 28%. Out of this response group, forty customers were randomly chosen to receive the IHD units and became the "study" group. Those customers not chosen became the "control" group to which the study group was compared.

## Household Installation

Program design included independent contractors hired to install the DLC units and complete all installation paperwork. A general Request for Proposal (RFP) was issued with little response. Follow-up with potential contractors indicated that the technical nature of the RFP was the cause of the lack of response. Thereafter, the Company's local office/service centers within the two communities selected for the pilot made recommendations of local electricians and Heating, Ventilation and Air-Conditioning (HVAC) companies. Following these recommendations, phone calls and site visits were made directly to these businesses to solicit their participation in the pilot program. A contractor was then hired in each community to install and test the DLC equipment, handle any customer equipment problems as a result of the DLC equipment, and complete the Company's installation paperwork with the participants.

The Contractors were sent paperwork directly from Avista for each participant along with a spreadsheet of outstanding requests. In addition to tracking participants by spreadsheet, the customer's account was noted with a "premise" remark and a service work order created with detail on the type of DLC equipment installed and what particular appliance was eligible for Company control.

Quality contractors with a stake in the pilot program were invaluable. Both contractors had good reputations and were an active part of the communities they served. Through this pilot, the contractors' focus on customer service were good representations for this project.

Twenty-seven customers that responded did not qualify for the program either because their usage was very low (less than 500 kWh/month) or they had no qualifying electric appliances. Twenty-four of the original qualifying participants chose not to have DLC equipment installed after all. Three customers wanting to participate had equipment that was not compatible with the DLC equipment. For example, a multistage heating system won't work with the PCT (thermostat). As a result, not all 100 DLC units were installed.

As the pilot program was underway, seven customers moved. Five of which the new owner did not want to participate in the pilot program. These homes had a PCT and no monetary

incentive. Conversely, the other two new homeowners having a DLC switch and therefore a $10/month incentive chose to participate in the pilot. This suggests that an ongoing monetary incentive is needed to keep participation when a home with DLC equipment changes hands and to help mitigate stranded DLC equipment assets.

Shown in the following tables, sixty-eight of the original one-hundred DLC devices and thirty-four of the original forty IHD devices were still in operation when the program concluded. The initial customer demand for the DLC program outnumbered the units available. Over-recruitment was intentionally done because of an expected non-qualifying rate, which was greater than expected.

Of the forty in-home-display participants, four relocated and one never installed the unit due to its perceived complexity.

TABLE 1: Direct Load Control Device Allocation

| Device & Location | Requested | Final |
|---|---|---|
| Sandpoint - thermostat | 6 | 0 |
| Sandpoint - digital control unit | 6 | 3 |
| Moscow - thermostat | 60 | 34 |
| Moscow - digital control unit | 55 | 31 |

TABLE 2: In-Home-Display Device Allocation

| Location | Requested | Final |
|---|---|---|
| Sandpoint | 20 | 18 |
| Moscow | 20 | 17 |

## Test Operations:

The Company chose a minimum of two test events per season, for a total minimum of four test events per year as a condition of the pilot terms. No maximum test event level was set. Test events were only allowed on weekdays. No test events could be held on a holiday or a weekend. Customers were given one day advanced notification and had the ability to opt-out of any test event[4].

On August 14th, 2008 the Company held its first DLC test. There would be nine additional tests performed before the pilot end date of December 31st, 2009. All events were successfully deployed, as defined as notification to customers and reduction in equipment usage performed by Avista.

TABLE 3: Direct Load Control Test Event Dates

| Target Load | Date | Time |
|---|---|---|
| Air-conditioning, water-heater | August 14th, 2008 | 4:00 to 6:00 PM |
| Air-conditioning, water-heater | August 15th, 2008 | 4:00 to 6:00 PM |
| Space heat, water-heater | December 17th, 2008 | 4:00 to 7:00 PM |
| Space heat, water-heater | February 25th, 2009 | 4:00 to 7:00 PM |
| Space heat, water-heater | February 26th, 2009 | 5:00 to 8:00 AM |
| Air-conditioning, water-heater | July 23rd, 2009 | 4:00 to 8:00 PM |
| Air-conditioning, water-heater | July 30th, 2009 | 4:00 to 8:00 PM |
| Air-conditioning, water-heater | August 20th, 2009 | 2:00 to 6:00 PM |
| Space heat, water-heater | December 16th, 2009 | 3:00 to 6:00 PM |
| Space heat, water-heater | December 29th, 2009 | 7:00 to 9:00 AM |

An initial survey was sent to all target IHD customers. The returned survey resulted in establishing a demographic baseline. Analysis on the IHD group was performed one and two years after installation. Average monthly electric usage for both the study and control group was compared to prior year usage and each other. Customer demographics varied extremely which warranted segmentation by home square footage, space heat and water heat. Some participants in

[4] Customers had the ability to opt-out of any event by indicating their preference to the program administrator at the time of notification or by phone call to the Company at any time before or during a test event.