AVISTA

IDAHO LOAD MANAGEMENT PILOT
Final Report

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Table of Contents

Executive Summary 2

Background 3

The Pilot Team 4

Configuration 5

Figure 1: DLC Equipment 5

Figure 2: Direct Load Control System Configuration 7

Figure 3: Blue Line Innovations PowerCost Monitor™ In-Home-Display Unit 7

Participant Recruitment 8

Household Installation 9

TABLE 1: Direct Load Control Device Allocation 10

TABLE 2: In-Home-Display Device Allocation 10

Test Operations: 11

TABLE 3: Direct Load Control Test Event Dates 11

Pilot Results & Evaluation 12

Customer Acceptance: 12

Operational Components 14

Cost Effectiveness 15

Conclusion 18

Appendix A: Direct Load Control – Test Event Data 19

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:

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

<u>INSTALLATION CONTRACTORS:</u>

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

<u>OTHER VENDORS:</u>
ITRON™
Pass Word, Inc™ Paging
COMVERGE™

Configuration

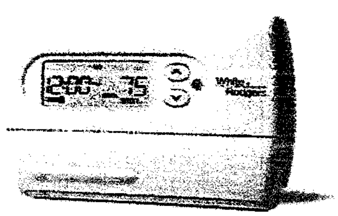
The Sandpoint and Moscow communities selected for the pilot are part of a larger project called the Distribution Reliability and Energy Efficient Project (DREEP). DREEP consists of distribution automation, conservation voltage reduction, optimal feeder balancing, outage validation improvement, power 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.

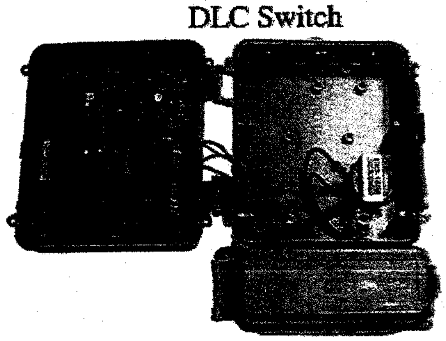
Participating customers were assessed no incremental costs. Customers opting in for a programmable controllable thermostat (PCT) received a thorough inspection of their HVAC system, and a state of the art PCT[3]. Participating customers with DLC switches also received an audit on all equipment controlled 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

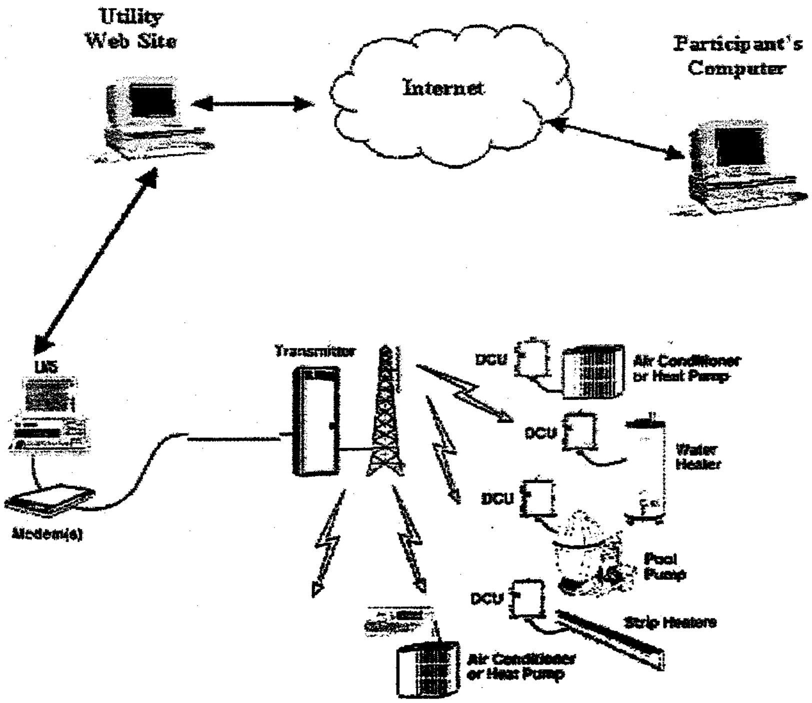
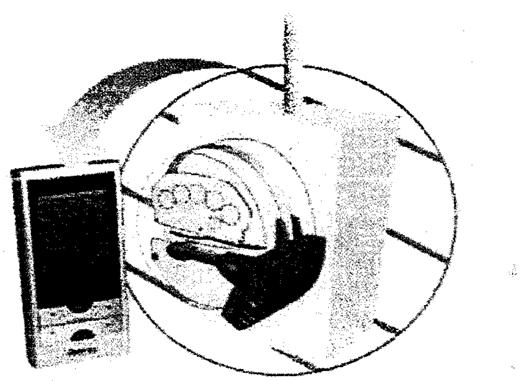


Figure 3: Blue Line Innovations PowerCost Monitor™ In-Home-Display Unit



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.

the control group and study group were eliminated because of demographics such as 5000 square foot and above homes, residential nursing homes, fraternities or sororities. As a result, the sample size was reduced within each demographic to be too small to provide statistically valid results to determine energy reductions.

A survey was sent to IHD participants three months after IHD product installation and a second survey nine months later. The feedback gained from these surveys allowed the Company to gain knowledge on the customer experience.

Pilot Results & Evaluation

The three result categories which will affect future program design:

- Customer Acceptance
- Operational Components
- Cost Effectiveness

The results of these aspects are described in the following sections.

Customer Acceptance:

The initial response to the DLC direct mailer of 3,100 was 155 customers, or 5%. Of these, thirty-one decided against participation once they discovered the details and nature of the pilot program. The reason for not participating was solely due to the customers not wanting anyone else to control their appliances. Typically in these instances one household decision maker wanted to participate, however, their partner did not. An additional twenty-four customers who had signed up to participate opted-out of the program before equipment could be installed for reasons unknown.

There were twenty-seven customers wanting to participate in the pilot program but had too low of use or did not have qualifying electric appliances to participate in the program.

Once the program was underway, no customers opted-out of the program and very few participants opted out of events. The largest opt-out rate occurred on February 26th, 2009 from 5:00 AM to 8:00 AM exclusively with DLC, water-heater participants. Three households with several members needing a morning shower were impacted and did not want to rearrange their schedule to shower at a different time. This reflected a four-percent opt-out rate for that particular event. Otherwise, throughout the pilot, no electric heat customers opted out, and only one customer chose to opt-out of two the air-conditioning tests. This particular customer was an at-home mother with several children and did not want any discomfort.

Notifications of the test events listed above were given in several ways. Most chose to be notified by e-mail or telephone or both. One customer preferred being notified by facsimile (or

FAX). The paging option was not selected. Seventy-five percent of the customers chose the e-mail notification; eighty-five percent chose the phone notification option. Several chose both.

From a qualitative perspective, participants were "pleasant" both by phone or e-mail and would share their thoughts and opinions of the program freely. A larger scale deployment would need to consider the impacts on the contact center for customers who "want to chat" with their utility. Again this program created a "relationship" between the Company and the customers.

Three customers experienced equipment failure of their appliance. All failures were determined to be the customer's equipment problem through discussions directly with the program administrator. For example, one customer believed the DLC switch was active outside the load-control the months causing his water heater to not produce water. The other two customer equipment problems occurred on forced-air furnaces.

One DLC switch was faulty and had to be replaced. Fortunately, the customer was home at the time of the event and could hear the DLC switch's contactors opening and closing. A temporary remedy of overriding the switch by tripping the circuit breaker was made. Additional events were not called on this customer until the installation contractor could replace the switch. Two of the PCTs (thermostats) failed, one in the warranty period and the other outside the warranty period. Avista replaced the thermostats at Company cost with remaining PCT inventory.

None of the PCT participants used the online programming feature available to them. Through the interactive relationship developed, customers shared with the Company the ease of manually programming the thermostat. However, two participants with a DLC switch on their water heaters requested Avista provide on-line programming for water-heater control in the future.

Thirty-nine of the forty customers that were randomly selected for an IHD participated by self-installing the units. The majority of the IHD customers indicated ease of use and that they would recommend this to others, it helped them better manage their energy use and they refer to it 2-3 times per month on average after having the unit installed for a year. While customers like having real time energy usage feedback, most of the participants indicated they would pay no more than $20 for the IHD.

Participants ranked the following features as important:

- Saving money
- Having real time energy usage knowledge
- And having other features on the IHD such as outdoor temperature.

On the other hand, opinions about helping the environment equally ranged between not important and very important in the surveys.

Anecdotally, customer response varied. IHD participants with several people in their household appreciated the ability to identify specific energy usage and, then, make modifications by family members. On the other hand, "empty-nesters" did not find opportunities to reduce usage other than when they next acquire new appliances.

Operational Components

Initiated by the Company, Comverge's Load Management Software (LMS) and a local paging service signaled test events and test event durations. The Company's MDM system measured the effects of shifting load during peak times. The LMS and paging system were successful 100% of the time and the MDM system was successful 90% of the time. One of the ten test events was not analyzed as a result of problems with the MDM system; data was lost for the December 17th, 2008 event.

Five minute interval data from the MDM system was used to determine the results of the test events compared to day prior, and day after, at the same time of day. As show in Appendix A for each of the test events, the DLC equipment proved to be successful in peak load shifting. As expected, a "snap-back" occurred after the release of the DLC test event and is easily identifiable on the graphs as well. The outcome of this evaluation method revealed that meter interval data measures usage on the whole building and is not granular enough to measure the effects of demand response on individual equipment with the one-way demand response technology that was deployed. Therefore, we were unable to validate individual appliance savings resulting from direct load control. Either a two-way demand response system or data load loggers installed on a sample would be necessary for this sort of evaluation.

Customer participation (opt-out) was tracked manually by the program administrator and noted above in the customer acceptance section. The pilot focused on learning customer acceptance, and, therefore, the direct personal contact was used for determining this. For a larger scale program, an automated process using a two-way DLC system would be less administratively cumbersome and subsequently reduce program costs.

Peak demand affects Avista's distribution system in several ways such as increased conductor losses and unpredictable load imbalance. The pilot evaluated the effects of peak demand on the Company's distribution system. This evaluation was performed by using primary-line load loggers at the end of a distribution feeder where a high concentration of DLC participants resided, or the "target neighborhood." Load-logger results data is identified on each graph in Appendix A as "PI Feeder Amps." This data shows that the load on the distribution system "smoothed" (or was reduced at peak) during the test event periods.

The Blue Line Innovations IHD devices were independent of Avista back-haul and metering equipment and operations. IHD participants relied on Avista for product support and guidance on general use. Customers installing the transmitter device on digital meters had some difficulty compared to those who installed the unit on electro-mechanical meters. Eventually, as Avista converted meters in Moscow, all IHD participants installed the Blue Line Unit on a digital meter. Battery life in the transmitting unit proved to be short in the two cold winters the area experienced, which frustrated some users. On a scale of 1 to 5, 1 being poor, 3 average and 5 being excellent, 80% of the customers ranked ease of use of the IHD as 4s and 5s. And 20% ranked the unit as average (3) in ease of use. The IHD device selected for the pilot proved to be intuitive to use.

Cost Effectiveness

Pilot costs were kept to a minimum in order to gain experience with little financial impact.

Filed Pilot Budget:	Actual Cost:	Variance:
$123,000	$132,000	$9,000 over[5]

The Company's view of the cost-effectiveness of this pilot project as well as potential larger deployments of DLC and IHD technologies has changed considerably based upon the observations and analysis of this pilot. This section will summarize how and why the Company's approach to these valuations has changed and the influence that these changes may have upon the prospects and design of future larger deployments of these technologies.

At the outset of this pilot project there was the expectation that the primary long-term benefit would include:

- an improved understanding of how the DLC technologies could be integrated into Avista's existing system,
- an understanding of customer acceptance of DLC, including the rate at which they utilized the override provisions and the response to various types and levels of incentives for voluntary participation.
- It was also anticipated that the benefits from triggering DLC events and thereby reducing energy use within extraordinarily high-cost time periods would exceed the cost of the two-year pilot.

Considerable experience was gained in how the DLC technology would best be integrated into Avista's system and how customers are likely to respond to voluntary DLC program participation. This experience included thorough validation of vendor claims on products and services is required, UL label standards, department of Labor and Industry standards, one-way demand response equipment limitations on savings measurements, the importance of a reliable and robust MDM system, few customers exercising their ability to opt-out and online equipment-programming features.

The inclusion of these demand-response technologies provide an accurate understanding of the cost of such an integration, an understanding of the hurdles involved in the installation of the

[5] The variance is due to purchasing the Blue Line Innovations & Aztech© In-Home Display units, which were contemplated as "other" potential installations in the Company's 2007 application, but weren't contained in the initial budget.

devices within the home and a higher degree of confidence in the customer acceptance of the program. Most importantly a firm basis was established for expecting that controlled devices will receive and react to the curtailment signal and customers are unlikely to exercise the opt-out provision in significant numbers.

As a direct consequence of the degree of technological reliability and the customer's willingness to permit load controls to occur without interruptions the Company has come to view this program more as a potential capacity resource than an energy resource. The value of the energy reductions was found to be small relative to the project cost, even when that energy interruption was tightly focused upon the highest cost periods. However, due to the reliability of being able to successfully curtail load, the cost-effectiveness evaluation of this product can be recasted as a reliable capacity resource rather than as an energy resource.

The ten pilot events covering a total of 16 summer and 14 winter hours resulted in an estimated reduction of energy usage of 29 kWh's per participating customer or approximately 1,885 kWh's for the total pilot project[6]. Even when optimistically valuing energy savings at $100 per mWh and assuming no make-up energy usage after the interruption, the total energy value of the pilot was $189 for all participating customers. If this two year pilot were extrapolated to the likely ten-year life[7] with a total of 40 hours of annual interruption, the undiscounted cumulative nominal value of those energy savings accrue to $40 per customer if the energy were valued at $100 per mWh[8]. When compared to the $250 cost of the device and installation and a utility cost of $50 per year to obtain voluntary customer participation, it is clear that the energy value does not offset the incremental utility cost of each additional participating home. Additionally, there would be infrastructure costs to the overall program that even when spread over a larger deployment of DLC devices would nevertheless add to the cost-ineffectiveness of the program when evaluated solely as an energy resource.

Alternatively, given the reliability of the technology at successfully triggering interruptions of subscribed end-uses and the customer's willingness to forfeit their option to override such interruptions, the DLC program seems to have sufficient reliability to be viewed as an alternative

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[6] Since the Company's attempts to measure the load reduction occurring as a result of the pilot were frustrated by the higher than expected variability in load of the overall home it is necessary to continue to rely upon the original assumptions of a 0.5 kW reduction in summer usage during interruption periods and a 1.5 kW reduction in winter usage. For the 65 customers that participated in the 16 hours of summer interruption (five separate events) and 14 hours of winter interruption (five separate events) the total load energy reduction was 1,885 kWh's.

[7] A residential customer typically stays within a home for seven years before moving. If approximately 1/3[rd] of the new residents in the home confirmed their willingness to participate in the program, each device would have an average of ten years of program participation.

[8] In a typical year consisting of five four-hour summer events and five four-hour winter events, a total of approximately 40 kWh's per customer would be shed using the estimated 0.5 kW summer and 1.5 kW winter load. Valued at $100 per mWh this would represent an annual energy savings of $4.00 per year. Undiscounted over ten years this sums to $40 per customer.

to electrical generation capacity. Given a total of 40 hours of interruption availability, the probability of successfully triggering the unit at (or very close to) the highest cost or highest native demand hours of the year is possible. In this sense, the installation of the devices is actually establishing a 1.5 kW ten-year capacity resource that is comparable to a "super-peaking" generation unit.

The present value of installing the DLC equipment and maintaining customer participation over a full ten-year period is approximately $600[9]. Given the expected 1.5 kW winter capacity benefit this leads to a capacity cost of $400 per kW[10]. Though this does not include an assignment of overall infrastructure cost to each additional program participant, with the economy of scale involved in a full deployment of this device the additional cost are not expected to substantially increase this capacity cost. Additionally, a larger program is likely to result in a lower per unit cost of the DLC devices and the installation of those devices.

Though this is above the current expected cost of a generation unit with "super-peaking" characteristics, the difference is fairly modest. Continued optimization of the program, economies of scale in the purchase and installation of equipment, revised estimates regarding the controlled load at peak periods and improvements at generating continued customer participation at lower utility costs could easily bring the DLC program into the realm of being a cost-effective capacity resource. Additionally, there is potential value for using demand response as a regulating reserve, especially with respect to wind mitigation, which has not been analyzed in this pilot.

A related component of the pilot project that was not originally contemplated is the installation of IHD to encourage customers to better manage their energy use through improved and convenient real-time information regarding their usage. Due to the time constraints of the pilot project, only 39 devices of a single manufacturer could be deployed. The small sample size made it impossible to develop rigorous estimates of the energy savings. However, customer response and feedback indicated favorable prospects for a larger test of similar IHD products. The following survey results indicate energy usage feedback does promote conservation.

- 82% indicated the IHD made a positive impact on their total energy consumption.
- 100% planned to continue using the IHD in the coming year.
- 18% replaced old appliances with Energy Star appliances as a result of the IHD.
- 73% evoked conservation measures as a result of the IHD. Some anecdotes included:
    - "turned down the temperature on the hot tub."

[9] This includes a $250 installed cost of the unit and a $350 present value for ten years of an annual $50 participation incentive ($10 per month for five months available for events) at a 7.08% discount rate.

[10] This amount would actually be modestly lower in comparison to generation capacity when adjusted for line losses at peak. The peak, in calculation, is assumed to be a winter peak. This value does not include energy savings.

- "will do some replacements on weather stripping soon on a window and some doors."
- "more attentive to the length of showers, use of lights, checking on how much appliances use."

Conclusion

The Demand Response pilot project led to key findings in two categories explored within the project. These findings have contributed to a fundamental shift in the manner in which the Company will evaluate future similar deployments of DLC as well as establish critical starting points for the design and ongoing customer service aspects of prospective larger scale projects.

Specifically, the pilot project led to a design which integrates proven equipment into the unique pre-existing distribution and communication systems that Avista has in place. Despite the recognition that the equipment had been successfully utilized within other utilities, the integration of the technologies within each utility's unique distribution system was an important challenge to overcome. The system design proved to be achievable within the expected cost parameters, did not incur any unexpected adverse impacts or costs on the remainder of the distribution system and reliably communicated the curtailment signal to the DLC units in the field which, in turn, resulted in the expected load curtailment.

Just as important as integrating into Avista's system, the practical capabilities of the technology was gaining experience with voluntary customer participation (e.g., opting out), and program incentives. Considerable additional program design can be built around these findings for subsequent demand-response deployments to improve the continued participation and utility cost-effectiveness of the effort. Future customer incentives will almost certainly include financial remuneration in addition to other products such as the programmable communicating thermostats. Automated event notifications would improve future larger scale use of DLC's presuming pre-notification and opt-out provisions are retained in future designs.

Evaluation of the cost-effectiveness of future deployments can be better based upon the capacity benefit rather than merely energy benefit as a consequence of this pilot. As a result of this analytical revision the prospect for being able to design cost-effective full-scale programs is significantly greater. Viewing the DLC devices as delivering a capacity benefit rather than a substitute for energy during high-cost periods may also influence the future design of the program to include the end-uses controlled and the protocols for triggering events. This may include expanding the current five-month window for load control to enhance the probability of capturing the most valued capacity hours.

The addition of IHD to the program design has demonstrated sufficient promise to potentially justify a larger deployment with a statistically valid sample size. Measurement of the potential energy reduction over a significant period of time, the load shape of the savings and an evaluation of the determinants of the energy savings would be examined for a larger roll-out.

Appendix A: Direct Load Control – Test Event Data

GRAPH 1: August 14th & 15th, 2008 test results

No data for test event date December 17th, 2008

GRAPH 2: February 25th & 26th, 2009 test results

GRAPH 3: July 23rd, 2009 test results

GRAPH 4: August 20th, 2009 test results

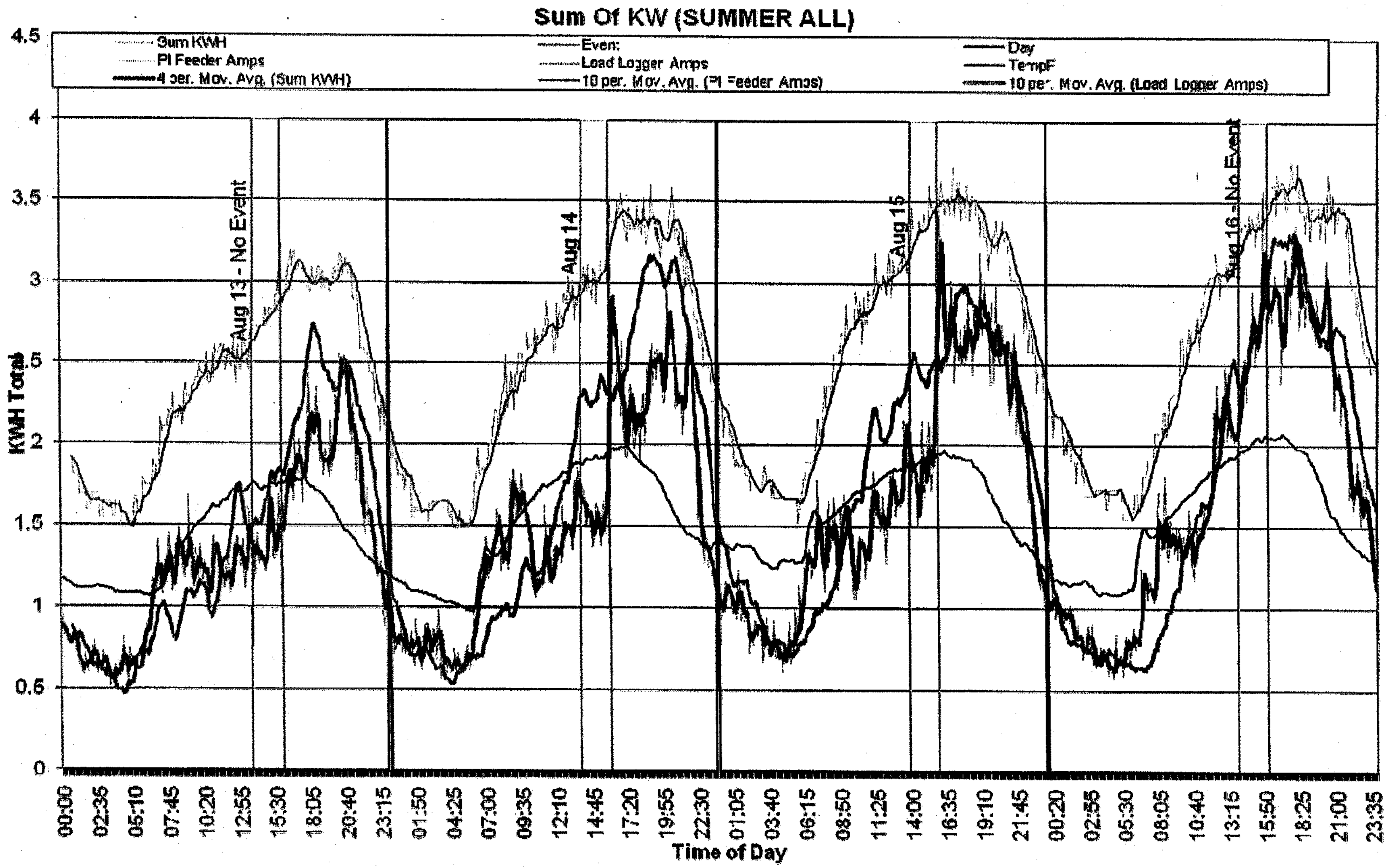
GRAPH 5: December 16th, 2009 test results

GRAPH 6: December 29th, 2009 test results

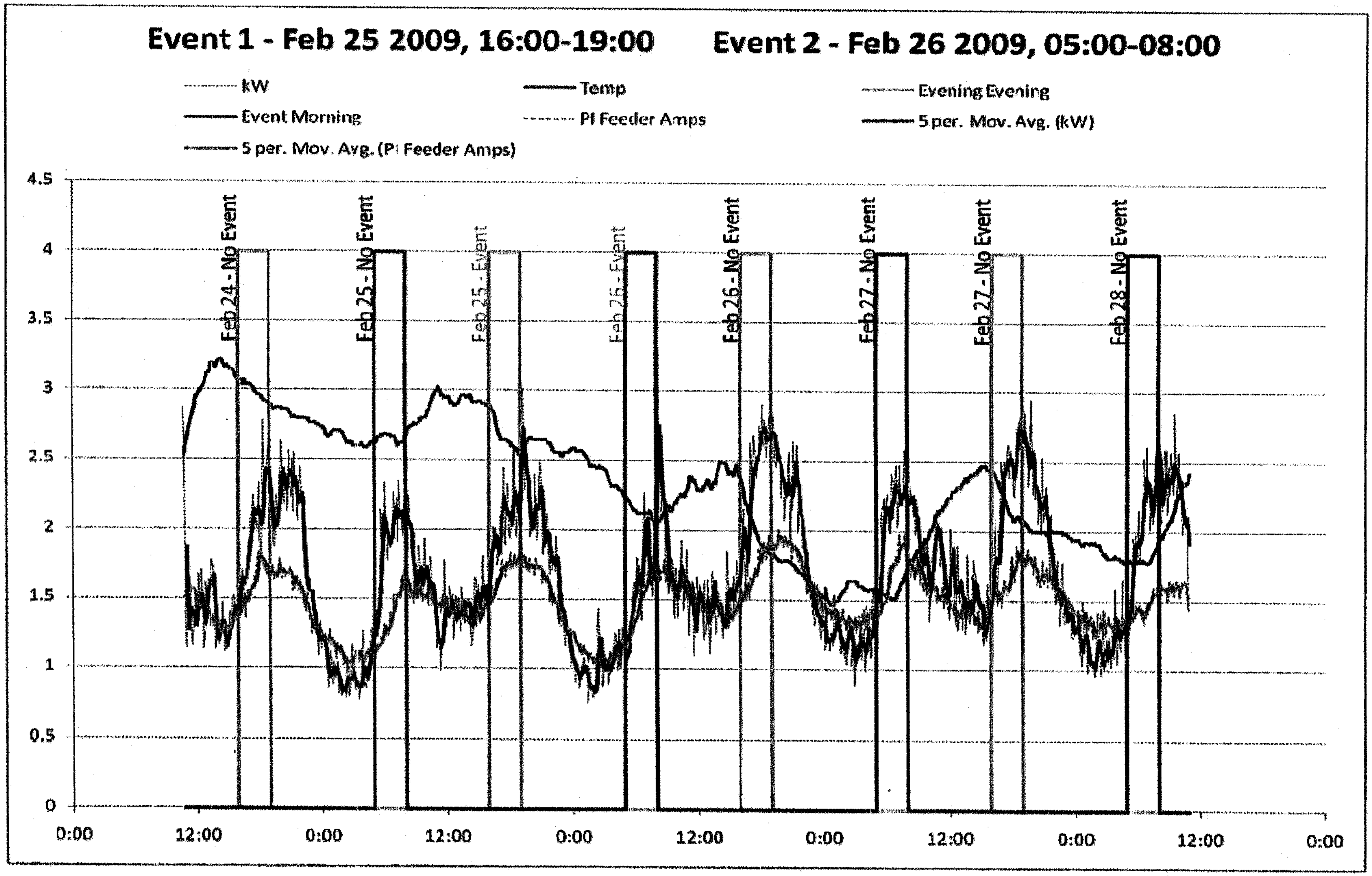
GRAPH DEFINITIONS:

- Temperature: Ambient air temperature data from www.weatherunderground.com for Moscow Idaho. Timestamps are within 5 minutes of correct.
- kW: Average kilowatt demand taken from meter interval data on participants in test event. These units are more easily understandable than KWH. The KWH per 5 minute was multiplied by twelve to get average KW for every 5 min.
- Event: Demonstrates time of day the test event took place.
- PI Feeder Amps: Load loggers were installed at the end of feeder M15515 serving the "test neighborhood." The data graphed is a scaled version of the average of the TWO phases which were measured.

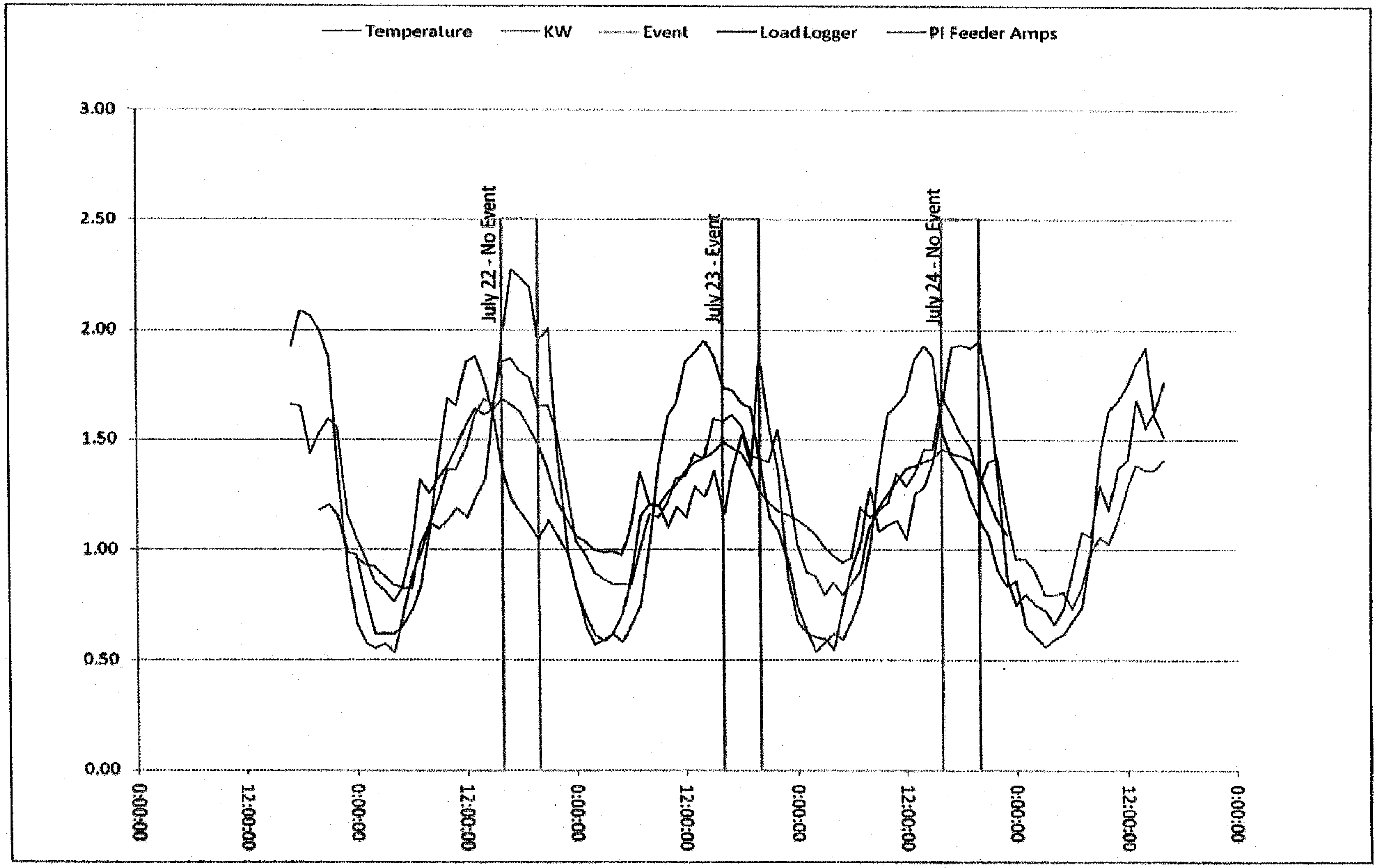
GRAPH 1: AUGUST 14TH & 15TH, 2008 TEST RESULTS



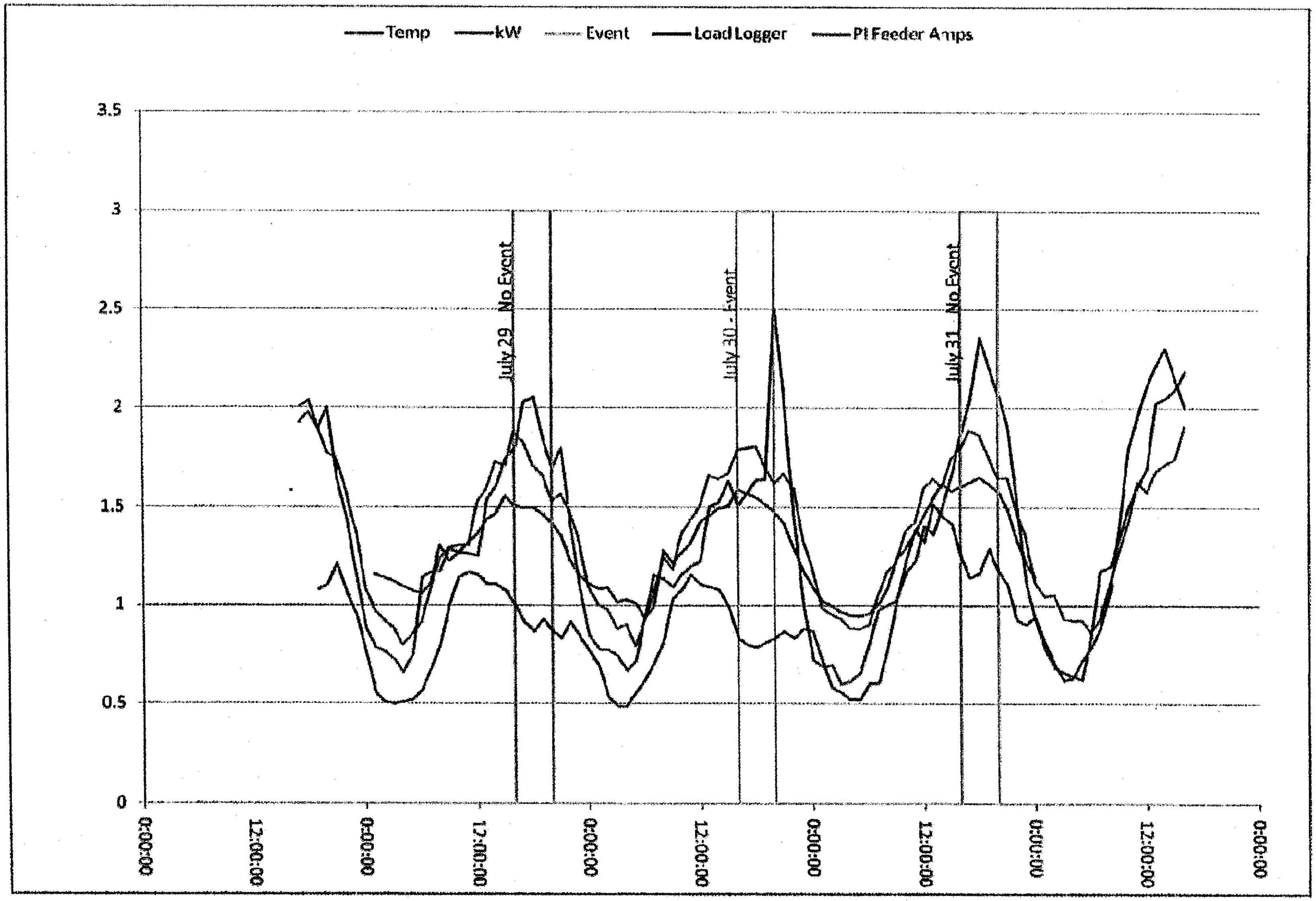
GRAPH 2: FEBRUARY 25TH & 26TH, 2009 TEST RESULTS



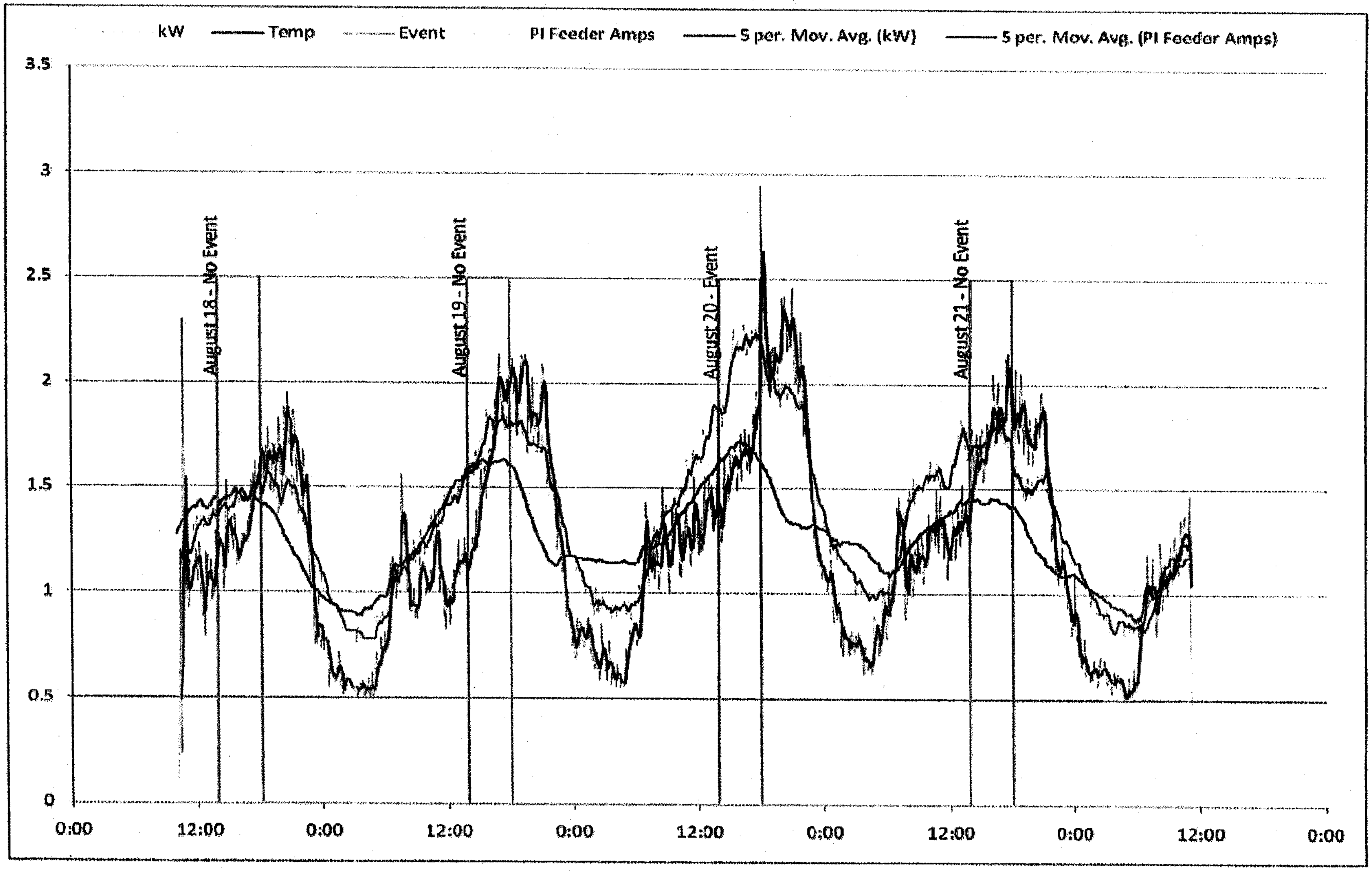
GRAPH 3: JULY 23RD, 2009 TEST RESULTS



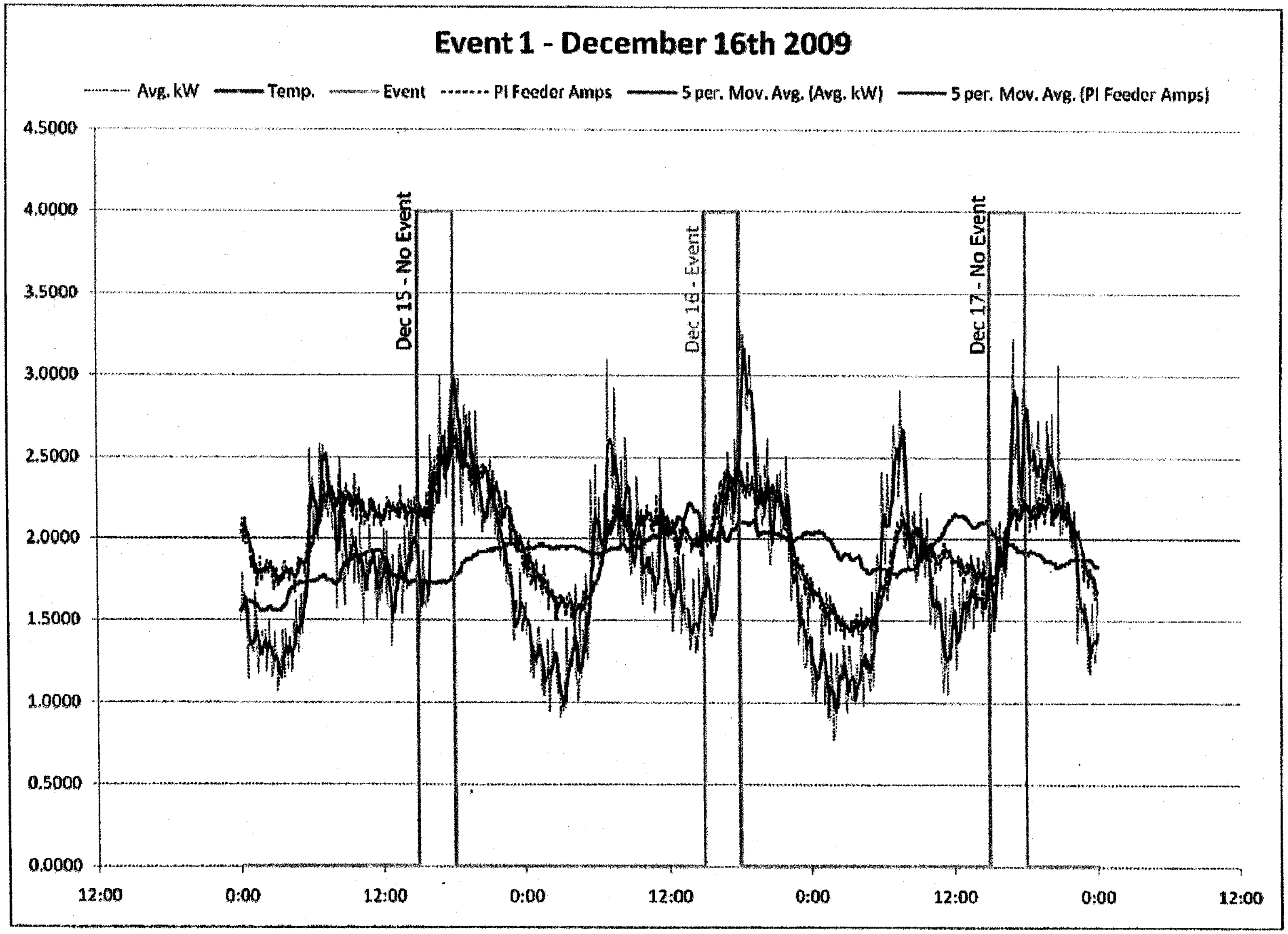
GRAPH 4: AUGUST 20TH, 2009 TEST RESULTS



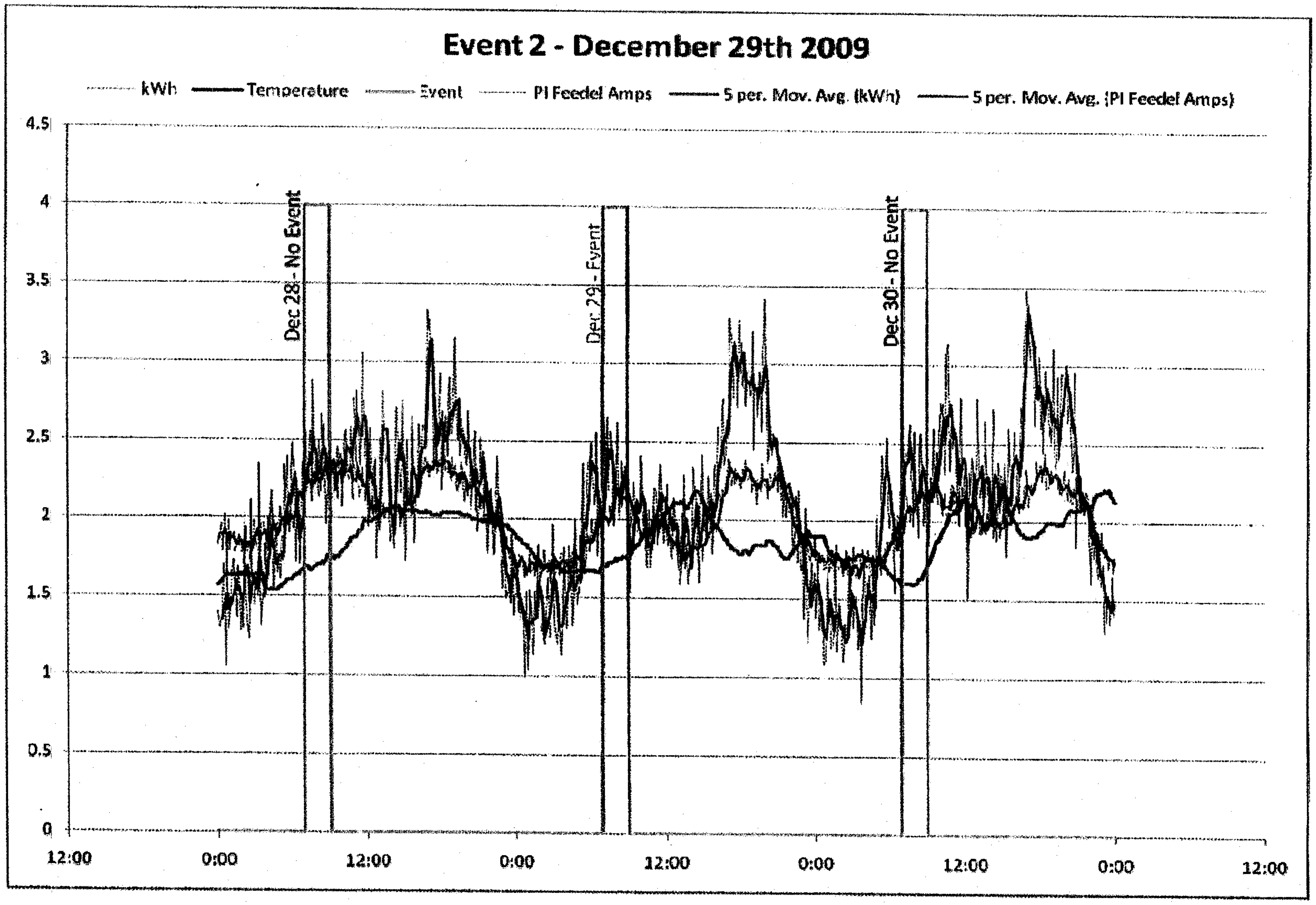
GRAPH 5: DECEMBER 16TH, 2009 TEST RESULTS



GRAPH 6: DECEMBER 29TH, 2009 TEST RESULTS



GRAPH 7:



Event 2 - December 29th 2009
kWh
Temperature
Event
PI Feedel Amps
5 per. Mov. Avg. (kWh)
5 per. Mov. Avg. (PI Feedel Amps)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
12:00
0:00
12:00
0:00
12:00
0:00
12:00
0:00
12:00
Dec 28 - No Event
Dec 29 - Event
Dec 30 - No Event