Opinion Dynamics

Boston | Headquarters

617 492 1400 tel
617 497 7944 fax
800 966 1254 toll free

1000 Winter St
Waltham, MA 02451

National Grid Rhode Island System Reliability Procurement Pilot: 2012-2017 Summary Report

July 25, 2018

Opinion Dynamics

Contributors

Antje Flanders
Vice President

Jennifer Watters
Managing Consultant

Stefanie Wayland
Senior Director, Data Science

Drew Blumenthal
Consultant

Table of Contents

Table of Tables

Table of Figures

This page intentionally left blank.

Executive Summary

Feeders 33 and 34 of the Tiverton substation serve approximately 4,200 residential and 1,000 commercial customers in the coastal Rhode Island communities of Tiverton and Little Compton. In 2010, National Grid forecasted that these feeders would be capacity-constrained during summer afternoon peak hours starting in 2014. Weighing the cost of substation upgrades against non-wires alternatives, National Grid designed the System Reliability Procurement (SRP) pilot with a goal of reducing summer peak demand by up to 1 MW by 2017, thus deferring substation upgrades to at least 2018. Plans for the SRP non-wires alternative were filed and approved in 2012. After five years of activity, National Grid ended the SRP pilot in late 2017.

This report presents a summary of key findings from annual evaluations of the Rhode Island System Reliability Procurement (SRP) Pilot (2012-2017), conducted by Opinion Dynamics Corporation under contract to National Grid, and a final assessment of whether the pilot met its goal of delivering 1 MW in summer peak demand reduction to defer the substation update to 2018.

Program Offerings

National Grid used a three-pronged strategy to pursue its SRP peak demand reduction goals: (1) implementation of the DemandLink Programmable Controllable Thermostat Program, a new SRP-specific demand response offering, (2) enhancement of existing statewide energy efficiency offerings, and (3) introduction of new SRP-specific energy efficiency offerings. All three components were supported by an intensive and targeted marketing and outreach campaign that began in March 2012.

- **DemandLink Thermostat Program.** The DemandLink Thermostat Program provided temperature control devices to pilot-area customers. All participants received a WiFi-enabled programmable thermostat. Customers with window air conditioning (window AC) also received one or more plug devices, which allowed the WiFi-enabled thermostat to control their window AC unit(s). To be eligible, customers had to have a WiFi internet connection and either central air conditioning (central AC) or window AC, and they had to agree to participate in demand optimization events for at least two years. National Grid began calling demand response events in July 2014.

- **Enhanced Statewide Energy Efficiency Offerings.** National Grid provided increased incentives and conducted targeted customer outreach for three existing statewide energy efficiency offerings:

  - The **EnergyWise Home Energy Assessment Program** provides residential customers with a home energy assessment and a range of direct install measures. Beginning in 2014, the program offered pilot area customers LEDs instead of CFLs.

  - The **Small Business Direct Install (SBDI) Program** is the commercial equivalent of the EnergyWise Program, targeting small non-residential customers.

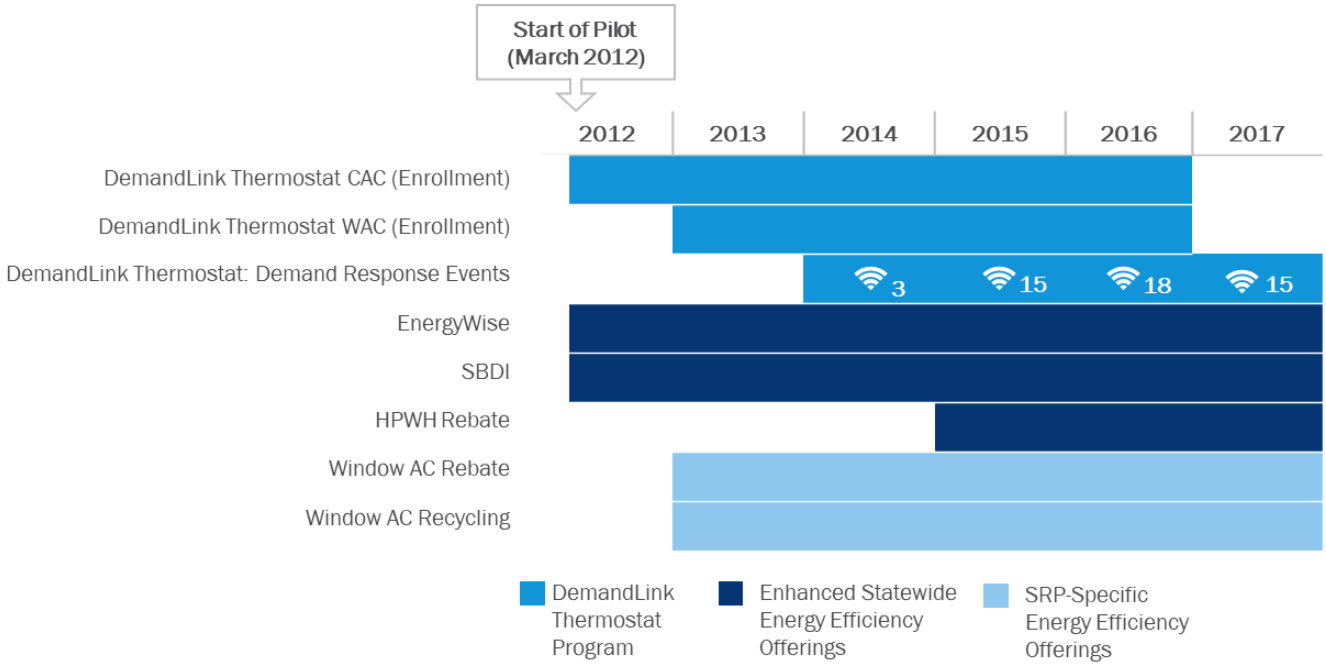
  - In 2015, National Grid began offering customers an enhanced rebate for the purchase of a new electric **heat pump water heaters (HPWH)**. To be eligible for the rebate, customers had to participate in the DemandLink Thermostat Program.

- **SRP-Specific Energy Efficiency Offerings.** To capitalize on the high incidence of window AC in the pilot area, National Grid introduced two new SRP-specific window AC rebate opportunities in 2013. Both rebates were available each year between May 1st and November 1st:

- **DemandLink Window AC Rebate Program.** Customers in Tiverton and Little Compton could receive a $50 rebate for the purchase of qualifying new window AC units, up to four units per household. Eligible units included those with an energy efficiency ratio (EER) greater than or equal to 10.8.
- **DemandLink Window AC Recycling Program.** Customers in Tiverton and Little Compton could receive a $25 rebate for window AC units they recycled, up to four units per household.

Figure ES-1 summarizes the timeline of the various program offerings.

Figure ES-1. Timeline of Program Offerings



Evaluation Activities

National Grid Rhode Island contracted with Opinion Dynamics to conduct annual evaluations of the SRP pilot. Throughout the pilot, evaluation activities were focused on two main topics: (1) the effectiveness of marketing activities in promoting and increasing program participation and (2) the load impacts realized by the pilot. In addition, some of the evaluations covered process-related topics such as drivers of and barriers to participation and participant experience during demand response events.

In support of the annual evaluations, Opinion Dynamics conducted a range of primary data collection activities, including several surveys with EnergyWise and DemandLink participants, two residential leads surveys, a general population survey, a DemandLink event follow-up survey, and a non-participant focus group. Impact analyses included application of deemed savings values to estimate EnergyWise and SBDI load impacts as well as HPWH savings; development of per unit savings estimates for window AC rebates; and estimation of central AC and window AC DR event impacts using regression analysis. Each annual evaluation concluded with an annual evaluation report.

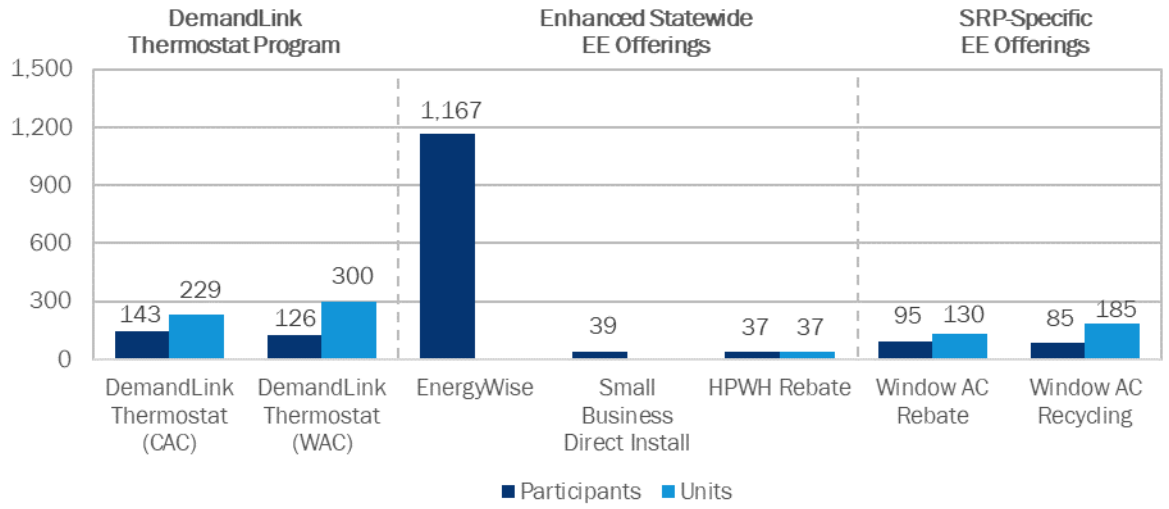
The findings and conclusions presented in this report are drawn from these annual evaluations. The objective of this summary report is to provide a big picture synthesis of the pilot's efforts, including what worked well and what did not work well, as well as lessons learned for potential future pilots. This report therefore does not repeat detailed findings from the earlier evaluation reports. However, where helpful, we include supporting information in the appendices and provide references to the earlier evaluation reports.[1]

Participation and Impact Summary

Overall, participation in the SRP pilot fell short of expectations, and cumulative load impacts did not meet the 1 MW goal. While the pilot succeeded in increasing enrollment in the EnergyWise Program and, to a lesser extent the SBDI Program, participation in the other program offerings was modest. In particular, participation in and savings from the DemandLink Thermostat Program fell short of expectations, largely driven by the low incidence of central AC among pilot area residents, challenges with thermostat and plug device connectivity, and a conservative event strategy.

Figure ES-2 summarizes pilot period participation in the pilot program components.

Figure ES-2. Pilot Area Participation and Equipment Installations (2012-2017)



Source: Program Tracking Data

We estimate cumulative peak demand savings for the pilot period to be 316 kW, less than a third of the 1 MW goal. Cumulative savings include all installations through the EnergyWise, SBDI, and rebate programs since 2012, excluding measures that have reached the end of their useful life. For the demand response events, impacts are based on participants whose thermostats were operational and able to receive the event signal and control cooling equipment the events.

The EnergyWise and SBDI programs were the biggest contributors to total load impacts, with 152 kW (48% of the total) and 96 kW (31% of the total), respectively. Demand response events accounted for 36 kW (11% of the total). Notably, load impacts from participants with window AC were nearly zero in 2016, leading the

[1] Appendix A presents a summary of the evaluation activities and key deliverables completed for each year of the SRP pilot.

program to stop calling events for these participants. Savings from the HPWH and window AC rebates were relatively small, accounting for a combined 31 kW (10% of the total).

Table ES-1 summarizes the cumulative SRP peak load impacts.

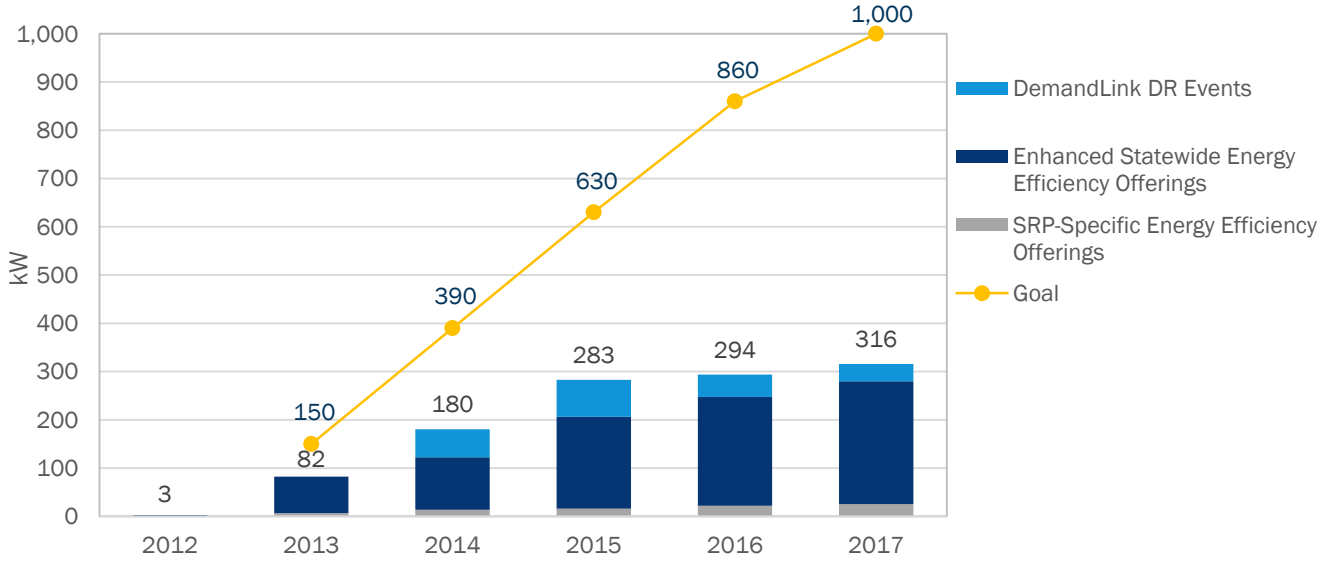
Table ES-1 Cumulative SRP Peak Load Impacts (kW)

Program	2012	2013	2014	2015	2016	2017	% 2017
DemandLink DR Events (CAC)	--	--	56.0	76.0	46.4	35.7	11%
DemandLink DR Events (WAC)	--	--	2.0	0.6	0.02	--	0%
EnergyWise Program	2.7	17.6	41.6	102.4	130.7	152.4	48%
Small Business Program	--	57.9	67.2	86.1	90.6	96.4	31%
Heat Pump Water Heater Rebate	--	--	--	1.6	4.3	5.9	2%
Window AC Purchase Rebate	--	0.8	1.0	1.2	1.5	1.6	1%
Window AC Recycling Rebate	--	6.1	12.6	14.9	20.4	23.6	7%
TOTAL	**2.7**	**82.4**	**180.3**	**282.9**	**293.9**	**315.7**	**100%**

Source: PY2012-2017 Gross Impact Analyses

Figure ES-3 shows the pilot's cumulative load impacts compared to the cumulative reduction National Grid expected to need to defer substation upgrades.

Figure ES-3. Cumulative Load Impacts (kW) Compared to Goal



Source: PY2012-2017 Gross Impact Analyses

Even though the pilot did not meet the 1 MW load reduction goal, its initial progress postponed the investment of the wires alternative that would have occurred in 2014 if not earlier. The investment in the substation upgrade was further deferred due to slower than expected load growth and cooler summer temperatures in 2017. However, since peak demand on feeders 33 and 34 is still high, National Grid decided in 2017 to issue a Request for Proposal (RFP) for a battery storage solution. Battery power will be

used to meet the remaining excess demand during peak load times, meaning that substation upgrades can be further deferred.

Key Findings and Recommendations

Based on the annual evaluations of the SRP pilot, we provide the following key findings and recommendations for potential future pilot offerings.

Goal Attainment

- While the pilot did not meet the 1 MW load reduction goal, its initial progress postponed the investment of the wires alternative that would have occurred in 2014 if not earlier. The investment in the substation upgrade was further deferred due to slower than expected load growth and cooler summer temperatures in 2017. Two key factors contributed to the pilot falling short of its goal:
  - **Lower than expected savings from the DemandLink Thermostat Program:** Residential demand response events achieved only 40 kW in 2017, compared to a target of 455 kW.[2] Low incidence of central AC among pilot area residents, challenges with thermostat and plug device connectivity, and a conservative event strategy were largely responsible for the residential shortfalls. In addition, the pilot had a target of 134 kW for commercial demand response events but never rolled out a commercial DemandLink program.
  - **Limited savings from SRP-specific energy efficiency offerings:** National Grid had set an aggressive load reduction target of 685 kW for SRP-specific energy efficiency offerings. However, National Grid only introduced two SRP-specific energy efficiency measures (rebates for new energy efficient window AC units and for window AC recycling), which only achieved a combined 25 kW due to limited uptake.
- Compared to the other two components, impacts from the enhanced statewide energy efficiency offerings (255 kW) were much closer to target (320 kW). These impacts largely resulted from increased participation in the EnergyWise Program. The pilot might have met this target, had it not been for two factors: (1) Lighting measures accounted for the vast majority of the savings in the EnergyWise Program. The changing baseline for residential lighting measures due to new EISA standards means that savings from these measures have been decreasing over time. (2) The pilot deemphasized the commercial sector after an initial push in 2013. As a result, savings from the SBDI Program between 2014 and 2017 were small.
- Because peak demand on feeders 33 and 34 is still high, National Grid decided in 2017 to issue an RFP for a battery storage solution. Battery power will be used to meet the remaining excess demand during peak load times, meaning that substation upgrades can be further deferred.

Marketing Effectiveness

- Pilot marketing efforts were effective in generating awareness of and interest in the various SRP offerings. Lead activity, as well as participation, tended to increase following outreach campaigns, particularly in 2013, the first full year of the pilot. In subsequent years, there was a much smaller increase in participation, suggesting that much of the “low hanging fruit” had been harvested.

[2] The total cumulative kW reduction target was greater than 1 MW to allow for some loss of impacts due to DemandLink participants opting out of demand response events.

- Direct mail was consistently identified as the most recalled and memorable marketing channel among both participants and non-participants. More resource-intensive strategies, such as outbound phone calls for residential customers and door-to-door canvassing for small business customers, were also very successful, when deployed, and should be considered for future efforts (if budgets allow). Email outreach tended to be less memorable than other methods, but given its low cost is a good supplementary approach to other outreach methods.

- Throughout the course of the pilot, the EnergyWise Program had the highest levels of awareness and interest among the various pilot offerings. This is not surprising, given that EnergyWise is a long-running statewide program and is applicable to a broad range of residential customers. For future efforts, National Grid should continue to leverage programs like EnergyWise as a screening and channeling mechanism for other offerings. Future programs should also ensure that other program offerings are systematically promoted during the in-home assessments.

- Focus group participants expressed a desire for more transparent messaging around the demand response events and why National Grid had targeted Tiverton and Little Compton for the offering. The societal and community benefits of the program, including lower greenhouse gas emissions and improved grid reliability, were thought to be potential drivers of participation for customers who are not motivated by free equipment or bill savings. While National Grid began including a "Good for you/good for your community" theme in its messaging in 2014—mainly in newsletters and often combined with other offers and messaging—research conducted with residential leads in 2014 and 2015 suggests that this theme and the messaging around local benefits did not fully take hold among potential participants. For future community-focused efforts like the SRP pilot, National Grid should consider making community benefits a more central and clearly visible theme of outreach messaging, as they are often effective in motivating additional groups of customers. Incorporating the community name into the name of the pilot (e.g., the "Marshfield Energy Challenge"), if possible, can be another way of emphasizing the community-aspects of the program.

- While awareness of the various program offerings was generally high, it was lowest for the window AC recycling rebate, and that offering also had the lowest number of leads in 2014 and 2015. Messaging for this rebate was generally combined with information about other offerings and might therefore not have received much notice by customers. Yet, this offering accounted for 7% of pilot load impacts. For future efforts, to better promote offers like the window AC recycling rebate, National Grid should consider more focused messaging, e.g., in combination with a time-limited enhanced rebate, or an "event" like *Window AC Recycling Month*, which can be effective in promoting action by potential participants.

DemandLink Thermostat Program

- Savings from the DemandLink demand response events fell short of expectations, with only 36 kW, or 11% of total pilot load impacts, compared to a target of 590 kW.

- The DemandLink Thermostat Program encountered three challenges in realizing expected load reductions from demand response events: (1) low enrollment in the program; (2) significant connectivity issues, especially for participants with window AC; and (3) an event strategy that resulted in lower than expected hourly per household event savings.

Enrollment

- Enrollment in the program was limited, largely due to the small population in the pilot area and the low incidence of central AC among pilot area residents. Even among those that do have central AC, some customers questioned whether they use it enough to justify the need for supplemental equipment to automate a cooling schedule or to warrant participation in events. Adapting to these local circumstances, National Grid began offering plug devices to enable customers with window AC to participate in the program. However, this approach was plagued with technical issues such as low connectivity, even in the year when the participant enrolled and first installed the equipment, leading to few event participants. Following extremely low evaluation results, the plug device offering was discontinued in 2016. Given the challenges inherent in basing a demand response program on equipment that, by definition, will be removed every year, we do not recommend this approach for any future pilots.

Event Participation

- The high incidence of missing log files and log files with no data severely limited the load impacts realized by the program. While connectivity issues were not too surprising for customers with window AC, the high incidence of missing data for customers with central AC, especially in the final years of the pilot, was unusual. While National Grid did some investigations of the issue with Ecobee, the source of the problem was never fully diagnosed. For future programs, we recommend keeping a close eye on connectivity issues and asking for more accountability from the event implementer.

Event Strategy

- Savings per thermostat tended to be lower than generally seen for similar demand response programs. Several components of the event strategy chosen by the program contributed to this:
  - The program chose a 2°F offset strategy for customers with central AC, fearing that a cycling strategy or a higher offset would lead to participant dissatisfaction. However, small temperature offsets are subject to decreasing load impacts in later event hours, as the room temperature more quickly reaches the new setpoint. For example, average hourly impacts for the 2017 events were 0.75 kW for the first hour, 0.52 kW for the second hour, and 0.33 kW for the third hour. For future efforts, National Grid should consider using a cycling strategy, which would avoid the decrease in savings in later event hours, or a more aggressive offset strategy, e.g., of 3 or 4°F, which would reduce the decrease in savings.
  - In 2017, National Grid changed the length of its demand control events from 4 hours to 3 hours. This change helped avoid the near-zero savings observed in the last hour of prior events and resulted in the highest average hourly per thermostat savings across the four event seasons. For future efforts, National Grid should keep the shorter event length. National Grid should also ensure that events start as closely to the predicted peak demand as possible, so that the higher first-hour savings are realized during the times of highest demand. (In addition, most events have snapback that increases load for at least an hour after the event period. If events start too far ahead of peak conditions, snapback could occur during peak demand.)
  - The SRP event strategy did not include pre-cooling. Precooling is an effective approach for both offset and cycling strategies as it delays the room temperature reaching the new setpoint, thereby further reducing event time usage. For future efforts, National Grid should consider the addition of pre-cooling to its event strategy.
  - In 2017, National Grid called events when daytime temperatures, nighttime temperatures, or humidity forecasts met certain trigger conditions. In prior program years, events had been called

based on load forecasts, i.e., when peak demand was predicted. The 2017 strategy resulted in one-third of events being called when event time temperatures were very moderate (between 69 to 73°F); these events tended to have lower savings than events with higher event time temperatures. Calling events during moderate temperature conditions is justified if the demand reduction is needed at that time (based on load forecasts). If it is not needed, then these events will result in lower average event savings for the program. For future efforts, National Grid should ensure that events are called at times of predicted peak demand, rather than using trigger conditions, which may not well correlate with peak demand.

Enhanced Statewide Energy Efficiency Offerings

- National Grid's enhancement of existing statewide offerings, i.e., the EnergyWise Program, the SBDI Program, and the HPWH rebate, were the most successful component of the pilot, contributing 255 kW, or 81%, to total pilot load impacts.

EnergyWise Program

- SRP outreach efforts were successful in increasing annual EnergyWise participation rates from 1.1% prior to the pilot to 3.6% during the pilot period (an increase of 228%). In contrast, average annual participation rates in the comparison towns increased from 1.5% to 2.5% (an increase of 70%). Direct mailings, word-of-mouth, and outbound phone calls from National Grid were the most common ways for participants and leads to find out about the program.

- Research with program leads identified difficulty finding the time to be home for the assessment as the top barrier to participation. In addition, 10% of leads in the program reported challenges when they tried to schedule an appointment, including difficulty reaching a representative and limited options for appointments (including lack of weekend appointments and no available appointment for over a month). While program participation was generally strong, it did start to decline towards the end of the pilot period. For future efforts, National Grid should consider ways to reduce these barriers, e.g., by ensuring that appointments can be made in a timely fashion and at times that work for the prospective participants.

- Lighting measures accounted for the vast majority of savings, initially in the form of CFLs (2012-2013) and later in the form of LEDs (2014-2017). While these measures contributed significantly to deferring substation upgrades in the early years of the pilot, the changing baseline for residential lighting measures (due to new EISA standards) resulted in decreasing savings from these measures over time. As is the case for residential demand side management programs across the country, National Grid will have to diversify away from lighting measures for future efforts if it wishes to leverage this type of program in support of its peak load reduction goals.

SBDI Program

- Participation in the SBDI Program increased markedly in 2013 (from 2% prior to the pilot to 7%) because of increased outreach activity, including door-to-door canvassing. However, the program discontinued these efforts in 2014 because the door-to-door canvassing was expensive and small business opportunities were judged to be limited. As a result, participation returned to pre-pilot levels in 2014 and stayed at this level for the remainder of the pilot. Considering that the SBDI Program achieved over 50% of its 5-year participation in 2013—and accounted for almost one-third of cumulative pilot load impacts—the pilot may have missed an opportunity for additional savings, by discontinuing small business outreach efforts after 2013. For future efforts, National Grid should

consider continued small business outreach, even if using less expensive outreach channels, especially if residential opportunities are limited.

HPWH Rebate

- Introduced in 2015, the HPWH rebate had a relatively small impact on overall pilot savings (2% of pilot totals). Receipt of the HPWH rebate was tied to participation in the DemandLink Thermostat Program, which can be an effective strategy in promoting other program offerings. For future efforts, National Grid should carefully examine the effect of this conditionality on rebate participation and monitor participation in the other offerings: Based on SRP pilot tracking data, only four of 27 HPWH participants in 2015 and 2016 were also enrolled in the DemandLink Thermostat Program.

New SRP-Specific Energy Efficiency Offerings

- To capitalize on the high incidence of window AC in the pilot area, National Grid introduced two new SRP-specific window AC rebate opportunities in 2013. Overall, these new rebates generated 25.2 kW in peak load reductions (or 8% of pilot totals). The majority of these impacts came from recycling inefficient window AC units without replacing them with a new unit. Savings from the purchase of new efficient window AC units or the recycling of inefficient units with replacement, on the other hand, generated relatively small savings.

- A majority of non-participants were unaware of the available rebates for purchasing new efficient window AC units (57%) and recycling old inefficient units (71%). However, the potential customer base eligible to receive a rebate for purchasing a new window AC unit was quite large: Almost 4 out of 10 customers (39%) used or planned to use window AC to cool their home in the summer, and 35% of those window AC users (or 14% of all customers) were likely to purchase a new window AC unit in 2017. In addition, 19% of customers had window AC units that they no longer used or that they were thinking about replacing in 2017.

1. Introduction

Feeders 33 and 34 of the Tiverton substation serve approximately 4,200 residential and 1,000 commercial customers in the coastal Rhode Island communities of Tiverton and Little Compton. In 2010, National Grid forecasted that these feeders would be capacity-constrained during summer afternoon peak hours starting in 2014. Weighing the cost of substation upgrades against non-wires alternatives, National Grid designed the System Reliability Procurement (SRP) pilot with a goal of reducing summer peak demand by up to 1 MW by 2017, thus deferring substation upgrades to at least 2018. Plans for the SRP non-wires alternative were filed and approved in 2012.

1.1 Program Offerings

National Grid used a three-pronged strategy to pursue its SRP peak demand reduction goals: (1) implementation of the DemandLink Programmable Controllable Thermostat Program, a new SRP-specific demand response offering, (2) enhancement of existing statewide energy efficiency offerings, and (3) introduction of new SRP-specific energy efficiency offerings. All three components were supported by an intensive and targeted marketing and outreach campaign that began in March 2012.

DemandLink Programmable Controllable Thermostat Program

The DemandLink Thermostat Program provided temperature control devices to pilot-area customers. All participants received a WiFi-enabled programmable thermostat. Customers with window air conditioning (window AC) also received one or more plug devices, which allowed the WiFi-enabled thermostat to control their window AC unit(s). To be eligible, customers had to have a WiFi internet connection and either central air conditioning (central AC) or window AC, and they had to agree to participate in demand optimization events for at least two years. Customers received an annual bill credit for participating in all demand optimization events.

During 2016, the pilot discontinued offering plug devices and began enrolling new pilot participants with central AC through the statewide Connected Solutions Demand Response Program. National Grid began calling demand response events in July 2014. During the first summer, only three events were called. Between 2015 and 2017, National Grid called between 15 and 18 events per summer. Events lasted for four hours in 2014 to 2016 and for three hours in 2017.

Enhanced Statewide Energy Efficiency Offerings

National Grid provided increased incentives and conducted targeted customer outreach for three existing statewide energy efficiency offerings:

- **EnergyWise Home Energy Assessment Program.** The EnergyWise Program provides residential customers with a home energy assessment and a range of direct install measures. Beginning in 2014, the program offered customers in the pilot area LEDs instead of CFLs.
- **Small Business Direct Install (SBDI) Program.** The SBDI program is the commercial equivalent of the EnergyWise program, targeting small non-residential customers.
- **Electric Heat Pump Water Heater (HPWH) Rebate.** In 2015, National Grid began offering customers an enhanced rebate of $1,100 (compared to a $750 rebate offered through the statewide program) for the purchase of a new electric HPWH. To be eligible for the rebate, customers had to participate in the DemandLink Thermostat Program.

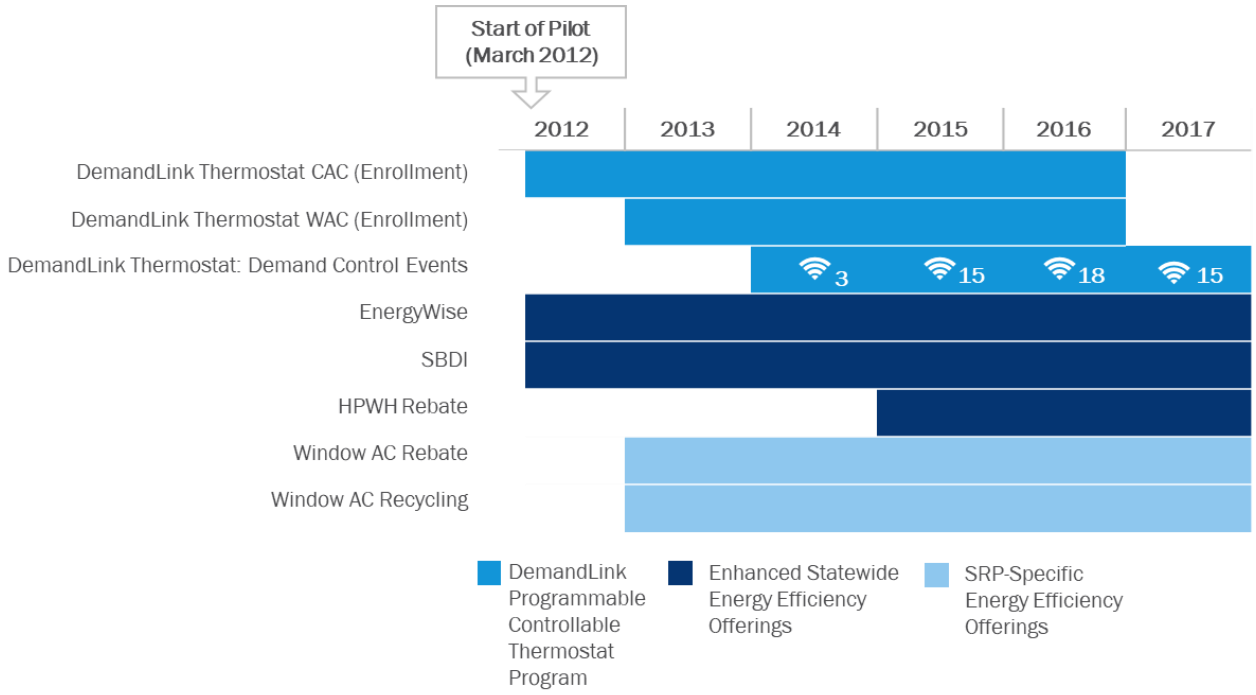
SRP-Specific Energy Efficiency Offerings

To capitalize on the high incidence of window AC in the pilot area, National Grid introduced two new SRP-specific window AC rebate opportunities in 2013. Both rebates were available each year between May 1st and November 1st:

- **DemandLink Window AC Rebate Program.** Customers in Tiverton and Little Compton could receive a $50 rebate for the purchase of qualifying new window AC units, up to four units per household. Eligible units included those with an energy efficiency ratio (EER) greater than or equal to 10.8.
- **DemandLink Window AC Recycling Program.** Customers in Tiverton and Little Compton could receive a $25 rebate for window AC units they recycled, up to four units per household.

Figure 1-1 summarizes the timeline of the various program offerings.

Figure 1-1. Timeline of Program Offerings



1.2 Evaluation Activities

National Grid Rhode Island contracted with Opinion Dynamics to conduct annual evaluations of the SRP pilot. Throughout the pilot, evaluation activities were focused on two main topics: (1) the effectiveness of marketing activities in promoting and increasing program participation and (2) the load impacts realized by the pilot. In addition, some of the evaluations covered process-related topics such as drivers of and barriers to participation and participant experience during demand response events.

In support of the annual evaluations, Opinion Dynamics conducted a range of primary data collection activities, including several surveys with EnergyWise and DemandLink participants, two residential leads surveys, a general population survey, a DemandLink event follow-up survey, and a non-participant focus

group. Impact analyses included application of deemed savings values to estimate EnergyWise and SBDI load impacts as well as HPWH savings; development of per unit savings estimates for window AC rebates; and estimation of central AC and window AC DR event impacts using regression analysis. Each annual evaluation concluded with an annual evaluation report.

The findings and conclusions presented in this report are drawn from these annual evaluations. The objective of this summary report is to provide a big picture synthesis of the pilot's efforts, including what worked well and what did not work well, as well as lessons learned for potential future pilots. This report therefore does not repeat detailed findings from the earlier evaluation reports. However, where helpful, we include supporting information in the appendices and provide references to the earlier evaluation reports.

Appendix A presents a summary of the evaluation activities and key deliverables completed for each year of the SRP pilot.

1.3 Organization of Report

The remainder of this report presents key impact and process evaluation findings for the Rhode Island SRP pilot. It is organized as follows:

- Section 2 presents an overview of Marketing and Outreach Efforts including a summary of campaign activities and an assessment of marketing effectiveness.
- Section 3 presents key participation, impact, and process findings for the DemandLink Thermostat Program.
- Section 4 presents key participation, impact, and process findings for the Enhanced Statewide Energy Efficiency Offerings, i.e., the EnergyWise Program, the SBDI Program, and the HPWH rebate.
- Section 5 presents key participation and impact findings for the SRP-Specific Energy Efficiency Offerings, i.e., the window AC rebates.
- Section 5 presents key conclusions and recommendations.
- Section 7 presents references, including the various evaluation reports upon which the findings in this report are based.
- Appendix A provides additional detail on the evaluation activities performed over the course of the pilot.
- Appendix B provides additional detail on EnergyWise gross impacts
- Appendix C provides additional detail on EnergyWise net impacts
- Appendix D provides additional detail on SBDI gross impacts
- Appendix E provides additional detail on SBDI net impacts

2. Marketing and Outreach Efforts

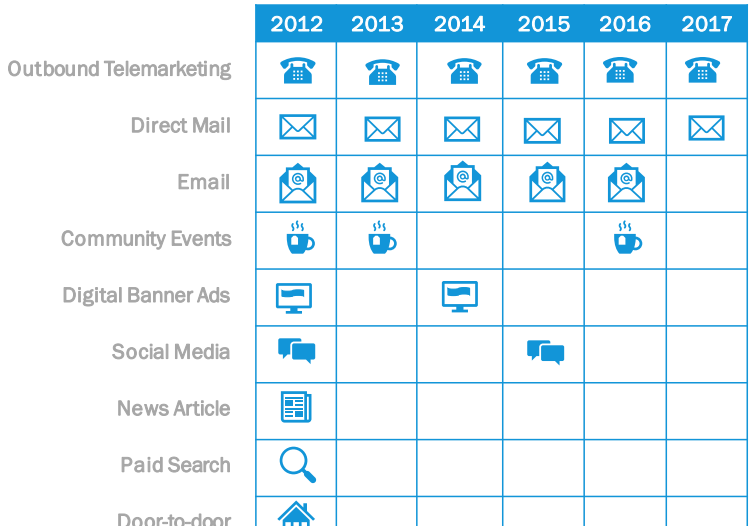
Starting in 2012, National Grid increased marketing and outreach to encourage participation in select existing statewide energy efficiency programs as well as new programs that were offered exclusively to customers in the Tiverton and Little Compton pilot area.

2.1 Summary of Campaign Activities

National Grid deployed a multi-touch, multi-channel marketing campaign to reach customers over the course of the pilot and encourage participation in the various program offerings. While messaging was disseminated through a variety of channels, the cornerstone of the campaign consisted of outbound telemarketing, direct mail, and email. Throughout the campaign, marketing materials provided customers with a phone number or email address to contact program staff and learn more about the offerings. RAM Marketing received these calls and emails and directed qualified customers to RISE Engineering to sign up for the EnergyWise and DemandLink Thermostat programs.

Although the pilot officially started in March 2012, marketing activities did not begin to ramp up until June 2012, targeting residential customers. Marketing towards commercial customers started in August 2012. In the first program year, the campaign targeted DemandLink messaging to customers who had previously had an audit through the EnergyWise Program or who were identified as having historically high summer usage. Marketing activities to small businesses focused on door-to-door outreach. In 2013, National Grid began deploying marketing activities much earlier in the year, with the first materials going out to customers by mid-April. The campaign shifted its focus from targeting specific lists of customers and began including all pilot area customers in its outreach. It also increased the frequency of direct mail, email, and outbound telemarketing.

Figure 2-1. SRP Marketing Channels 2012-2017



The campaign held one community event in both 2012 and 2013. In 2016, the campaign enlisted volunteers to staff information tables and promote the pilot offerings at local organizations and community events between June and September.

Figure 2-1 provides a summary of channels employed throughout the campaign, by year.

National Grid typically kicked off campaign activities in April each year, deployed the bulk of messaging in the late spring and summer months, and ramped activities down through the fall. Telemarketing activities typically closely followed key direct mail campaigns. Figure 2-2 provides an example of the annual timeline of marketing activities for a typical year.

Figure 2-2. 2016 SRP Marketing Timeline

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Direct Mail				■	■		■	■		■	■	
Email									■			■
Telemarketing					■	■		■	■			
Community Outreach						■	■	■	■			

Messaging in 2012 and 2013 centered around a "Save money/save energy" theme. Prompted by focus group findings in late 2013, the pilot added a "Good for you/good for your community" theme beginning in 2014. This theme focused on positioning the DemandLink Program as beneficial to both the participant and the local community. National Grid also launched the LinkUp newsletter in 2014, which grounded DemandLink as a program designed to benefit the community by preventing the need to build additional infrastructure. The newsletter provided updates on participation counts, called non-participants to sign up, and provided current participants with additional tips on using their thermostat and plug devices throughout the year.

Starting in 2015, marketing pieces also began to include information on the HPWH rebate as well as reminders for participants to reinstall removed devices and check that the WiFi thermostats and the plug devices were connected to their internet.

September 2012 Email

Summer 2016 Post Card

October 2016 Newsletter

2.2 Marketing Effectiveness

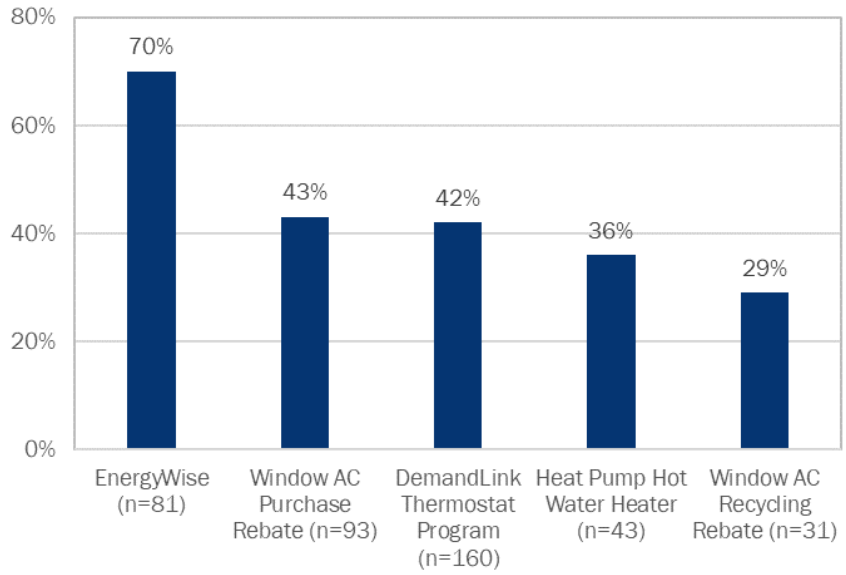
To assess the effectiveness of the pilot's marketing and outreach efforts, all annual evaluations included primary research with participants, leads, and/or non-participants. In specific, Opinion Dynamics conducted focus groups with non-participants in late 2013; online surveys with EnergyWise participants following the 2013, 2014, 2015, and 2017 program years; telephone surveys with residential leads in early 2015 and 2016; and an online general population survey in early 2017. Covered topics included awareness of and interest in the various program components, recall of specific marketing materials, and the effectiveness of those materials in inducing program participation.

2.2.1 Program Awareness

Based on the pilot's outreach strategy, all customers in Tiverton and Little Compton should have received multiple pilot-related messages through various marketing channels over the course of the pilot period. To assess the effectiveness of these outreach efforts, we fielded a general population survey in early 2017 after close to five years of SRP marketing. This survey asked about customer awareness of the various SRP program components. Among non-participants, survey results showed the highest levels of awareness with the EnergyWise Program (70%). This is not surprising, given that EnergyWise is a long-running statewide program and is applicable to a broad range of residential customers. Awareness of other program components, although lower, was strong as well, with over 40% reporting awareness of the SRP-specific window AC purchase rebate and the DemandLink Thermostat Program. Awareness of the HPWH rebate, which was introduced in 2015, and the window AC recycling rebate were lowest, at 36% and 29%, respectively.

These results suggest that the program did a good job overall, making pilot area residents aware of the various SRP offerings.

Figure 2-3 Awareness of Program Components (Non-Participants)



Source: PY2016 General Population Survey

2.2.2 Program Interest

Another indicator of effective marketing is heightened lead activity following outreach efforts. SRP leads are customers who expressed interest in one or more SRP program offerings (through inbound requests or outbound telemarketing) but had not yet participated in that program offering. To correlate lead activity with marketing efforts, Opinion Dynamics, in support of the 2015 annual program evaluation, conducted an analysis of 2013-2015 tracking data compiled by RISE and RAM.

Overall, the program recorded 628 residential leads in 2014 and 555 residential leads in 2015. In both years, the vast majority (over 80%) of SRP leads were interested in the EnergyWise Program. Interest in the other SRP programs was much lower, and leads in all program components decreased between 2014 and 2015.

Table 2-1. 2015 Customer Interest by Program

SRP Program	2014 Leads		2015 Leads	
	Count	% [a]	Count	% [a]
EnergyWise Program	526	84%	450	81%
DemandLink Programmable Controllable Thermostat Program	173	28%	84	15%
DemandLink Window AC Rebate Program	76	12%	31	6%
DemandLink Window AC Recycling Program	69	11%	20	4%
Total Leads (Any Program)	**628**		**555**	

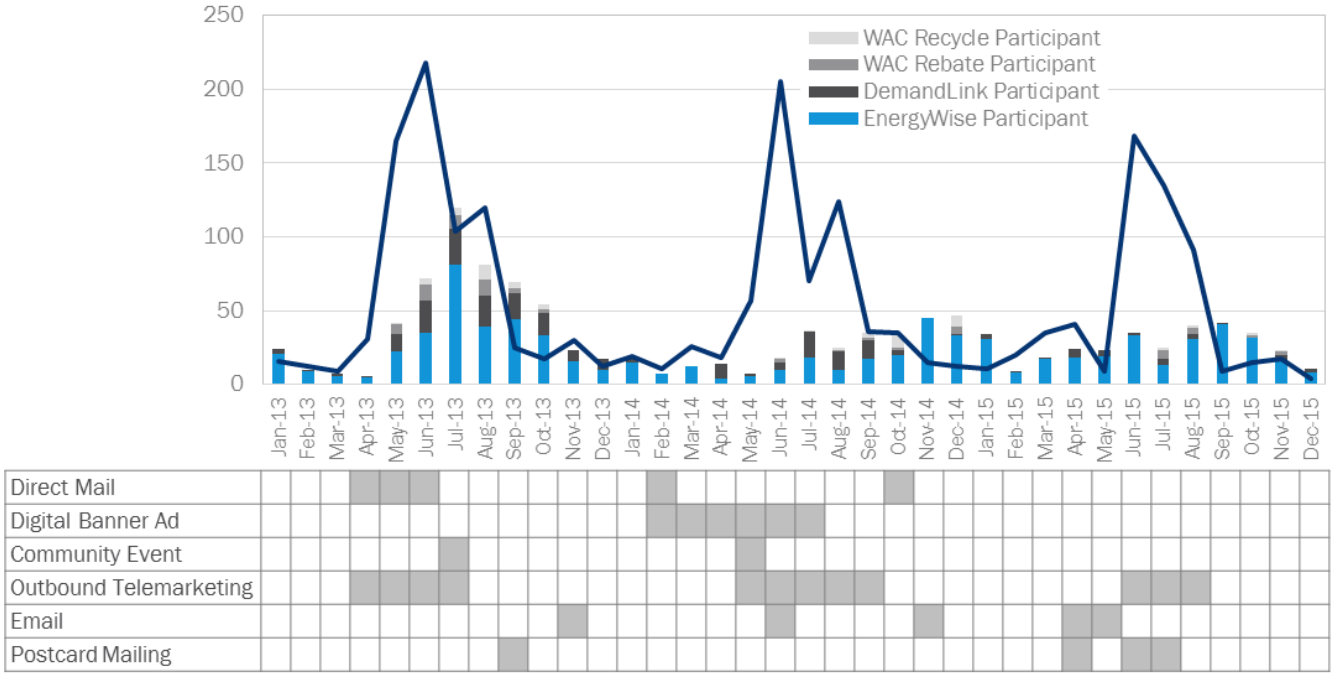
Source: PY2015 Residential Leads Analysis

[a] Total sums to more than 100% because some customers expressed interest in multiple programs.

Heightened lead activity followed increases in marketing efforts in the spring and early summer of 2013, 2014, and 2015, suggesting success in generating program interest. Program tracking data also shows an increase in participation, following the peak in leads. This spike in participation is especially pronounced in 2013, the first full year of the pilot. Subsequent years show a much smaller increase in participation, suggesting that much of the “low hanging fruit” had been harvested.

Figure 2-4 summarizes lead activity and participation between 2013 and 2015.

Figure 2-4. Program Leads in SRP Pilot Communities (2013-2015)



Source: PY2015 Residential Leads Analysis

2.2.3 Effectiveness of Different Outreach Channels

In addition to program awareness, the 2017 general population survey also explored customer recall of 2016 marketing activities, including specific outreach materials (a newsletter, a post card, and an email) as well as the effectiveness of these materials in stimulating interest in participation.

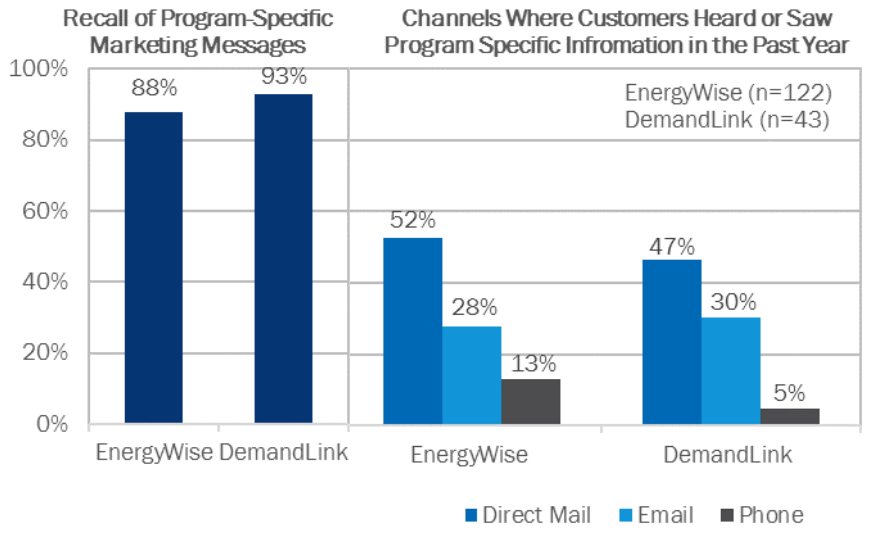
General Recall of Messaging

The survey first asked customers if they recalled hearing or seeing any information about each program component during 2016.[3]

Participant recall of messaging about components in which they had already participated (in 2016 or prior years) was very high, with 88% of EnergyWise and 93% of DemandLink participants remembering receiving program information in 2016. These participants most often recalled receiving information in the mail (52% and 47%, respectively). Program participants less frequently remembered receiving emails (28% and 30%, respectively) or phone calls (13% and 5%, respectively) from the pilot. Figure 2-5 summarizes these findings.

[3] These questions were only asked of customers who had heard of the program component prior to the survey. Customers who reported not owning their home did not receive questions about the HPWH rebate, and customers who did not plan to use window AC or to recycle a window AC unit in 2017 did not receive questions about window AC rebates.

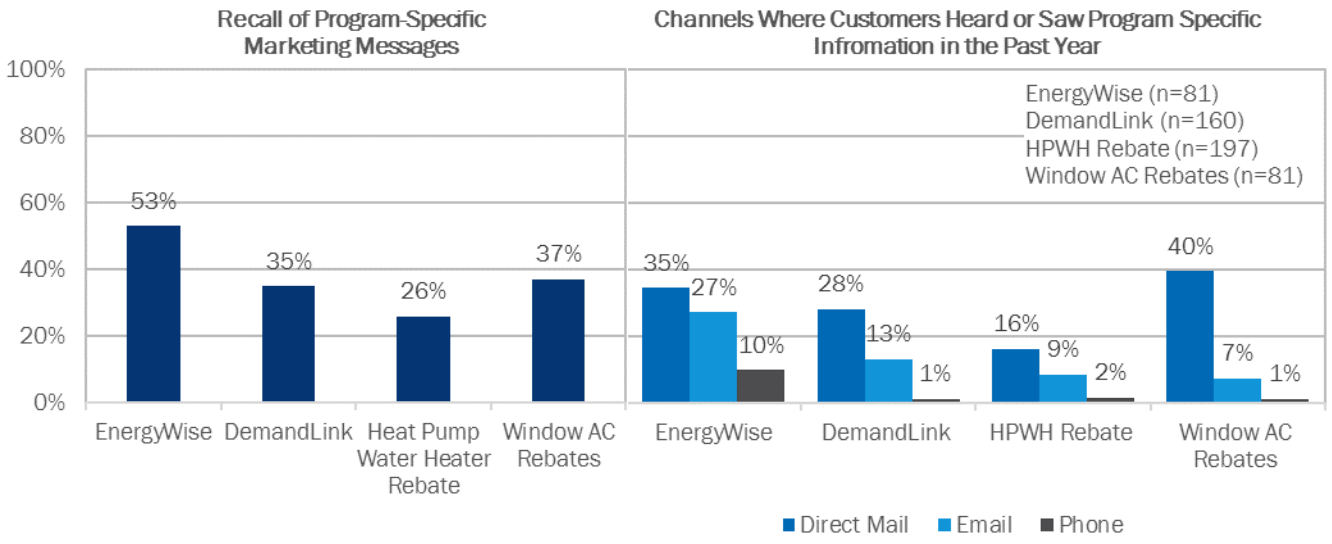
Figure 2-5. Recall of Program-Specific Marketing Messages (Participants)



Source: PY2016 General Population Survey

Recall of component-specific messaging among non-participants was lower compared to participants, but still high: 53% of customers who had not yet participated in the EnergyWise Program remembered receiving information about it 2016, most often in the mail. Recall rates for other program components were significantly lower (37% for window AC rebates, 35% for DemandLink, and 26% for HPWH rebates), yet still relatively high. Across all components, non-participants were most likely to remember information they received in the mail.

Figure 2-6. Recall of Program-Specific Marketing Messages (Non-Participants)



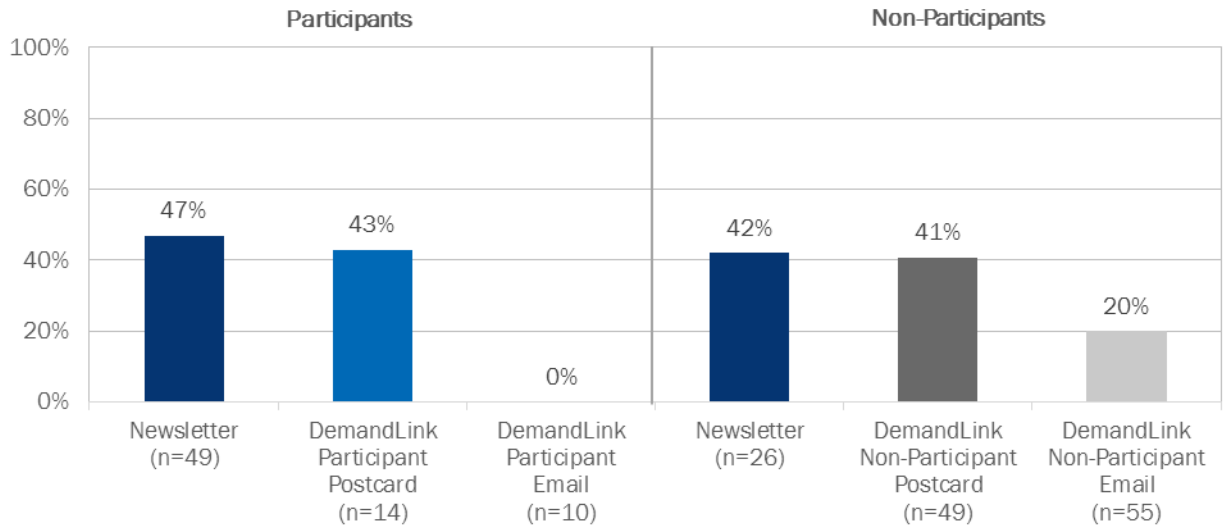
Source: PY2016 General Population Survey

Recall of Specific Marketing Materials

To assess the effectiveness of messaging used by the pilot in 2016, the 2017 general population survey included detailed questions about three key marketing pieces: a postcard sent in August, a newsletter sent in October, and an email sent in December. DemandLink participants and non-participants received different versions of the postcard and email, each with messaging tailored to their participation status. The online survey showed respondents images of the materials and assessed customer recall of the specific materials as well as prior familiarity with the content.

Figure 2-7 shows respondent recall of the key marketing pieces. In general, the direct mail pieces were more memorable than the emails, and participants and non-participants tended to recall the materials at similar rates. Recall rates by non-participants are relatively high, at 42% for the newsletter, 41% for the postcard, and 20% for the email.[4]

Figure 2-7. Recall of Marketing Materials



Source: PY2016 General Population Survey

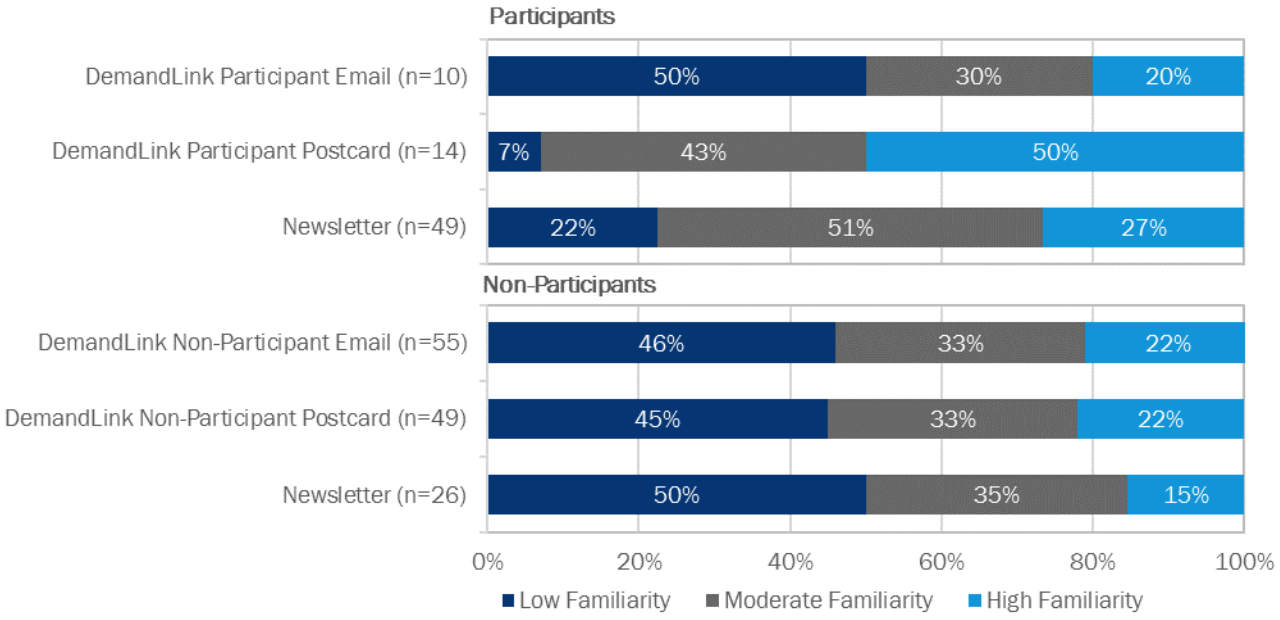
After reviewing the materials, respondents were asked how much of the information in the images was new to them. We used this question to assess the degree to which past program messaging is remembered by customers. We categorized customers who indicated that none or very little of the information was new as having "high familiarity" while those who indicated that most or all of the information was new as having "low familiarity."

Overall, DemandLink participants had the highest level of familiarity with the content of the postcard (50% high familiarity; 43% moderate familiarity), followed by participant familiarity with the content of the newsletter (27% high familiarity; 51% moderate familiarity). Non-participant familiarity was relatively consistent across the three outreach channels and comparable to DemandLink participant familiarity with

[4] The utility industry standard for email open rates is (22%). Considering a customer has to open an email to recall it, a recall rate of 20% suggest an open rate that is in line with, or exceeds, what would be expected for email outreach. (Source: Questline, 2015 Energy Utility Email Benchmarks Report available at: https://cdn.questline.com/asset/get/47a2f0f7-f0fd-4917-b7b6-2625e84ef911)

the content of the email: all had a level of high familiarity between 15% and 22% and a level of low familiarity between 45% and 50%.

Figure 2-8. Recall of Information Provided by Marketing Material (By Participation Status)



Source: PY2016 General Population Survey

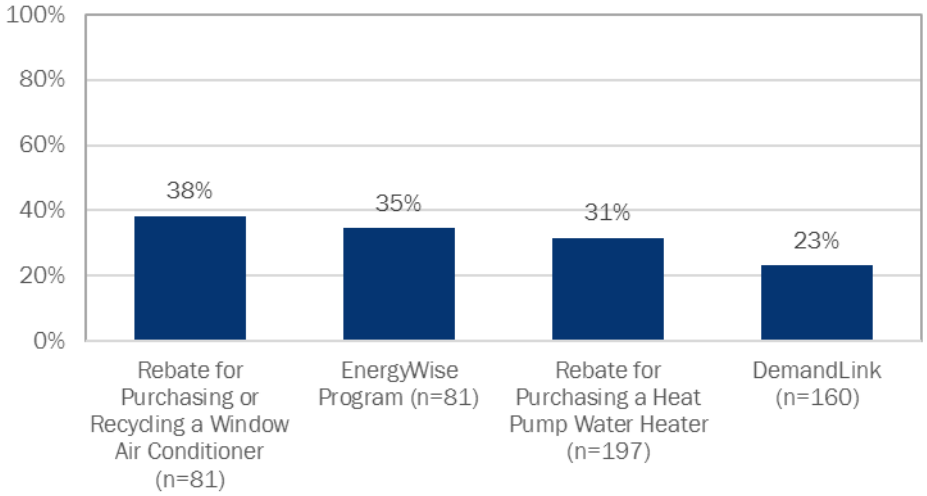
Interest in Programs after Review of Messaging

The final set of questions in the 2017 general population survey assessed customers' likelihood to visit the pilot's website or get more information about one or more of the offerings, following their review of the materials. Overall, 48% of respondents reported being likely[5] to seek out more information.

Of non-participants eligible to participate in the various components, about one-third were interested in seeking more information about window AC rebates (38%), the EnergyWise Program (35%), and the HPWH rebate (31%). Significantly fewer DemandLink Thermostat Program non-participants were likely to seek more information about that program (23%).

[5] A rating of 3 or greater on a 5-point scale, where 1 means "not at all likely" and 5 means "very likely".

Figure 2-9. Interest in More Information About Program (Non-Participant in Program Component)



Source: PY2016 General Population Survey

2.2.4 Understanding of DemandLink Thermostat Offering

Two key findings from the 2013 non-participant focus groups included (1) a desire for more transparent messaging around the demand response events and why National Grid had targeted Tiverton and Little Compton for the offering; and (2) societal and community benefits of the program, including lower greenhouse gas emissions and improved grid reliability, are potential drivers of participation for customers who are not motivated by free equipment or bill savings. In response to these findings, the pilot added a "Good for you/good for your community" theme beginning in 2014. This theme focused on positioning the DemandLink Program as beneficial to both the participant and the local community.

To test the effectiveness of this new messaging, the residential leads survey (fielded in early 2016) explored how well leads in the DemandLink Thermostat Program understood various components of the program, including its community benefits. In specific, leads who were familiar with the program and who had not already scheduled an equipment installation appointment, were asked about their awareness of several key aspects of the pilot program.[6] Survey results showed the following:

- Most respondents were aware that WiFi-enabled programmable thermostats allow users to remotely control their central or window AC (13 out of 15 respondents) and that National Grid provides participants with WiFi-enabled programmable thermostats at no cost (12 respondents).
- Less than half of interviewed leads (6 respondents) were aware that the program is only available to customers with central or window AC or that the program is only available to customers in Tiverton and Little Compton.
- Out of the program aspects asked about in the survey, customers were least aware that the program helps delay the need for an upgrade to a local substation (3 respondents). This suggests that the program's attempts to emphasize benefits to the community (beginning in 2014 with the marketing message of *"Good for you. Good for our community. Good for everyone.")* did not fully take hold among potential program participants.

[6] Of 43 interviewed leads, four had already scheduled an appointment for the installation of DemandLink equipment and 24 were not at all familiar with (or unaware of) the program. These questions were therefore asked of 15 leads.

- Similarly, few interviewed leads (5 respondents) were aware that participation in the program includes participation in demand optimization events called by National Grid.

3. DemandLink Thermostat Program

The DemandLink Thermostat Program was a key SRP-specific offering designed to directly address peak load conditions through demand response events. The goal of the program was to reduce electricity usage during times of peak load (generally hot summer afternoons) by controlling the air conditioning usage of program participants via WiFi-enabled programmable controllable thermostats.

3.1 Program History

The program began providing WiFi-enabled thermostats to customers with central AC in 2012. However, due to the relatively low incidence of central AC in the pilot area, the program added plug devices in 2013. The plug devices allowed the WiFi-enabled thermostat to control window AC units, thereby expanding program eligibility to customers with window AC units. To participate in the program, customers had to have a WiFi internet connection and either central AC or window AC, and they had to agree to participate in demand optimization events for at least two years. Customers received an annual bill credit for participating in all demand optimization events in a given summer.

The program began calling demand response events in July 2014. During the first summer, only three events were called. These events lasted from 3 p.m. to 7 p.m. for central AC units and from 4 p.m. to 6 p.m. for window AC units. For central AC, setpoints were increased by 2°F; for window AC, the unit was shut off for the duration of the event. In 2015 and 2016, the program called 15 and 18 events, respectively, with event durations and cycling strategies similar to those used in 2014.

Annual impact evaluations of the 2014, 2015, and 2016 events showed lower than expected overall savings due to several factors: (1) overall enrollment in the program was limited: a total of 208 thermostats controlling central AC and 158 thermostats controlling window AC were in place during the 2016 event season; (2) there were significant connectivity issues, especially for participants with window AC, meaning that a large share of enrolled customers never had the chance to participate in the events; and (3) hourly event savings per household were lower than in other similar programs, which was partially due to the relative conservative setback strategy of 2°F and the long event duration of four hours. In response to these results, the pilot discontinued offering plug devices in 2016 and did not include participants with window AC in the 2017 events. In addition, anticipating the end of the pilot in late 2017, the program began enrolling new participants with central AC through the statewide Connected Solutions Demand Response Program. These enrollees were included in the SRP-specific events as well as events called for Connected Solutions.

The program made additional changes to its event strategy in 2017. In prior summers, events had been called based on forecasted hot weather. In 2017, on the other hand, events were called if forecasted conditions for daytime temperatures, nighttime temperatures, or humidity exceeded trigger points. In addition, the event time was more closely linked to forecasted peak demand, which falls between 2 pm and 8 pm. Finally, the event duration was reduced from four to three hours, based on negative savings during the last event hour found in prior evaluations.

3.2 DemandLink Thermostat Participation

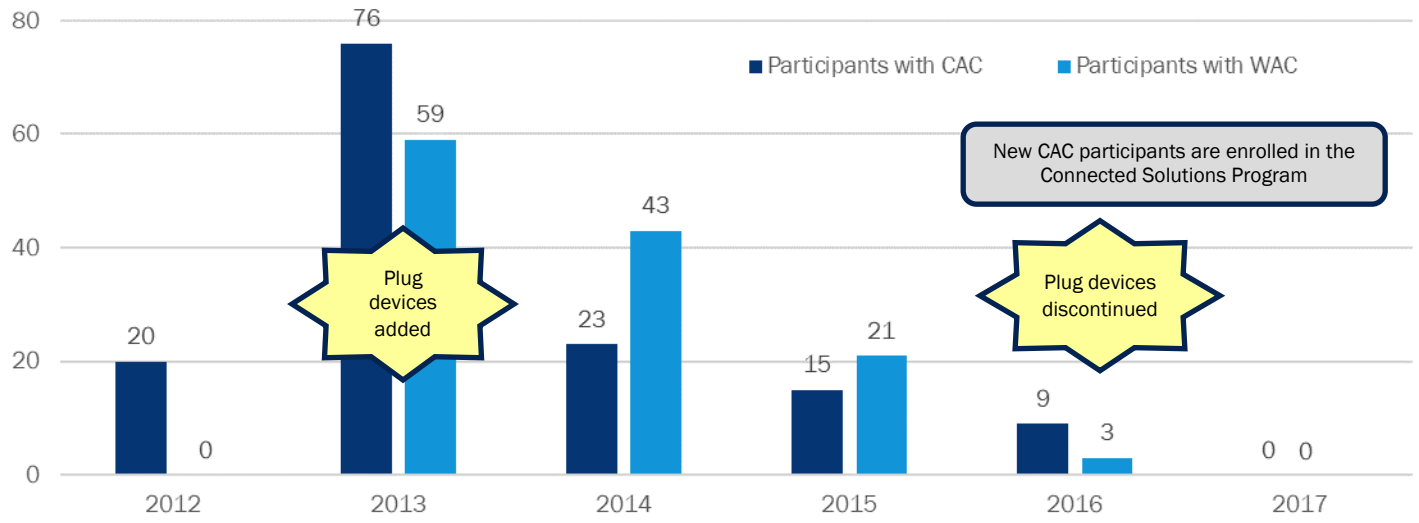
Participation in a demand response program can be divided into two stages: (1) enrollment and (2) event participation. Both stages are necessary for the program to realize load impacts. The DemandLink Thermostat Program experienced challenges in both stages, as described below, leading to lower than expected savings.

3.2.1 Enrollment

Between March 2012 and the end of 2016, 269 customers signed up to participate in the DemandLink Thermostat Program, 143 with central AC and 126 with window AC. In total, participants with central AC installed 229 thermostats (an average of 1.6 per home) and participants with window AC installed 300 plug devices (an average of 2.4 per home). Enrollment of new participants peaked in 2013, with 135 new participants.

Overall, enrollment of customers with central AC fell short of initial projections as many households in the pilot area do not have central AC. As a result, the program began offering plug devices to enable customers with window AC to participate in the program. However, due to connectivity issues, the plug device option was discontinued in 2016. Figure 3-1 summarizes annual enrollment in the DemandLink thermostat program component, by type of AC unit and first year of participation.

Figure 3-1. DemandLink Thermostat Program Enrollment by Year in SRP Pilot Communities (2012 - 2017)



Source: Program Tracking Data

3.2.2 Event Participation

In addition to lower than expected enrollment, participation in the demand response events was low as well. This was largely due to connectivity issues, especially for plug devices, which were likely removed during the fall and not always reinstalled during the next summer, or not reconnected to the WiFi thermostat.

Analysis of thermostat log files for the four summer event seasons (2014-2017) shows several unusual trends with respect to event participation:

- A progressively smaller share of installed thermostats participated in the events: for thermostats controlling central AC, the participation rate fell from 73% in 2014 to 27% in 2017; for thermostats controlling window AC, the participation rate fell from 22% in 2014 to 0% in 2016.
- Conversely, the share of thermostats for which no log file data was available (either because there was no log file or because the log file did not contain any valid data) increased over the pilot period, from 14% in 2014 to 66% in 2017 for thermostats controlling central AC and from 77% in 2014 to

99% in 2016 for thermostats controlling window AC. Notably, the share of missing/invalid log files for window AC was already 77% in 2014, the first year that demand response events were called, indicating the considerable challenges associated with this type of demand control strategy.

- Event failures (defined as thermostats that did not respond to the event, either because they were offline or because they did not receive the signal to begin the event) were moderate for central AC thermostats, ranging from 5% to 10% of all installed thermostats. While the overall event failure rate was lower for window AC thermostats, event failure as a percentage of non-missing/invalid log files was similar to that of central AC thermostats.
- Event opt-outs (defined as thermostats that received the event signal, but the setting switched out of event mode and the AC unit began cooling before the end of the event) were also moderate, ranging from 2% to 12% for participants with central AC and less than 1% for participants with window AC (the latter again driven by the large number of thermostats with missing/invalid log data).

Based on this analysis, the overall non-participation rate—defined as thermostats with missing log files/no data *plus* event failures—increased from 23% to 71% for central AC participants and from 78% to 99% for window AC participants. As noted above, these non-participation rates were largely driven by thermostats with missing log files or log files with no data. While event failure rates for the SRP pilot were fairly typical, overall non-participation rates were not.[7]

Table 3-1 summarizes the results of the thermostat log file analysis.

Table 3-1 Summary of Demand Response Event Participation

	2014[a]		2015[a]		2016		2017	
Central AC								
Thermostats Installed	205		228		208		208	
Event Participant	150	73%	122	54%	91	44%	56	27%
Opt-out	8	4%	28	12%	15	7%	4	2%
Event Failure	18	9%	23	10%	10	5%	11	5%
Missing Log File/No Data	29	14%	55	24%	91	44%	138	66%
Window AC								
Thermostats Installed	123		150		158		n/a	
Event Participant	27	22%	11	7%	0	0%		
Opt-out	0	0%	1	<1%	0.4	<1%		
Event Failure	1	1%	2	1%	0	0%		
Missing Log File/No Data	95	77%	136	91%	157	99%		

Source: PY2014-2017 Thermostat Log Files

[a]2014 and 2015 thermostat counts include customers in Tiverton and Little Compton who are not in the pilot area.

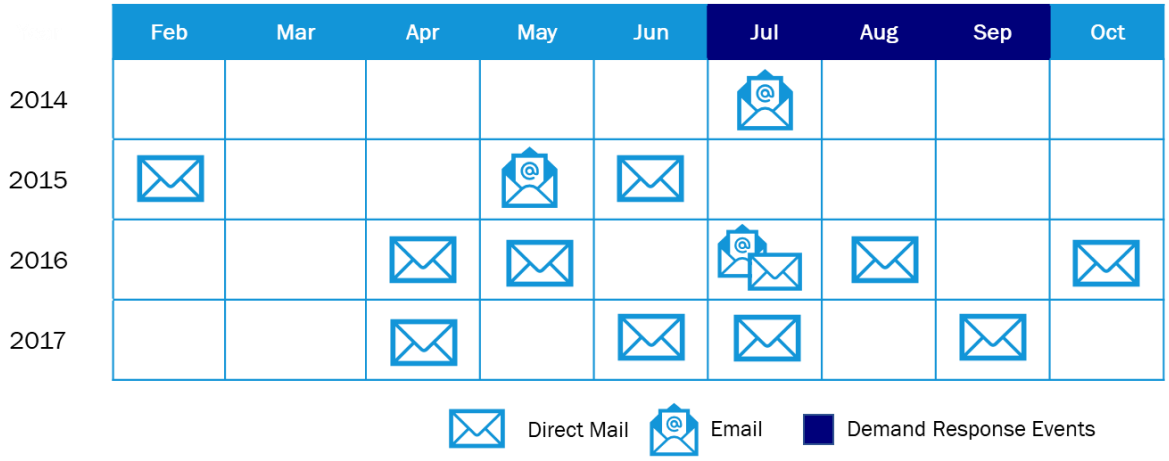
Given the significant impact of missing log files/data on program savings (see next subsection), National Grid implemented several mitigation strategies: (1) At the beginning of the event season, Opinion Dynamics examined thermostat log files and provided Ecobee, the event implementer, with a list of thermostats with missing log files/data. This strategy was intended to rectify any potential connectivity issues in the event portal. (2) Prior to the event season, National Grid began reaching out to past participants to remind them to

[7] More typical non-participation rates for central AC programs are between 10% and 20%. Since window AC demand response programs are uncommon, comparison non-participation rates for the window AC component are not available.

reinstall any removed devices and check that the WiFi thermostats and the plug devices are connected to the participant's internet. This strategy was intended to rectify any connectivity issues on the customer end.

Figure 3-2 summarizes the outreach conducted to reduce customer-related connectivity issues. The reminder email deployed in July 2016 was targeted specifically at participants whose thermostats were offline and reminded them to connect their thermostats. All other outreach was delivered in conjunction with other program messages.

Figure 3-2 Thermostat Connectivity Messaging



Despite the reminder messages, overall connectivity did not increase. Survey research with DemandLink participants between 2014 and 2016 indicated that a significant and increasing portion of plug devices (42% in 2014, 47% in 2015, 68% in 2016) were not being used with window ACs during the cooling season. Not unexpectedly, survey results also showed that usage of plug devices with window AC units was lower for participants who had the equipment installed in a prior year, suggesting that at least some customers were not reconnecting their window AC units to the plug devices at the start of new cooling season.

3.3 DemandLink Thermostat Impacts

Opinion Dynamics used regression modeling combined with day matching to estimate the demand response load impacts for window AC participants and the runtime reduction for central AC participants. The load impact for central AC events was then calculated by multiplying the runtime reduction by the mean full load demand, to arrive at the demand response attributable to the event. (See the annual evaluation reports for 2014, 2015, and 2016 for more detail on our methodology.)

For participants with central AC, the average runtime reduction ranged from 9% to 15% for the four event seasons. The corresponding per thermostat impacts ranged from 0.32 kW to 0.52 kW. For participants with window AC, we only developed regression-based impact estimates for 2014 (0.07 kW per thermostat) and 2015 (0.04 kW per thermostat). By 2016, the number of usable log files was insufficient to develop a new regression model, and we estimated the 2016 per thermostat impact as the weighted average of 2014 and 2015.

Annual program impacts were calculated as the per thermostat kW impact multiplied by the number of thermostats included in the analysis.[8] Given that few new devices were installed after the peak in 2013, the increasing number of thermostats with missing log files/data means that progressively fewer thermostats could be included in our analysis. As a result, even though the per thermostat impacts for central AC were highest in 2017, the small number of thermostats included in the analysis resulted in the lowest program impacts of the four event seasons. This trend is even more pronounced for participants with window AC, where program impacts approached zero in 2016.

Table 3-2 summarizes demand response impacts for the four program years.

Table 3-2 Summary of Demand Response Impacts

Program Year	# of Events	Per-Thermostat Impact		Mean # of Thermostats in Analysis[b]	Program Impact (kW)
		Runtime Reduction	kW[a]		
Central AC					
2014	3	8.6%	0.32	176	56
2015	15	13.3%	0.49	155	76
2016	18	10.9%	0.40	115	46
2017	15	14.8%	0.52	68	36
Window AC					
2014	3	n/a	0.07	28	2.0
2015	15	n/a	0.04	14	0.6
2016	15	n/a	0.045[c]	0.4	0.018
2017	n/a				

Source: PY2014-2017 Gross Impact Analyses

[a] Impacts in this table are average impacts across all event hours. The average first-hour impacts were 0.26 for 2014, 0.87 for 2015, 0.91 for 2016, and 0.72 for 2017.

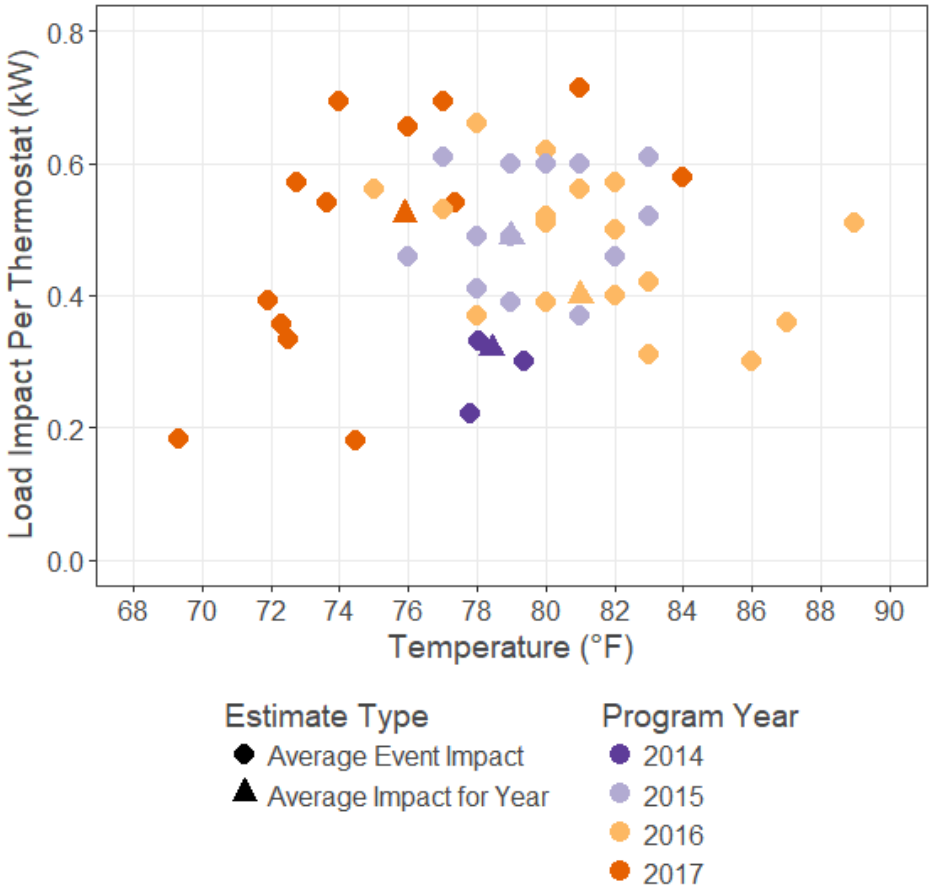
[b] The number of thermostats in the analysis differs slightly from the number of participating thermostats above as thermostats in the analysis include opt-outs and certain types of event failures.

[c] Due to the small number of thermostats with valid data, the 2016 per thermostat kW impact was estimated as the weighted average of the 2014 and 2015 kW impacts.

Figure 3-3 provides a visual depiction of the average per-thermostat load impacts plotted against the average temperature during event hours. The figure includes each event over the four program years as well as the average for each program year.

[8] The number of thermostats included in the analysis includes event participants, opt-outs, and certain types of event failures.

Figure 3-3 Average Per-Thermostat Load Impact by Temperature



3.4 DemandLink Thermostat Key Process Findings

Over the course of the SRP pilot, Opinion Dynamics administered two surveys with DemandLink Thermostat Program participants, one DR event follow-up survey, two residential leads surveys, as well as a general population survey and focus groups with non-participants. Based on this research, the following key process findings emerged:

- Saving energy and money was the primary driver to program interest and participation. Other drivers included the opportunity to receive free equipment and the ability to remotely control the thermostat. Customers with window AC were less interested in remotely monitoring or controlling equipment than customers with central AC. Early focus groups also identified benefits to the community as strong motivators.
- While the program focus was on air conditioning, the ability to monitor and control *heating* equipment was a more compelling driver for some customers, due to the relatively mild summer climate and low air conditioning usage in the pilot area.
- Based on non-participant focus groups and surveys of program leads, the pilot faced several key barriers to participation:

  - Lack of understanding of how the program worked, what the main benefits were, and how those benefits applied to customers;
  - The perception that customers do not use their air conditioning enough to justify the need for supplemental equipment to automate a cooling schedule or to warrant participation in events;
  - Technical concerns including how the WiFi thermostat would interface with their existing HVAC systems;
  - Concern around letting someone else control their thermostat during events; and
  - Concern about uncomfortable humidity levels during events.
- More than half of DemandLink Thermostat leads (56%) were either unaware of the program or not at all familiar with it (a rating of 1 on a scale of 1 to 5). Only 12% of DemandLink Thermostat leads considered themselves very familiar with the program.
- Participants reported continued installation and use of 99% of installed WiFi thermostats during the 2016 cooling season. All interviewed respondents with central AC reported using at least one of their thermostats to control their central AC system. Not surprisingly, participants with window AC reported lower rates of installation and continued use of their plug devices: 73% had one or more plug devices not in use during the 2016 cooling season.
- Participants with central AC were highly aware of the various elements of the DemandLink Thermostat Program; awareness of participants with window AC was systematically lower. Findings from both the 2015 DemandLink Participant Survey and 2016 DemandLink Event Follow-Up Survey suggested that participants with Window AC who were not aware of the events were less likely to plug their window ACs into their plug devices.
- The 2016 DemandLink Event Follow-Up Survey showed moderate participant awareness of the August 29th, 2016 event: 57% of those with central AC and 50% of those with window AC were aware that the event had been called. Among participants with central AC, close to half (47%) were home during the event and 10% reported opting-out of the event, due to discomfort or the anticipation of discomfort. Among respondents with window AC, only 17% were home during the event, and none reported opting out.
- Research with participants throughout the pilot period indicated uniformly high satisfaction with the equipment installed through the program. Areas of dissatisfaction among participants with window AC included the inability to connect to the thermostat to the plug devices and not knowing how to use the equipment.
- Almost all interviewed participants (95%) said they planned to participate in future events.

4. Enhanced Statewide Energy Efficiency Offerings

A second key strategy of the SRP pilot was increasing pilot area participation in existing statewide programs through enhanced marketing and increased incentives. National Grid offered enhancements to three statewide energy efficiency offerings: the residential EnergyWise Program, the commercial SBDI Program, and the heat pump water heater incentive.

Below, we present highlights for each of these three offerings.

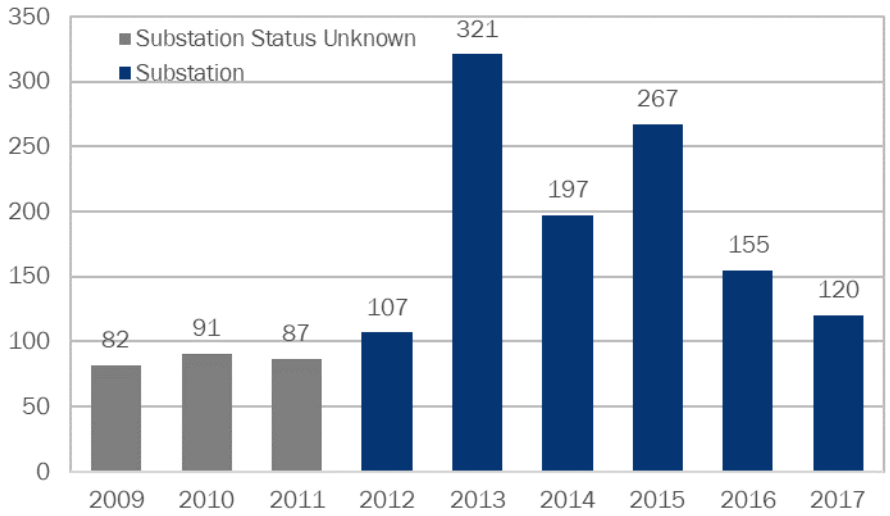
4.1 EnergyWise Program

Beginning in March 2012, National Grid conducted targeted customer outreach in the pilot area to promote participation in the statewide EnergyWise Program, which provides residential customers with a home energy assessment and a range of direct install measures. In addition to contributing directly to pilot area impacts, the program served as an important recruitment and screening tool for the DemandLink Thermostat Program.

4.1.1 EnergyWise Participation

In total, 1,167 customers in the pilot area participated in the EnergyWise Program during the pilot period, an average of 195 participants per year. This compares to average annual participation levels of less than 90 prior to the start of the pilot (see Figure 4-1).

Figure 4-1 EnergyWise Participants in SRP Pilot Communities (2009-2017)[a]



Source: Program Tracking Data

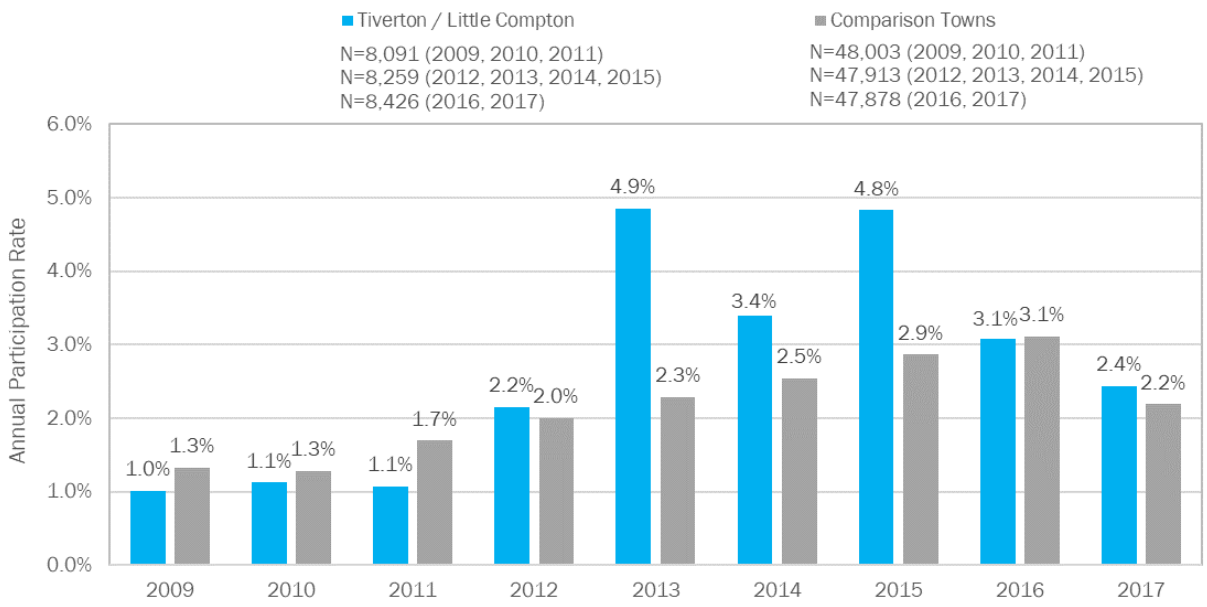
[a] Participant counts for the pre-pilot period 2009-2011 include non-substation participants.

Given that EnergyWise was an existing, statewide program, a key question when assessing the success of the pilot is: *To what extent did the pilot increase participation relative to what it would have been without the pilot?* Or in other words: *What was the* incremental participation *due to the enhanced SRP efforts?* We estimated incremental participation in the pilot area by comparing participation rates (calculated, for each year, as the number of participants divided by the number of occupied households) for the pilot area with

participation rates in a set of matched comparison towns.[9] Based on this comparison, we can determine what expected participation rates in the pilot area would have been, if only the statewide program had existed.

Results of the incremental participation analysis show that average annual participation rates in Tiverton and Little Compton increased from 1.1% prior to the pilot to 3.6% during the pilot period (an increase of 228%). In contrast, average annual participation rates in the comparison towns increased from 1.5% to 2.5% (an increase of 70%). These participation rates translate into actual pilot area participation 48% higher than what would have been expected in the absence of the SRP pilot,[10] suggesting that the SRP marketing campaign indeed had a positive impact on participation in the EnergyWise Program. Figure 4-2 compares the annual participation rates in Tiverton and Little Compton and the comparison communities.

Figure 4-2 EnergyWise Participation Rates in SRP Pilot and Comparison Towns, 2009-2017



Source: Program Tracking Data; American Community Survey (2012, 2014, 2016)

Note: This analysis includes both substation and non-substation participants in Tiverton and Little Compton

4.1.2 EnergyWise Impacts

Pilot area participants in the EnergyWise Program generated 152.4 kW in cumulative gross impacts (see Table 4-1).[11] As is often the case with residential assessment programs, lighting measures accounted for the vast majority of savings, initially in the form of CFLs (2012-2013) and later in the form of LEDs (2014-2017). However, given the changing baseline for residential lighting measures, due to changing EISA standards,

[9] The matched comparison towns are Narragansett, North Kingstown, South Kingstown (excluding URI), Bristol, Barrington, and Warren. For a detailed discussion of the selection of the comparison communities, see National Grid Rhode Island System Reliability Procurement Pilot: 2012-2013 Focused Energy Efficiency Impact Evaluation, by Opinion Dynamics Corporation, dated May 12th, 2014.

[10] For detailed discussion of the EnergyWise incremental participation rate calculation methodology, see National Grid RI SRP 2015 Annual Evaluation Report, by Opinion Dynamics, dated August 3, 2016.

[11] Calculated for each measure i as Peak Load Reduction $(kW)_i$ = $Quantity_i$ * per Unit kW $Reduction_i$ * Summer Diversity $Factor_i$

savings from these measures have been decreasing over time.[12] Nevertheless, the EnergyWise Program accounted for the largest share of cumulative SRP peak load impacts, with 48% of the pilot total.

Table 4-1 summarizes the annual installations, and peak load savings, from EnergyWise measures. The cumulative measure quantity is equal to the sum of installations throughout the pilot period. The cumulative peak load reduction, however, excludes savings from measures in the early years, once the measures have reached the end of their useful life.[13]

Appendix B presents a more detailed overview of gross peak load reduction for all EnergyWise measures. Appendix C presents the estimated "take rate" as well as net impacts for the program.

Table 4-1 EnergyWise Installed Measures and Annual Gross Peak Load Impacts: March 2012-2016

Measure Category	2012	2013	2014	2015	2016	2017	Cumulative
Quantity Installed							
LED Bulb	87	998	3,946	10,973	5,060	3,952	25,016
CFL	2,382	8,670	1,867	233	47	0	13,199
Smart Strip	60	539	363	568	347	232	2,109
Refrigerator Brush	103	297	191	253	158	111	1,113
Other	37	285	140	142	95	121	820
TOTAL	**2,669**	**10,789**	**6,507**	**12,169**	**5,707**	**4,416**	**42,257**
Peak Load Reduction (kW; *excluding measures that have reached the end of their useful life***)**							
LED Bulb	0.5	5.3	21.0	58.5	27.0	21.1	133.3
CFL	1.9	6.8	1.5	0.2	<.1	-	10.3
Smart Strip	0.2	1.6	1.1	1.7	1.0	0.7	6.0
Refrigerator Brush	0.1	0.3	0.2	0.3	0.2	0.1	1.0
Other	0.1	0.9	0.3	0.2	0.1	0.1	1.8
TOTAL	**2.7**	**14.9**	**24.0**	**60.8**	**28.3**	**22.0**	**152.4**

Source: Program Tracking Data; PY2017 Gross Impact Analysis

4.1.3 EnergyWise Key Process Findings

Over the course of the SRP pilot, Opinion Dynamics administered four online surveys with EnergyWise participants, two residential leads surveys, and one general population survey. Based on this research, the following key findings emerged:

- The EnergyWise Program tended to have higher awareness and attract more interest than other SRP offerings throughout the course of the pilot period.
- Based on the 2016 leads survey, only 22% of EnergyWise leads had ever had an energy assessment at their home, and over half of those assessments (56%) had taken place five or more years ago. This indicates an opportunity for the EnergyWise Program to reach a new audience among its customers.

[12] Each annual evaluation applied the kW reduction of the program year under evaluation. As a result, the 2012-2016 results presented here do not match results presented in the prior annual evaluation reports.
[13] Savings excluded because of measures' end of useful life include torchieres installed in 2012 and 2013 (with an expected useful life of 4 years) as well as 2012 smart strips and refrigerator brush measures (with an expected useful life of 5 years).

- EnergyWise leads most often learned about the program through direct mailings from National Grid (43%), followed by friends and colleagues (21%), National Grid outbound phone calls (18%), and emails (9%).
- The opportunity to save energy and money were the most common reasons for interest in the EnergyWise Program, noted by almost 9 out of 10 leads (87%). The "free" aspects of the program, including the audit itself and the free measures, were also attractive program attributes (43%). Getting information on home energy usage was of less interest (21%).
- While barriers to participation in the EnergyWise Program varied, difficulty finding the time to be home for the assessment was consistently identified as the top barrier. While program participation was generally strong, it did start to decline towards the end of the pilot period.
- EnergyWise leads most often reported having taken no further action towards receiving an EnergyWise assessment since they first learned about the program (59%). Those who had taken action most frequently spoke with a program representative (32%), spoke with someone who participated in the program (24%), or looked online to learn more about the program (16%). Notably, 27% of 2015 EnergyWise leads had already scheduled an energy assessment by the time we conducted the survey in January of 2016. Together with the 48% of all 2015 EnergyWise leads that had already participated, this indicates good success in getting interested customers into the program.
- A number of EnergyWise leads reported difficulty scheduling the appointment for their assessment. Notably, of EnergyWise leads that had tried to schedule an assessment but had not actually scheduled it at the time of the survey, 80% reported having difficulty doing so (representing 10% of all EnergyWise leads). Reasons cited by individual respondents included difficulty reaching a representative, limited options for appointments (including lack of weekend appointments and no available appointment for over a month), and personal scheduling difficulties.

4.2 Small Business Direct Install Program

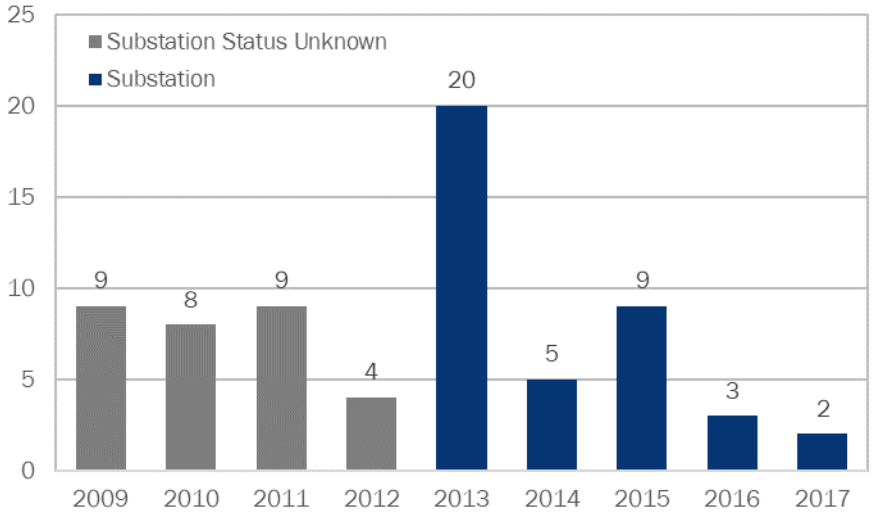
In August 2012, the pilot began enhanced outreach for the statewide SBDI Program, the commercial equivalent of the EnergyWise Program, targeting small non-residential customers. Initial efforts included door-to-door outreach in 2013. However, this strategy, while successful in 2013, was soon discontinued because it was expensive and implementation staff saw little opportunity among the very small businesses. As a result, the later years of the pilot saw little to no targeted effort to increase SBDI Program participation among commercial customers.

4.2.1 SBDI Participation

In total, 39 small commercial customers in the pilot area participated in the SBDI program during the pilot period, an average of 8 participants per year. This compares to average annual participation levels of just under 8 prior to the start of the pilot (see Figure 4-3).

Participation in the SBDI Program increased markedly in 2013, as a result of increased outreach activity, including door-to-door canvassing. However, participation returned to pre-pilot levels in 2014 and stayed at this level for the remainder of the pilot. Considering that the SBDI Program achieved over 50% of its 5-year participation in a single year—and ended up accounting for almost one-third of cumulative pilot load impacts—the pilot may have missed an opportunity for additional savings, by discontinuing small business outreach efforts after 2013.

Figure 4-3 Small Business Direct Install Participation in SRP Pilot Communities: 2015-2017a



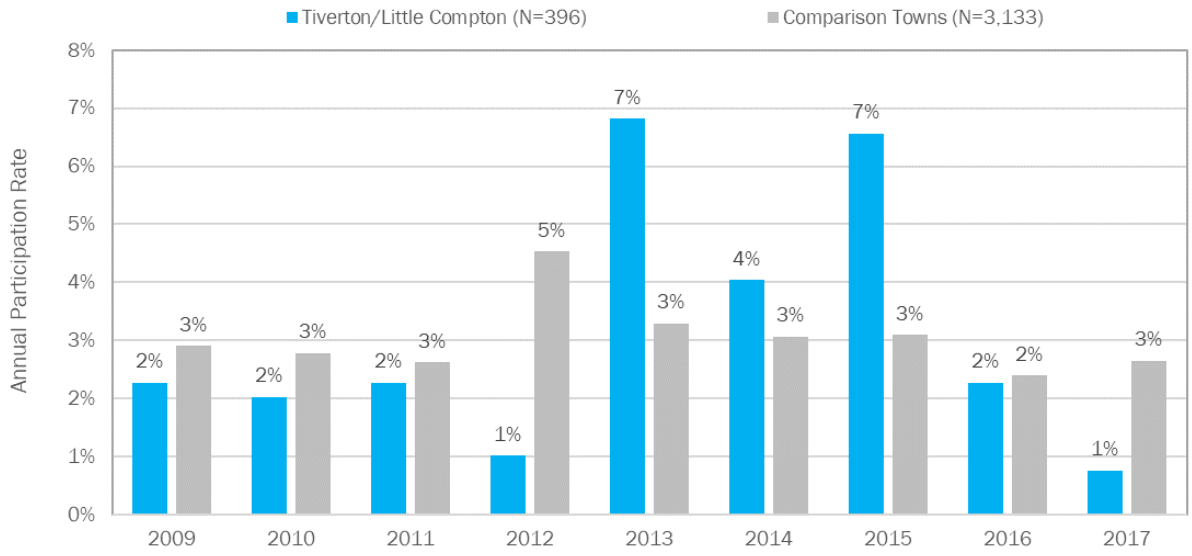
Source: Program Tracking Data
[a] Participant counts for the pre-pilot period 2009-2011 include non-substation participants.

To assess the effect of the SRP pilot, above and beyond what the statewide SBDI Program would have likely achieved, we conducted an incremental participation analysis similar to that conducted for the EnergyWise Program (see Section 4.1.1).[14]

Results of this analysis show that average annual participation rates in Tiverton and Little Compton increased from 2.1% prior to the pilot to 3.8% during the pilot period (an increase of 82%). In contrast, average annual participation rates in the comparison towns increased from 2.9% to 3.1% (an increase of 9%). These participation rates translate into actual pilot area participation 40% higher than what would have been expected in the absence of the SRP pilot, suggesting that the 2013 SRP outreach indeed had a positive impact on participation in the SBDI Program, even when considered over the full 5-year pilot period. Figure 4-4 compares the annual participation rates in Tiverton and Little Compton and the comparison communities.

[14] For detailed discussion of the SBDI incremental participation rate calculation methodology, see National Grid RI SRP 2015 Annual Evaluation Report, by Opinion Dynamics, dated August 3rd, 2016.

Figure 4-4 SBDI Participation Rates in SRP Pilot and Comparison Towns, 2009-2017a



Source: Program Tracking Data; American Community Survey (2012, 2014, 2016)

[a] This analysis includes both substation and non-substation participants in Tiverton and Little Compton

4.2.2 SBDI Impacts

Pilot area participants in the SBDI Program generated 96.4 kW in cumulative gross impacts (see Table 4-2), or 31% of cumulative pilot load impacts. Similar to the EnergyWise Program, LEDs were the dominant measure, accounting for 66% of cumulative demand savings. No non-lighting measures were installed by substation customers after 2014.

Table 4-2 summarizes the annual installations, and peak load savings, from SBDI measures. The cumulative values are equal to the sum of measure quantities and kW load reduction, respectively, throughout the pilot period. In contrast to the EnergyWise Program, no SBDI measures installed during the pilot period had reached the end of their useful life by 2017.

Appendix D presents a more detailed overview of gross peak load reduction for all SBDI measures. Appendix E presents net impacts for the program.

Table 4-2. SBDI Installed Measures and Annual Gross Peak Load Impacts: 2013-2016

Measure Category	2013	2014	2015	2016	2017	Cumulative
Total Measure Quantity						
LED Bulbs	982	12	305	90	152	1,541
Linear Fluorescent Lighting	320	89	10	0	0	419
Custom Lighting	0	0	2	1	0	3
HID Lighting	0	10	6	9	0	25
Other	42	43	11	12	0	108
TOTAL	**1,344**	**154**	**334**	**112**	**152**	**2,096**
Total Peak Load Reduction (kW)						
LED Bulbs	44.2	0.9	8.7	4.0	5.9	63.6
Linear Fluorescent Lighting	12.7	3.2	0.7	<0.1	<0.1	16.6
Custom Lighting	<0.1	<0.1	8.4	0.2	<0.1	8.6
HID Lighting	<0.1	1.3	0.8	0.1	<0.1	2.2
Other	1.1	3.8	0.4	0.1	<0.1	5.5
TOTAL	**57.9**	**9.2**	**19.0**	**4.4**	**5.9**	**96.4**

Source: Program Tracking Data; PY2017 Gross Impact Analysis

4.2.3 SBDI Key Process Findings

Given that the pilot deemphasized efforts for non-residential customers early on, the annual pilot evaluations did not include process analyses specific to non-residential customers or the SBDI Program.

4.3 Heat Pump Water Heater Program

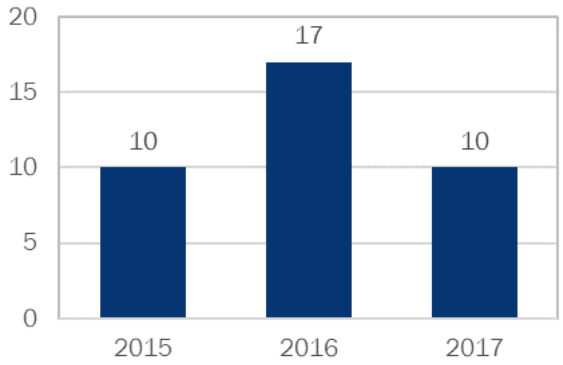
To further diversify the range of pilot offerings, National Grid, in 2015, began offering customers an enhanced rebate of $1,100 (compared to a $750 rebate offered through the statewide program) for the purchase of a new electric HPWH. To be eligible for the rebate, customers had to also participate in the DemandLink Thermostat Program.

4.3.1 HPWH Participation and Impacts

In total, 37 customers in the pilot area received enhanced rebates for installing heat pump water heaters between 2015 and 2017 (Figure 4-5), generating 5.9 kW in cumulative gross impacts for the pilot.[15]

[15] Calculated as Peak Load Reduction (kW) = Quantity * per Unit kW Reduction * Summer Diversity Factor

Figure 4-5. HPWH Rebate Participation in SRP Pilot Communities: 2015-2017



Source: Program Tracking Data

4.4 Key HPWH Process Findings

The annual evaluations did not include process work specific to the HPWH rebate. However, the 2017 general population survey explored awareness of and interest in the HPWH rebate among customers who own their home and have not yet participated in the program.

- Given that the HPWH rebate was a relatively new offering at the time of the survey, non-participating homeowners reported a relatively high awareness of the rebate (36%) and likelihood[16] to purchase a new HPWH through the program (38%). Not surprisingly, those who had previously considered replacing their current water heater (22% of non-participating homeowners) had higher levels of awareness and a significantly higher likelihood to participate than those who had not considered doing so (78% of non-participating homeowners).
- Non-participating homeowners who indicated a low likelihood[17] to participate in the program in 2017 had recently installed a new water heater (39%) or are simply not interested/do not feel that they need a new water heater (23%). Another 17% indicate they use a different type of water heater and are not interested in switching.
- After review of marketing materials related to the HPWH rebate, a majority of non-participants thought that the materials made it clear that signing up for the DemandLink Thermostat Program was a condition for receiving the rebate (noted by 66% who reviewed the newsletter and 56% who reviewed the DemandLink non-participant email).

[16] A rating of 3 or greater on a 5-point scale, where 1 means “not at all likely” and 5 means “very likely”.
[17] A rating of 1 or 2 on the same 5-point scale.

5. SRP-Specific Energy Efficiency Offerings

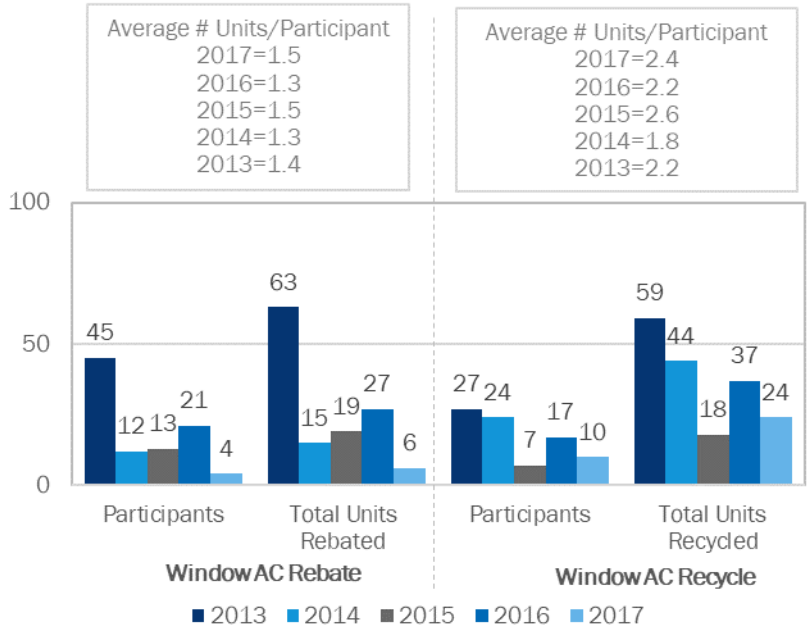
To capitalize on the high incidence of window AC in the pilot area, National Grid introduced two new SRP-specific window AC rebate opportunities in 2013. Both rebates were available each year between May 1st and November 1st:

- **DemandLink Window AC Rebate Program.** Customers in Tiverton and Little Compton could receive a $50 rebate for the purchase of qualifying new window AC units, up to four units per household. Eligible units included those with an energy efficiency ratio (EER) greater than or equal to 10.8.
- **DemandLink Window AC Recycling Program.** Customers in Tiverton and Little Compton could receive a $25 rebate for window AC units they recycled, up to four units per household.

5.1.1 Window AC Rebate Participation

In total, 95 customers in the pilot area received window AC rebates for installing 130 new ENERGY STAR® units, while 85 received rebates for recycling 185 old units (Figure 5-1). Participation in both programs peaked in 2013, the first year the rebates were offered. On average, participants recycled more units (between 1.8 and 2.6) than they purchased through the rebate program (between 1.3 and 1.5).

Figure 5-1 Window AC Rebate and Recycling Participation in SRP Pilot Communities: 2013-2017



Source: Program Tracking Data

5.1.2 Window AC Rebate Impacts

Since rebates for the purchase and recycling of window ACs are a new SRP-specific offering, no Rhode Island TRM values for these measures existed at the time of our evaluations. As such, Opinion Dynamics developed per unit savings values[18] and applied these to the quantities incented by the SRP pilot.

Table 5-1 summarizes load impacts, by rebate type (purchase or recycling) and by year. Overall, these new rebates generated 25.2 kW in peak load reductions. The majority of these impacts comes from recycling inefficient window AC units without replacing them with a new unit. Savings from the purchase of new efficient window AC units or the recycling of inefficient units with replacement, on the other hand, generated relatively small savings.

Table 5-1 Ex-post Gross Peak Load Impacts for Recycled and Rebated Window AC Units: 2013-2017 (kW)

Measure	2013	2014	2015	2016	2017	Cumulative
Window AC Purchase	0.8	0.2	0.2	0.3	0.1	1.6
Window AC Recycling	6.1	6.5	2.4	5.4	3.2	23.6
Recycled WAC (no replacement)	5.0	6.2	2.2	5.2	3.0	21.7
`Recycled WAC (with replacement)	1.0	0.3	0.2	0.2	0.2	1.9
Total Window AC	**6.9**	**6.7**	**2.6**	**5.8**	**3.3**	**25.2**

Source: Program Tracking Data; PY2017 Gross Impact Analysis

5.1.3 Window AC Rebate Key Process Findings

The annual evaluations did not include process work specific to the window AC rebates. However, the 2017 general population survey explored awareness of and interest in the rebates among customers who had window AC units or were planning to use them during the summer.

- A majority of non-participants were unaware of the available rebates for purchasing new efficient window AC units (57%) and recycling old inefficient units (71%).
- More than half of window AC rebate and window AC recycling leads (57%) reported first hearing about the rebates through direct mailings from National Grid; another 19% first heard about the rebates through a phone call from National Grid. Only two out of 21 leads (10%) first heard about the window AC offering through an EnergyWise audit.
- The potential customer base eligible to receive a rebate for purchasing a new window AC unit was quite large: Almost 4 out of 10 customers (39%) used or planned to use window AC to cool their home in the summer, and 35% of those window AC users (or 14% of all customers) were likely[19] to purchase a new window AC unit in 2017. A large majority of these likely buyers (93%) reported that they were likely to purchase an ENERGY STAR® rated model and apply for a rebate from National Grid.[20] In contrast to the large pool of potential participants, the number of actual 2017 participants was quite small (10). While a self-reported likelihood to take energy efficient actions always has to

[18] For details on the methodology and the resulting per unit values, see the 2014 Annual Evaluation Report, dated August 10th, 2015, developed by Opinion Dynamics.
[19] A rating of 3 or greater on a 5-point scale, where 1 means "not at all likely" and 5 means "very likely".
[20] Based on a population of 4,756 unique residential substation customers, these percentages translate into 1,874 customers who use window AC, 656 customers likely to purchase a new unit in 2017, and 609 customers likely to apply for a rebate.

be interpreted with caution, awareness of the rebate appears to be a major barrier: only 38% of eligible customers likely to apply for a rebate, were aware of the rebate before taking the survey. For future efforts, to better promote offers like the window AC rebates, National Grid should consider more focused messaging, e.g., in combination with a time-limited enhanced rebate, or an "event" like Window AC Recycling Month, which can be effective in promoting action by potential participants.

- Only 19% of customers had window AC units that they no longer used or that they were thinking about replacing in 2017.

6. Conclusions and Recommendations

Estimated cumulative peak demand savings for the pilot period are 316 kW, less than a third of the pilot's 1 MW goal. While the pilot did not meet its goal, its initial progress postponed the investment of the wires alternative that would have occurred in 2014 if not earlier. The investment in the substation upgrade was further deferred due to slower than expected load growth and cooler summer temperatures in 2017. Two key factors contributed to the pilot falling short of its goal:

- **Lower than expected savings from the DemandLink Thermostat Program:** Residential demand response events achieved only 40 kW in 2017, compared to a target of 455 kW.[21] Low incidence of central AC among pilot area residents, challenges with thermostat and plug device connectivity, and a conservative event strategy were largely responsible for the residential shortfalls. In addition, the pilot had a target of 134 kW for commercial demand response events but never rolled out a commercial DemandLink program.

- **Limited savings from SRP-specific energy efficiency offerings:** National Grid had set an aggressive load reduction target of 685 kW for SRP-specific energy efficiency offerings. However, National Grid only introduced two SRP-specific energy efficiency measures (rebates for new energy efficient window AC units and for window AC recycling), which only achieved a combined 25 kW due to limited uptake.

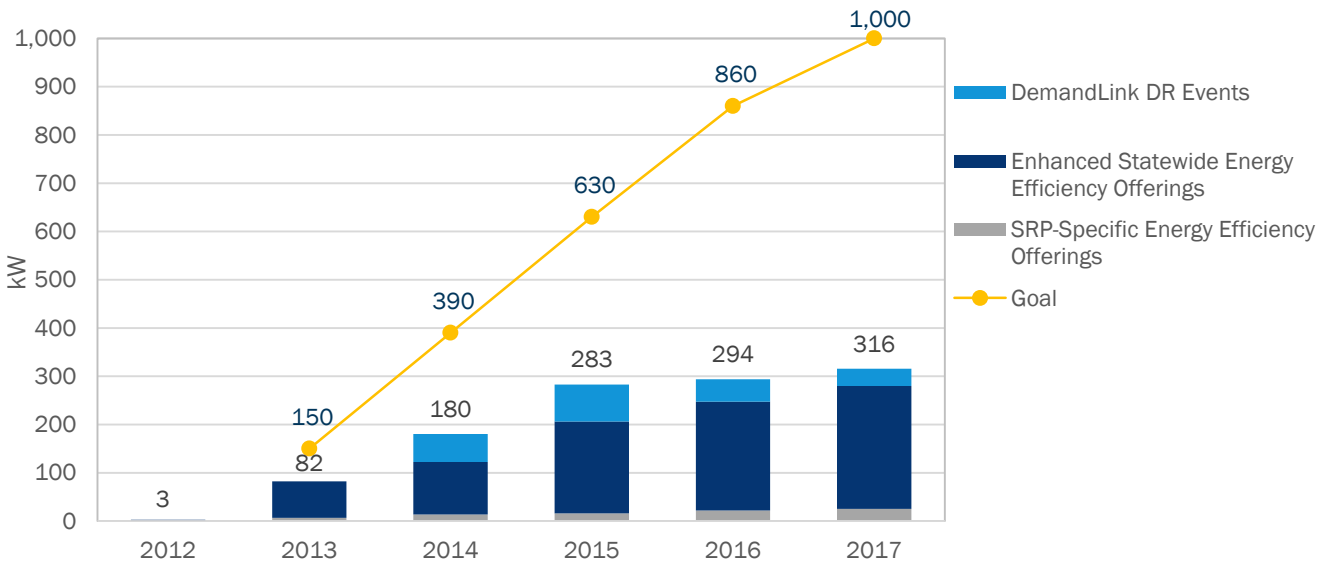
Compared to the other two components, impacts from the enhanced statewide energy efficiency offerings (255 kW) were much closer to target (320 kW). The pilot might have met this target, had it not been for two factors: (1) Lighting measures accounted for the vast majority of the savings in the EnergyWise Program. The changing baseline for residential lighting measures due to new EISA standards means that savings from these measures have been decreasing over time. (2) The pilot deemphasized the commercial sector after an initial push in 2013. As a result, savings from the SBDI Program between 2014 and 2017 were small.

Because peak demand on feeders 33 and 34 is still high, National Grid decided in 2017 to issue an RFP for a battery storage solution. Battery power will be used to meet the remaining excess demand during peak load times, meaning that substation upgrades can be further deferred.

Figure 6-1 shows the pilot's cumulative load impacts compared to the cumulative reduction National Grid expected to need to defer substation upgrades.

[21] The total cumulative kW reduction target, was greater than 1 MW to allow for some loss of impacts due to DemandLink participants opting out of demand response events.

Figure 6-1. Cumulative Load Impacts (kW) Compared to Goal



Source: PY2012-2017 Gross Impact Analyses

For future similar non-wires alternatives, National Grid should consider the following recommendations:

Table 6-1. Recommendations for Future Non-wires Alternatives

Recommendation	Explanation
Demand Response Offerings	
Do not base a demand response program on equipment that, by definition, will be removed each year.	The approach of offering plug devices to enable customers with window AC to participate in the program was plagued with technical issues such as low connectivity, leading to few event participants and near-zero savings by 2016.
Keep a close eye on connectivity issues and ask for more accountability from the event implementer.	The high incidence of missing log files and log files with no data severely limited the load impacts realized by the program. While connectivity issues were not too surprising for customers with window AC, the high incidence of missing data for customers with central AC, especially in the final years of the pilot, was unusual. While National Grid did some investigations of the issue with Ecobee, the source of the problem was never fully diagnosed.
Consider using a cycling strategy, which would avoid the decrease in savings in later event hours, or a more aggressive offset strategy, e.g., of 3 or 4°F, which would reduce the decrease in savings.	The program chose a 2°F offset strategy for customers with central AC, fearing that a cycling strategy or a higher offset would lead to participant dissatisfaction. However, small temperature offsets are subject to decreasing load impacts in later event hours, as the room temperature more quickly reaches the new setpoint.

Recommendation	Explanation
Keep the 3-hour event length and ensure that events start as closely to the predicted peak demand as possible.	The switch from 4-hour to 3-hour events, helped avoid the near-zero savings observed in the last hour of prior events and resulted in the highest average hourly per thermostat savings across the four event seasons. Starting the event as close as possible to the predicted peak ensures that the higher first-hour savings are realized during the times of highest demand.
Consider adding a pre-cooling period.	The SRP event strategy did not include pre-cooling. Precooling is an effective approach for both offset and cycling strategies as it delays the room temperature reaching the new setpoint, thereby further reducing event time usage.
Call events at times of predicted peak demand, rather than using trigger conditions, which may not well correlate with peak demand.	In 2017, National Grid called events when daytime temperatures, nighttime temperatures, or humidity forecasts met certain trigger conditions. This strategy resulted in one-third of events being called when event time temperatures were very moderate (between 69 to 73°F); these events tended to have lower savings than events with higher event time temperatures. Calling events during moderate temperature conditions is justified if the demand reduction is needed at that time (based on load forecasts). If it is not needed, then these events will result in lower average event savings for the program.
Energy Efficiency Offerings	
Continue to leverage established programs, such as EnergyWise or SBDI.	The enhanced statewide energy efficiency offerings were the most successful part of the pilot. EnergyWise is an established program that enjoys high levels of customer awareness and popularity and can serve as a channel into other offerings.
Diversify away from lighting.	Lighting measures accounted for the vast majority of EnergyWise savings, initially in the form of CFLs (2012-2013) and later in the form of LEDs (2014-2017). While these measures contributed significantly to deferring substation upgrades in the early years of the pilot, the changing baseline for residential lighting measures (due to new EISA standards) resulted in decreasing savings from these measures over time. Earlier diversification away from lighting might have mitigated the loss in savings in the final years of the pilot.
Pursue opportunities in all sectors.	The pilot discontinued small business outreach efforts after 2013, despite a substantial increase in SBDI program participation. Considering that the SBDI Program achieved over 50% of its 5-year participation in 2013—and accounted for almost one-third of cumulative pilot load impacts—the pilot may have missed an opportunity for additional savings, by not continuing outreach to this sector.

Recommendation	Explanation
Marketing Strategy	
Ensure that community benefits are a central and visible theme of outreach messaging for future community-focused efforts.	A community benefits theme is generally effective in motivating additional groups of customers. Focus group participants expressed a desire for more transparent messaging around the demand response events and why National Grid had targeted Tiverton and Little Compton for the offering. The societal and community benefits of the program, including lower greenhouse gas emissions and improved grid reliability, were thought to be potential drivers of participation for customers who are not motivated by free equipment or bill savings. While National Grid began including a "Good for you, good for your community" theme in its messaging in 2014, it was often combined with other offers and messaging and therefore likely not sufficiently visible to the target audience.
Consider more focused messaging to better promote pilot-specific offerings.	The window AC recycling rebate had the lowest awareness among all program offerings. Messaging for this rebate was generally combined with information about other offerings and might therefore not have received much notice by customers. Yet, these rebates accounted for 7% of pilot load impacts. For future efforts, to better promote offers like the window AC recycling rebate, National Grid should consider more focused messaging, e.g., in combination with a time-limited enhanced rebate, or an "event" like *Window AC Recycling Month*, which can be effective in promoting action by potential participants.

7. References

The following evaluation deliverables form the basis for this report:

- Opinion Dynamics Corporation, 2018. Central Air Conditioning Demand Response Event Analysis. Memorandum dated April 6, 2018.
- Opinion Dynamics Corporation, 2017. National Grid Rhode Island System Reliability Procurement Pilot: 2016 Annual Evaluation Report. Report dated June 6, 2017.
- Opinion Dynamics Corporation, 2016. National Grid Rhode Island System Reliability Procurement Pilot: 2015 Annual Evaluation Report. Report dated August 3, 2016.
- Opinion Dynamics Corporation, 2015. 2014 Annual Evaluation Report. Report dated August 10, 2015.
- Opinion Dynamics Corporation, 2014a. National Grid Rhode Island System Reliability Procurement Pilot: 2013 Marketing Effectiveness Findings. Report dated April 24, 2014.
- Opinion Dynamics Corporation, 2014b. National Grid Rhode Island System Reliability Procurement Pilot: 2012-2013 Focused Energy Efficiency Impact Evaluation. Report dated May 12, 2014.
- Opinion Dynamics Corporation, 2013. National Grid Rhode Island System Reliability Procurement Pilot: 2012 Marketing Effectiveness Findings. Memorandum dated March 29, 2013.

Other references include:

- U.S. Census Bureau. American Community Survey. 2012 – 2016 American Community Survey 5 – Year Estimates. *DP04: Selected Housing Characteristics.* Retrieved January 2016. from factfinder.census.gov.
- U.S. Census Bureau. American Community Survey. 2010 – 2014 American Community Survey 5 – Year Estimates. *DP04: Selected Housing Characteristics.* Retrieved April 2014, from factfinder.census.gov.
- U.S. Census Bureau. American Community Survey. 2008 – 2012 American Community Survey 5 – Year Estimates. *DP04: Selected Housing Characteristics.* Retrieved April 2013, from factfinder.census.gov.
- U.S. Census Bureau. Business Patterns. 2013 Business Patterns. *CB1300CZ21: ZIP Code Business Statistics: Zip Code Business Patterns by Employment Size Class.* Retrieved January 2016, from factfinder.census.gov.

Appendix A. Summary of Evaluation Activities

The following table summarizes the evaluation activities and key deliverables completed for each year of the SRP pilot.

Table A-1. Summary of Evaluation Activities and Key Deliverables, by Program Year

PY	Primary Data Collection	Process Evaluation	Impact Evaluation
2012/ 2013	▪ EnergyWise Participant Survey (Online: May 2013, Oct. 2013, Mar. 2014) ▪ Residential Non-Participant Focus Groups (Nov. 2013)	▪ Data tracking review ▪ 2012 Marketing effectiveness analysis (residential and commercial) ▪ 2013 Marketing effectiveness analysis (residential)	▪ EnergyWise gross and incremental load impacts
	Key Deliverables: ▪ 2012 Marketing Effectiveness Findings. Memorandum dated March 29, 2013. ▪ National Grid Rhode Island System Reliability Procurement Pilot: 2013 Marketing Effectiveness Findings. Report dated April 24, 2014. ▪ 2012-2013 Focused Energy Efficiency Impact Evaluation. Report dated May 12, 2014.		
2014	▪ EnergyWise Participant Survey (Online: Dec. 2014) ▪ DemandLink Participant Survey (Telephone: June 2014, Oct. 2014) ▪ Residential Leads Survey (Telephone: Mar. 2015)	▪ 2014 Marketing effectiveness analysis ▪ Residential leads analysis ▪ DemandLink process analysis (awareness/perceptions, satisfaction, participation in DR events)	▪ EnergyWise gross and incremental load impacts ▪ Window AC rebate and recycling gross impacts ▪ DR event impacts (CAC and WAC) ▪ Potential for efficiency impacts (WiFi Thermostats, Plug Devices)
	Key Deliverables: ▪ 2014 Annual Evaluation Report. Report dated August 10, 2015.		
2015	▪ EnergyWise Participant Survey (Online: Jan. 2016) ▪ DemandLink Participant Survey (Telephone: Dec. 2014) ▪ Residential Leads Survey (Telephone: Jan. 2016)	▪ DemandLink process analysis (awareness/perceptions, satisfaction, participation in DR events) ▪ Residential leads analysis	▪ EnergyWise gross and incremental load impacts ▪ SBDI gross and incremental load impacts ▪ Window AC rebate* and recycling* gross impacts ▪ DR event impacts (CAC and WAC)
	Key Deliverables: ▪ National Grid Rhode Island System Reliability Procurement Pilot: 2015 Annual Evaluation Report. Report dated August 3, 2016.		
2016	▪ General Population Survey (Online: Mar. 2017) ▪ DemandLink Event Follow-up Survey (Phone: Aug. 2016)	▪ 2016 Marketing effectiveness analysis (awareness, interest, barriers) ▪ 2016 DR event follow-up analysis	▪ EnergyWise gross and incremental* load impacts ▪ DR event impacts (CAC and WAC*)
	Key Deliverables: ▪ National Grid Rhode Island System Reliability Procurement Pilot: 2015 Annual Evaluation Report. Report dated August 3, 2016.		
2017	▪ EnergyWise Participant Survey (Online: Dec. 2017)	▪ No process evaluation	▪ EnergyWise gross and incremental load impacts ▪ SBDI gross and incremental load impacts

PY	Primary Data Collection	Process Evaluation	Impact Evaluation
			▪ Window AC rebate* and recycling* gross impacts ▪ DR event impacts (CAC)
	Key Deliverables: ▪ Central Air Conditioning Demand Response Event Analysis. Memorandum dated April 6th, 2018. ▪ National Grid Rhode Island System Reliability Procurement Pilot: 2012-2017 Summary Report. Report dated July 25, 2018.		

* Using per unit impact values from a prior evaluation.

Appendix B. EnergyWise Gross Impacts

Table B-1 presents the measure counts and load impacts for all EnergyWise measures. The cumulative measure quantity is equal to the sum of installations throughout the pilot period. The cumulative peak load reduction, however, excludes savings from measures in the early years, once the measures have reached the end of their useful life. Savings excluded because of the measures' end of useful life include torchieres installed in 2012 and 2013 (with an expected useful life of 4 years) as well as 2012 smart strips and refrigerator brush measures (with an expected useful life of 5 years).

Table B-1. EnergyWise Installed Measures and Ex Ante Gross Peak Load Reduction: March 2012-2017

Measure Category	Total Measure Quantity							Total Peak Load Reduction (kW)						
	2012[a]	2013	2014	2015	2016	2017	Cumulative	2012[a]	2013	2014	2015	2016	2017	Cumulative
LED Bulb	87	998	3,946	10,973	5,060	3,952	25,016	0.5	5.3	21.0	58.5	27.0	21.1	133.3
CFL	2,382	8,670	1,867	233	47	0	13,199	1.9	6.8	1.5	0.2	<0.1	-	10.3
Indoor Fixture	24	95	25	13	18	29	204	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.2
Torchiere[c]	4	1	0	2	0	0	7	<0.1	<0.1	-	<0.1	-	-	0.0
Outdoor Fixture	1	11	26	19	31	34	122	-	-	-	-	-	-	-
Smart Strip[c]	60	539	363	568	347	232	2,109	0.2	1.6	1.1	1.7	1.0	0.7	6.0
Refrigerator Brush[c]	103	297	191	253	158	111	1,113	0.1	0.3	0.2	0.3	0.2	0.1	1.0
Refrigerator Rebate	3	6	5	4	2	0	20	0.1	0.2	0.1	0.1	0.1	<0.1	0.5
Programmable Thermostat (all fuels)	5	41	18	32	25	4	125	<0.1	0.1	0.1	0.1	0.1	<0.1	0.3
Weatherization (all fuels)[b]	0	31	27	25	11	25	119	-	-	-	-	-	-	-
Ventilation – Other[b]	0	28	23	19	5	13	88	-	-	-	-	-	-	-
AC Timer	0	0	1	0	0	0	1	-	-	-	-	-	-	-
Aerator	0	65	0	0	3	12	80	-	0.4	-	-	<0.1	0.1	0.5
HPWH 50 Gallon	0	1	0	0	0	0	1	-	0.2	-	-	-	-	0.2
DHW Pipe Wrap/Insulation	0	3	12	21	0	0	36	-	-	-	<0.1	-	-	0.0
Low Flow Showerhead	0	3	3	7	0	4	17	-	<0.1	<0.1	<0.1	-	<0.1	0.1
TOTAL	2,669	10,789	6,507	12,169	5,707	4,416	42,257	2.7	14.9	24.0	60.8	28.3	22.0	152.4

[a] The 2012 participation period is between 3/1/2012 and 12/31/2012.

[b] Quantities of Ventilation and Weatherization are the accounts of unique participants. All other quantities are measure counts (e.g., count of installed bulbs).

[c] Measures that have reached the end of their useful life are excluded from the cumulative peak load reduction estimate. They include torchieres installed in 2012 and 2013 (expected useful life = 4 years) as well as 2012 smart strips and refrigerator brush measures (expected useful life = 5 years).

Appendix C. EnergyWise Net Impacts

To estimate net impacts for the EnergyWise Program, we developed a "take rate," which represents the proportion of pilot area installations that are attributable to the SRP pilot. The take rate is based on two measures of attribution: (1) the incremental participation rate (see Section 4.1.1) and (2) an attribution rate developed based on responses to the EnergyWise participant survey.[22]

The estimated take rate for the SRP pilot is 47%, which is the mid-point between the incremental participation rate (48%) and the attribution rate from the EnergyWise surveys (46%). Applying the two rates to the measure-level results, we estimate that the pilot overall achieved net summer peak load savings totaling 71.5 kW, with a range of 69.6 kW to 73.3 kW.

Table C-1 presents the impact ranges for each EnergyWise measure category.

Table C-1. EnergyWise Incremental Load Impacts by Measure Category: March 2012-2017

Measure Category	Peak Load Reduction (kW)	
	Cumulative	Range
LED Bulbs	62.5	60.9 - 64.1
CFL	4.8	4.7 - 5.0
Indoor Fixtures	0.1	0.1 - 0.1
Torchiere	<0.1	<0.1 - <0.1
Outdoor Fixture	-	-
Smart Strip	2.8	2.7 – 2.9
Refrigerator Brush	0.5	0.5 - 0.5
Refrigerator Rebate	0.2	0.2 - 0.3
Programmable Thermostat	0.2	0.2 - 0.2
Weatherization (multiple fuels)	-	-
Ventilation – Other	-	-
AC Timer	-	-
Aerator	0.2	0.2 - 0.2
HPWH 50 Gallon	0.1	0.1 - 0.1
DHW Pipe Wrap/Insulation	<0.1	<0.1 - <0.1
Low Flow Showerhead	<0.1	<0.1 - <0.1
TOTAL	71.5	69.6 - 73.3

[22] For detailed discussion on incremental participation rate calculation methodology, see National Grid RI SRP 2015 Annual Evaluation Report, by Opinion Dynamics, dated August 3rd, 2016.

Appendix D. SBDI Gross Impacts

Table D-1 presents the measure counts and load impacts for all SBDI measures. The cumulative values are equal to the sum of measure quantities and kW load reduction, respectively, throughout the pilot period. In contrast to the EnergyWise Program, no SBDI measures installed during the pilot period had reached the end of their useful life by 2017.

Table D-1. SBDI Installed Measures and Ex Ante Gross Peak Load Reduction: August 2012-2017

Measure Category	Total Measure Quantity [a]						Total Peak Load Reduction (kW)					
	2013	2014	2015	2016	2017	Cumulative	2013	2014	2015	2016	2017	Cumulative
LED Bulb	982	12	305	90	152	1,541	44.2	0.9	8.7	4	6	63.6
CFL	320	89	10	-	-	419	12.7	3.2	0.7	-	-	16.6
Indoor Fixture	-	-	2	1	-	3	-	-	8.4	0.2	-	8.6
Torchiere	-	10	6	9	-	25	-	1.3	0.8	0.1	-	2.2
Outdoor Fixture	-	2	-	-	-	2	-	1.1	-	-	-	1.1
Smart Strip	4	9	-	-	-	13	0.2	0.6	-	-	-	0.8
Refrigerator Brush	22	5	-	-	-	27	0.6	0.0	-	-	-	0.6
Refrigerator Rebate	11	5	8	-	-	24	0.3	0.1	0.1	-	-	0.6
Programmable Thermostat (all fuels)	-	-	3	12	-	15	-	-	0.3	0.1	-	0.5
Weatherization (all fuels)[a]	-	7	-	-	-	7	-	0.7	-	-	-	0.7
Ventilation – Other[a]	-	3	-	-	-	3	-	0.4	-	-	-	0.4
AC Timer	-	3	-	-	-	3	-	0.2	-	-	-	0.2
Aerator	-	8	-	-	-	8	-	-	-	-	-	-
HPWH 50 Gallon	-	1	-	-	-	1	-	0.6	-	-	-	0.6
DHW Pipe Wrap/Insulation	4	-	-	-	-	4	-	-	-	-	-	-
Low Flow Showerhead	1	-	-	-	-	1	-	-	-	-	-	-
TOTAL	1,344	154	334	112	152	2,096	57.9	9.2	19.0	4.4	5.9	96.4

[a] Quantity and savings by year are based on installation date and include projects with audits after 8/15/2012 and invoice dates through 12/31/2017.

Appendix E. SBDI Net Impacts

To estimate net impacts for the SBDI Program, we applied the evaluated incremental participation rate of 40% (see Section 4.2.1) to ex ante gross savings, by measure category. We estimate that the pilot overall achieved net summer peak load savings totaling 38.4 kW.

Table E-1 presents the incremental impacts for each measure category.

Table E-1. SBDI Incremental Load Impacts by Measure Category: August 2012-2017

Measure Category	Incremental Peak Load Reduction (kW)
LED Bulbs	25.3
Linear Fluorescent Lighting	6.6
Custom Lighting	3.4
HID Lighting	0.9
Custom Refrigerator Lighting	0.4
LED Refrigerated Case Lighting	0.3
Occupancy Sensors	0.2
LED Exit Signs	0.2
CFLs	0.2
Non-HVAC Motors/Drives	0.3
Fan Control	0.2
Door Heater Control	0.1
Novelty Cooler Shutoff	-
Custom Motors/Drives	0.2
Vending Machines	-
Custom Hot Water	-
TOTAL	38.4

This page intentionally left blank.

For more information, please contact:

Antje Flanders
Vice President

617-492-1400 tel
617-497-7944 Fax
aflanders@opiniondynamics.com

1000 Winter Street
Waltham, MA 02451