

Manage, then Measure: Utilizing Adaptive Management to Drive Behavior Change

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ABSTRACT

There has been significant discussion about how to track and verify savings from programs that encourage changes in energy-using behaviors or operating practices that affect consumption. Much of the discussion assumes all programs are created equally and focuses solely on how to measure savings amongst participants, how persistent savings are, and how to differentiate savings from program participation vs. changes in operational or behavioral practices.

We contend that the ability to drive active participation, increase the savings achievement, ensure persistence, and attribute savings is a function of program design. Good program design provides mechanisms for actively engaging participants by increasing awareness and understanding of the factors that affect energy use, identifying the best savings opportunities, developing a prioritized action plan to meet specified goals, providing feedback on savings accomplishments, and maintaining ongoing dialogue. Early evaluation efforts need to focus on which program design elements are most effective.

Through a program that targets both residential and business customers, the Energy Challenge uses a multi-faceted approach to changing energy consumption behavior community-wide. Participants pledge to reduce consumption by a targeted amount over a specified period of time. Competition is friendly, and public/private cooperation is encouraged. A continuous improvement philosophy and adaptive management ensure the program optimizes customer engagement to deliver savings.

This paper will examine early results (through February 2010), including participation levels; participant feedback on program effectiveness, changes in knowledge and awareness, and savings actions; program adaptations to maximize savings; and early savings results measured through bill analysis.

Introduction

Energy savings from operational or behavioral change provides a potential new programmatic approach and conservation resource for much of the energy efficiency industry. Behavioral change programs are less straightforward to implement and more difficult to evaluate than traditional technology-based conservation programs, as the energy saving actions (e.g., turning off lights, reducing thermostat settings, washing laundry in cold water, etc.) cannot be measured through mechanisms such as tracking retail sales or quantity of units installed. As a result, much of the attention and conversation around behavior change programs has concentrated on how to measure and verify savings and persistence (Loper et al. 2010) rather than how to design successful programs.

As an industry driven by metrics, the focus on conservation potential, setting of targets, tracking achievements, and verification of savings is not surprising. However, program design and implementation strategies can significantly affect the degree to which savings are realized

and to which they persist. Including provisions to measure the effectiveness of program design in achieving short-, intermediate- and long-term objectives throughout program implementation helps ensure that a program delivers optimal results.

The Energy Challenge program (the Challenge) was designed by Snohomish County PUD (the District) to encourage adoption of energy saving behaviors. The District developed the Challenge around an adaptive management model that enables ongoing evaluation of program performance (with higher frequency in the first two years) and allows for implementing changes to increase program effectiveness. This paper outlines the Challenge, the adaptive program management model, and the process and methods the District has utilized for early program evaluation.

The PUD Energy Challenge

With steadily increasing conservation goals, driven by District management in response to load growth, legislative and regional requirements, and 30 years experience implementing technology-based conservation programs, the District strives to find new ways to engage and partner with customers on energy efficiency efforts. Given this context, the District launched the Challenge in May 2009.

Designed to establish an ongoing, two-way dialog with customers about their energy use, the Challenge enables the District to help customers save energy through operational and behavior changes while increasing participation in its other energy efficiency programs. Participants are encouraged to reduce their use through no-cost energy saving behaviors, low cost improvements and energy-saving investments.

Program Design

In developing the Challenge, the District concentrated research efforts as much on implementation and management of the program as on efforts to document savings. While planning for impact measurement is important, making it the primary focus can overshadow the importance of optimal design and implementation.

Realizing that the likelihood of the District (or any entity) conceiving an optimal program design that would achieve immediate success was extremely slim; the District designed the Challenge to be implemented and managed through an iterative process. The District intends to deploy various programmatic strategies, observe impacts in terms of knowledge, action and energy savings, gather feedback from participants and stakeholders, and adapt the program based on what is learned.

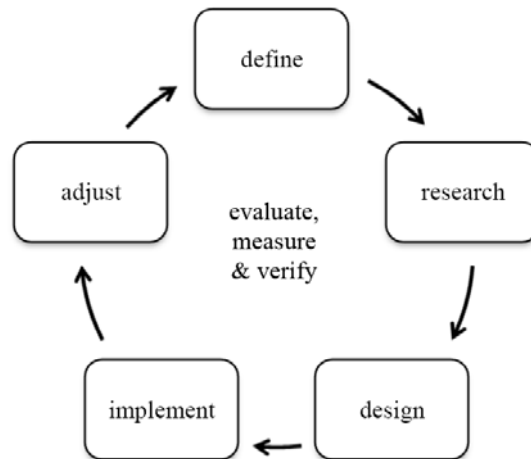
Key elements in both the planning and management of the Challenge are outlined in Figure 1 based on the principles of action research¹ and are complemented by on-going assessment, evaluation, measurement and verification (EM&V). This model is utilized in an iterative process to:

- **Define** program objectives, target audiences, and behaviors to change through the program

¹ A brief definition of action research can be found on the Southern Cross University website at www.scu.edu.au/schools/gcm/ar/whatisar.html

- **Research** customer energy use behaviors, awareness levels, barriers to change, and attitudes
- **Design** program elements, including performance metrics, messaging, outreach, incentives, and EM&V plans
- **Implement** program as designed
- **Adjust** program as indicated by regular assessment of early program performance and the effectiveness of key program elements against established metrics
- **Evaluate, measure, and verify** impacts

Figure 1: Adaptive Management Design



Using this model, the District regularly assesses the Challenge’s impact and implementation through feedback and monitoring of key metrics. The insights gained are used to define program enhancements or changes to increase success, identify additional research needs, redesign program elements, and implement changes. Ongoing assessment and EM&V are an integral part of program implementation and management instead of only tracking and reporting.

Program Objectives

While the Challenge is expected to generate savings, the program’s early success is judged mainly on volume and quality of customer participation as well as impact on participation in the PUD’s other efficiency programs. Developing an ongoing relationship with customers through the principals of relationship marketing delivers numerous benefits to the District beyond energy savings (O’Malley & Tynan 2000) including the opportunity to: better understand customer needs and behaviors, “sell” customers on other utility conservation programs, and; increase customer awareness and adoption of energy efficient behaviors.

The Challenge is intended to meet several goals and objectives for the District including stimulating interest in energy efficiency; moving customers from concern to action; and engaging customers in ongoing dialog about energy use and conservation as it relates to them as individuals and to the community. By creating a sense of community around efficiency, the District hopes to encourage both investment in energy efficiency measures (e.g., ENERGY STAR appliances, system upgrades, and efficient retrofits) and behavior change (e.g., turning off lights, unplugging unused appliances, and reducing hot water use). Achieving these objectives

requires knowledge of District customer beliefs, current behavior, past and future conservation actions and awareness that not all program implementation strategies or participants will deliver energy savings (Hastings 2003) but may instead support non-conservation objectives. The program’s progress and success are measured by:

- Awareness: percentage of customers aware of program
- Participation: percentage of customers participating within a given segment
- Engagement: degree to which customers open emails, reach out to ask questions or request information, and respond to survey requests
- Satisfaction: customer satisfaction with information and services
- Savings: degree to which participants are saving relative to non-participants. Identification of savings from behavior or business operation changes and participation in other utility programs.

Targeted Participation

All 320,000 residential and business customers of the District are eligible to join the Challenge. Recognizing that it is difficult to appeal to all customers, the District decided to target the program’s messaging and design toward select customer segments.

Residential customers. The District serves approximately 290,000 households and chose to target four residential customer segments identified in a 2008 Residential Segmentation Study². The segments were chosen based on their perceived receptiveness to participating in utility programs, their awareness of the importance of energy conservation, and their likelihood to connect their actions to environmental and community benefits (Table 1).

Table 1. Targeted Residential Segments

Segment	Size (%; # accounts)	Attitude
Green Idealist	15%; 43,500	Those most concerned with conserving, controlling energy use and costs, and the environment. See a strong connection between conservation activities and their role in protecting the environment.
Practical Idealist	21%; 60,900	Second highest concern with conserving, controlling energy use and costs, and the environment. Slightly less aware of connection between conservation activities and their role in protecting the environment.
Affluent Conserver	10%; 29,000	Least concerned/lowest awareness among the “green” segments with conserving, energy costs, and protecting the environment. Despite lower awareness and concern, do participate in conservation activities.
Follows the Crowd	20%; 58,000	Saving money and controlling energy costs are very important though not to exclusion of at least some concern with environment/ impact of energy use on environment. Most likely to be influenced by behavior of others.

The remaining customer segments, where energy savings are potentially higher and behavior change more difficult to influence, will be targeted using the insight gained from early participant feedback as well as primary research of non-participating customers.

² The PUD Residential Segmentation study was conducted by Momentum Research and done in coordination with Puget Sound Energy, Tacoma Power and the Bonneville Power Administration.

Top 700 customers. The District assigns account managers to its top 700 commercial, industrial, and institutional customers. Initially, the Challenge is targeted to key customers with significant opportunities for energy savings and willingness to engage employees and customers in dialog about and promotion of the Energy Challenge.

Small business customers. There are approximately 12,000 small businesses in the District’s service territory. The Challenge is targeted to small businesses that are interested in energy efficiency and sustainability practices to demonstrate their environmental and community responsibility or for business strategy reasons.

Program Features & Incentives

The Challenge places little reliance on traditional financial incentive mechanisms, instead using mechanisms for engagement and feedback to motivate and reward customers. The premise of the program is communicated via its tagline, “Save Energy, Save Money, Save 10%,” and its features include those highlighted in Table 2.

Table 2: Program Features

Feature	Residential	Small Business	Top 700 Customers
Pledge Goal	10% reduction measured against the prior year’s consumption achieved over 12 months.	10% reduction measured against the prior year’s consumption achieved over 12 to 24 months.	10% reduction from a benchmark, typically the average of the prior 36 months consumption. Reduction to be achieved in a defined time of 12 – 36 months.
Promotion	Advertising, utility communications, community outreach		Advertising as well as one-to-one promotion by account manager and energy efficiency staff
Opt-in Participation	Self-service online pledge form	Self-service online pledge form	Direct consultation with PUD representative
Opt-in Incentives	Certificate, window decal, free temperature cards, entry into quarterly prize drawings	Certificate, window decal, listing on program website	Certificates, window decals, ENERGY STAR portfolio manager support, listing on program website
Achievement Incentives	Non-incented bill savings	Non-incented bill savings, recognition on program website	Non-incented bill savings, public recognition
Savings Recommendations	Letters, e-Newsletters, tips, on-line audits		Individual energy efficiency improvement plans (Strategic Energy Plans)

Designed for Customer Engagement

For the sake of clarity and length, this discussion of customer engagement focuses on the portion of the Challenge targeted to residential customers. A similar model is used for communication with both small businesses and top 700 accounts.

Connecting at the Customer's Level

Individuals who work in the energy efficiency field tend to care passionately about the cause. We believe that everyone else is similarly inclined, or would be if we just made them cognizant of why they should be (McKenzie-Mohr 2010). In reality, for customers, energy efficiency is way down their list of priorities and increasing their awareness doesn't often translate directly into action (Midden et al. 1983).

Customers often resist changing their behavior either due to their perception that an inefficient behavior works for them or inertia. To affect behavior change, there must be a reward that is sufficiently motivating to make meaningful and lasting changes, or there must be customer commitment to influence follow-through and movement from intention to action (Werner et al. 1995). Figuring out both what people want and how to connect it to energy efficient behaviors is the crux of the problem that behavior change programs must solve to deliver significant and persistent savings (McKenzie-Mohr 2010). Of particular importance is understanding the barriers preventing discrete energy saving behaviors as barriers tend to be activity specific, not general (McKenzie-Mohr et al. 1995).

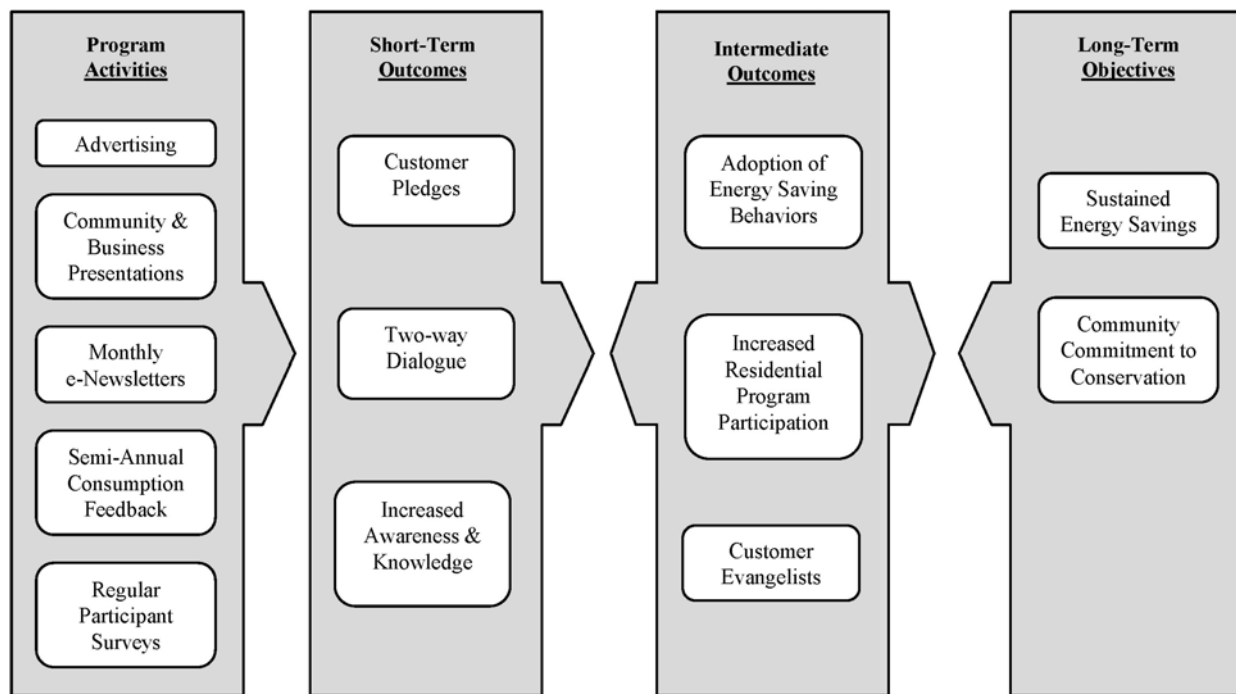
The Challenge attempts to connect commitment and reward in ways that effectively move customers from awareness, to intent, to actions that deliver energy savings. Motivating rewards differ between customer segments and might range from personal satisfaction, to savings on their bill, to prizes in a contest, to comparing favorably to their peers.

Because of the difficulty in testing the connection between action and reward with real customers, and because what people say they want and what they actually respond to can be very different, the District chose to implement the Challenge by asking for customer commitment to saving energy at the front-end and then offering a series of different recognition rewards. Based on customer response and early assessments, program management will adjust program elements as required, assess again, and repeat the process until the desired effects are realized.

Customer engagement model. Behavior change takes time (Prochaska & DiClemente 1983). Helping customers move through the process of learning about a desired behavior, contemplating engaging in it, performing it, and turning it into a habit is an important part of achieving initial energy savings and persistence. By focusing on relationship building and regular, two-way communication with customers over months and even years, the District regularly reinforces customers' commitment to reducing their energy use by providing feedback on their progress and reminders of actions they can take (Cialdini 1993).

By combining traditional marketing strategies and activities with opportunities for two-way dialog and customer feedback, the District hopes to create a customer engagement model that delivers positive outcomes in the short, intermediate and long term (Figure 2).

Figure 2: Customer Engagement Model



Making It Approachable

The District conducts regular telephone and online surveys with residential customers to gauge satisfaction, opportunities to improve service, and efficiency program awareness. Surveys conducted between 2005 and 2009 indicate that customers care about energy efficiency and that many believe they should do something to reduce their use. Unfortunately, most customers seem unsure which actions are most beneficial. In addition, actions or behaviors that deliver the greatest savings can be perceived as difficult or intimidating (caulking the windows), expensive to accomplish (upgrading a space heating system) or as having potential to reduce their comfort (turning down the thermostat). Customers are unlikely to take these actions unless the District can make them seem approachable and “worth the effort.”

During focus groups conducted during the development of the Challenge, customers highlighted a need for clear and actionable information about: which actions to take and how to prioritize them; the impacts of each action in terms of kWh, money, or social benefit; and the cost of specific actions in terms of money or effort.

Giving this information to customers, along with a clear link to the reward for the action, makes behavioral change feasible. Combining the information with insight into what others are doing and the benefits they are seeing helps strengthen the connection customers make between a desired behavior and the expected rewards (McKenzie-Mohr 2010).

The District employs this model by breaking energy efficient actions into “Free and Easy,” “Low Cost” and “Smart Investments.” The District provides Challenge participants with information about the desired action, costs, rebuttals to common objections, and expected savings in kWh and dollars. It combines this information with tips and stories from other community members and a direct line to utility staff for answers to customer questions.

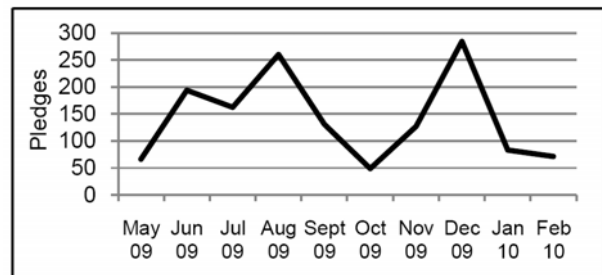
Early Insights and Adaptations

The following areas related to short-term residential customer objectives are monitored regularly, and various program changes have been made in response to observed results. In the future, the tracking information outlined in this section can be overlaid with information comparing participant consumption with a baseline period to look at the effectiveness of program elements in deriving program impacts.

Awareness and Participation

Rate of new pledges. New pledges are tracked by month (Figure 3). Fluctuations correspond to shifts in outreach activities. When sign-ups dropped in October 2009, the District reinforced program promotions. The drop-off in early 2010 reflects a reduction in program promotional activity as 2009 efforts were evaluated and adjustments initiated.

Figure 3: New Pledges by Month



Total participation. More than 1,400 residential households had joined the Challenge by February 2010. Together, they will save more than 1,750,000 kWh annually if the 10% reduction goal is achieved. Participants closely resemble the District’s overall customer population in geographic distribution, home type, heating fuel, and water heating fuel (Table 3).

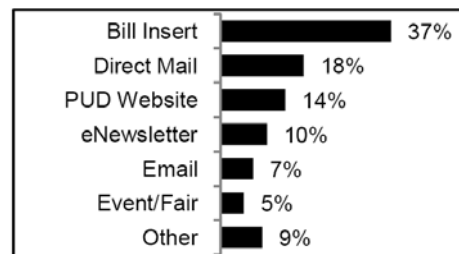
Table 3: Participant Home Characteristics

Home Type	% Participants
Single Family	77%
Condo / Townhome	9%
Mobile / Manufacture	6%
Apartment	5%
Duplex / Triplex	2%
Other (houseboat, RV, etc)	1%

Heating Fuel	% Participants
Space - Electric	47%
Space - Natural Gas	41%
Space - Other	12%
Water - Electric	50%
Water - Natural Gas	45%
Water - Other	5%

Outreach tracking. In order to determine the effectiveness of different outreach efforts, the District asks participants how they learned about the program (Figure 4). This information is tracked over time to determine the impact and sustainability of various efforts. As fruitful methods are identified, results are analyzed, and insights are integrated to increase the effectiveness of other materials and efforts.

Figure 4: Pledges by Source



Customer awareness. Through various efforts, including semi-annual satisfaction and needs surveys, we track general awareness of the program, another avenue for measuring outreach

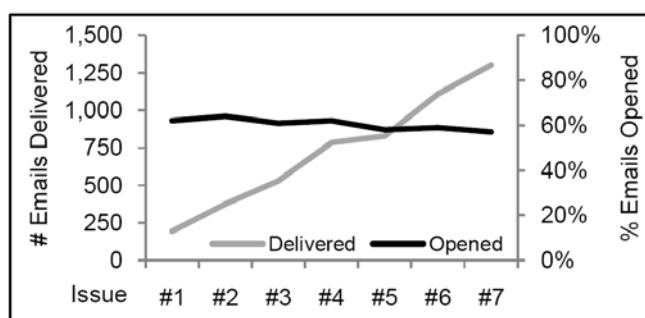
effort effectiveness. A survey conducted in February 2010, a little more than 9 months after launching the program, found that 16% of District customers surveyed were aware of the Challenge.³

Customer Engagement Rates

Engagement activity takes place most frequently with the residential customers; therefore it is the focus of this section. Key metrics tracked include e-newsletter open rates, survey response rates, customer self-reporting, and customer energy efficiency knowledge. To date, metrics tracking engagement methods have been high, yielding valuable opportunities to dialog with customers and gain insight into customer actions taken.

Email readership. While the number of emails delivered has grown with increasing participation in the program, the measurable email open rate has consistently hovered around 60% (Figure 5). This is an impressively high open rate when compared with the roughly 35% open rates of other District email newsletters and the 20-25% of business-to-consumer emails in general (Sherpa 2010) and illustrates the power of asking customers to opt-in to conservation communications.

Figure 5: e-Newsletter Open Rates



Feedback Requests

Two requests have been sent to residential participants and both resulted in high response rates: 1) a survey in October 2009 to solicit feedback on actions taken and insight into customer weatherization and heating systems (26.2%) and 2) a knowledge quiz in February 2010 to compare participant energy efficiency knowledge levels to those of non-participants (39.7%).

October 2009 survey⁴. When asked if they had made any changes to the way they used electricity to become more efficient since joining the Energy Challenge, 86% of customers had made at least a few changes. Customers were also asked if they were planning to make any changes in the future, and 66% intended to make at least a few changes in the next 6 months. Changes made or planned included simple actions, low cost changes, equipment investments and participation in the District's other conservation programs.

Customers also provided valuable insight into how they learned about the Challenge, why they joined, the features that are most useful to them and opportunities for the District to improve the program. This feedback was valuable in informing plans for modifying the program in 2010.

February 2010 knowledge quiz. To understand if customers in the program are more energy savvy than the average District customer and/or if customer knowledge increased after joining,

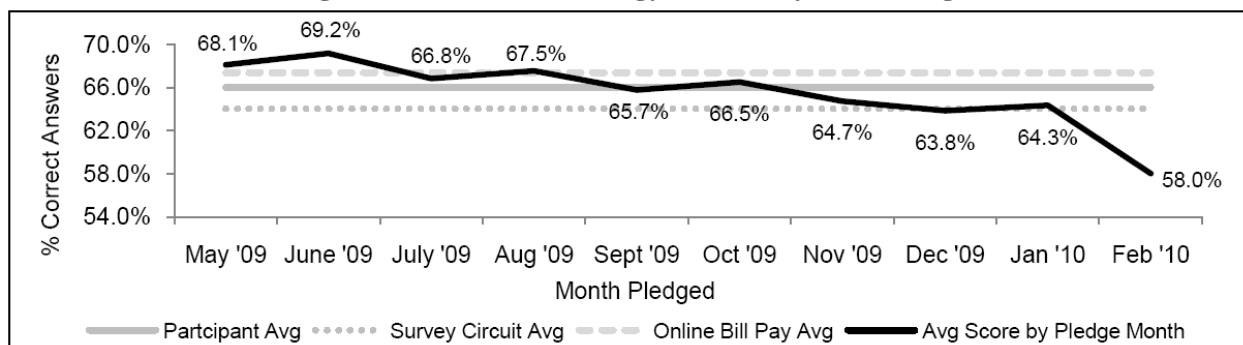
³ Drawn from the March 2010 Snohomish PUD February Residential Customer Satisfaction Survey conducted by Hebert Research. Sample size of 414 households with a margin of error of +/- 4.8%

⁴ Conducted using cvent.com online survey tool. Sample size of 269 from a program group of 815 households.

program management asked participants to answer a 10 question knowledge quiz (n=581). To establish a baseline, two non-participating groups of customers were surveyed; 1) customers that use the District’s online bill pay system (277 responses) and 2) the District’s “Survey Circuit” members (209 responses)⁵.

While the responses showed that Challenge participants are a little smarter than survey circuit participants (but not smarter than customers that pay their bills on-line), we see a distinct difference in participant knowledge compared by pledge month (the later the pledge date, generally, the lower the score on the Energy Efficiency Quiz). This disparity in participant energy efficiency knowledge illustrates the need to reinforce basic knowledge and recommended actions on a regular basis.

Figure 6: Customer Energy Efficiency Knowledge



Long-Term Monitoring and Evaluation

While the current focus of the program assessment is on program awareness, participation, and engagement, ultimately the District will assess the energy savings potential and impacts of the program using regionally accepted methods as described here.

In the fall of 2009, a group of Northwest utilities and energy organizations (including Puget Sound Energy, BPA, Seattle City Light, Snohomish County PUD, Energy Trust of Oregon, and Eugene Water & Electric Board) held a series of meetings to discuss regional evaluation strategies for behavior-based energy programs. The group agreed on the need for standard methods for measurement and verification of programs in the Pacific Northwest, particularly for programs targeted to residential customers.

The group developed protocols and took them to the Regional Technical Forum⁶ for review and consideration. The RTF approved the protocols on March 2, 2010⁷. The District utilized the protocols when designing the EM&V plans for the Challenge.

⁵ These groups may have more knowledge than a typical customer since they are more likely to have visited our website, but served as expeditious comparison groups.

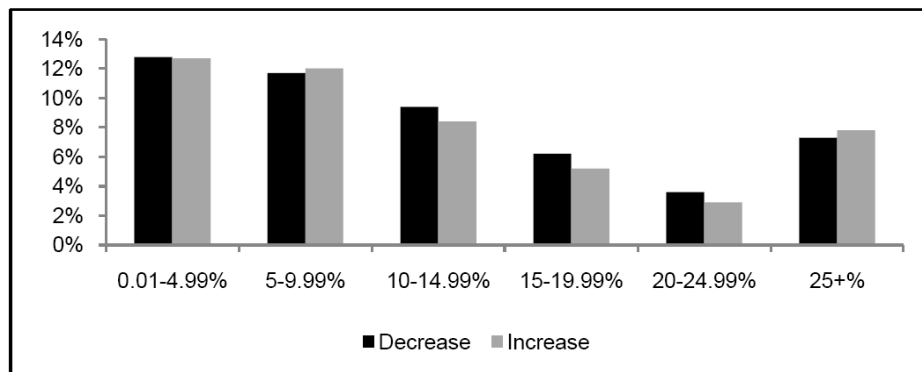
⁶ The Regional Technical Forum is an advisory committee convened by the Northwest Power and Conservation Council (NWPCC) to develop standardized protocols for verifying and evaluating conservation savings.

⁷ The protocols are available at <http://www.nwcouncil.org/energy/rtf/archive.htm>.

Changes in Residential Participant Energy Use To-Date

Strictly comparing pre- and post-pledge energy consumption of early residential participants shows that customers are slightly more likely to reduce their energy use than to increase it after taking the Challenge pledge (Figure 7). In this comparison, energy consumption is not normalized for weather, which was more severe in the post-participation period (higher heating degree days).

Figure 7: Change in Electricity Use Since Pledge as Compared to 2008⁸



Showing the percentage of participants whose electricity use changed within a given interval. E.g. 12.8% of participants analyzed reduced their energy use by 0.01-4.99% since taking the pledge as compared to the same period in 2008.

As Compared to a Control Group

Comparing pre- and post-pledge energy use by participant is interesting, but to measure and verify savings for the program as a whole, evaluators need to use a comparison group to account for other changes in consumption driven by non-programmatic or non-weather related factors. Program impact is determined as the “difference in differences” in the pre- and post-period between the participant and the control groups.

While it is early to assess whether the program will ultimately deliver measurable, persistent energy savings, program management wanted to get an early indication of program impacts and ensure data accessibility and integrity for EM&V in late 2010. To support these goals, a third party consultant was engaged to perform an analysis of participant accounts and evaluate whether early changes in participant energy use were measurable and/or statistically significant.

Raw data was provided for 814 residential participants and 14,000 customers for the control group. Of these 14,000 customers, a control group of 8,000 non-participants was randomly selected to reflect characteristics of the participant group such as heating fuel, geographic location and housing type.

Because the number of days within a billing period varies across customers, average kWh/day is used as the metric for comparison. Average kWh/day for July to December 2009 meter reads was compared to consumption for the same period in 2008. Table 4 shows the average daily consumption of the participant and control groups and the differences in consumption between those periods.

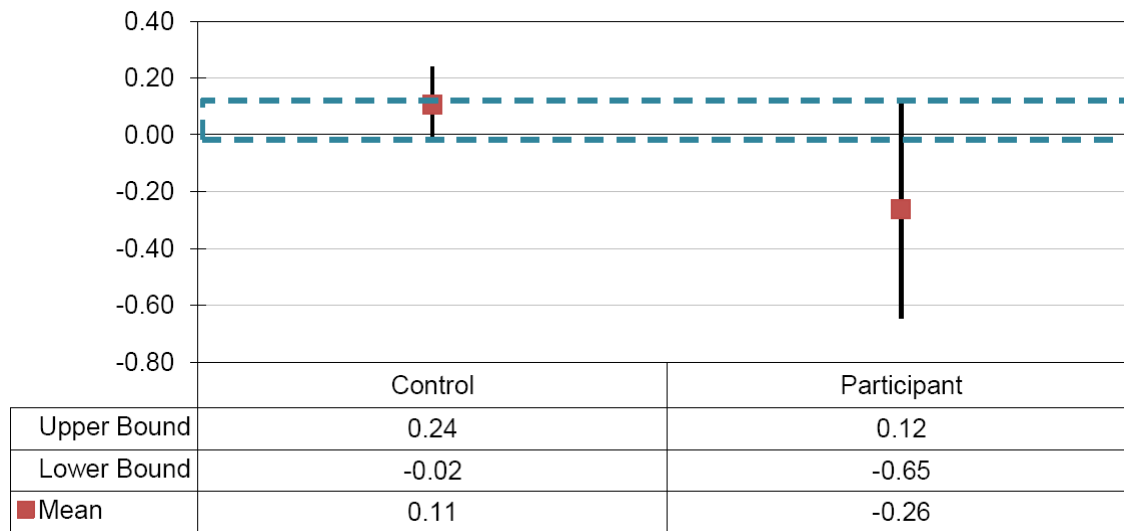
⁸ Consumption analysis includes 631 participants that joined the Challenge prior to November 1, 2009 and had 24 months of billing data. Comparison periods range from ~240 days for the earliest participants to ~60 days for the last participants. Comparison is based on gross meter reads in kWh and calculated using average kWh/per day.

Table 4: Comparing kWh per Day

	Participant	Control	Difference
Number	814	7,976	
2008 Average Use, kWh/day	29.2	30.8	1.6
2009 Average Use, kWh/day	28.9	30.9	2.0
Mean	-0.26	0.11	0.37
Standard Deviation	6.6	7.1	

The hypothesis test was conducted to determine if the participant mean change in average use was significantly different than the control group mean. A two-sample z-test results in a test statistic equal to 1.496.⁹ At the 90 percent level of confidence, the difference in means between the two groups is not significant. The Critical Z-statistic is 1.65. For further illustration, Table 8 shows the 90 percent confidence intervals around the means of the two data series. The band between the blue dotted lines shows the region where the two 90 percent confidence intervals around the means overlap.

Figure 8: Sample Mean 90 Percent Confidence Intervals



While the difference between the participant and control groups is not statistically significant, participants appear to be reducing consumption. Because of the short time that the program has been in place the analysis did not adjust for actual pledge dates, so some participants had been in the program for fewer than the full six months analyzed. This may result in underestimation of actual savings to date.

⁹ Analysis conducted by Amber Nyquist and Brendan O'Donnell of EES Consulting. Memo dated April 15, 2010.

Conclusion

From a program management perspective, the Challenge is progressing well, with frequent assessment of effectiveness and adaptations that are expected to improve program performance. By focusing on understanding which program elements are most successful at eliciting behavior change, reducing energy use, and influencing persistence of savings, the District is gaining insight into how best to design and implement a behavior change program to deliver savings. While the Challenge is still in its early stages, ongoing assessments and customer feedback have already informed changes in program promotion and participant engagement that are expected to yield increased program savings and persistence over time.

An evaluation focused on changes in energy use for residential participants that have been in the program for at least twelve months is planned for late 2010. Methods and protocols will be based on the early 2010 analysis of residential participants.

Based on the early results, stronger messages about ways to save energy are being developed and shared with participants. Beginning in June 2010, when customers enroll in the program they will be provided specific daily, billing period and annual kWh savings targets based on their historic consumption. In the future, communication will place stronger emphasis on congratulating customers that have made significant reductions in consumption and encouraging those that have not. And while the perfect program may be unattainable, the process of adaptive management, as applied to the Challenge, should help it achieve a high degree of success.

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