Timing, Longevity, Depth: Investigating Customer Engagement in Residential Behavior Programs

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ABSTRACT

Utility-sponsored residential behavior-change programs comprise a growing portion of DSM budgets. From 2010 to 2013, the number of utilities including behavior change programs in their energy efficiency portfolios more than tripled. No longer just a paper report, newer types of behavior-change programs include a variety of engaging features. These additional program features offer evaluators more opportunities to study the program mechanisms and consumer characteristics that promote and dissuade energy savings. While the impact of behavior change programs on energy usage has been consistently documented at one to two percent of usage, not as much is known about the mechanism of those impacts. Indeed little is known about how customer engagement in program features varies by customer or impacts energy savings. Drawing on longitudinal data from over four years of energy use and participation in an opt-in behavioral program, our paper explores savings by varying levels of engagement and energy usage. Specifically, we report findings from an in-depth examination of customer engagement in the program in three key areas: timing, longevity, and depth. We found clear patterns that customers who are active in the program for longer time periods save more than those active for shorter time periods. Likewise, customers who engage more deeply (based on the number of logins) experience more savings. We also found that customers who engaged in additional program features experienced lower energy savings than those who did not use those features.

Introduction

Increasingly utilities are adding or expanding behavior change programs, which can include optout reports, community-based events, and online feedback, as part of their demand-side management portfolios. While evaluations have consistently estimated that behavior change programs save one to two percent of energy usage, the mechanism by which the savings occur is less clear. Particularly among online feedback programs, customers can differ in terms of frequency of log-ins, length of engagement, and use of program features. Research on how different features impact energy usage is important for improving behavior program design. Drawing on longitudinal data from over four years of energy use and participation in Accelerated Innovations' MyMeter program, this paper builds on a recent impact analysis to explore electricity savings by varying levels of engagement and energy usage among customers of four Minnesota utilities.

Introduction to the Program

MyMeter is an opt-in program that enables customers to use their desktop or mobile devices to: monitor how their usage changes over time; how weather, occupancy, and appliance use affect their usage patterns; and how they compare to their neighbors. The platform incorporates energy challenges, bill threshold alerts, peak time alerts, energy markers, and outage alerts. Participating utilities encouraged customer to participate via bill inserts, direct mail including newsletters and postcards, and YouTube videos. Some of MyMeter's key features are reviewed below.

Load Management and Efficiency Help

MyMeter helps utilities operate programs that manage customer usage loads and achieve energy savings. Capabilities include dynamic pricing programs; air conditioning cycling for residential and small business customers; direct load control programs for large commercial and industrial customers; and behavioral energy efficiency programs. MyMeter can also run contests and challenges that promote energy conservation.

Energy Usage Visualizations

MyMeter provides visualization tools that enable customers to track energy usage and billing information. These tools include:

- Comparative usage: a feature that benchmarks customer usage against their own usage history and others in the territory.
- Energy challenges: customers set their own conservation goals and track their progress.
- Property profile: customers fill out detailed information on their homes and businesses.
- Bill threshold alerts: notifies customers when they hit pre-set usage thresholds.
- Peak time alerts: notifies customers when peak demand hours are occurring.
- Energy markers: tracks major changes in the home that may impact usage.
- Outage alerts: notifies customers about power outages in their region.

These features, available on desktop and mobile devices, allow customers to see how their usage changes over time; how weather, occupancy, and appliance use affect their usage patterns; and how they compare to their neighbors.

Additionally, these visualizations are filterable by time intervals, from hourly to monthly. MyMeter's Energy Markers[™] allow customers to track time-based efficiency events to better understand how changing usage behavior impacts consumption.

Customer Communication Platform

MyMeter developed a platform that facilitates communication with energy end-users. The platform includes automated real-time notifications and alerts via email and text messaging, which notifies customers of significant changes in energy usage, possible issues at second homes, or potential power outages. Using its consumers' demographic and behavioral information, MyMeter also sends customized messages regarding rebates or programs that can help them lower their bill.

Introduction to the Utilities

The four utilities evaluated in this report are:

- Beltrami Electric Cooperative
- Lake Region Electric Cooperative
- Stearns Electric Association
- Write Hennepin

All four utilities are member-owned and serve between 15,000 and 46,000 members with between roughly 10 and 15% of their member population participating in MyMeter. The service territories cover areas of Northern, Western and Central Minnesota and contain mix of suburban, rural and vacation homes. The utilities average from 8300 heating degree days annually in Rockford where Wright Hennepin is headquartered to over 10,300 heating degree days annually in Bemidji.

Table 1 below summarizes the MyMeter features available to customers in each utility, evaluation time periods and overall savings achieved for each utility.

Utility	Total Participants	Number of Years Implemented	Evaluation Period	Avg. (% Redu	Annual Residential Savings iction and Total kWh)	MyMeter Features Delivered (Opt-In)		
Beltrami Electric Cooperative	2,522 Res 13% of Population	3+ years 5/2010-4/2013	05/10-05/13	2.80%	705,344 kWh	Comparative usage Energy challenge	Threshold alerts Property profile	Energy markers
Lake Region Electric Cooperative	3,569 Res 15% of Population	~4 years 1/2010-4/2013	01/10-04/13	2.60%	857,849 kWh	Comparative usage Energy challenge	Threshold alerts Property profile	Energy markers
Stearns Electric Association	2,169 Res 9% of Population	3+ years 5/2010-4/2013	05/10-04/13	1.80%	463,783 kWh	Comparative usage Energy challenge	Threshold alerts Energy markers	
Wright Hennepin Electric Cooperative	6,718 Res 16% of Population	6+ years 7/2007-4/2013	04/07-06/13	2.20%	844,030 kWh	Comparative usage Energy challenge Property profile	Threshold alerts Peak alerts	Energy markers Outage alerts

Table 1. Summary of MyMeter Utility Programs Evaluated in this Report

Characteristics of Opt-In Customers

As of April 2013, between 9 and 16 percent of each utility's residential customers had opted in to the MyMeter program. Participating customers differed by baseline energy use, enrollment timing, longevity with the program and depth of engagement:

- The largest group of customers, 39%, had baseline usage of under 1,000 kWh per month. Thirty percent used between 1,000 and 2,000 kWh per month, 14% used between 2,000 and 3,000 kWh and 17% used more than 3,000 kWh per month prior to opting into the program.
- Over the analysis period, more customers opted in to the programs during the winter months than the summer months, with January, February and December being the highest months for enrollment. May and September were the lowest months.
- With respect to longevity, 10% of customers had been with the program for less than six months, 12% for six months to one year, 23% for one to two years, 42% for two to three years and 14% for longer than three years¹.
- Almost half (49%) of the customers had logged in between two and nine times, 35% had logged in one time and 17% had logged in 10 or more times. Approximately 6% had gone on to use at least one additional feature such as Energy Markers, Property Profile or Threshold alerts.

Methodology

Discussion of Opt-in Methods

Since the MyMeter program is an opt-in program, we estimated savings using a quasi-experimental "matching method". This approach has been described in the academic literature (Imbens and Woolridge, 2009; Stuart 2010; Abadie and Imbens 2011, Provencher et al 2013) and has been used and approved by utility stakeholder or regulatory groups in several jurisdictions (Opinion Dynamics June 2013, Illume Advising and Navigant Consulting 2014, Illume Advising and Klos Energy 2014). Using this approach, we created a comparison group based on energy usage. To create this group, program participants' pre-period electricity usage was matched to households with similar patterns of usage. Only participants with twelve contiguous months of electricity usage data prior to enrollment were retained for the analysis. As savings vary seasonally, a full year of data ensured coverage during all periods.

Following this process, the fifteen best non-participant matches were selected for each participant. The utilities had significant numbers of seasonal residents with large variations in usage. Since these customers had non-typical seasonal usage patterns, we incorporated usage variation in the matching so that participants were matched to non-participants with similar levels of variability. That is, seasonal customers were matched with seasonal customers. Finally, comparison households were then given a "bias adjustment" to account for remaining differences between themselves and participants during the matching pre-period (Abadie & Imbens 2011).

Figure 1 below shows the pre-period usage and post-period changes for participants and the matched comparison group for one of the four utilities.

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¹ Two of four utilities had been implementing the program for over 3 years.



Figure 1. Graphic Depiction of Pre-period Usage Matches (-60-0 months) and Post Period Changes (0-50 months) in Consumption between Participants and Comparison Group Matches for Beltrami Customers.

Data Cleaning

After the best matches were identified, additional data cleaning checks were performed, which subsequently removed some participants. Participants were removed if they had insufficient pre- or postperiod data or had large changes in usage in shoulder months (April, May, September, and October). Participants whose shoulder month usage dropped or increased by more than 50% from pre to post-period were removed.

It is unusual to see a change of more than 50% from one year to the next owing to weather alone. It is highly unlikely that participation in MyMeter was responsible for usage changes at those levels in the shoulder months. This preserved a broad spectrum of changes and was an equal cut-off in both directions, so as to not pre-impose estimated savings results.

Model

As shown in Table 1, first we estimated impacts of MyMeter participation on energy use for each utility separately. Then, to have sufficient numbers of customers in each sub-group, we pooled the sample to examine differences by baseline usage and program engagement parameters. Formally, the regression model is:

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kWH_{kt} = \alpha_{0t} + \alpha_1 Partic_{kt} + \alpha_2 PrekWh_{kt} + \varepsilon_{kt}
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Where:

 kWH_{kt} is the average daily electricity use by household k in month t

 α_{ot} is a monthly fixed effect

Partickt is an indicator variable with a value of 1 for participants and 0 for matched non-participants

 $PrekWh_{kt}$ is the average daily pre-participation electricity use by household k that is also the same calendar month as month t

 ε_{kt} is the error term

Results

Baseline Usage

The first area of savings explored was baseline usage. We divided customers into four categories based on their baseline average monthly electricity use. All customers except those with the lowest preprogram usage (<1000 kWh/mo) saved energy over the program period (**Figure 2**). The largest customers (>3000 kWh/mo) experienced the greatest percentage savings. All of the groups showed savings in the base months (April, May, September, October) and none of the groups showed savings in the summer. The largest energy users experienced savings in winter. These seasonal patterns suggest that most customers are reducing energy use from year-round sources such as lighting. Year-round sources like lighting comprise a larger share of energy use during the base months so changes in use are most likely to show up then. The largest customers, who likely use electric space heating, also reduced energy use in winter.





Timing

The first indicator of timing that we examined was the length of time between first and last login, which suggests how long customers were engaged with the program. We compared customers who logged in only once to customers who were active in the program for one to six months and those who were active for more than 6 months. Savings increased as length of time customers were active with the program increased from just one login to more than six months (**Figure 3**).



Figure 3. Savings by Length of Time Active in the Program

We also examined whether the time of year that a customer signed up for the program had an effect on savings. Over the course of the analysis period, the largest numbers of enrollments occurred in January, February and December. Typically these are months with high heating bills when customers may be more motivated to take immediate action. However, savings for those who sign up in winter are identical to those who enroll in shoulder months and only slightly higher than summer months. We explored this further by including baseline usage (**Figure 4**). Customers with higher baseline energy use who sign up for the program during the winter save significantly more than lower baseline users who sign up during the winter and they also save more than higher baseline users who sign up during other times of year. In contrast, customers with lower baseline energy use who sign up during the winter have significantly lower savings than those who sign up during other times of the year. The utilities may be successful at motivating enrollments during the high bills of winter months, but it is only translating to higher savings among those customers who have higher baseline energy savings. One possible explanation is that the customers with lower baseline energy usage could have a higher incidence of non-electric heat than those with higher baseline energy use.



Figure 4. Savings by Baseline Usage and Month of Opt-in to the Program

Longevity

To examine longevity, or persistence, of savings customers were grouped based on the number of years they participated in the program. The results show that savings persist at the same level over the first two years of the program and drop only slightly in the third year (**Figure 5**).





Depth

We used two approaches to model customer engagement. First, we divided customers into groups based on the number of times customers logged into MyMeter (one time, two times, three to nine times, 10 to 50 times and more than 50 times). Customers at all engagement levels saved energy with customers at the highest levels of engagement saving the most. These savings occurred during the spring and fall base months, again indicating that savings are coming from year-round sources such as lighting. Note that large energy users were spread across the engagement categories and were slightly over-represented in the highest engagement category. In order to explore the relationship between engagement and savings independent of baseline usage we looked at savings by the number of times customers logged into the program for the baseline groups under 2,000 kWh and over 2,000 kWh (**Figure 6**). We found that regardless of baseline usage, customers who logged in more often had higher savings, with the higher baseline usage customers experiencing higher savings than the lower baseline usage customers.



Figure 6. Savings by Baseline Usage and Number of Logins

Second, we compared customers who used additional program features such as energy markers, property profiles and threshold alerts to those who did not use those features. Customers that used the additional MyMeter features saved less energy than those that did not use any additional features. One potential explanation for this unexpected finding is that the use of these features is correlated with other factors that drive up energy use. Opt-in programs such as MyMeter may attract customers who are anticipating increases in their energy usage. These customers may be more likely to use additional features to monitor their energy use more closely in hopes of off-setting those planned increases. We further analyzed differences in savings among higher and lower baseline users who did and did not use the additional features, but found no clear pattern. These features were not available until later in the implementation period so further examination of the relationship between use of the features and energy savings is needed when more data are available.

Conclusions

In this paper we explored what drives savings in an opt-in online feedback behavior change program. Understanding who is more likely to save and under what conditions is important for fine-tuning the design of program and recruitment techniques. The data show several opportunities to improve design and recruitment as well as opportunities for further research.

The data show clear patterns that customers who use more energy and those who engage more deeply (based on the number of logins) and over a longer period of time, experience more savings.

The data also show that while winter months are the most frequent enrollment months, only customers with higher baseline usage experienced higher savings than customers who enrolled in other months. Conversely, customers with lower baseline usage who enrolled in the winter experienced significantly lower savings than those who enrolled in other months. This suggests an opportunity for the program to encourage enrollment to customers with different baseline usage at different times of year.

Future steps for this analysis include using a comprehensive multivariate analysis to isolate the impact of each factor and further examination of the relationship between use of additional program features and energy savings. For example, can incenting customers to engage with the program more frequently result in larger savings? Or do only customers who independently choose to more deeply engage experience more savings?

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