Staying out of Hot Water: Best Practices in Implementing Electric and Gas Water Heating Programs

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ABSTRACT

Water heaters have been the forgotten appliance in utility program implementation in recent years. But new technology innovations - including tankless and solar thermal designs coupled with quantum leaps in smart meter and load control communications - are driving a reemergence of utility programs designed and implemented to address this significant residential energy end use.

This paper examines the best practices drawn from innovative electric and gas utility water heater programs coast to coast. This paper combines the lessons learned from program evaluations and case studies that identify the most successful tactics to deploy a utility water heater program including:

- Strategies to address both tank and tankless water heaters
- Developing a strong and engaged contractor network and
- How to gain traction for solar water heaters in the market

Several utility programs profiled in this paper illustrate these various "best practices." These include Missouri Gas Energy's dedicated database called WHAM which tracks all critical program benchmarks for both its tanked and tankless water heating offerings.

Other utilities featured in this paper include documenting the innovative marketing approaches used by both Portland General Electric and Georgia Power that shifted customer perceptions about water heating.

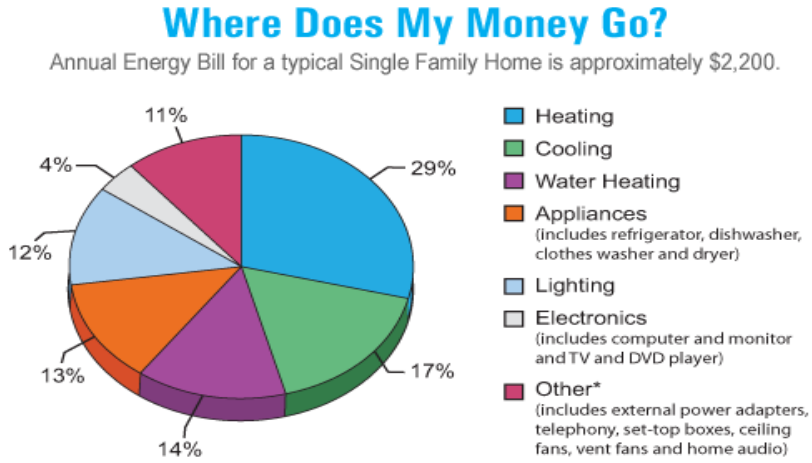
This paper also describes the role that water heaters can play in peak load reductions, as demonstrated by Great River Energy while Hawaiian Electric's SolarSaver Pilot Program tests the effectiveness of using on-bill-financing to encourage the installation of this premium energy efficient technology.

Introduction

Water heaters are usually the forgotten appliance for both residential customers and utilities. However, new technology innovations - including tankless and solar thermal designs coupled with advances in smart meter and load control communications - are driving a reemergence of utility programs designed and implemented to address this significant residential energy end use. As Figure 1 shows, water heating accounts for between 15 and 20 percent of a typical residential customer's annual energy usage –making it the second most energy intensive

end use after heating and cooling. But, as the examples in the paper will demonstrate, several utilities have been successful in promoting the benefits to customers of early replacement water heater before it fails--and floods the basement.

Figure 1: Estimates of Typical Household Annual Energy Usage



Source: Department of Energy

This paper draws on the findings from in-depth assessments of five utility water heating programs. Two of these assessments were completed as part of process evaluations: Hawaiian Electric Company (HECO) and Missouri Gas Energy (MGE). Three others were based on interviews completed by Johnson Consulting Group with the program managers, trade allies, and implementation partners.

Several themes emerged regarding what works best for water heating programs, regardless of the equipment type (i.e., solar, tankless, storage) or fuel type (e.g., gas or electric). These conclusions formed the basis for identifying the best practices described in this paper.

Summary of Utility Program Offerings

To set the stage and provide an overview of each utility's approach, this section summarizes the water heating programs offered by each utility.

Georgia Power (GA)

Water heaters have become an important element in Georgia Power's positioning in the energy market. Georgia Power began promoting electric storage water heaters as an energy efficient alternative to tankless water heaters and as a way to offer their customers a more cost-effective choice compared to natural gas water heaters. Table 1 illustrates the cost savings of high efficiency storage water heaters compared to conventional gas and electric systems.

Table 1: Water Heater Operating Costs Comparison

Water Heater type	Efficiency Factor (EF)	Installed Cost	Annual Energy Cost	Life Expectancy	Total Cost
Conventional gas storage	0.6	$850	$350	13	$5,394
High-efficiency gas storage	0.65	$1,025	$323	13	$5,220
Condensing gas storage	0.86	$2,000	$244	13	$5,170
Conventional oil-fired storage	0.55	$1,400	$654	8	$11,299
Minimum Efficiency electric storage	0.9	$750	$463	13	$6,769
High-efficiency electric storage	0.95	$820	$439	13	$6,528
Demand gas (no pilot)[4]	0.8	$1,600	$262	20	$5,008
Electric heat pump water heater	2.2	$1,660	$190	13	$4,125
Solar with electric back-up	1.2	$4,800	$175	20	$7,072

1. Purchase costs include our best estimates of installation labor and do not include financial incentives.
2. Operating cost based on hot water needs for typical family of four and energy costs of 9.5¢/kWh for electricity, $1.40/therm for gas, $2.40/gallon for oil.
3. Future operating costs are neither discounted nor adjusted for inflation.
4. Estimates for tankless gas water heaters are based on the federal EF rating method, which may over-estimate the efficiency of tankless water heaters in houses.

Source: ACEEE Consumer Guide to Home Energy Savings: Condensed Online Version *Water Heating* Sept. 2007 www.aceee.org/Consumerguide/waterheating.htm#lcc

Georgia Power, a subsidiary of Southern Company, developed its innovative water heater program in 2007. The utility serves 2.25 million customers throughout Georgia, and is the largest of four electric utilities that make up Southern Company.

Georgia Power offers customers up to a $525 rebate (depending on house type) to switch from an existing natural gas water heater to a Marathon water heater. However, the actual costs for this conversion may be higher depending on the extent of the electrical wiring required. The program which initially targeted both single family existing homes has also experienced success in the multi-family housing market. The durability of the Marathon water heaters was another selling point to the multi-family property managers, because these water heaters require less maintenance and have a strong track-record of good performance.

Great River Energy (GRE)

This is a generation and transmission (G&T) company serving most of Minnesota and parts of North Dakota. It has more than 800 megawatts (mW) of generation, 4,500 miles of transmission lines and revenues in excess of $776 million. However, this G&T is facing

increased costs associated with rising fuel price which also increase the price of purchased power. To minimize the effects of these cost increases, GRE developed a system-wide peak load reduction program in the mid-1980s. To date, the utility has more than 65,000 water heaters enrolled in its off-peak thermal storage program. These storage tank water heaters allow the utility to shift more than 80 MW of peak load reduction each month and shave more than 40,000 kilowatt hours (kWh) of interruptible peak load. This program has saved GRE approximately $10 million annually by shifting 275 gigawatt hours (GWh). To achieve these savings, GRE offers customers of its member cooperatives rebates ranging from $50 to $500 including a bill credit for its residential customers.

Hawaiian Electric (HECO)

HECO's Solar Saver Program (SSP) is a three-year pilot program (June 30, 2007 - June 30, 2010) designed to overcome the barrier of up-front costs in the residential solar water heating market. This program was implemented across its subsidiaries: HECO, MECO, and HELCO. The program is marketed through approved residential water heater contractors, who already specialize in installing solar water heating. Hawaii's climate and location make solar water heating a viable alternative for residential customers. Participating customers incur no upfront cost but rather are able to finance the cost of a solar water heater on their monthly bill. According to the commission requirements, the SolarSaver fee "shall be equal to 80% of the estimated monthly energy bill savings for a family of four at the time that the SolarSaver fee is issued by the utility." The estimated fee is adjusted quarterly as show in Table 2.

Table 2: Monthly Fee for PY2 by Operating Company

	Q3 2008[1]	Q4 2008[2]	Q1 2009[3]	Q2 2009[4]
HECO Monthly Fee	$ 44.88	$ 46.49	$ 32.06	$ 25.65
HELCO Monthly Fee	$ 70.97	$ 74.71	$ 57.90	$ 48.56
MECO (Maui Division)Monthly Fee	$ 67.89	$ 64.41	$ 41.78	$ 36.56
MECO (Lanai Division)Monthly Fee	$ 78.33	$ 78.33	$ 55.70	$ 48.74
MECO Molokai Division)Monthly Fee	$ 74.85	$ 76.59	$ 60.92	$ 48.74
Footnotes:				
1 - Q3 2008 = July 7 to October 5, 2008				
2 - Q4 2008 = October 6 to January 6, 2009				
3-Q1 2009= January 7 to April 5, 2009				
4-Q2 2009=April 6-June 30, 2009				

However, the energy savings from this installation more than offset the monthly fee. Participants also receive a $1,000 rebate for participating in HECO's Residential Water Heating Program (REWH), free maintenance and insurance on the solar water heater, and a 12-year warranty.

Missouri Gas Energy (MGE)

The Water Heater Program is designed to assist MGE customers with natural gas conservation efforts by encouraging them to replace current water heaters with high efficiency natural gas water heaters. The program is open to all current active MGE customers who purchase either a qualifying tanked or tankless water heater. Participating customers will receive a bill credit to offset the cost of this higher efficiency equipment. Each customer purchasing a qualifying system will be eligible to receive a rebate issued in the form of a bill credit of either a $40 bill credit for qualifying hot water tank purchase with Energy Factor (EF) or a $200 bill credit for qualifying tankless hot water system purchase (EF of 0.80 or greater).

During the first year of program operations, the utility processed more than 500 applications. The findings from the billing analysis revealed that the energy savings for *program participants* were significantly higher than for non-participants — between 18 and 20 percent of annual energy usage for those customers who purchased both tanked and tankless water heaters (MGE Process Evaluation 2009).

Portland General Electric (PGE)

Working with a water heater manufacturer, a local plumbing contractor and the Energy Trust of Oregon, PGE developed a limited offer for its customers with a fixed-fee installation. The goal of this program was to educate customers about the importance of selecting an energy efficient water heater before they actually needed to replace it

PGE worked with Energy Trust of Oregon to establish an incentive level based on its cost-benefit analysis. PGE also worked with local contractors and distributors during this four-month program. The program exceeded all expectations and led to installations of more than 300 water heaters as well as long-term changes in stocking practices among water heater distributors in the Portland area (Naleway 2009). As a pilot program, PGE anticipated having only 100 installations, so 300 installations was a major bump in expectations. Moreover, the largest plumbing suppliers began stocking and promoting energy efficient storage water heaters directly as a result of this program increasing overall consumer demand for this equipment.

Summary of Utility "Best Practices"

These five programs provide excellent examples of six "Best Practices" in water heater program implementation. An in-depth examination of each program revealed the following best practices used by these utilities, as summarized in Table 3. Each best practice is expanded on in this section, with specific examples from these utilities.

Table 3: Summary of Utility Best Practices for Water Heating Programs

Best Practice	Georgia Power	Great River Energy	Hawaiian Electric	Missouri Gas Energy	Portland General Electric
Reduce first cost barrier	✓	✓	✓	✓	✓
Nurture local contractors	✓		✓		✓
Promote early replacement	✓	✓		✓	✓
Promote non energy benefits	✓	✓	✓		✓
Make it easy for customers & contractors	✓			✓	✓
Measure results carefully		✓	✓	✓	

Best Practice #1: Reduce First Cost Barrier

A major barrier to installing an energy efficient water heater, whether gas or electric, tankless or storage, is the first-cost. These water heaters always cost more than their non-energy efficiency versions. The first cost barrier is even higher for solar water heaters.

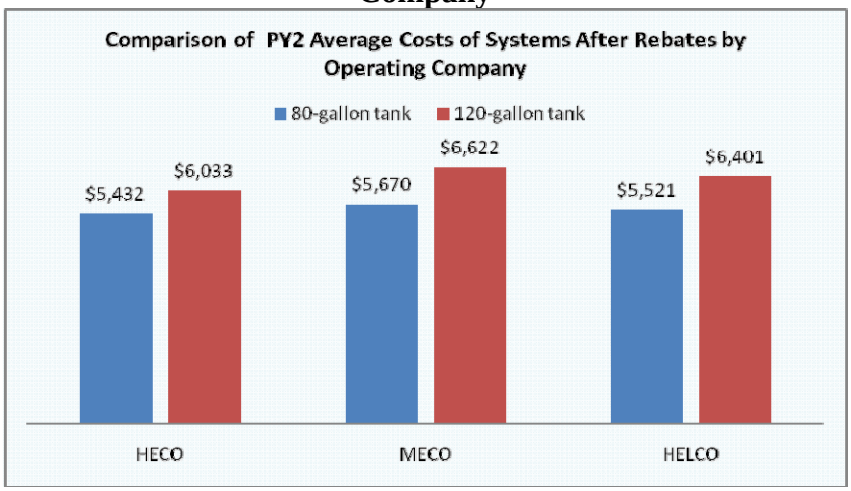
All five of these programs offered incentives ranging from $50 to more than $5000. However, the most generous program was HECO's SSP which eliminated the entire up-front cost of the solar water heater through its on-the-bill financing program. Participating customers financed the installation of this water heater on their monthly bill. The energy savings from this installation more than offset the monthly fee, according to both utility staff and the customer surveys in the process evaluations.

HECO also had fairly lenient credit requirements, as part of its overall strategy to encourage low income households and renters (rather than just landlords) to install this equipment. To qualify for the program, a HECO customer only had to be in "good standing" with the utility and have six months of good payment history.

Figure 2 illustrates the effective amounts that were financed through this program during its second year of operation (PY2). These amounts were what the customers were responsible for paying back on their monthly bills. Since this was a tariffed program, the monthly payment was tied to the premises, not the occupant. The monthly payments were designed to recoup all utility costs at the end of the product life of 12 years. As of the close of PY2, there have been no loan defaults in this program.

In addition to rebates, PGE and Georgia Power were able to offer a fixed-fee installation of the premium efficiency water heaters, which also significantly reduced the out-of-pocket fees for customers installing new water heaters. This fixed-fee approach also made it easier for these utilities to effectively position energy efficient water heaters in their service territories.

Figure 2: Comparison of PY2 Average Cost of Systems After Rebates by Operating Company



PGE worked with Energy Trust of Oregon to establish an incentive level based on its cost-benefit analysis. Based on the analysis, Energy Trust of Oregon was able to offer PGE customers a $75 dollar incentive. This incentive, combined with the $100 instant rebate from Roto-Rooter, helped to reduce the installed cost to $765. The following text box summarizes the incentive levels used in this program.

Incentive Levels for PGE's Electric Water Heater Program

$940 Marathon 50 gallon electric water heater with standard installation by Roto-Rooter.

-$100 Instant Rebate from Roto-Rooter
-$75 Cash-back incentive from EnergyTrust of Oregon

765 ** Special price for a lifetime, super efficient, rust-proof Marathon electric water heater - including installation

Best Practice #2: Nurture Local Contractors

Roto-Rooter, a nationwide plumbing firm, was integral to the overall success of this program for both PGE and Georgia Power. The manufacturer, Marathon, had established contacts at the national level with Roto-Rooter that were invaluable as PGE launched the program. The local franchise owner was willing to negotiate a “flat rate” installation fee that would cover about 95% of the water heater installation jobs. This allowed the program to be marketed consistently to all PGE customers.

PGE's success with this promotion also increased contractor interest and spurred several others in Oregon to develop their own water heater programs. This program provided an opportunity for the Energy Trust of Oregon to reconsider the importance of promoting both electric and gas water heaters. As a result of PGE's promotion, Energy Trust modified their

program requirements to allow point-of-purchase incentives at retail and wholesale locations as way to reach out to those customers who prefer to "self-install" water heaters.

Georgia Power worked with several local plumbers and electricians as well as Roto-Rooter. Furthermore, Roto-Rooter hired an electrician for the wiring conversions so it became much easier to encourage customers to switch from gas to electric water heaters. Because of its relationship with Roto-Rooter, Georgia Power was able to expand its installer network to now include more than 20 qualified plumbers across Georgia- a significant factor in achieving its 1,400 installations the first year.

HECO's SSP Program tapped into its existing contractor network currently participating in its standard Residential Electric Water Heater Program. Since many of these contractors installed both standard and solar water heaters, this helped to jump-start program awareness and installations in the first year of program operations. Moreover, HECO also promoted this program to the Solar Industries Association as well as local builders as a way to further expand its network of interested contractors.

Conversely, MGE had difficulties in its first year of program operations in recruiting contractors who were interested in installing both tanked water heaters. According to the first year process evaluation report (MGE Process Evaluation 2009), the biggest challenge has been to attract plumbers who install tanked water heaters. These plumbers are still not convinced of the value of the energy savings for qualified equipment for the tanked systems. This lack of "contractor commitment" coupled with the lower rebate levels does help to explain why some plumbers are not generating "warm leads" into actual sales or installations.

Best Practice #3: Promote Early Replacement

PGE's goal was to educate about the importance of selecting an energy efficient water heater before they actually needed to replace it. Usually buying a water heater is a replacement "panic" purchase and there is little time for decision-making, so PGE the wanted the customers to make a different choice, not just a price shopping decision (PGE Case Study 2008). Furthermore, most customers are not accustomed to making this type of purchase. So, PGE developed a promotional philosophy that focused on "preventative medicine" and make this purchase much easier and transparent for PGE customers.

The importance of promoting early replacement strategy was also reinforced in MGE's process evaluation (Johnson 2009). Since water heaters are typically an overlooked appliance, a key recommendation for MGE's program as a way to increase installations of tanked water heaters, was to promote the value of early replacement to customers. This lead time will also allow the local plumbers time to procure the qualifying equipment and have it in stock.

Best Practice #4: Promote Non Energy Benefits

Customers typically do not purchase new water heaters for energy efficiency but rather for other reasons, specifically equipment replacement, or to address health, comfort and safety concerns (Johnson 2009). This finding was corroborated in MGE customer surveys as well as in the program results for PGE and Georgia Power.

Both PGE and Georgia Power emphasized the non-energy benefits in their water heating programs such as the lifetime cost of ownership—that is promoting the

longevity and low maintenance required for high efficiency storage water heaters, the reduction of "black mold"—a big area of concern in Portland and a way to help minimize landlord liability (PGE Case Study 2008).

Georgia Power's unique messaging that focused on the "non energy" benefits of using energy efficient water heaters including the reduction of space in landfills and the savings associated with lower energy consumption. The utility factored in the "green" benefits of Marathon water heaters in its modeling for the program. Using an average 9-year gas water heater life and a 36-year life for Marathon, the landfill space avoided per Marathon Water Heater is 28.8 cubic feet. This is equivalent to 50 full dump truck loads of heaters saved from the landfill for every 1,000 Marathon water heaters that are installed (Georgia Power Case Study 2009). According to Georgia Power, nearly 10 million water heaters are produced, transported and installed annually in North America to replace failed units. Installing lifetime tank warranty heaters could potentially cut that number in half.

Another non energy benefit that the utility focused on was the durability of the system- which appealed to multi-family property managers. This was a major selling point to multi-family property managers who did not have to worry about the service calls or water damage from leaking heaters (Georgia Power Case Study 2009).

Best Practice #5: Make It Easy for Customers and Contractors

While this may seem to be an obvious "best practice," it is much more difficult that it seems to make water heating program installations seamless. It is also important that for water heating programs that involve load control, the event is "invisible" to the customer. This has been a major area of focus in GRE's program for the past 20 years. The G&T, which serves 28 member cooperatives, sends out load control events for up to eight hours. During these events, the water heaters may be shut off to reduce peak demand during the hours of 4 to 10 p.m., especially in the summer. GRE has approximately 55,000 water heaters controlled through the program and during peak days they may control about 2,500 MW. Because GRE is relying on well-insulated water heater storage tanks, the customers do not even realize that the water heater is being controlled or shut off during peak load times. This program has been so successful to the G&T and its member utilities that it has reduced the need to build additional generation facilities- which amounts to significant cost savings for these rural co-ops.

Georgia Power also made its water heating program easy for its contractors and MGE is considering implementing a similar approach. For example, Georgia Power also provided the forms electronically on their Web site, so local plumbers and contractors could download all the forms they needed and provide customers with a Marathon wherever they were. The website also provided customers with helpful information about the program; including a statewide map of recommended installers, an interactive water heater graphic illustrating all the benefits of the product, numerous forms and fact sheets, and satisfied customer testimonials (Georgia Power Case Study 2009).

Conversely, HECO experienced numerous difficulties because of the challenges associated with implementing its SSP program "from scratch." This program was anything but easy for either customers or contractors to participate in-especially in the first year. HECO had to properly document the SSP installation on the deed which was complicated if there were

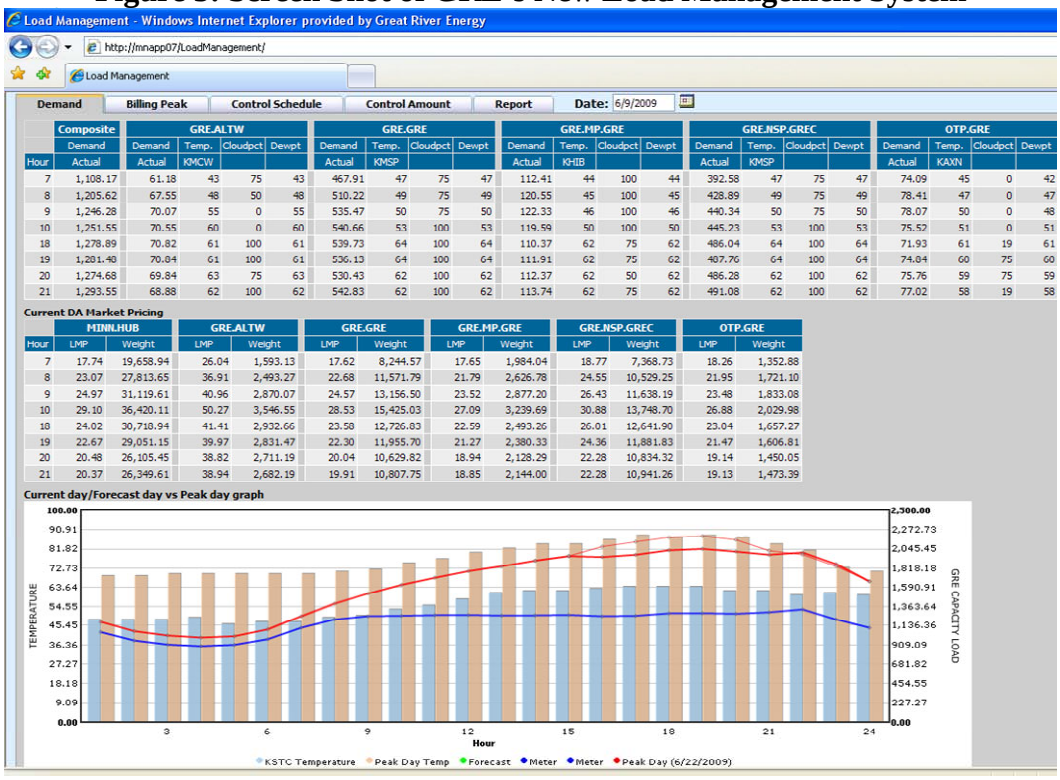
multiple parties involved. In all, it took the first full year of program implementation to completely work through this process and streamline applications (HECO SSP PY1 and PY2 Process Evaluations 2008-2009).

Best Practice #6: Measure Results Carefully

MGE and GRE are at the forefront of demonstrating the value of measuring program results and impacts carefully and comprehensively. MGE was new to program implementation and the staff wanted to be responsive to any possible requests from the Missouri Public Service Commission as well as utility senior management. Therefore, the utility developed a dedicated database called WHAM which tracks all critical program benchmarks. This database tracks critical metrics beyond program installation numbers and contractors and includes tracking responses to monitor self-reported free ridership, fuel switching and key demographics such as home ownership. Since all these critical data are collected in one comprehensive database, it can automatically generate documents and statistics as needed to respond to both the utility staff or Commission requests (MGE Process Evaluation Report 2009). This database is both comprehensive and easy to use, thus freeing up staff time for program operations rather than the "scavenger hunting" that too often occurs in new programs.

GRE recently has modernized its load management and tracking tools to make it easier to both measure savings from the load control events as well as "true up" the results. The GRE water heating control programs are successful, saving the utility approximately $10 million annually by shifting 275 gigawatt hour (GWh). These programs have reduced both energy purchases by approximately $7.5 million and demand expenses by $13 million. However, it often became a challenge for the utility to compare the savings to what would have been the cost without the load event. So, GRE developed and implemented a new load management software package that summarizes all critical information for each event, compares it to previous years, and accounts for weather conditions. Prior to this software, these tasks would take several hours and would be completed by multiple staff members. Now, this process has been streamlined into a simple spreadsheet operation that informs all appropriate staff, from the load control engineer to the CEO, about the pertinent facts and energy savings associated with each load control event (Webster 2009). Figure 3 shows a screen shot of this program enhancement.

Figure 3: Screen Shot of GRE's New Load Management System



Conclusions

This paper examined the best practices in water heating program implementation from five diverse utilities. As this paper showed, these best practices are applicable to utilities of all types regardless of the program strategy or equipment used. This paper also observed that it is difficult for all utilities to fully cultivate these best practices, and illustrated the challenges in doing so. However, when a utility or energy organization can design a program that is easy to participate in and supports local contractors, promotes the benefits of early replacement, and highlights messages beyond traditional energy benefits-- then they are well on their way to implementing a successful program. Even better is when the utility can remove the first cost barrier to purchasing and installing energy efficient water heating.

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