

# Evaluation of Residential Behavioral Savings Pilot

## Executive Summary

The Vermont Public Service Department (PSD) contracted with Cadmus to evaluate the Efficiency Vermont (EVT) Residential Customer Behavioral Savings (RCBS) Pilot. Starting in November 2014, Opower (now Oracle Utilities Opower), the RCBS Pilot implementer, delivered home energy reports (HERs) to residential customers of Green Mountain Power. The HERs provided energy efficiency education and tips to encourage customers to reduce their energy consumption. The PSD tasked Cadmus with estimating the RCBS Pilot's electricity savings, identifying behavior changes and energy efficiency improvements caused by the HERs, assessing customer satisfaction with the HERs, assessing the program cost-effectiveness, savings persistence, and measure life.

In December 2017, Cadmus delivered an RCBS Pilot evaluation report with 2016 findings and recommendations to the PSD. The report covered the pilot from January 2016 to December 2016, with separate analyses of savings for the original treatment group (Wave 1) and a refill group (Wave 2). The evaluation revealed that the RCBS Pilot saved 1.3% of consumption, increased participation in EVT upstream and downstream rebate programs, and was cost-effective. In addition, while customer satisfaction with HERs remained high, some customers found fault with the accuracy of the *neighbor comparison* featured on the report.

In 2017, EVT redesigned the home energy reports and emails to remove the social-normative neighbor comparison in response to complaints from customers about the accuracy of the comparisons. In place of the neighbor comparison EVT provided personalized energy-savings analyses and energy-saving tips to rebrand the reports as *Current Insights*. EVT also added a third pilot wave (Wave 3) of approximately 12,400 treatment group customers and 8,700 control group customers to account for participant attrition due to customer account closures. EVT delivered HERs to approximately 105,000 customers in 2017.

This evaluation covered the HER's pilot from January to December 2017, with impact findings for the three waves that tracks the progress of the Wave 1 and Wave 2 treatment groups since they first received HERs.

## Key Findings

### Evaluated Savings

Although EVT removed the neighbor comparison from the reports in 2017, the RCBS Pilot continued to generate electricity savings. Wave 1 customers saved approximately 1.4% of electricity consumption, while Wave 2 customers saved 0.6% and Wave 3 customers save 0.1%. Across all waves, treated customers saved 1.2% of consumption. The RCBS Pilot saved 9,380 MWh, which was 97% of Opower's forecast of 2017 savings.

Electricity savings in 2017 were essentially unchanged from 2016. Wave 1 savings decreased by 0.1% and Wave 2 savings increased by 0.1% from 2016 through 2017, suggesting that electricity savings reached a steady state. In contrast to previous waves, Wave 3 did not save electricity during the first year of treatment. This lack

of Wave 3 savings may be attributable to removing the neighbor comparison from reports in 2017, which meant that Wave 3 customers were not exposed to this form of treatment.

While the overall electric savings remained unchanged from 2016, there was a clear downward trend in monthly savings during 2017, suggesting diminution of savings. This downward trend in Wave 1 customer savings may be related to removing the neighbor comparison. However, to know with certainty, it would have been necessary to conduct a randomized experiment in 2017, with some randomly selected customers continuing to receive the neighbor comparison.

In 2017, high electricity consumption homes saved the most electricity. In Wave 1, high electricity consumption homes saved an average of 0.57 kWh per day, medium consumption homes saved 0.36 kWh per day, and low consumption homes saved 0.11 kWh per day. Although high consumption homes only accounted for 27% of treated homes in Wave 1, they were responsible for 50% of the savings.

Low-income customers saved as much electricity as regular-income customers. Comparison of Wave 1 low-income and regular-income customers revealed small and statistically insignificant differences in 2017 electricity savings. Low-income and regular-income customers had similar electricity consumption, which appears to have been a more important driver of savings than income.

## Efficiency Program Uplift

In 2017, HERs caused customers to participate in EVT's downstream energy efficiency programs and increased pilot electricity savings. HERs increased the rate of participation in the EVT downstream rebate program by 4.6% for Wave 1 customers, 3.7% for Wave 2 customers, and 12.5% for Wave 3 customers. Across the waves, customers receiving HERs were 5.5% more likely to participate.

HERs caused customers to adopt more efficient lighting. In surveys, treated customers reported purchasing 0.7 more LEDs over the previous 12 months than control group customers. The savings attributable to these LED purchases—after adjusting for in-service rates, installation dates, and other factors—was about 532 MWh.

Participation in upstream and downstream EVT programs in 2017 and previous years accounted for about 1,506 MWh, or 15% of the estimated RCBS Pilot savings for 2017. Approximately one-third of the uplift savings are attributable to customer adoption of LEDs. The remaining uplift savings are from customer adoption of measures rebated through EVT's downstream programs.

## Savings Persistence and Measure Life

Studies of HER programs in the United States indicates that electricity savings persist after treatment ends. Many studies of HER programs administered by other utilities have revealed that the average annual rate of savings decay is between 20% and 50% after customers stop receiving HERs, implying an HER measure life of between two and five years. However, some studies found significantly lower rates of savings decay, implying measure life greater than 10 years. The rate of savings decay depends on the frequency and duration of treatment. Customers who receive HERs more frequently and for longer periods of time have lower savings decay rates and longer measure life.

Existing studies of HER savings persistence may not have validity for Vermont. EVT has not conducted a HER savings persistence study. Program administrators of other HER programs have conducted such studies, but the utility service areas have different customer populations. Comparatively, Vermont utility customers tend to consume less electricity on average and have significantly lower penetrations of central air conditioning and electric space heat than customers of other electric utilities. These differences present validity challenges when comparing savings persistence outcomes.

The pause in HER delivery in April 2015 strongly suggest that HER savings persist after treatment ends but that savings decay rapidly if customers have been treated for less than one year. Between April 2015 and August 2015, when report delivery resumed, savings decayed from 1.2% to 0.4%, or at 22% per month. If EVT had not resumed delivery and with this rate of savings decay, the RCBS Pilot would have ceased to save electricity by April 2016.

### **Cost Effectiveness**

On balance, the RCBS Pilot was cost-effective from 2014 through 2017. Based on the societal cost test (SCT), the RCBS Pilot had a benefit/cost ratio of 1.4 from 2014 to 2017, and of 1.6 in 2017. The pilot continued to be cost-effective in 2017 because the electricity savings remained essentially unchanged from 2016. Cadmus attributed RCBS Pilot savings and costs to the low-income and regular-income customer segments, which helped to lift the pilot cost-effectiveness because of additional non-energy benefits attributable to low income customers.

### **Recommendations**

EVT should consider equity for all customer segments while targeting energy reports or other behavior-based treatments to the largest electricity consumers, since on average these customers save the most energy. To uplift and increase program participation EVT should continue to market its standard energy efficiency programs in any future behavior-based programs.

Given substantial uncertainty and lack of empirical evidence about HER measure life in Vermont, EVT should continue to assume a one-year HER measure life. While it is probable that the HER measure life is greater than one year, there remains great uncertainty about the specific measure life and there are too many differences between Vermont utility customers and customers of utilities elsewhere to assume that previous studies of other HER utility programs have validity for Vermont. EVT should consider conducting a measure life study based on analysis of utility customer consumption data to develop an accurate measure life assumption for the RCBS Pilot or a new, large behavior-based pilot. This study should be conducted as a randomized control trial (RCT) and the treatment groups should be sized to estimate the expected savings decay rate with sufficient precision.

EVT should consider re-evaluating the pilot cost-effectiveness annually.