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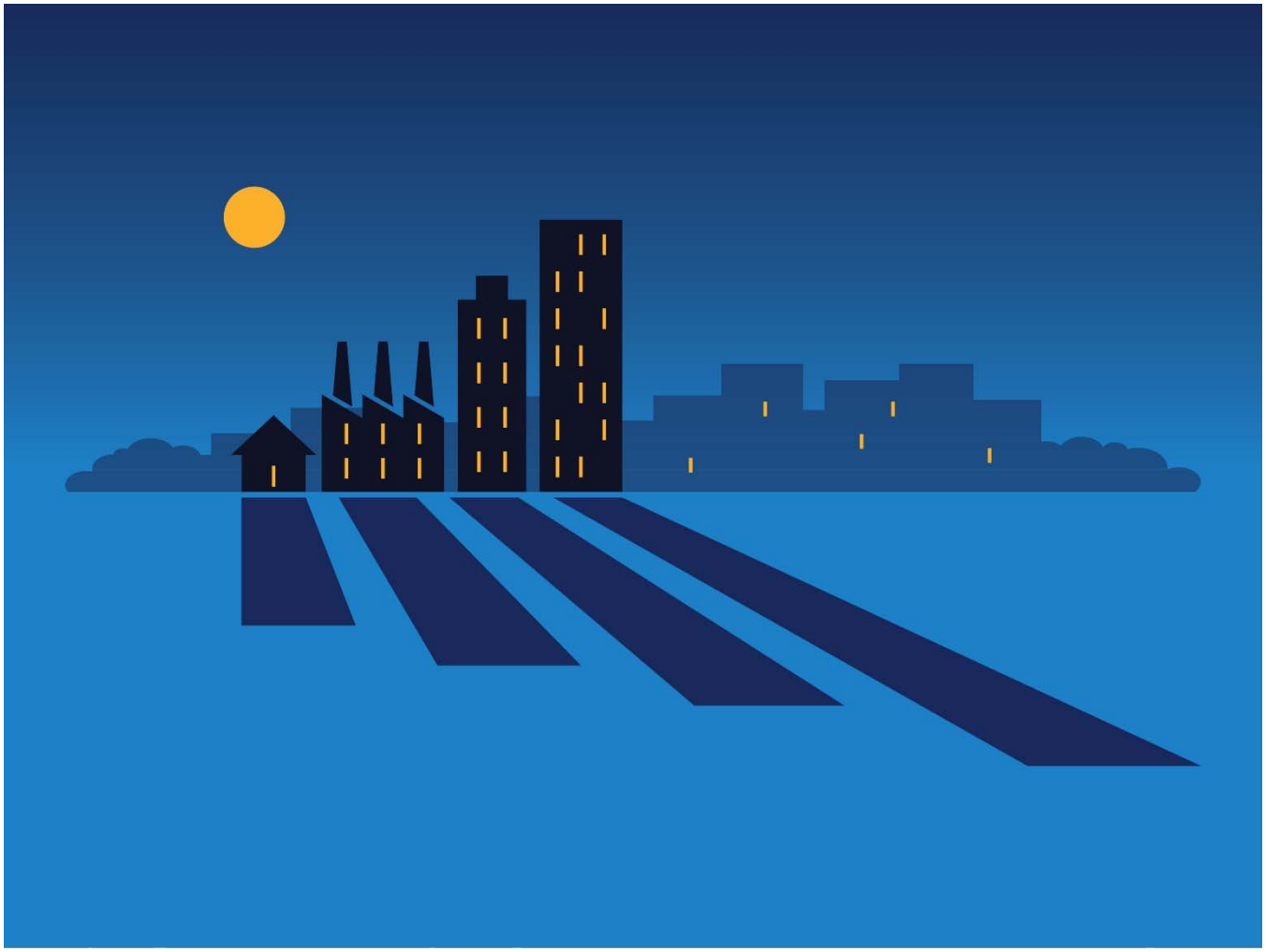

National Grid Rhode Island System Reliability Procurement Pilot: 2015 Annual Evaluation Report

Final

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Table of Contents

Executive Summary 1
Impact Results 1
Other Findings 2
Recommendations 4
1. Introduction 6
1.1 Program Overview 6
1.2 Organization of Report 8
2. EnergyWise Evaluation 10
2.1 EnergyWise Participation 10
2.2 EnergyWise Gross Impact Analysis 11
2.3 EnergyWise Net Impact Analysis 12
3. DemandLink WiFi Thermostat and Plug Device Evaluation 21
3.1 DemandLink Thermostat Participation 21
3.2 Process Evaluation 22
3.3 Analysis of Demand Response Event Logs and Opt-Outs 27
3.4 Demand Response Impact Analysis 33
4. Window AC Rebate and Recycling Evaluation 41
4.1 Window AC Participation 41
4.2 Window AC Rebate and Recycling Gross Impact Analysis 43
5. Small Business Analysis 44
5.1 Participation Summary 44
5.2 Small Business Impact Analysis 44
6. Leads Analysis 51
6.1 EnergyWise Leads 53
6.2 DemandLink Programmable Controllable Thermostat Leads 58
6.3 Window AC Rebate and Recycling Leads 64
Appendix A. EnergyWise Evaluation – Additional Details 68
Appendix B. DemandLink Evaluation – Additional Details 74
Hourly Event Results 85
Appendix C. Survey Sampling and Dispositions 87

Table of Tables

Table ES-1. Summary of kW SRP Impacts Compared to Targets – Cumulative through 2015 2
Table 1-1. 2015 Demand Response Events..... 6
Table 1-2. Equipment Installations Among Substation Customers Compared to 2015 Planning Projections and Cumulative Targets..... 8
Table 2-1. Energy Wise Installed Measures and Ex Ante Gross Peak Load Reduction: March 2012-2015 12
Table 2-2. Increase in Participation – Pilot Area and Comparison Towns 14
Table 2-3. 2014 SRP Influence Score to Overall SRP Influence Conversion 18
Table 2-4. Summary of EnergyWise Program Attribution..... 19
Table 2-5. 2012-2015 EnergyWise Incremental Load Impacts by Measure Category 19
Table 3-1. Awareness of Demand Optimization Events 25
Table 3-2. 2015 Demand Response Events..... 27
Table 3-3. Event Failure and Opt-Out Counts and Rates 32
Table 3-4. Central AC Demand Response Impact 34
Table 3-5. Window AC Demand Response Impact 38
Table 4-1. Unique Participants, 2015 42
Table 4-2. Ex-post Gross Savings for Recycled and Rebated Window AC Units –2015 43
Table 4-3. Ex-post Gross Savings for Recycled and Rebated Window AC Units – 2013-2015 43
Table 5-1. SBDI Installed Measures and Ex Ante Gross Peak Load Reduction: August 2012-2015 46
Table 5-2. Change in Participation – Pilot Area and Comparison Towns..... 47
Table 5-3. 2012-2015 SBDI Incremental Load Impacts by Measure Category, 2012-2015 50
Table 6-1. 2015 Customer Interest by Program..... 51
Table 6-2. Conversion Rates Lead for Any Program..... 52
Table 6-3. EnergyWise Conversion Rate (2012-2015) 54
Table 6-4. DemandLink Programmable Controllable Thermostat Program Conversion Rate (2013-2014) 59
Table 6-5. Window AC Rebate Conversion Rate (2013-2015) 65
Table A--1 Increase in Participation – Pilot Area and Comparison Towns 2015 68
Table A-2. Conversion and Influence Rating to % Influence Score 70
Table A-3. Respondent-Level Influence Score Scenarios 71
Table A-4. EnergyWise 2015 Load Impact Factors 73
Table B-1. Thermostat Counts 78
Table C-1. EnergyWise Participant Survey Response Rates 87
Table C-2. DemandLink Participant Survey Response Rates 88
Table C-3. Program Participation Summary for Sample Development 89
Table C-4. DemandLink Leads Response Rates 90

Table of Figures

Figure 1-1. Pilot Area Participation (2015) 7
Figure 2-1. EnergyWise Audit Participants in SRP Pilot Communities (2009-2015) 10
Figure 2-2. EnergyWise Audits in SRP Pilot Communities by Month (2015) 11
Figure 2-3. Incremental Participation in Pilot Communities 14
Figure 2-4. EnergyWise Participation Rates[a] in SRP Pilot and Comparison Towns, 2009-2015 15
Figure 2-5. Percent of 2015 Participants who Recall at Least One Marketing Effort 16
Figure 2-6. 2015 SRP and Statewide Influence Scores 17
Figure 3-1. DemandLink Thermostat Program Participation in SRP Pilot Communities (2012 -2015) 21
Figure 3-2. How 2015 Participants Heard about the DemandLink Program 22
Figure 3-3. Reasons for Installing DemandLink Equipment 23
Figure 3-4. Overall Satisfaction with DemandLink Thermostat and Plug Devices 24
Figure 3-5. Ease of Programming Thermostat 24
Figure 3-6. Importance of bill credit on future participation 27
Figure 3-7. Run-Time per 5-Minute Interval for the 2015 Peak Season for One Central AC Unit 29
Figure 3-8. Watt Usage Over Each 5-Minute Interval for the 2015 Peak Season for One Window AC 31
Figure 3-9. Overall Hourly Event Day Usage with Baseline 35
Figure 3-10. Event 6, July 31 Hourly Usage with Baseline (Typical Event) 36
Figure 3-11. Event 7, August 4 Hourly Usage with Baseline 37
Figure 3-12. Event 14, September 8 Hourly Usage with Baseline 37
Figure 3-13. Non-event Day Baseline versus Actual AC Run Percentage 38
Figure 3-14. Overall Hourly Event Day Usage with Baseline 39
Figure 3-15. Non-event Day Baseline versus Actual AC Load 40
Figure 4-1. Window AC Rebate and Recycling Program Participation in SRP Pilot Communities (2013-2015) 42
Figure 5-1. Annual Small Business Audits in SRP Pilot Communities 44
Figure 5-3. SBDI Participation Rates[a] in SRP Pilot and Comparison Towns, 2009-2015 49
Figure 6-1. Program Leads in SRP Pilot Communities (2013-2015) 52
Figure 6-3. EnergyWise Leads in SRP Pilot Communities (2015) 54
Figure 6-10. DemandLink Programmable Controllable Thermostat Leads in SRP Pilot Communities (2015) 59
Figure 6-17. Window AC Rebate and Recycling Leads in SRP Pilot Communities (2015) 65
Figure A-1. Incremental Participation in Pilot Communities – 2015 69
Figure B-1. Event Day and Non-event Day Temperature Profiles 76
Figure B-2. Event Day and Matched Day Temperature Profiles 77
Figure B-3. Mean Central AC Runtime versus Temperature for Peak Season Afternoons 78
Figure B-4. Central AC Event 1 (July 13, 2015, 3-7pm) 79

Figure B-5. Central AC Event 4 (July 29, 2015, 3-7pm) 80
Figure B-6. Central AC Event 5 (July 30, 2015, 3-7pm) 80
Figure B-7. Central AC Event 6 (July 31, 2015, 3-7pm) 81
Figure B-8. Central AC Event 7 (August 4, 2015, 2-6pm) 81
Figure B-9. Central AC Event 8 (August 17, 2015, 3-7pm) 82
Figure B-10. Central AC Event 9 (August 18, 2015, 3-7pm) 82
Figure B-11. Central AC Event 10 (August 31, 2015, 3-7pm) 83
Figure B-12. Central AC Event 11 (September 1, 2015, 3-7pm) 83
Figure B-13. Central AC Event 12 (September 2, 2015, 3-7pm) 84
Figure B-14. Central AC Event 13 (September 3, 2015 3-7pm) 84
Figure B-15. Central AC Event 14 (September 8, 2015, 4-8pm) 85
Figure B-16. Central AC Event 15 (September 9, 2015, 3-7pm) 85

Executive Summary

This report presents evaluation findings for the fourth year of the Rhode Island System Reliability Procurement (SRP) pilot, conducted by Opinion Dynamics Corporation under contract to National Grid. The SRP pilot was designed to determine whether demand-side management could be an effective method of reducing peak demand on the Tiverton substation (substation feeders 33-34), which serves over 5,000 customers in the pilot communities. Starting in March 2012, National Grid increased marketing and outreach to encourage participation in select statewide energy efficiency programs, enrollment in SRP DemandLink offerings (WiFi programmable controllable thermostats and plug device window AC control), and enrollment in SRP-specific energy efficiency offerings (window AC rebates and recycling).

This report presents the results of the various research activities and analyses conducted for the 2015 SRP pilot year. Research activities included three primary data collection efforts: an online survey of EnergyWise participants, a telephone survey of DemandLink participants, and a telephone survey of SRP program leads. We conducted analyses of gross impact on the substation for (1) measures installed through the EnergyWise Program, (2) measures installed through the Small Business Direct Install (SBDI) Program, (3) 2015 demand response events, and (4) rebated new ENERGY STAR® window AC units and recycled old Window AC units. We also calculated a "take rate" for the EnergyWise Program and an incremental participation rate for the SBDI Program, which are measures of net impacts. Finally, we conducted limited process analyses for the DemandLink thermostat and plug device offerings as well as an analysis of program leads.

Impact Results

We estimate peak demand savings for the 2015 SRP pilot to be 398 kW for event days, i.e., days when demand response events were called.[1] Demand response events account for 19% of this total, with 76 kW from participating households with central AC and 0.6 kW from participating households with window AC. Measures installed through the EnergyWise Program account for the largest reduction in demand (219 kW, or 55%). Savings from the SBDI Program account for another 86 kW (22%), while savings from window AC rebates and recycling account for less than 5% (16 kW). On non-event days, peak demand impacts are estimated to be 322 kW, with EnergyWise measures accounting for 68% and SBDI measures for 27% of this total.

Overall, estimated peak demand savings for the pilot-to-date fall somewhat short of planning targets. Notably, savings from the EnergyWise and the SBDI programs exceed targets, while savings from the demand response events and from window AC rebates and recycling fall short of targets.

Table ES-1 summarizes these findings.

[1] For the EnergyWise Program, the Window AC Rebate and Recycling Programs, and the Small Business Direct Install Program this estimate includes all installations for the pilot-to-date, i.e., it assumes that all rebated measures are still in place. For the DemandLink demand response analysis, the estimate is based on only those households where logs indicated functioning equipment during the summer season.

Table ES-1. Summary of kW SRP Impacts Compared to Targets – Cumulative through 2015

Program	Event Days			Non-Event Days		
	Peak Demand Savings (kW)	Target (kW) [a]	% Target	Peak Demand Savings (kW)	Target (kW) [a]	% Target
EnergyWise	219	174	126%	219	174	126%
Small Business	86	28	308%	86	28	308%
DemandLink- Demand Response Events (Central AC)	76	147	52%	n/a	n/a	n/a
DemandLink- Demand Response Events (Window AC)	0.6	11	5%	n/a	n/a	n/a
Window AC Rebate	1.2	24	5%	1.2	24	5%
Window AC Recycle	15	71	22%	15	71	22%
TOTAL	398	455	87%	322	297	108%

[a] Targets do not include efficiency savings from the DemandLink Demand Response Program of 39.4 kW for CAC and 166.5 kW for WAC because this evaluation did not quantify savings for these efforts.

Other Findings

Below, we present other key findings based on the research activities and analyses conducted for the 2015 program year. We present our findings and recommendations by the four main SRP Programs (EnergyWise, DemandLink Thermostats, Window AC rebate and recycling, and SBDI). In addition, we present findings from interviews with program leads.

EnergyWise Evaluation

- In 2015, customers in the pilot area completed 267 audits. Participation in the pilot area continues to be strong compared to pre-pilot averages and exceeded 2015 planning projections of 200 substation audits. The total participation for 2015 represents a 36% increase from 2014.
- In 2015, LEDs continued to be a predominant measure. Participants installed close to 11,000 LED bulbs which accounted for 85% of new peak load reduction from EnergyWise measures in 2015. Meanwhile, installations of CFLs continued to decline from previous years. Total peak load reduction from EnergyWise measures for the pilot-to-date is 219 kW.
- The 2015 evaluation shows a slight uptick in the take rate, a measure of net impacts, from 44% in 2014 to 52% in 2015. We estimate the take rate for the pilot-to-date to be 51%.
- A total of 331 customers were new leads in the EnergyWise Program in 2015. The majority of new leads (61%) are at least somewhat familiar with the program, having learned about it most frequently through direct mail (43%). The EnergyWise Program enjoys a strong same-year rate of converting leads into participants of 48%. Leads who have not yet participated show high levels of interest in the program. They consider their ability to be home for the assessment the main barrier to participation in the program.

DemandLink WiFi Thermostat and Plug Device Evaluation

- In 2015, 32 new participants signed up to participate in the DemandLink Programmable Controllable Thermostat Program, bringing the total for the pilot-to-date to 254 participants. Substation participants with central AC installed 23 thermostats and participants with window AC installed 42 plug devices in 2015.
- New participant sign-ups continues to wane. In 2015, the number of customers who signed up to participate in the DemandLink Programmable Controllable Thermostat Program was less than half compared to 2014, indicating that the pool of potential new participants is shrinking.
- The pilot area experienced its first full year of demand response events, with 15 events being called between July and September. The program employed a new AC cycling strategy in 2015, consisting of a 2° temperature increase for customers with central AC for a duration of four hours and a shut-down of customers' window AC units for a duration of two hours.
- Similar to 2014, the program experienced difficulty with the functionality and connectivity of window AC thermostats and plug devices. Installation difficulties in 2015 appear to have exacerbated this problem as no valid log data was recorded for any of the plug devices installed in 2015. As a result, our impact analysis included fewer than 10% of installed window AC thermostats (14 out of 150), which severely reduced the estimated load impacts for this program component.
- Participants have low awareness and comprehension of demand optimization events. Just over half of participants (56%) are aware that National Grid might call demand optimization events and even fewer are aware of the details of these events. This lack of understanding persists despite efforts to clarify the program offering in marketing messaging. In addition, our research continues to suggest that lack of awareness of events might be associated with lower usage of plug devices with window AC units.
- Overall, participant satisfaction is high. Eighty-two percent of participants are satisfied with their thermostat and 65% are satisfied with their plug devices.
- In total, 68 customers were new leads in the DemandLink Thermostat Program in 2015. Of these 32% converted to participants in 2015. The majority of leads who have not yet become participants (56%) are either unaware of the program or not at all familiar with it. While more than half of leads with some familiarity with the program have taken further action towards participation, overall interest in participating in the program is mixed. Key barriers to participation include the perception of using air conditioning too infrequently to benefit from the program; concern about humidity levels during events; discomfort about having someone else control their thermostats; and difficulty being home for the installation (all considered barriers by more than one-third of leads).

Window AC Rebate and Recycling Evaluation

- In 2015, customers on the substation received rebates for purchasing 19 new ENERGY STAR® rated units and for recycling 18 old units. While, the program exceeded its 2015 target of providing 10 rebates for new ENERGY STAR® rated units to customers on substation feeders, it fell slightly below its target for recycling 25 units.
- Overall, 38 customers were new leads in either or both of the window AC programs in 2015. Conversion of leads to participants continues to be slow, with only 19% of window AC recycling leads and 10% of window AC rebate leads becoming participants in 2015.

SBDI Evaluation

- In 2015, 26 small business customers participated in the SBDI Program in Tiverton and Little Compton, but only 9 of these were on the substation. Participation in the SBDI Program increased markedly in 2013, following the introduction of the SRP pilot in August 2012, but returned to pre-pilot levels in 2014 and 2015.
- Similar to the EnergyWise Program, LEDs were the dominant measure in 2015, accounting for 46% of demand savings. Custom lighting measures account for another 44% of demand savings. No non-lighting measures were installed by substation customers in 2015.
- The SBDI net impact analysis, conducted for the first time during this evaluation cycle, showed an incremental participation rate of 50%, meaning that 50% of SBDI participants in Tiverton and Little Compton would not have participated without the SRP program.

SRP Leads

- In 2015, 555 pilot community customers expressed interest in the EnergyWise Program or one of the three components of the DemandLink Program. Customers continue to be most interested in the EnergyWise Program (81% of leads). Interest in the other SRP programs was much lower: 15% for the DemandLink Thermostat Program, 6% for the Window AC Rebate Program, and 4% for the Window AC Recycling Program.
- Lead activity for the three components of the DemandLink program declined significantly in 2015 compared to 2014, showing a reduction of 51% for the DemandLink Thermostat Program, 59% for the Window AC Rebate program, and 71% for the Window AC Recycling Program.
- Heightened lead activity and participation has followed increases in marketing efforts, particularly outbound telemarketing, in 2013, 2014, and again in 2015, suggesting telemarketing has been effective in generating leads and increasing program participation in the EnergyWise and DemandLink offerings.
- Of the 364 customers who were new SRP leads in 2015, 44% participated in one or more programs in 2015. This level of same-year participation is slightly lower than in 2012 (56%) and 2013 (48%) but higher than in 2014 (36%). In addition, over the past three years, between 7% and 16% of leads have converted to a participant the year after they first became a lead, suggesting that additional conversion can still be expected.

Recommendations

Based on our research and analyses, we provide the following opportunities for program improvement:

- **Continue outreach to customers for participation in the EnergyWise and SBDI programs**, particularly via telemarketing. These two programs continue to account for a majority of demand impacts and have exceeded their planning targets.
- **Follow-up with customers who received new thermostats and plug devices** within a week or two of installation. In 2015, the program experienced apparent installation difficulties, which were not detected until after the cooling season. Following up shortly after equipment installation would quickly uncover any issues and provide the opportunity to correct the problem in time to allow for participation in the season's demand response events. In addition, a follow-up call could also solve any customer satisfaction issues associated with equipment that is not working properly.

- **Perform real-time checks on the portal and/or thermostat log files** to detect connectivity and other operational issues in a timely manner and follow-up with affected customers. In addition to broader efforts to remind participants to "link up" their thermostats and plug devices at the beginning of the new cooling season, the program should consider doing targeted outreach to customers with equipment that does not appear to work correctly. Real-time checks on the portal and/or thermostat log files can uncover such issues at the beginning of the cooling season and possibly correct them in time to allow for participation in the season's demand response events. In addition, such follow-up would provide another customer touch-point and show participants that the program cares about their participation.

- **Perform research with plug device participants from prior years** to explore whether participants reinstall their plug devices for the next cooling season and whether they use the plug devices differently from participants in their first year of participation. A short series of questions could be included with any follow-up calls to resolve connectivity issues. Alternatively, this research could be conducted as a separate evaluation activity. Results from this research could help inform the viability of the plug device offering.

- **Consider testing different demand control strategies** to determine the most effective strategy for SRP participants. In 2014, the program cycled AC units on and off at 30-minute intervals for the duration of the event. In 2015, the strategy changed to a 2° temperature increase for central AC customers for a duration of four hours and a shut-down of customers' window AC units for a duration of two hours. Based on our experience with other demand response programs, a temperature offset of 2° is not very aggressive and might not lead to optimal savings during events. On the other hand, on and off cycling of units might also result in sub-optimal savings, especially on days that are not very hot, where the units are not continuously running to begin with. In addition, optimizing savings has to be balanced against customer comfort and satisfaction. We recommend testing different demand control strategies by dividing participants into two groups; each group would get a different control strategy during the same event. Such a design would allow us to directly compare the impacts resulting from the tested strategies. This design could also be accompanied by a quick follow-up survey with participants the day after the event to determine customer awareness of the event, their satisfaction with the control strategy, and any discomfort or other issues experienced.

1. Introduction

This report presents evaluation findings for the fourth year of the Rhode Island System Reliability Procurement (SRP) pilot, conducted by Opinion Dynamics Corporation under contract to National Grid.

1.1 Program Overview

The SRP pilot was designed to determine whether demand-side management could be an effective method of reducing peak demand on the Tiverton substation, which serves over 5,000 customers in the pilot communities of Tiverton and Little Compton.[2] Starting in March 2012, National Grid increased marketing and outreach to encourage participation in select statewide energy efficiency programs as well as three programs that are offered exclusively to customers in the Tiverton and Little Compton pilot area:

- **DemandLink Programmable Controllable Thermostat Program**. The DemandLink Programmable Controllable Thermostat Program provides temperature control devices — WiFi Programmable Controllable Thermostat and plug devices — to customers in Tiverton and Little Compton when they agree to participate in demand optimization events for at least two years. Customers receive an annual bill credit for participating in all demand optimization events. Customers must have a WiFi internet connection and either central air conditioning (central AC) or window air conditioning (window AC) to be eligible. The program supplies all participants with a WiFi-enabled programmable thermostat. Customers with window AC also receive one or more plug devices, which allow the WiFi-enabled thermostat to control their window air conditioners. During 2015, the pilot installed 44 new thermostats and 42 new plug devices at the homes of 32 substation customers. National Grid called 15 demand response events as identified in Table 1-1 below. Events generally 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 degrees; for window AC, the unit was shut off for the duration of the event.

Table 1-1. 2015 Demand Response Events

Event #	Date	Event Times	
		CAC	WAC
1	Mon 7/13	3-7 pm	4-6 pm
2	Mon 7/20	3-7 pm	4-6 pm
3	Tue 7/21	3-7 pm	4-6 pm
4	Wed 7/29	3-7 pm	4-6 pm
5	Thur 7/30	3-7 pm	4-6 pm
6	Fri 7/31	3-7 pm	4-6 pm
7	Tue 8/4	2-6 pm	3-5 pm
8	Mon 8/17	3-7 pm	4-6 pm
9	Tue 8/18	3-7 pm	4-6 pm
10	Mon 8/31	3-7 pm	4-6 pm
11	Tue 9/1	3-7 pm	4-6 pm

[2] Not all customers in the towns of Tiverton and Little Compton are served by the two sub-feeders (33 and 34) that are the focus of SRP demand reduction efforts. Except where noted, the analyses in this report are based on customers served by the two sub-feeders only. We refer to these as "substation" or "pilot area" customers.

Event #	Date	Event Times	
		CAC	WAC
12	Wed 9/2	3-7 pm	4-6 pm
13	Thur 9/3	3-7 pm	4-6 pm
14	Tue 9/8	4-8 pm	4-6 pm
15	Wed 9/9	3-7 pm	4-6 pm

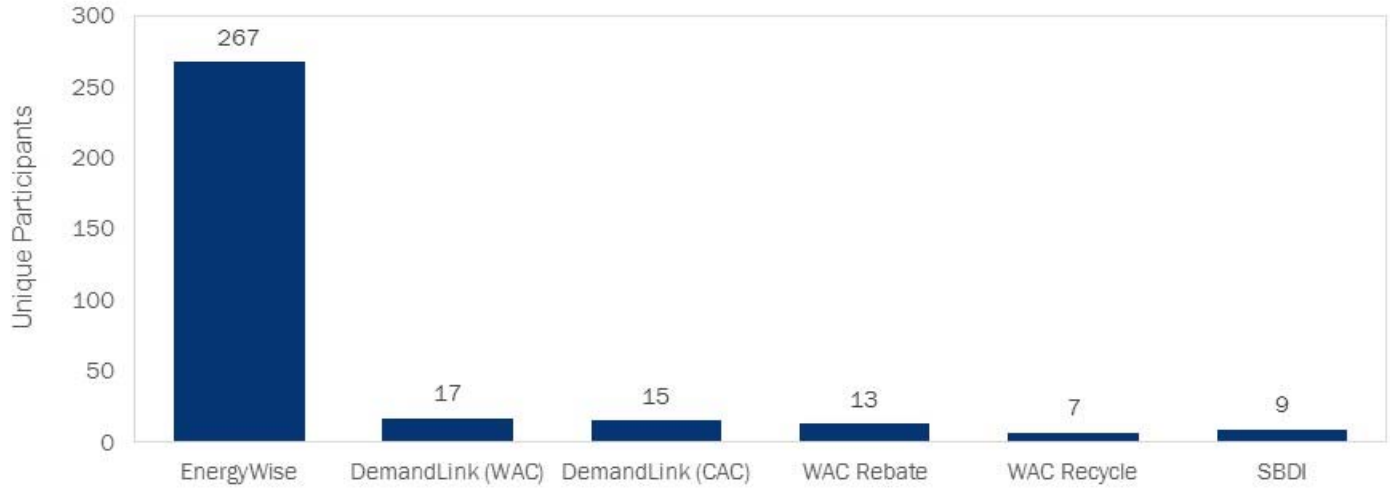
- **DemandLink Window AC Rebate Program.** Between May 1st and November 1st, 2015 National Grid offered customers in Tiverton and Little Compton a $50 rebate for the purchase of qualifying new window AC units, up to four units per household. Equipment was required to have an energy efficiency ratio (EER) greater than or equal to 10.8 to qualify. During 2015, the pilot provided rebates for 19 new ENERGY STAR® rated air conditioning units to customers on the substation.

- **DemandLink Window AC Recycling Program.** Between May 1st and November 1st, 2015 National Grid offered customers in Tiverton and Little Compton a $25 rebate for window AC units they recycled, up to four units per household. During 2015, the pilot provided rebates for 18 recycled units to customers on the substation.

In addition to these SRP-specific offerings, the pilot encouraged participation in existing energy efficiency programs that may contribute to pilot savings: the EnergyWise Home Energy Audit Program and the Small Business Direct Install (SBDI) Program. These two programs each perform two functions: (1) they are a platform for determining DemandLink eligibility and encouraging DemandLink participation and (2) they offer direct install energy efficiency measures that can help reduce peak load on the target substation. During 2015, the pilot performed 267 EnergyWise Home Energy Assessments and direct installations in 9 small businesses.

Figure 1-1 summarizes 2015 participation in the five key pilot program components: the EnergyWise Program, the DemandLink Thermostat Program, the Window AC Rebate Program, the Window AC Recycling Program, and the SBDI Program.

Figure 1-1. Pilot Area Participation (2015)



The most recent cumulative targets for residential equipment installations of WiFi programmable thermostats (among central AC customers) and plug device installations among customers served by the Tiverton

substation through the end of 2015 were filed in November 2014. The DemandLink Thermostat Program fell below 2015 planning projections for both equipment types and for cumulative equipment installations for customers with central AC (see Table 1-2). While the program currently exceeds cumulative equipment installation targets for customers with window AC, the connectivity issues experienced with plug devices (discussed in Section 3.3 of this report) severely limit the savings achieved from these devices.

For planning purposes, SRP pilot program staff also developed projections for 2015 measure counts for the EnergyWise Program and the Window AC Rebate and Recycling Programs.[3] In addition, although National Grid did not establish cumulative targets for the Window AC Rebate and Recycling programs, they do establish internal annual projections. The Recycling Program ended the year slightly below planning projections while the Rebate Program ended the year above planning projections.

Table 1-2. Equipment Installations Among Substation Customers Compared to 2015 Planning Projections and Cumulative Targets

Program	Measure	2015 Units		Cumulative Units 2012-2015	
		# Projected	# Achieved	Target	# Achieved
EnergyWise Program	Energy Audit	200	267	825 [b]	892
DL Programmable Controllable Thermostat Program	Thermostats for Central AC customers	50	23	262[a]	216
	Plug devices for Window AC customers	100	42	268 [a]	292
DL Window AC Rebate and Recycling Program	New ENERGY STAR® Window AC Units	10	19	88[b]	97
	Recycled Window AC Units	25	18	131[b]	124

[a] Source: Table S-6 of 2015 System Reliability Procurement Report. The Narragansett Electric Company. November 1, 2014. Docket number 4528.

[b] Calculated as cumulative units achieved in 2012-2014 plus projected units for 2015.

1.2 Organization of Report

This report presents the results of the various research activities and analyses conducted for the 2015 SRP pilot. The remainder of this report is organized as follows:

- Section 2 presents the analyses of the **EnergyWise Program**, including an overview of program participation and the analysis of gross and net demand impacts.
- Section 3 presents the analyses of the **DemandLink Thermostat Program**, including an overview of program participation, a limited process evaluation, an analysis of demand response event logs and opt-outs, and the demand response impact analysis.
- Section 4 presents the analyses of the **Window AC Rebate and Recycling programs**, including an overview of program participation and the gross impact analyses.

[3] Measure count for the EnergyWise Program is the target number of energy assessments to be completed.

- Section 5 presents the analyses of the **Small Business Direct Install Program**, including an overview of program participation and the analysis of gross and net demand impacts.
- Section 6 presents an analysis of program **leads** in the various SRP programs, including results from a survey with SRP leads.
- Appendix A provides additional detail on the methodology and results for the EnergyWise Program analyses.
- Appendix B provides additional detail on the methodology and results for the DemandLink demand response analysis.
- Appendix C presents dispositions for the three survey efforts conducted in support of this evaluation: the online EnergyWise Participant Survey, the telephone DemandLink Participant Survey, and the telephone SRP Leads Survey.

Findings in this report cover the period January 1, 2015 through December 31, 2015. In some cases, we provide program-to-date values, starting in March 2012 for residential program components and in August 2012 for small business program components.

2. EnergyWise Evaluation

This section presents evaluation results for the EnergyWise Program. The 2015 evaluation included the following analyses, presented in this section:

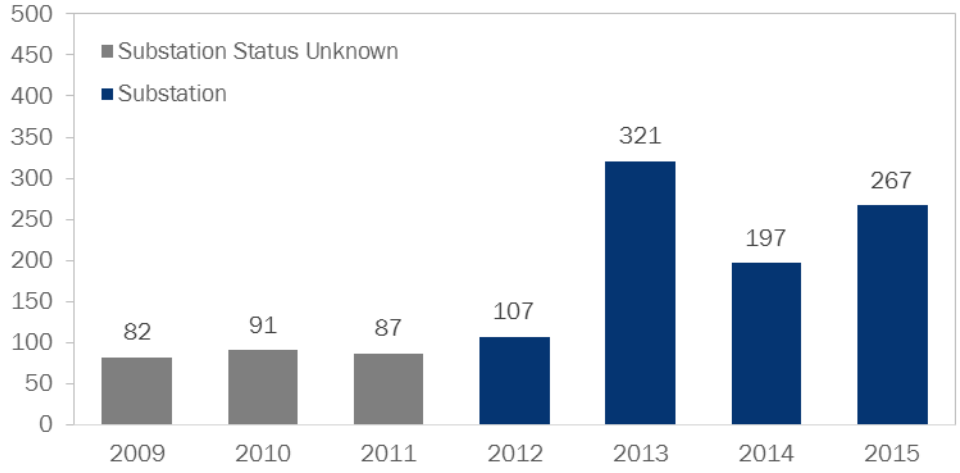
- A review of participation in the EnergyWise Program
- Development of ex ante gross load impacts from the installation of EnergyWise measures
- Development of ex ante net load impacts from the installation of EnergyWise measures

2.1 EnergyWise Participation

Participation in the EnergyWise Program is a key measure of the pilot's success and of its potential to recruit participants for the DemandLink Program. This section summarizes participation in the pilot area between 2009 and 2015. In Section 2.3, we provide a comparative analysis of EnergyWise participation rates in Tiverton and Little Compton and in similar, non-pilot towns in the same period.

Figure 2-1 shows annual participation counts in the pilot area. Participation in the SRP communities was fairly stable between 2009 and 2011, averaging just under 90 audits per year. Assessment participation picked up in 2012, the first year of the pilot, and reached a high of 321 in 2013. After a slow-down in 2014 (197 audits), participation jumped to 267 audits in 2015, exceeding the program's projection of 200 substation audits for the year.

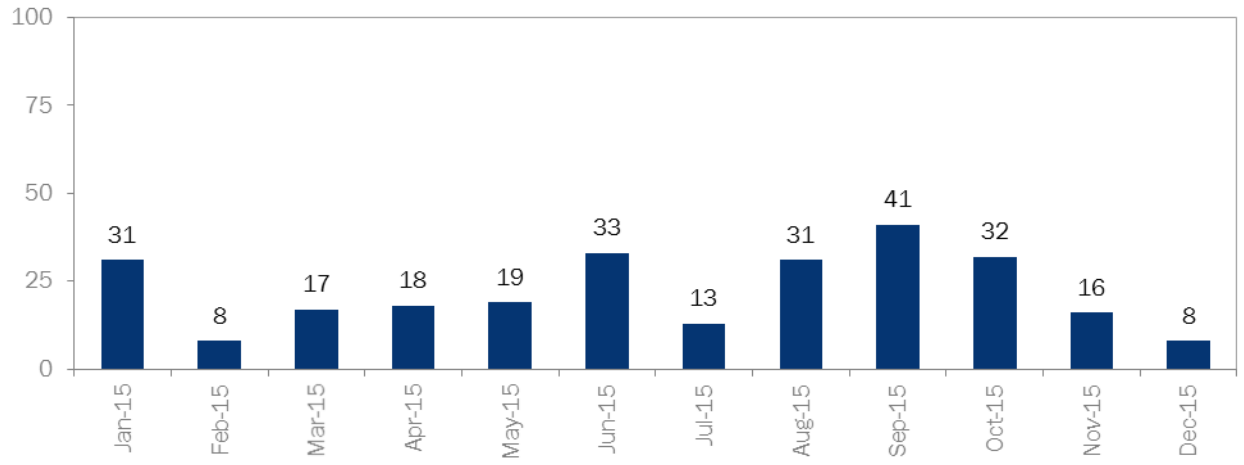
Figure 2-1. EnergyWise Audit Participants in SRP Pilot Communities (2009-2015)[a]



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

Audit activity was relatively steady throughout 2015. Of the 267 audits completed in 2015, just under half (47%) were completed between January and June, and just over half (53%) were completed between July and December. September was the busiest month, with 41 audits completed.

Figure 2-2. EnergyWise Audits in SRP Pilot Communities by Month (2015)



Based on responses to the EnergyWise participant survey, which included both substation and non-substation participants, just over half (53%) of EnergyWise participants are aware that energy efficiency programs offered through National Grid are funded through a surcharge on the electric bills of Rhode Island customers. For the majority of those participants (67%) awareness of the surcharge did contribute to the decision to participate in the program.

2.2 EnergyWise Gross Impact Analysis

To determine the gross load impacts in the SRP pilot area from the installation of EnergyWise Program measures, we applied National Grid's 2015 Rhode Island-specific impact factors to the quantity of measures installed during the pilot period (March 2012 through December 2015), using the following formula:

*Peak Load Reduction (kW) = Quantity * per Unit kW Reduction * Summer Diversity Factor*

The table below shows the quantities and resulting peak kW load impacts for all installations in the pilot area during each year of the pilot period as well as for the pilot-to-date. Total impacts for 2015 installations are 86.9 kW, an 89% increase relative to the 45.9 kW estimated for 2014 installations.[4] LED installations on the substation increased almost three-fold between 2014 and 2015, from just under 4,000 to almost 11,000 bulbs. LEDs account for 74 kW of total 2015 peak demand savings, or 85%. Smart strip installations increased by 56% between 2014 and 2015, accounting for 8% of 2015 load impacts. All other measures accounted for less than 2% of impacts.

Total cumulative gross impacts for the pilot-to-date are 219.5 kW.[5]

[4] Note that 2012, 2013 and 2014 impacts have been re-estimated using 2015 impact factors. The results for these years, presented in this table, are therefore different from those presented in Opinion Dynamics Corporation's report *2014 Annual Evaluation Report*, completed in 2015.

[5] National Grid established Focused Energy Efficiency goals for the pilot that apply to *all* measure installations in the pilot area, not just incremental savings achieved by the pilot. The cumulative load reduction goal through 2015 was 174 kW of net summer load

Table 2-1. Energy Wise Installed Measures and Ex Ante Gross Peak Load Reduction: March 2012-2015

Measure Category	Total Measure Quantity [a]					Total Peak Load Reduction (kW)				
	2012 [b]	2013	2014	2015	Pilot to Date	2012 [b]	2013	2014	2015	Pilot to Date
LED Bulb	87	998	3,946	10,973	16,004	0.6	6.7	26.7	74.2	108.2
CFL	2,382	8,670	1,867	233	13,152	13.9	50.7	10.9	1.4	76.9
Indoor Fixture	24	95	25	13	157	0.2	0.8	0.2	0.1	1.3
Torchiere	4	1	-	2	7	<0.1	<0.1	-	<0.1	0.1
Outdoor Fixture	1	11	26	19	57	-	-	-	-	-
Smart Strip	60	539	363	568	1,530	0.7	6.3	4.2	6.6	17.9
Refrigerator Brush	103	297	191	253	844	0.5	1.5	1.0	1.3	4.2
Refrigerator Rebate	3	6	5	4	18	0.3	0.6	0.5	0.4	1.7
Programmable Thermostat (all fuels)	5	41	18	32	96	0.2	1.5	1.2	1.2	4.0
Weatherization (all fuels) [a]	-	31	27	25	83	-	1.4	1.2	1.5	4.2
Ventilation – Other [a]	-	28	23	19	70	-	-	-	-	-
AC Timer	-	-	1	-	1	-	-	-	-	-
Aerator	-	65	-	-	65	-	0.5	-	-	0.5
HPWH 50 Gallon	-	1	-	-	1	-	0.2	-	-	0.2
DHW Pipe Wrap/Insulation	-	3	12	21	36	-	<0.1	<0.1	0.1	0.1
Low Flow Showerhead	-	3	3	7	13	-	<0.1	<0.1	0.1	0.1
TOTAL	2,669	10,789	6,507	12,169	32,134	16.5	70.2	45.9	86.9	219.5

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

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

It should be noted that this analysis simply applies measure counts to load factors used by National Grid; it does not include a review of the reasonableness of the load factors themselves nor a verification of measure installation and persistence. As such, these gross load impacts should be considered ex ante impacts, rather than ex post impacts.

2.3 EnergyWise Net Impact Analysis

The goal of the net impact analysis is to quantify the influence of the SRP pilot on customers' decisions to participate in the EnergyWise Program. To assess net peak load impacts, we estimate a "take rate" to

reduction. Applying a program-level net-to-gross ratio of 0.97 to the ex ante gross load savings of 219.5 kW, net peak kW savings within the SRP area are 212.9 kW. These savings represent about 122.3% of goal.

represent the proportion of EnergyWise savings that would not have occurred without incremental SRP marketing efforts. The take rate consists of two components:

1. **Incremental EnergyWise Participation Rate.** We first estimated the incremental EnergyWise participation rate among Tiverton and Little Compton customers relative to (a) past participants and (b) participants in nearby communities. We conducted a database analysis of historical and SRP pilot period participation in the EnergyWise Program, to compare participation rates in SRP communities and comparison communities. The incremental participation rate is the first input into the take rate for the EnergyWise Program.

2. **SRP Attribution.** We then estimated SRP attribution based on responses to the EnergyWise participant survey. We fielded several waves of an online survey among participants in the EnergyWise Program between 2012 and 2015. The survey collected information on participants' recall of SRP and statewide marketing efforts and the influence of those materials on customer participation. Based on survey responses we estimated the level of influence of SRP pilot efforts on participation. The estimate of SRP attribution is the second input into the take rate for the EnergyWise Program.

We then combined the incremental participation rate and the SRP attribution to determine the overall SRP take rate. This take rate is then applied to the estimated gross impacts to develop net impacts. This analysis was conducted for the program to date (March 2012 through December 2015).

The following subsections summarize these efforts. We present more details on the methodologies and additional results in Appendix A.

2.3.1 Incremental Participation Rate

Incremental participation is the increase in EnergyWise participation among Tiverton and Little Compton customers that would not have happened without the pilot. The incremental participation rate is one of two approaches to estimating the take rate of the EnergyWise Program.

We applied a difference-in-differences approach to determine incremental participation. First, we compared participation in the SRP pilot area between March 2012 and December 2015 to participation in the pilot area during the baseline period (January 1, 2009 – February 28, 2012).[6] Second, we compared the difference in participation in the pilot area with the difference in participation in a matched comparison region during the same time period.[7] This analysis essentially controls for market trends, i.e., changes in program participation that would have occurred even without the pilot.

Because the pilot and comparison groups are different in terms of (a) the numbers of accounts and (b) their pre-pilot participation rates, the comparison is made in terms of the percentage increase between the pre-pilot and pilot periods, rather than the change in the absolute number of participants. We calculated the percentage change in participation as follows:

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[6] Note that this analysis includes both substation and non-substation participants in Tiverton and Little Compton as information on which of the pre-pilot participants are on the substation was not available at the time of this report.

[7] 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.

$$\%\ Change\ in\ Participation = \frac{Annual\ Participation_{Pilot\text{-}to\text{-}Date}}{Annual\ Participation_{Pre\text{-}Pilot}}$$

Based on tracking data for the SRP pilot area and the comparison towns, we calculated an increase in annual participation of 263% for the pilot area and 65% for the comparison towns.

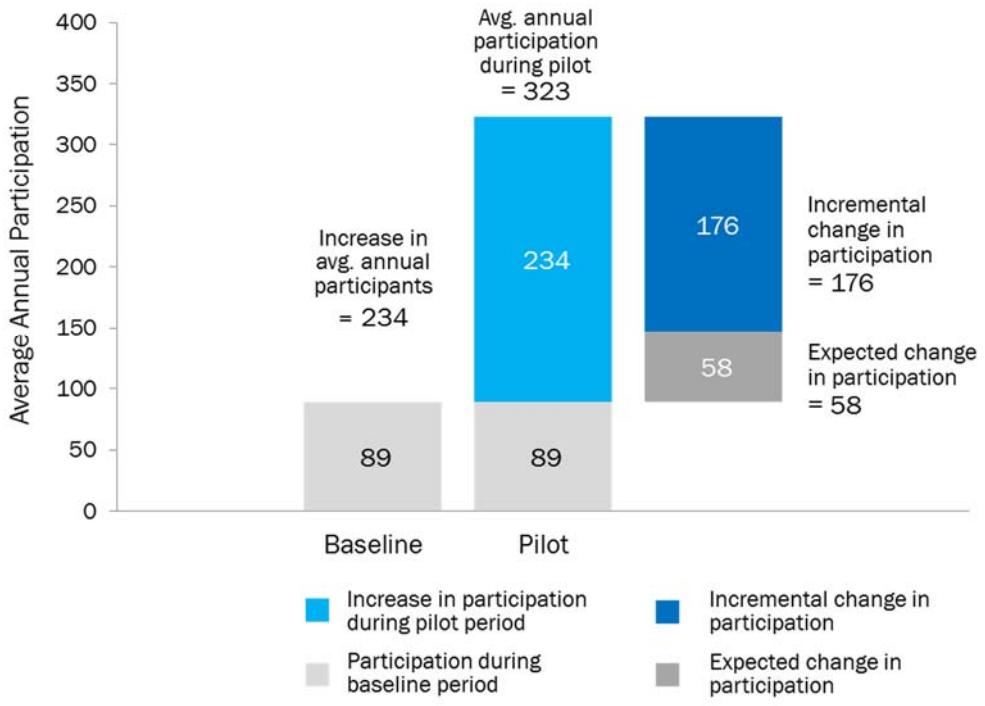
Table 2-2. Increase in Participation – Pilot Area and Comparison Towns

	Pilot Area	Comparison Towns
# Participants Pre-pilot (per year)	89	707
# Participants Pilot-to-Date (per year)	323[a]	1,168
% Increase	263%	65%

[a] A total of 1,237 customers in Tiverton and Little Compton participated from March 1, 2012 – December 31, 2015.

The "lift" or incremental change attributable to the pilot is 263% - 65% or a 198% increase. This number can be applied to the pilot area baseline period count (89 participants/year) to show that 176 participants are incremental. Without the pilot, we would have expected to see a 65% increase in participation in the pilot group (or 58 expected audits, for a total of 147 annual audits). Instead we saw 323 audits per year – of these, 176 can be considered incremental, or attributable to the pilot program. We can calculate the "incremental participation rate" as the percentage of audits that are incremental: 176/323 = 54%.

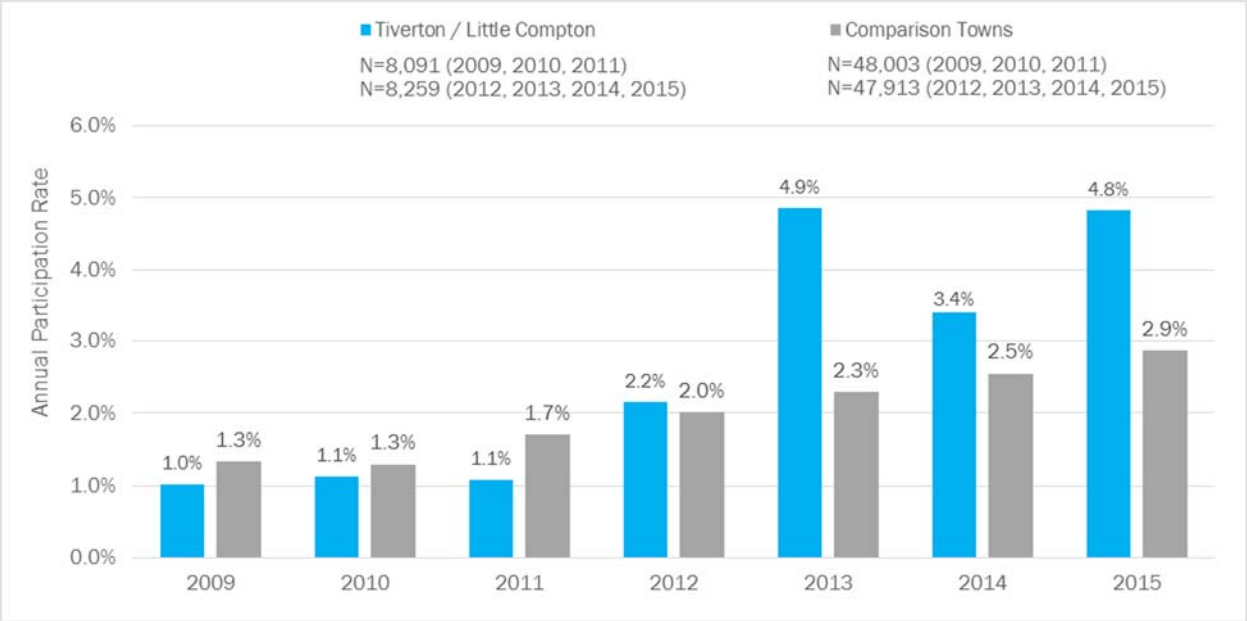
Figure 2-3. Incremental Participation in Pilot Communities (Average Annual Participation, 3/1/2012 – 12/31/2015)



The incremental participation rate calculated for this analysis (54%) is similar to the rate calculated for the pilot through the end of 2014 (53%).[8]

Figure 2-4 below shows participation rates in the pilot communities and the comparison communities for each year of the baseline and pilot periods. As shown in this figure, the comparison communities did not experience the same increase in participation during the pilot period as the SRP communities. We also see a drop in the participation rate differential in 2014 and an increase again in 2015.[9]

Figure 2-4. EnergyWise Participation Rates[a] in SRP Pilot and Comparison Towns, 2009-2015



[a] Calculated as the number of unique participants in each year divided by the US Census count of occupied housing units (2009-2011 based on 2012 American Community Survey count; 2014-2015 based on 2014 American Community Survey count). These counts are not fully equivalent to residential customer counts.

2.3.2 SRP Attribution Based on EnergyWise Participant Surveys

The SRP attribution analysis measures the influence of SRP marketing on participants' decision to have an energy assessment conducted in their home. It is the second approach to estimating the take rate of the EnergyWise Program.

The SRP influence rate is based on self-reported information from 113 participants on (1) recall of SRP-specific and statewide marketing materials, (2) the influence of marketing materials on participants' decision to have a home energy assessment conducted, and (3) the relative importance of SRP-specific versus statewide marketing materials on participants' decision to have a home energy assessment conducted.

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[8] See *2014 Annual Evaluation Report*, by Opinion Dynamics Corporation, dated August 10th, 2015.

[9] Note that this analysis includes both substation and non-substation participants in Tiverton and Little Compton as information on which of the pre-pilot participants are on the substation was not available at the time of this report.

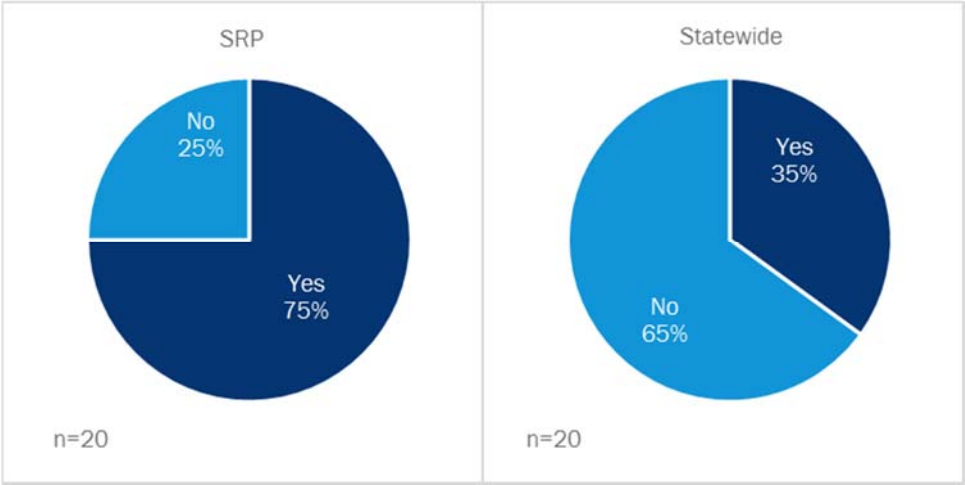
We estimate SRP attribution for the pilot-to-date to be 47%. This is the weighted average of the 2012/2013 attribution rate of 49% (based on 73 responses; estimated in the 2013 EnergyWise impact analysis), the 2014 attribution rate of 43% (based on 20 responses; estimated in the 2014 EnergyWise impact analysis),[10] and the 2015 attribution rate of 46% (based on 20 responses[11]).[12] Weights are based on the total number of participants on the substation for each program year.

The following subsections present more detail about the 2015 SRP attribution analysis. Appendix A presents a detailed description of the methodology used for this analysis.

Recall of SRP-Specific and Statewide Marketing Materials

During the pilot period, customers in the pilot towns were exposed to both SRP-specific and statewide marketing materials. The online survey[13] provided participants with a series of images and descriptions of materials from both marketing campaigns and asked them if they recalled seeing, hearing, or receiving each item. As shown in Figure 2-5, 75% of respondents recall at least one SRP-specific effort while 35% recall at least one statewide effort.

Figure 2-5. Percent of 2015 Participants who Recall at Least One Marketing Effort



[10] Note that we adjusted the 2014 attribution rate reported in the 2014 Annual Evaluation Report to exclude non-substation survey respondents.

[11] We dropped 14 respondents with audit dates of January-March 2015 from the 2015 attribution analysis. Due to participation and survey timing, these participants were only asked about one SRP-specific marketing effort. The responses of these 14 respondents were systematically different from those who were asked about multiple SRP-specific efforts and are not considered representative of program participants.

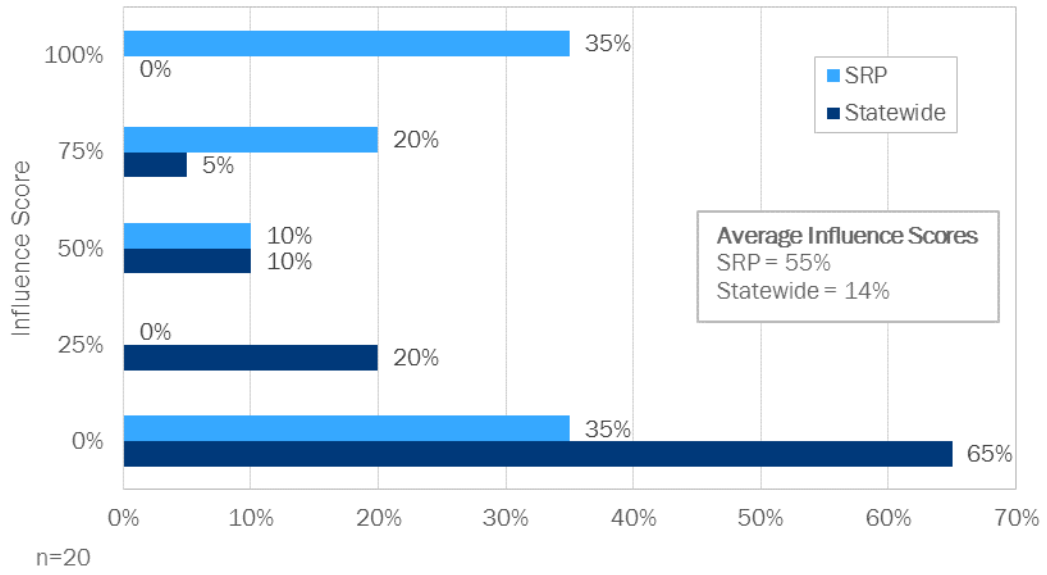
[12] The 2015 attribution rate of 46% is estimated by multiplying the 2015 influence rate of SRP marketing of 48% and the EnergyWise net-to-gross ratio of 0.97 (based on the 2015 Rhode Island TRM).

[13] The online survey was fielded in January 2016. It was sent to 221 customers who participated in the EnergyWise Program between January 1st, 2015 and September 30th, 2015; 43 participants responded and 20 were included in the attribution analysis.

Influence of Marketing Materials on Decision to Have a Home Energy Assessment

If respondents could recall a marketing piece, the online survey asked them to rate the level of influence it had on their decision to complete the home energy assessment (using a scale of 1 to 5 where 1 was "Not at all influential" and 5 "Very influential"). We then converted the highest self-reported influence rating for each campaign into an influence score.[14] The graph below illustrates the distribution of SRP-specific and statewide influence scores among survey respondents. The average influence score for SRP-specific materials among all respondents was 55% while the average influence score for statewide materials was 14%.

Figure 2-6. 2015 SRP and Statewide Influence Scores



Overall SRP Marketing Influence Based on Relative Importance of SRP-Specific and Statewide Marketing

The *Overall SRP Marketing Influence* score represents the influence of SRP materials, net of the influence of statewide materials, on the respondent's decision to have an energy assessment conducted. This score is calculated by applying the SRP share of marketing influence to the *SRP Influence* score.[15] The table below shows the distribution of the *Overall SRP Marketing Influence* scores among the 20 survey respondents. The table shows that 35% of participants were not at all influenced by SRP-specific marketing (an *Overall Marketing SRP Influence* score of 0%).

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[14] Respondents who did not recall any SRP-specific or any statewide materials, received an influence score of 0% for the respective campaigns.

[15] Both statewide and SRP-specific materials could have influenced a participant to have the energy assessment done. We therefore determined the share of overall marketing influence attributable to the SRP-specific marketing materials using the following formula: SRP Share of Marketing Influence = Highest self-reported influence rating for SRP campaign / (Highest self-reported influence rating for SRP campaign + Highest self-reported influence rating for Statewide campaign).

The program-wide *Overall SRP Influence* score, 48%, is the average of the *Overall SRP Influence* scores across all respondents.

Table 2-3. 2014 SRP Influence Score to Overall SRP Influence Conversion

Influence Score		SRP Share of Influence	Overall SRP Influence	Participants	
SRP	Statewide			n	%
100%	0%	100%	100%	5	25%
75%	0%	100%	75%	1	5%
100%	50%	67%	67%	2	10%
75%	25%	75%	56%	2	10%
50%	0%	100%	50%	2	10%
75%	50%	60%	45%	0	0%
75%	75%	50%	38%	1	5%
50%	50%	50%	25%	0	0%
25%	75%	25%	6%	0	0%
0%	50%	0%	0%	0	0%
0%	25%	0%	0%	2	10%
0%	0%	0%	0%	5	25%
Average Overall SRP Influence Score:			48%	20	100%

2.3.3 Estimation of the Take Rate

We compared the SRP attribution rate from the combined 2012/2013, 2014 and 2015 EnergyWise surveys (47%) and the 2012-2015 incremental participation rate (54%) to develop an overall take rate for the pilot-to-date. Given the benefits and uncertainties of each method, we recommend using the midpoint of these two rates – 51% – to estimate net pilot savings. Specifically, we considered the following tradeoffs between the two methods:

- **Incremental participation analysis:** This method accounts for all participants in Tiverton and Little Compton and comparison communities, making it a comprehensive "population" analysis. However, this method does not control for all non-program factors that may have occurred outside of statewide marketing (e.g., independent, community-based energy efficiency efforts) that may have influenced participation rates in the comparison communities. Additionally, the comparison communities, even as a group, are not perfectly identical to the SRP communities in terms of demographics and pre-pilot participation rates.[16] We therefore might expect slightly different rates of participation growth for each set of communities. By including numerous comparison communities in slightly different geographic areas, yet as close to the pilot area as possible, we attempted to mitigate these effects to the extent possible.

- **EnergyWise participant surveys:** This method represents a direct measurement of the variable of interest: recall of SRP-specific marketing and its influence on participants' decision to have a home

[16] For a detailed discussion of the selection of 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.

energy assessment. However, the method is based on a sample of participants and is therefore subject to potential response bias. In addition, this method uses self-reported information, which can be unreliable. Finally, this method incorporates a net-to-gross ratio based on the RI TRM (0.97), which we did not independently verify within the scope of this evaluation.

The take-rate of 51% for the program to-date is the weighted average of the rates estimated for the 2012/2013 program (53%), the 2014 program (44%), and the 2015 program (52%). We will continue to update the EnergyWise take rate in future years, using EnergyWise Program tracking data and ongoing EnergyWise survey results.

Table 2-4 presents the estimated program attribution based on the incremental participation analysis and the EnergyWise participant survey as well as the resulting take rate, for four time periods: (1) 2012/2013, (2) 2014, (3) 2015, and (4) the pilot-to-date.

Table 2-4. Summary of EnergyWise Program Attribution

Program Year	Incremental Participation Rate	Survey Attribution Rate	Take Rate
2012/2013	57%	49%	53%
2014 [a]	45%	43%	44%
2015	57%	46%	52%
Pilot-to-Date	54%	47%	51%

[a] Note that we adjusted the 2014 attribution rate reported in the 2014 Annual Evaluation Report to exclude non-substation survey respondents.

2.3.4 Incremental SRP Load Impacts

The estimated take rate for this evaluation period is 51%, which is the mid-point between SRP attribution based on the incremental participation rate (54%) and the EnergyWise surveys (47%). Applying the two rates to the measure-level results, we estimate that the pilot-to-date has achieved summer peak load savings totaling 111.1 kW, with a range of 102.8 to 119.7 kW. Table 2-5 presents the impact ranges for each measure category.

Table 2-5. 2012-2015 EnergyWise Incremental Load Impacts by Measure Category

	3/1/2012 - 12/31/2015	
Measure Category	Incremental Peak Load Reduction (kW)	Range (kW)
LED Bulbs	54.8	50.7 – 59.0
CFL	39.0	36.0 – 42.0
Indoor Fixtures	0.7	0.6 - 0.7
Torchiere	<0.1	0 - 0
Outdoor Fixture	-	-
Smart Strip	9.1	8.4 - 9.7
Refrigerator Brush	2.1	2.0 - 2.3
Refrigerator Rebate	0.9	0.8 - 0.9
Programmable Thermostat	2.0	1.9 - 2.2
Weatherization (multiple fuels) [a]	2.1	2.0 - 2.3
Ventilation – Other [a]	-	-

Measure Category	3/1/2012 - 12/31/2015	
	Incremental Peak Load Reduction (kW)	Range (kW)
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 - 0
TOTAL	111.2	102.8 - 119.7

3. DemandLink WiFi Thermostat and Plug Device Evaluation

This section presents evaluation results for the DemandLink WiFi Thermostat and plug device components of the SRP pilot. The 2015 evaluation included the following analyses, presented in this section:

- A review of participation in the DemandLink Thermostat Program
- A limited process analysis
- An analysis of event logs and opt-outs
- Demand response impact analyses for participants with central AC and window AC

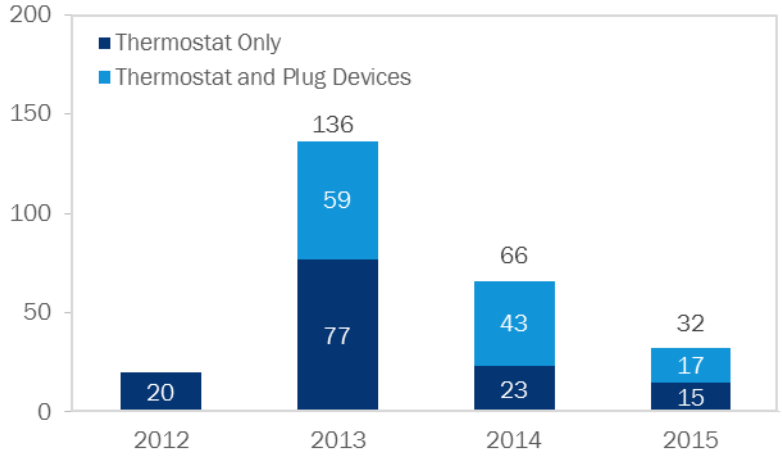
Appendix B presents additional detail on the DemandLink demand response impact analysis.

3.1 DemandLink Thermostat Participation

In 2015, 32 new participants signed up to participate in the DemandLink Thermostat Program, bringing the cumulative total to 254 substation participants. In 2015, just over half (53%) of new DemandLink participants were customers with window air conditioners. In total, participants with central AC installed 23 thermostats and participants with window AC installed 42 plug devices. These participation levels are short of the 2015 planning projections of 50 thermostats among central AC users and 100 plug devices among window AC users.

Figure 3-1 summarizes annual participation in the DemandLink Thermostat and plug device program components in the pilot area, by first year of participation.

Figure 3-1. DemandLink Thermostat Program Participation in SRP Pilot Communities (2012 -2015)



Based on the program tracking database, central AC participants in SRP pilot communities installed between one and two thermostats each, with an average of 1.5 units per home. Window AC Participants installed up to four plug devices each, with an average of 2.5 plugs per home.

The DemandLink participant survey, which included both substation and non-substation customers, explored how participants are using the plug devices they receive. Survey respondents reported receiving an average of 2.3 plugs; of these, 1.2 (or 53%) were used to control window AC units during the past summer. This means that 47% of plug devices provided to participants were not used with window AC units, compared to 42% in 2014. Most commonly, plug devices that were not used with window ACs were not used at all. Only two

interviewed participants used some of their plugs with other equipment (two to charge their iphone/ipad and one with a lamp).

Based on responses to the DemandLink participant survey, almost 6 in 10 (58%) of DemandLink Thermostat participants are aware that energy efficiency programs offered through National Grid are funded through a surcharge on the electric bills of Rhode Island customers. For the majority of those participants (74%) awareness of the surcharge did not contribute to the decision to participate in the program.

3.2 Process Evaluation

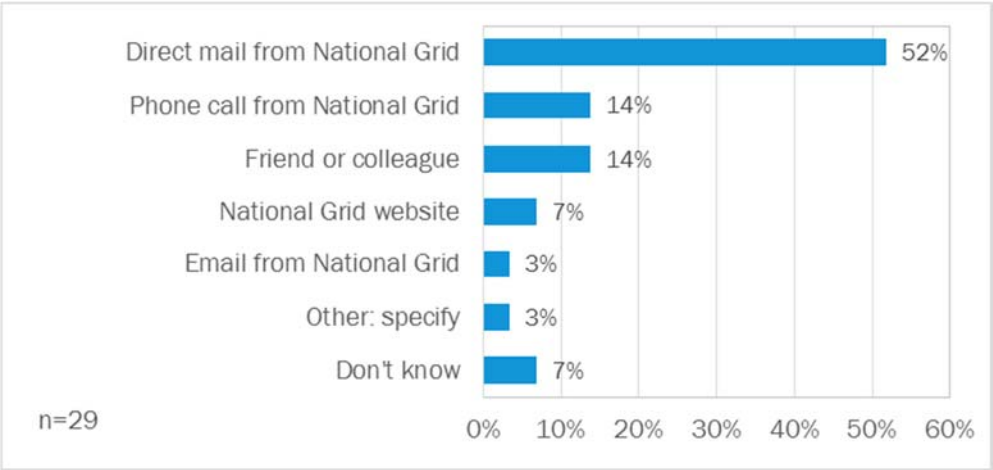
The process evaluation is based on an ongoing survey with participants in the DemandLink Program. This survey was fielded in June 2014, in October 2014, and most recently in December 2015. To date, Opinion Dynamics has completed telephone interviews with 102 participants, including both substation and non-substation customers, who received a WiFi-enabled programmable thermostat through the DemandLink Program since the pilot began in 2012. While the primary purpose of this survey is to collect information for the DemandLink impact evaluation, the survey also collects limited process-related information about the WiFi-enabled thermostat component of the DemandLink Program, including satisfaction with equipment as well as awareness and perceptions of and participation in demand response events.

The following subsections summarize findings from the DemandLink participant survey. Except where noted, findings are based on responses to all three waves of the survey, i.e., for the pilot-to-date.

How Participants Heard about the Program

Most commonly, 2015 participants first heard about the program through direct mail from National Grid (52%). Phone calls from National Grid and word-of-mouth (via a friend or colleague) are the next most common channels (both 14%).

Figure 3-2. How 2015 Participants Heard about the DemandLink Program

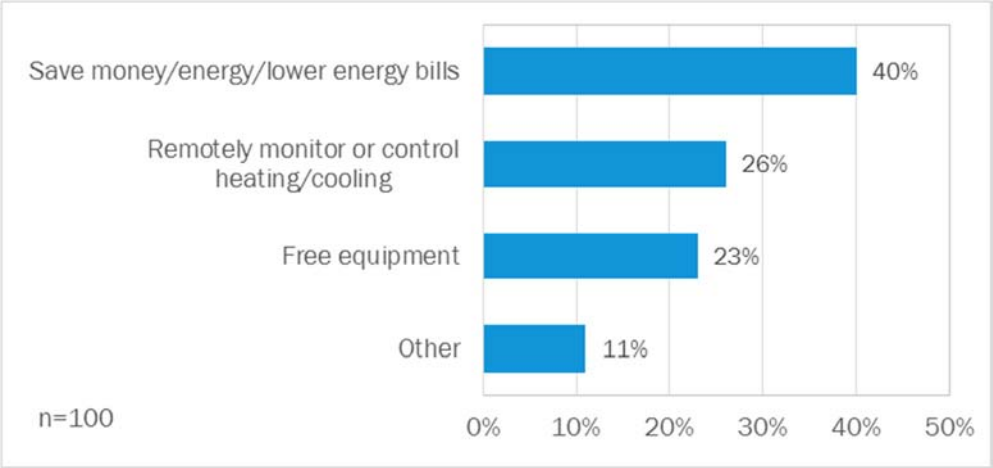


Source: December 2015 DemandLink Participant Survey

Reasons for Installing Equipment

Saving energy, saving money, or lowering energy bills is the primary driver of participants' decision to install DemandLink equipment (40%). Other reasons include the ability to remotely monitor or control heating/cooling (26%) and the opportunity to receive free equipment (23%). All other reasons are cited by three or fewer respondents and include convenience, curiosity, desire to update equipment, and desire for equipment that is more functional. Respondents with central AC are more likely to be motivated by the prospect of remotely monitoring or controlling equipment than respondents with window AC (32% compared to 19%).

Figure 3-3. Reasons for Installing DemandLink Equipment



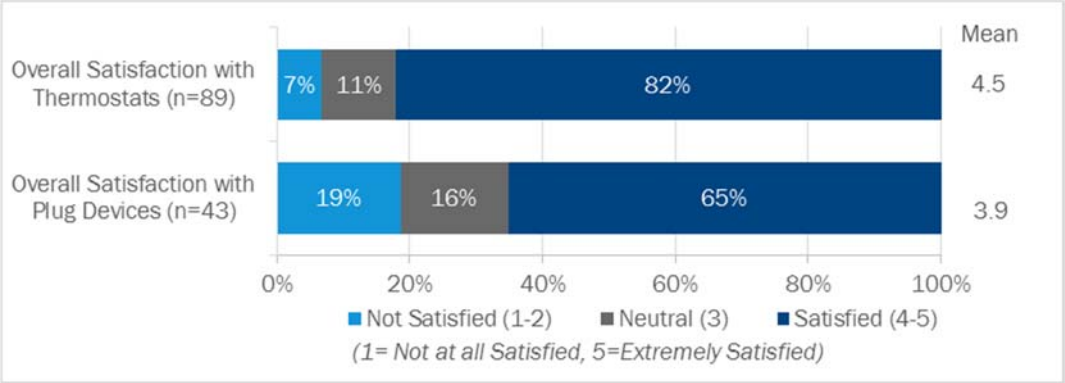
Source: December 2015, October 2014 and June 2014 DemandLink Participant Surveys

Satisfaction with Equipment

Overall, participants report high satisfaction with the thermostats they installed through the DemandLink Program. Eighty-two percent of participants say they are satisfied (a rating of 4 or 5, on a scale of 1 to 5), with a mean rating of 4.5. Those who are not satisfied (7%) found the equipment difficult to use or did not know how to use it (3%) or said that the equipment had not been installed properly (3%).

Satisfaction with plug devices is lower than satisfaction with the thermostats: Nearly two-thirds (65%) of window AC participants report being satisfied (a rating of 4 or 5 on a scale of 1 to 5) with their plug device, with a mean rating of 3.9. However, 19% rated themselves as not satisfied (a rating of 1 or 2). The main reasons for dissatisfaction with the plug devices included not being able to connect to the thermostat (12%) and not knowing how to use the equipment (5%).

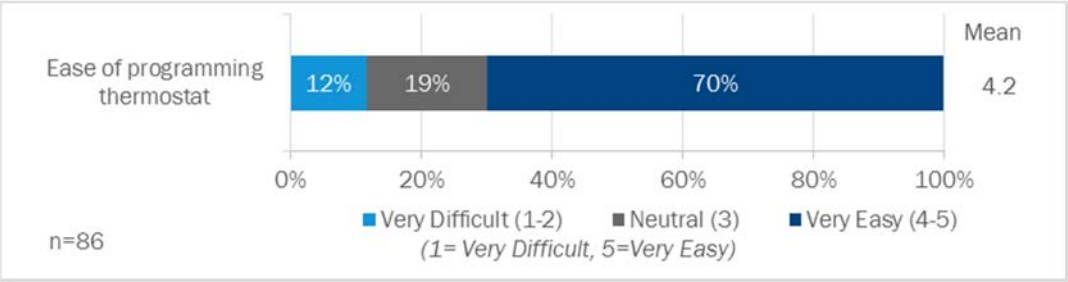
Figure 3-4. Overall Satisfaction with DemandLink Thermostat and Plug Devices



Source: December 2015, October 2014 and June 2014 DemandLink Participant Surveys

Over two-thirds (70%) of participants indicate that the thermostat was easy to program (a rating of 4 or 5 on a scale of 1 to 5) while 12% indicate it was difficult (a rating of 1 or 2). These responses, along with reasons for dissatisfaction with the equipment summarized above, indicate that some participants would benefit from additional education or instructions on how to program and use the new equipment.

Figure 3-5. Ease of Programming Thermostat



Source: December 2015, October 2014 and June 2014 DemandLink Participant Surveys

In addition to these survey responses, our review of thermostat log files (see Section 3.3.1 below) indicates that many of the thermostats and plug devices installed in 2015 had connectivity issues. While on site, the installers should make sure that thermostats and plug devices have been properly installed and are working correctly. The program may also wish to consider follow-up calls to all customers with newly installed thermostats and plug devices, within a week or two of installation, to ensure that the new equipment is working correctly and to help the customer resolve any connectivity issues.

Awareness of Demand Optimization Events

A series of focus groups conducted with non-program participants in 2013 showed low awareness and comprehension of demand optimization events, which are central to the DemandLink Program. In response, National Grid changed their messaging in 2014 to better clarify the program offering. The 2014 and 2015 DemandLink participant surveys explored awareness of these events and other components of the DemandLink Program among program participants.

Overall, only about half (56%) of DemandLink Program participants are aware that National Grid might call demand optimization events. There is no significant difference in awareness between participants who entered the program in 2012/2013, prior to the introduction of new marketing messages (61%) and those who entered the program after the new messages were integrated (50%). Participants who were aware of these events tend to be highly aware that the events are a required component of participation in the program (89%). They are less familiar with other details of participation – that National Grid notifies customers prior to

the start of an event (63%), that they will receive an annual bill credit for participating in all events (60%), and that they have the option to opt out of an event (46%). Again, there are no significant differences in terms of awareness of the various program components by participation period.

Table 3-1. Awareness of Demand Optimization Events

Participation Components	Pilot to Date	Entered Program: 2012/2013	Entered Program: 2014/2015
	% Aware *(n=102)*	% Aware *(n=54)*	% Aware *(n=48)*
National Grid might call demand optimization events	56%	61%	50%
Of those aware that National Grid might call events	% Aware *(n=57)*	% Aware *(n=33)*	% Aware *(n=24)*
Events are part of participation	89%	88%	92%
National Grid notifies customers prior to the start of an event	63%	55%	75%
You have the option to opt out of an event	46%	45%	46%
You receive an annual bill credit for participating in all events	60%	58%	63%

Source: December 2015, October 2014 and June 2014 DemandLink Participant Surveys

Lack of awareness of events (both generally and specific events that have been called), or the details of participation, are not necessarily of concern – unless it leads to (1) participant dissatisfaction, (2) participants changing temperature settings during an event and unknowingly opting out, or (3) participants permanently disabling or disconnecting their control devices.

Our research to-date has not shown that lack of event awareness has led to participant dissatisfaction. For participants with central AC, we do not have any evidence of changes to temperature settings during events or inadvertent opt-outs as a result of lack of event awareness. However, among participants with window AC, our research suggests that those not aware of the events are less likely to plug their window ACs into their plug devices. Overall, survey respondents reported that only 53% of plug devices were being used with window AC units during the summer of 2015. Those aware of events reported using 70% of their plug devices with window AC, compared to only 36% for those not aware of events.[17]

The DemandLink participant survey focused on new participants in 2015 and only included a small number of customers who received their plug devices in 2014. Therefore, we were not able to explore plug device usage behaviors among earlier participants who might have removed their window ACs and plug devices during the winter. Potential topics of interest are whether participants reinstall their plug devices for the next cooling season and whether they use the plug devices differently from participants who first participate in the year under evaluation. This research might be useful for the next evaluation cycle, to determine if continuation of the plug device offering is likely to result in impacts from prior year participants.

[17] It should be noted that these findings are based on a relatively small number of respondents for whom we collected information about use of their plug devices during the summer of 2015 (11 aware of events and 9 not aware of events). The difference in the percentage of plug devices being used with window AC is statistically significant at a 95% confidence level.

Participation in Demand Optimization Events in 2015

National Grid called a total of 15 demand optimization events between July 13th and September 9th 2015. The survey, fielded in December 2015, included questions about participation in these events. Of the 29 DemandLink participants that responded to the survey, only 14 received questions about the demand optimization events. We excluded the other 15 participants from these questions due to the following reasons:[18]

- Respondent indicated in response to an earlier question that they were not aware that National Grid might call demand optimization events (12 respondents)
- Respondent indicated in response to an earlier question that they did not use their plug device with a window AC during the summer of 2015 (5 respondents)
- Program tracking and log data indicated no connectivity between the thermostat and the portal, meaning the thermostats could not have been controlled during the events (4 respondents)

We asked the remaining 14 respondents about their awareness of and experience with the 2015 events. Almost all of these respondents were aware that National Grid called events in 2015 (86%, n=14). Of those aware of 2015 events, almost all thought that National Grid called between three and ten events (80%, n=10); very few thought that more events were called than actually were (20%, n=10). Similarly, almost all aware respondents reported that they were at home during the events (80%, n=10), and the majority of them (63%, n=8) reported noticing a change in temperature.

Close to half of those aware that National Grid called events in 2015 reported that they opted out of at least one event (40%; n=10). This translates into an opt-out rate of 19% among all interviewed participants who were eligible to participate (n=21; based on their connectivity to the portal and use of the thermostat/plug device for cooling purposes), assuming that those who were not aware of events did not opt out.[19] Reasons for opting out included being home and too hot during the event (mentioned by three of the four who opted out) and inconvenient timing of the event (mentioned by one). One respondent who was home and uncomfortably hot during the event noted that they keep their thermostat at 80° to begin with; to them, the strategy of increasing the setpoint by 2°, independent of the starting point, seemed unreasonable and unfair to those that try to be energy efficient.

Planned participation in future demand optimization events is high. All respondents, who were eligible to participate in an event in 2015 and who were aware that National Grid might call demand optimization events as part of the program indicate they plan to participate in future events.

Program participants receive an annual bill credit for participating in all demand optimization events. We asked participants to rate the importance of the bill credit in their decision to participate in future demand optimization events. Participants are fairly evenly divided between considering the bill credit important (32%), not important (35%), or being indifferent about it (32%).

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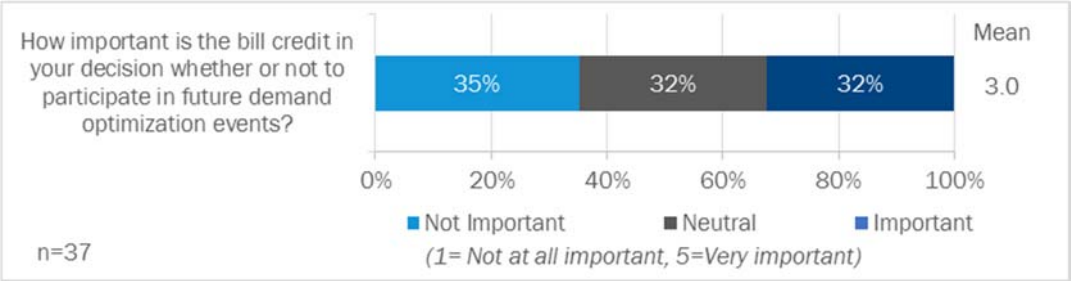
[18] For some respondents, more than one of the exclusion reason applied.

[19] Note that this rate is consistent with the estimated mean opt-out rate for central AC, 19%, based on our analysis of thermostat event logs (see Section 3.3.2). However, based on the event log files, no participant with window AC opted-out of any of the 2015 events, while the 19% opt-out rate includes window AC participants. We note, however, that only 14 out of 148 plug device logs recorded usage data and were usable for the impact analysis. It is therefore possible that window AC participants who opted out of events are among those with unusable log data.

Figure 3-6. Importance of bill credit on future participation



Source: December 2015, October 2014 and June 2014 DemandLink Participant Surveys

3.3 Analysis of Demand Response Event Logs and Opt-Outs

National Grid called a total of 15 demand response events during the 2015 summer peak season (see Table 3-2 below). Events generally 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 degrees; for window AC, the unit was shut off for the duration of the event.

Table 3-2. 2015 Demand Response Events

Event #	Date	Event Times	
		CAC	WAC
1	Mon 7/13	3-7 pm	4-6 pm
2	Mon 7/20	3-7 pm	4-6 pm
3	Tue 7/21	3-7 pm	4-6 pm
4	Wed 7/29	3-7 pm	4-6 pm
5	Thur 7/30	3-7 pm	4-6 pm
6	Fri 7/31	3-7 pm	4-6 pm
7	Tue 8/4	2-6 pm	3-5 pm
8	Mon 8/17	3-7 pm	4-6 pm
9	Tue 8/18	3-7 pm	4-6 pm
10	Mon 8/31	3-7 pm	4-6 pm
11	Tue 9/1	3-7 pm	4-6 pm
12	Wed 9/2	3-7 pm	4-6 pm
13	Thur 9/3	3-7 pm	4-6 pm
14	Tue 9/8	4-8 pm	4-6 pm
15	Wed 9/9	3-7 pm	4-6 pm

3.3.1 Thermostat Logs

To support the analysis of 2015 demand response events, Opinion Dynamics received and analyzed log files for 228 thermostats for participants with central AC and for 148 thermostats for participants with window AC.[20] Thermostat log files contain information about AC usage and event opt-outs in addition to the data that is the basis for the demand response impact analyses. We only examined and used log data for the 2015 peak season (June through September).

Central Air Conditioning

The logs for thermostats associated with central AC contain data recorded at five-minute intervals. During each of those intervals, the log records the run-time of the AC unit, the temperature setting, the indoor temperature, an event code, and several other variables. The central AC portion of the impact analysis uses the run-time as the dependent (or primary) variable.

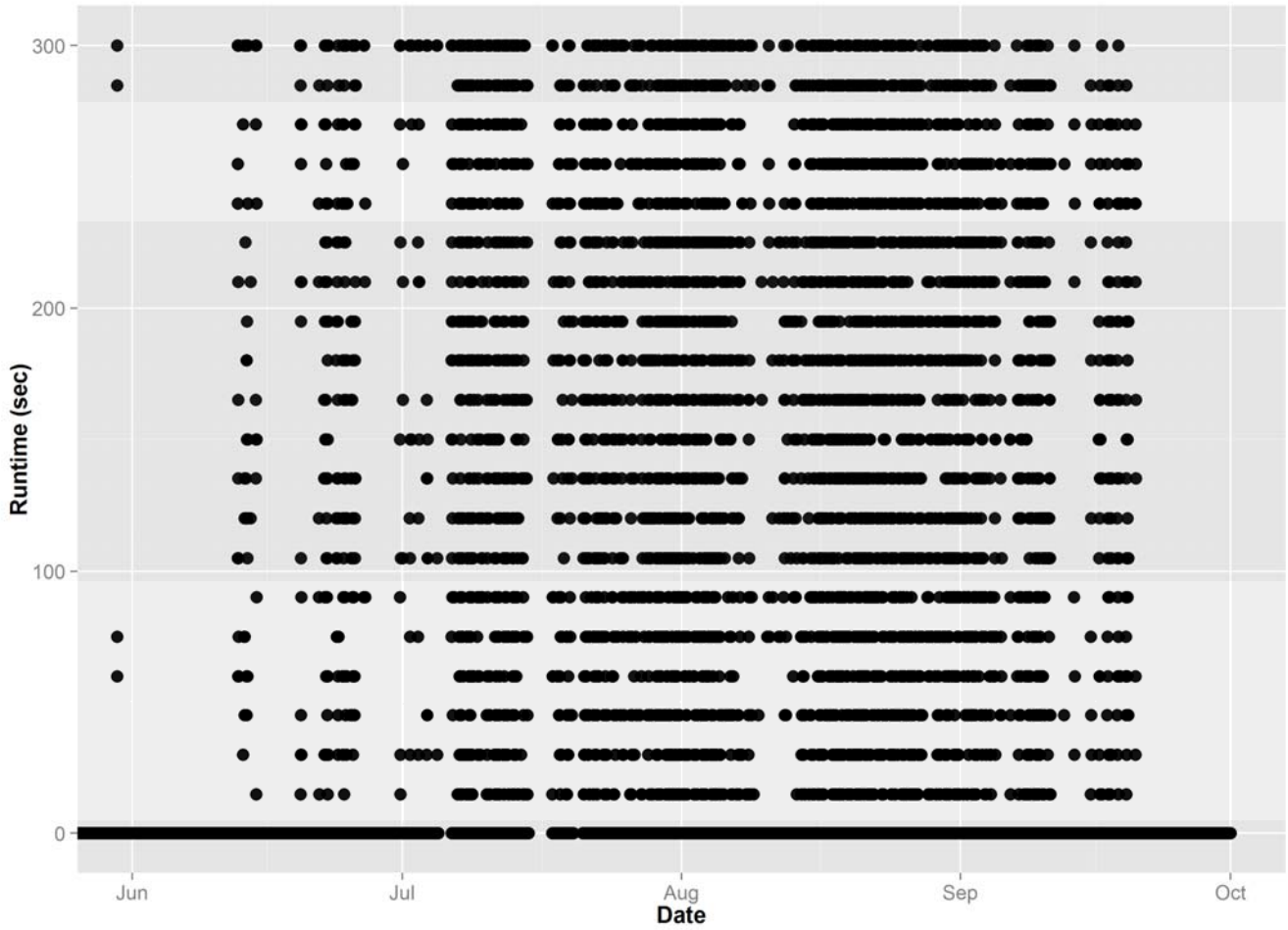
Figure 3-7 shows central AC run-time from one of the thermostat logs during the June through September 2015 peak season. Each dot on the chart shows the run-time for a five-minute period. When the plotted run-time is 300 seconds (i.e., five minutes), the AC was running continuously for that period. We examined these plots for all thermostats to understand how the thermostats and central AC units operated during the 2015 peak season.

Figure 3-7 shows that the unit was running mainly from mid-June through mid-September. There are several short periods in July during which the unit appears to be offline. These periods correspond to the gaps in the solid line across the bottom of Figure 3-7, and are present in all thermostat logs. Review of weather data found that most of these runtime gaps occurred during or shortly after thunderstorms, which suggests that severe weather temporarily knocked out power in the area or otherwise affected thermostat connectivity. While these outages generally do not affect our analysis, one such gap in data occurred just before the start of back-to-back DR events on July 20 and 21. Because most thermostats were offline on July 20 and 21, and because energy usage during and immediately after a severe weather event is likely to be different from typical usage, we dropped these events from our analysis.

Several of the central AC logs (41 of 228) contained no data or only zeroes. An additional 12 logs contained very few values greater than zero, which indicated that the central AC unit was only used for a couple of days or that the thermostat was malfunctioning. Another two thermostats were offline during every event. These 55 thermostat logs were dropped from the analysis, leaving us with logs for 173 thermostats for our analysis.

[20] Thermostats included in this analysis are associated with both substation and non-substation customers.

Figure 3-7. Run-Time per 5-Minute Interval for the 2015 Peak Season for One Central AC Unit



Window Air Conditioning

The logs for thermostats associated with window AC also contain data recorded at five-minute intervals. During each of those intervals, the thermostat log records the Watt consumption of up to five window AC units (each plugged into a separate plug device), the temperature setting, the indoor temperature, an event code, and several other variables. The window AC portion of the impact analysis uses the total AC demand in kW as the dependent variable.

According to the program tracking database, the program has installed 150 thermostats associated with window ACs. However, we were able to include only 14 of these 150 thermostats (9%) in our analysis. We had to drop the remaining 136 thermostats from our analysis due to the following issues:

- 116 logs (77%) showed connectivity issues with the portal. These logs did not contain plug data, indicating that the thermostat did not communicate with the portal at all.[21]

[21] Of these, 42 thermostats are listed as "Not Connected" in the program tracking databases.

- 10 logs (7%) were provided to us as a separate data pull, in response to our initial inquiry about missing log files. These log files had a different data structure than the other plug files and did not contain any usable data.
- 8 logs (5%) recorded almost all zeros or very low usage, indicating that either nothing or a device other than a window AC was plugged in during the evaluation period.
- Logs for 2 thermostats (1%) were missing. Both of these thermostats are tracked in the participation data as having been added to the portal in late September, i.e., after the last demand response event had been called.

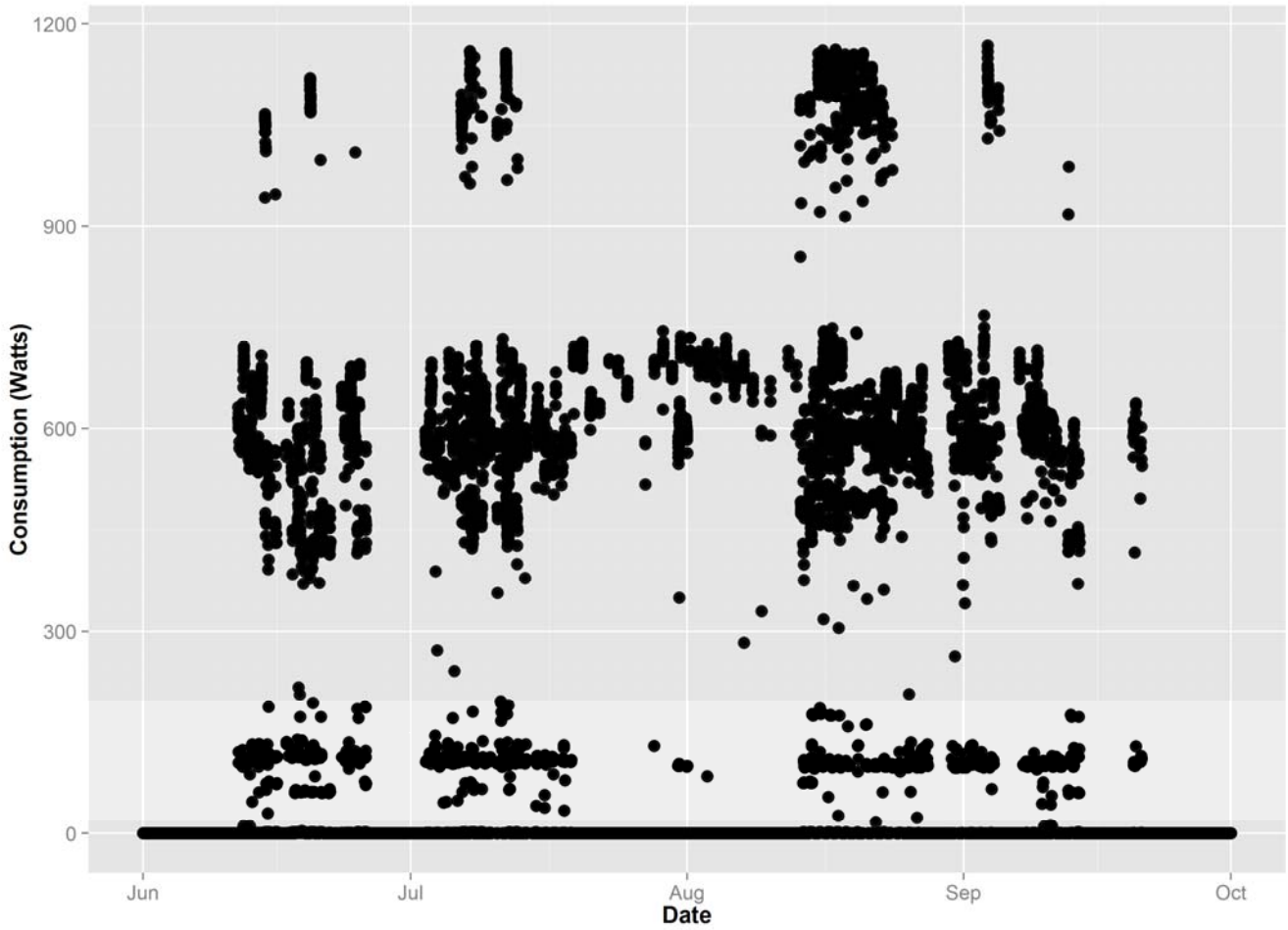
Notably, none of the 23 thermostats controlling window AC that were newly installed in 2015 contained data usable for the analysis. They included the 10 logs with a different file structure (43% of the 2015 installations), 6 logs with connectivity to the portal but no plug data (26%), 3 logs with almost all zeros or very low usage (13%), 2 logs with no connectivity to the portal (9%), and the 2 missing logs (9%).

We understand that a technician installs the plug device during the thermostat installation and connects the two pieces of equipment, so that the thermostats can cycle the window AC during events. For plug devices installed in 2014 or earlier, the most likely explanation for the observed connectivity issues is that participants removed their plug devices together with their window AC during the fall/winter and may not have reinstalled them (or reinstalled them correctly) at the beginning of the 2015 cooling season. Notably, though, thermostats installed prior to 2014 have the highest working rate with 14% (or 11 thermostats). For plug devices installed in 2015, however, it is unclear if the absence of usable log file data is systematic, given the different data issues encountered.

Figure 3-8 shows window AC consumption in Watts per 5-minute interval during the 2015 peak season for one of the thermostats that successfully controlled a window AC during the peak season. The log shows data from mid-June until the end of the season.[22]

[22] Similar to central AC thermostats, there are gaps in the data, although most are too small to be visible in the figure.

Figure 3-8. Watt Usage Over Each 5-Minute Interval for the 2015 Peak Season for One Window AC



3.3.2 Event Failure and Opt-out Rates

The previous section described thermostats excluded from our impact analysis because they appeared to be non-functional or the logs were empty. We define this as "complete failure." We classified 55 thermostats associated with central AC and 134 thermostats associated with window AC[23] as having experienced complete failure during the 2015 peak season. For the event failure and opt-out rate analyses presented in this subsection, we also excluded 18 central AC participants who are not substation customers but who for whom we had valid log data.

We examined the logs associated with the remaining thermostats (155 for central AC and 14 for window AC) to establish "event failure" and "opt-out" rates for each of the 13 valid event periods. We define "event failure" as cases where a thermostat with valid data does not have a record of having received the event signal. We define an event "opt-out" if the thermostat setting switched out of event mode *and* the AC unit begins cooling

[23] This includes eight thermostats where the logs showed unusually low usage, that cannot be associated with window AC units.

(the latter condition avoids flagging customers who *raised* their temperature set-point as an opt-out) before the end of the event.

Table 3-3 shows the event failure and opt-out rates for each 2015 event, by thermostat type. A "Total" count of fewer than 155 central AC or 14 window AC thermostats reflects thermostats that did not contain any data (including zeroes) during the event period. The count of total central AC thermostats always less than 155 because while each of the 155 thermostats was functional during at least one event, there was no event for which all of them recorded data.

Table 3-3. Event Failure and Opt-Out Counts and Rates

AC Type	Event	Total	Event Failures	Failure Rate	Opt-Outs	Opt-Out Rate
Central	July 13	135	53	39%	3	2%
	July 20	*Event dropped due to likely power outage*				
	July 21	*Event dropped due to likely power outage*				
	July 29	147	12	8%	11	7%
	July 30	147	11	7%	10	7%
	July 31	150	11	7%	12	8%
	August 4	150	15	10%	14	9%
	August 17	149	12	8%	48	32%
	August 18	149	14	9%	48	32%
	August 31	150	12	8%	46	31%
	September 1	146	9	6%	38	26%
	September 2	146	8	5%	39	27%
	September 3	146	11	8%	34	23%
	September 8	145	12	8%	29	20%
	September 9	145	12	8%	33	23%
	Mean	**146.5**	**14.8**	**10.1%**	**28.1**	**19.2%**
Window	July 13	14	0	0%	0	0%
	July 20	*Event dropped due to likely power outage*				
	July 21	*Event dropped due to likely power outage*				
	July 29	14	0	0%	0	0%
	July 30	14	0	0%	0	0%
	July 31	14	0	0%	0	0%
	August 4	13	1	8%	2	15%
	August 17	11	0	0%	1	7%
	August 18	11	0	0%	1	7%
	August 31	11	0	0%	1	9%
	September 1	10	0	0%	1	10%
	September 2	10	0	0%	0	0%
	September 3	10	0	0%	0	0%
	September 8	11	0	0%	0	0%
	September 9	11	1	9%	1	9%
	Mean	**11.8**	**0.2**	**1.3%**	**0.5**	**4.5%**

Failure Rates

Some of the thermostat logs do not show an event at all during the event period. This could happen for two reasons: (1) the thermostat was not functioning or communicating during the event period and therefore did not receive notification of the event or (2) an occupant opted out of the event during the first five minutes. Based on the logs, we cannot differentiate between these two causes, so we count all thermostats that show no record of an event as failures. The mean event failure rate is 10.1% for central AC thermostats and 1.3% for window AC thermostats (see Table 3-3). Noteworthy is the large number of central AC event failures during the first event on July 13, which drives up the overall event failure average. It is also worth noting that, while most window AC units successfully received event signals, many of the plugs were connected to AC units that were turned off.[24] Because usage was already zero, there was no way for the unit to respond. As a result, demand reduction values are lower than one might expect given the low event failure rate.

The overall failure rate, which combines *complete* thermostat failures and *event* failures, is 31% for central AC thermostats and a much larger 91% for window AC thermostats. Although, based on counts of logs received, there were more participants in 2015 than in 2014, the pervasive log problems meant that there was actually less data with which to conduct the analysis.

Opt-out Rates

The mean opt-out rate for central AC thermostats is 19.2%. This is a higher rate than in 2014 (4%), although this could partially be due to hotter weather on 2015 event days relative to 2014. The mean opt-out rate for window AC units was 4.5%, although the fact that many units were already turned off makes this value difficult to interpret. For most of the central AC opt-outs, the opt-out occurred in the last hour of the 4-hour event. However, each of the thirteen events showed several opt-outs in the first three hours of the event.

3.4 Demand Response Impact Analysis

Demand Response Impacts – Central Air Conditioning

This section presents the demand response impact results for participants with central AC. Table 3-4 presents the demand response impacts for the thirteen valid events called in 2015.[25] Each event has nine matched comparison days that we used to develop the modeled baseline. Opinion Dynamics also estimated impacts for an overall event that uses data from eleven of the thirteen events (the two events with different event times were dropped) and all matched comparison days. Note that the result for the overall event is not a simple average of the eleven single events: The baseline of the overall event is slightly different because all comparison days are used in the model, so the impact estimate is not exactly the same as if we had averaged the thirteen events. Estimated impacts for each event hour are presented in Appendix B. DemandLink Evaluation – Additional Details.

As noted above, 18 central AC participants with valid log data are not on the Tiverton substation. These participants were included in the model to determine the average per thermostat runtime reduction, but they were excluded from the total number of participating thermostats, i.e., their savings are not included in overall program impacts.

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[24] On average more than half of participating window AC units were off during the entire event.

[25] As described above, the July 20 and 21 events were dropped from the analysis due to the runtime gaps observed just before the start of these events.

Table 3-4. Central AC Demand Response Impact

	Per-Thermostat Impact		# of Participating Thermostats	Program Impact	Average Temperature During Event Hours
	Runtime Reduction	kW		kW	
Overall	**13.3%**	**0.49**	**155**	**76**	**79°F**
July 13	12.6%	0.46	135	63	76°F
July 29	14.2%	0.52	147	77	83°F
July 30	16.4%	0.61	147	89	77°F
July 31	16.2%	0.60	150	90	81°F
August 4	10.6%	0.39	150	59	79°F
August 17	10.1%	0.37	149	56	81°F
August 18	13.4%	0.49	149	73	79°F
August 31	16.5%	0.61	150	91	83°F
September 1	13.3%	0.49	146	71	78°F
September 2	11.1%	0.41	146	60	78°F
September 3	12.6%	0.46	146	68	82°F
September 8	16.2%	0.60	145	87	79°F
September 9	16.4%	0.60	145	88	80°F

We used a linear fixed-effects regression modeling approach for the demand response impact analysis. The models estimate the percentage of hourly runtime on a per-thermostat level. Event savings are the mean difference between the baseline runtime and the event runtime over the event period. The kW impact, therefore, is an average rather than the maximum instantaneous demand reduction. We used an average estimate of full load central AC demand of 3.69 kW at full load to estimate the kW savings per thermostat. Not all thermostats had logs for all of the event periods, so we only applied savings for those thermostats where we could confirm operation. The program total impact is the product of the per-thermostat kW impact averaged over the event period and the number of participating thermostats. All operational thermostats were included in the model, even if the participant opted out of the event. The impact estimates therefore include the effect of any participant opt-outs.

Opinion Dynamics calculated the full load kW demand for an average central AC unit in Rhode Island based on Equation 3-1 which uses deemed average equipment cooling capacity (in Btu per hour) and equipment efficiency (EER) values from the RI Technical Reference Manual (TRM). The resulting full load demand per central AC unit is 3,692 watts, or 3.69 kW.

Equation 3-1. Full Load kW for Central AC

$$\textit{Full load kW} = \textit{Capacity} / \textit{EER}$$

Where:

Capacity = 3 tons or 36,000 Btu/hr[26]

EER (Btu/watt-hr) = 9.75[27]

[26] RI PY2014 TRM Central AC page M-25: Tons = deemed average equipment cooling capacity: 3 tons

[27] The RI PY2014 TRM has measures for traditional AC replacement (page M-25) and early replacement central AC replacement (M-40). The EER used for this analysis assumes an average (i.e., 9.75) between the baseline EER of new equipment (EER = 11: page M-

Figure 3-9 depicts the hourly event usage and baseline usage for the overall average event. The event period shows significant runtime reduction, with a small snapback in the two hours after the event ends. The snapbacks are generally larger than those in 2014, possibly because of the higher event day temperatures.

Figure 3-9. Overall Hourly Event Day Usage with Baseline

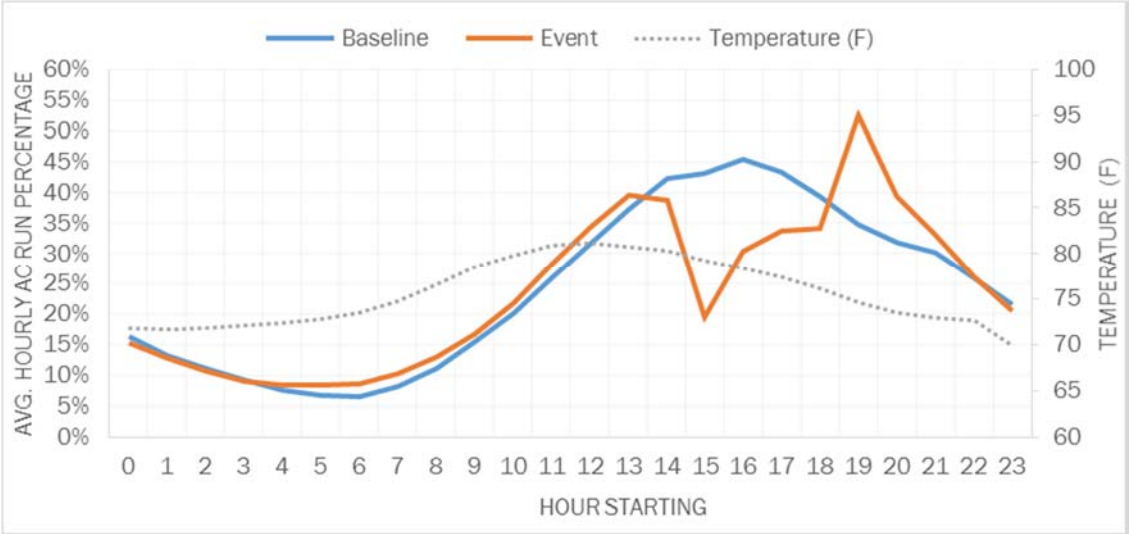


Figure 3-10, Figure 3-11, and Figure 3-12 show the runtime percentage along with the baseline used to calculate demand impact for three events of interest: one typical event and the two events that occurred at different hours. In all three events, there is significant demand reduction during the event hours followed by a short snapback period of increased demand.

25), and the baseline EER of early replacement equipment (EER = 8.5: page M-40). If we only used the current baseline of new equipment (EER 11) we would be underestimating savings since there are likely older pieces of equipment in use that do not meet current baseline requirements. If we assumed only the early replacement baseline (EER 8.5), we would likely be overestimating savings as there are likely newer pieces of equipment that have a higher efficiency. Taking the average appears to be a more accurate estimate and can be verified through future data collection efforts that analyze the exact capacity and efficiency of the units participating in the program.

Figure 3-10. Event 6, July 31 Hourly Usage with Baseline (Typical Event)

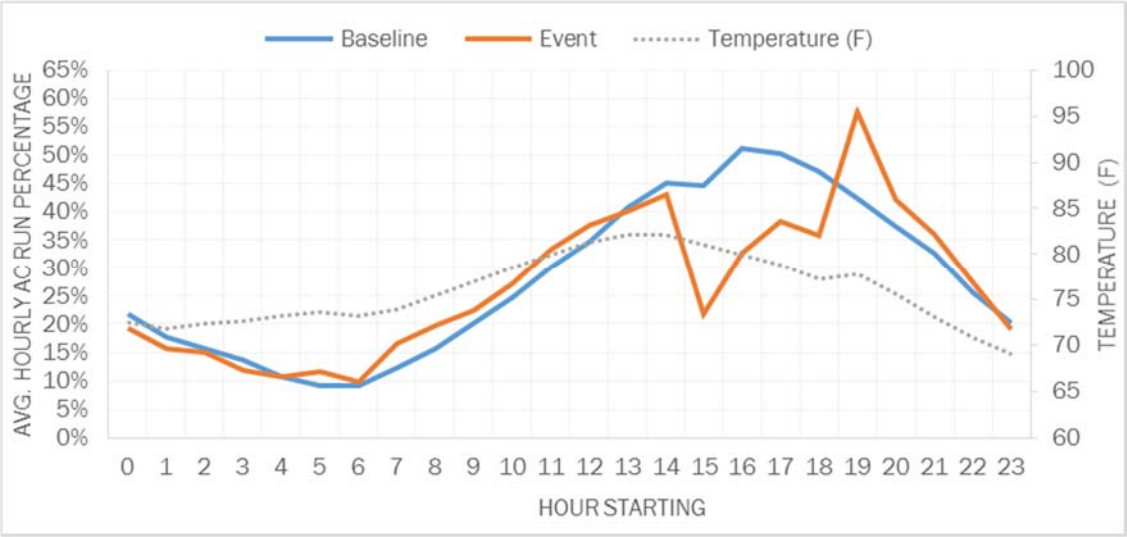


Figure 3-11 shows event day usage and the estimated baseline for Event 7, on August 4, which occurred an hour earlier in the day (2-6 pm as opposed to 3-7 pm). The runtime reduction for this event (10.6%) is less than the overall average (13.3%) despite its relatively low opt-out rate (10% vs an average of 19%). Given the data available, it is not possible to determine if the shift in timing is responsible for the lower savings. It is also possible that weather played a role. Reports for that August 4 indicate fog, rain, and thunderstorms.[28]

The runtime reduction of 16.2% for Event 14 (see Figure 3-12) – on September 8, which occurred an hour later in the day (4-8pm) – has one of the highest savings rates of all the events, although it is also impossible to determine whether the later time had any effect on savings given available data. In the future, using a randomized control experiment (in which a randomly selected subset of participants are called for any particular event) would make it possible to learn more about the savings implications of calling events at different times and under different weather conditions.

[28] See: http://www.wunderground.com/history/airport/KUUU/2015/8/4/DailyHistory.html?req_city=Tiverton&req_state=RI&req_statename=&reqdb.zip=02878

Figure 3-11. Event 7, August 4 Hourly Usage with Baseline

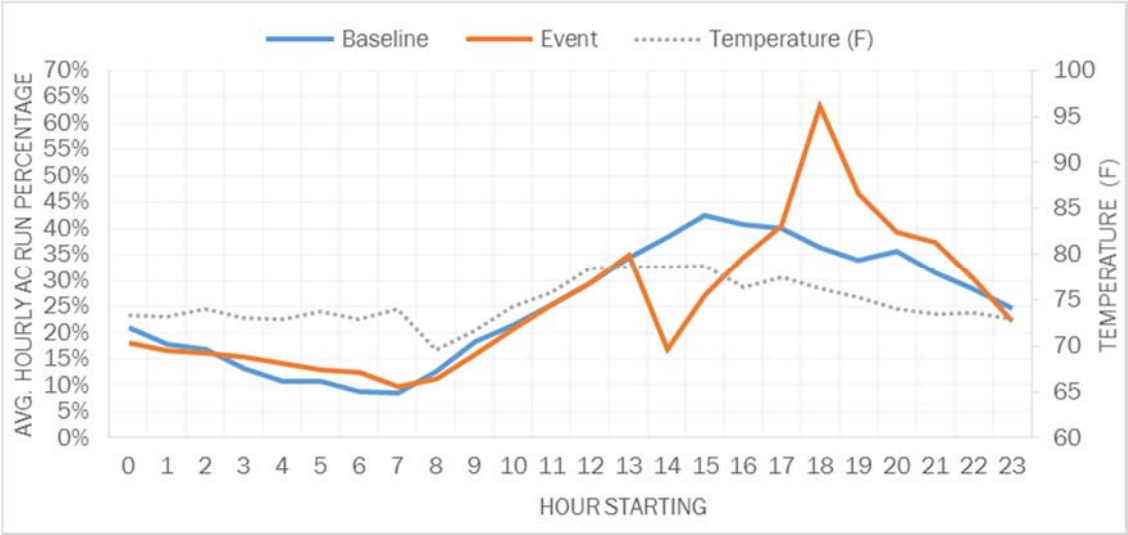
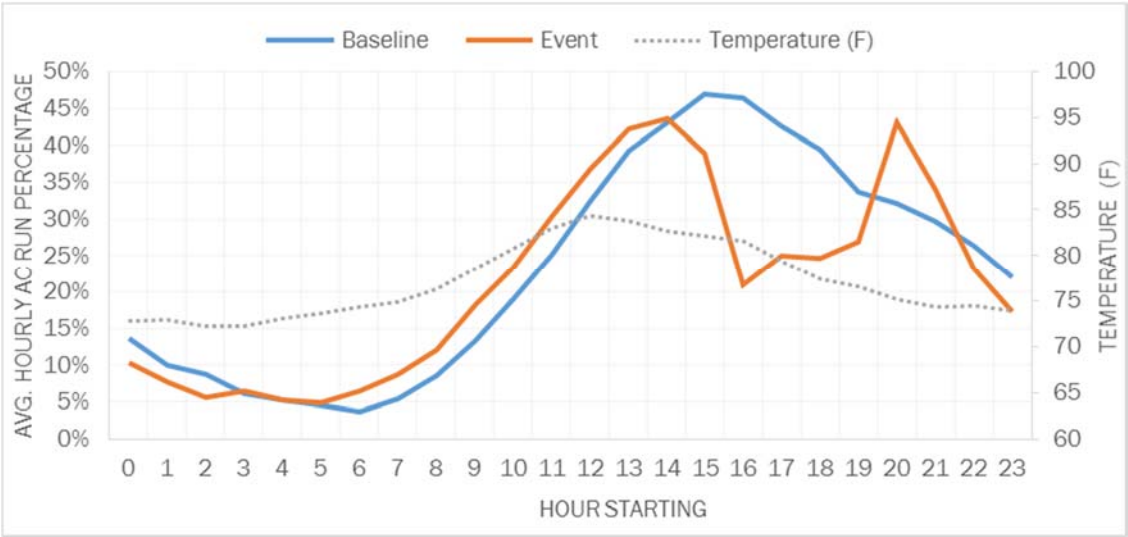


Figure 3-12. Event 14, September 8 Hourly Usage with Baseline

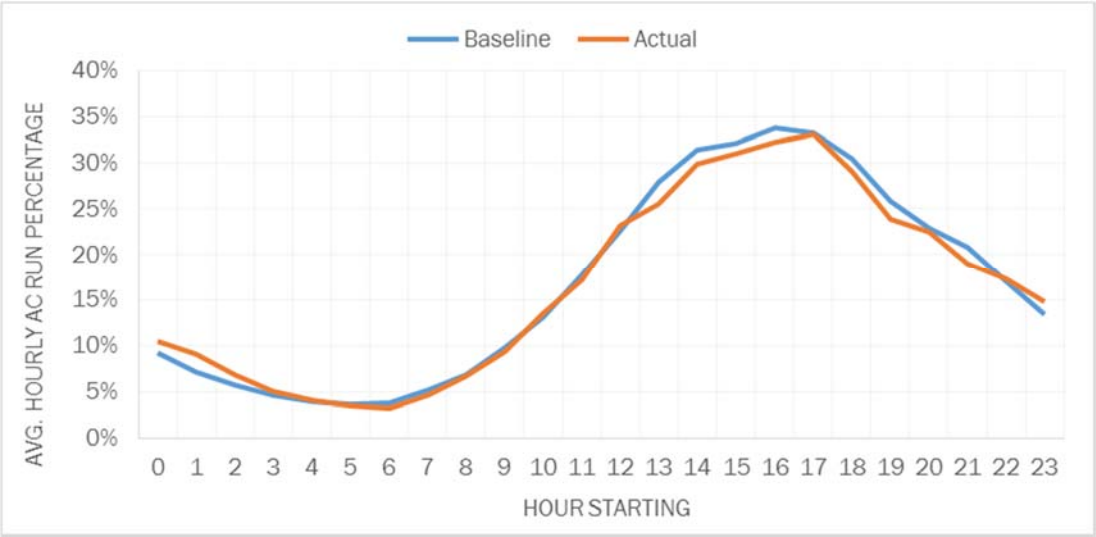


Model Validation

The primary method for evaluating the validity of a linear fixed effects model is to compare actual, logged run time to the baseline runtime predicted by the model. When actual and baseline are similar, especially on non-event days with weather similar to event days, it shows that the model is effectively estimating the baseline. The primary reason for the model is to estimate a baseline on event days, so matching non-event day usage is the best way to demonstrate model effectiveness. However, there was no single non-event day that truly approximated event day temperatures. Most event days had a rapid increase in temperature in the late morning, while the hottest non-event days were relatively hot all day. As a result, we evaluated the model using a combination of two days: one that was hot throughout and one that had a temperature increase comparable to that of an event day. Figure 3-13 shows that the modeled baseline using the combination of the two days matches the actual baseline to within about 1% runtime percentage for non-event days. When using only one of the two non-event days, the modeled baseline matches to within 3% of actual runtime. The close match of

the modeled baseline and actual usage in the hours leading up to the event in Figure 3-9 increases our confidence that the model estimates baseline usage accurately.

Figure 3-13. Non-event Day Baseline versus Actual AC Run Percentage



3.4.1 Demand Response Impacts – Window Air Conditioning

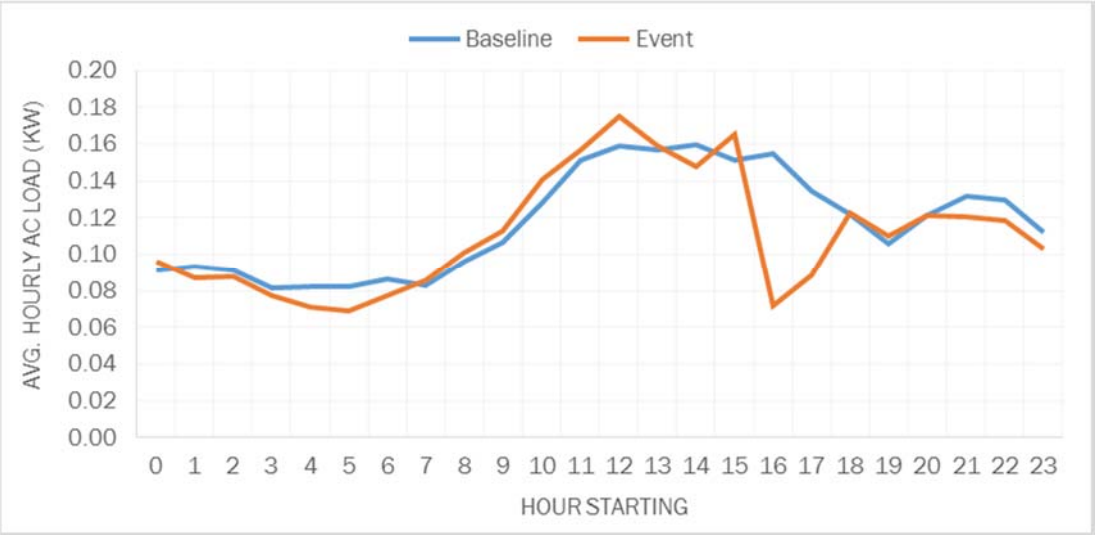
This section presents the demand response impact results for participants with window AC. Table 3-5 presents the average overall demand response impact for the thirteen 2015 events. The overall model uses data from twelve events (we dropped Event #7, on August 4, which occurred an hour earlier than the other events) and all matched comparison days. We do not separately present the demand impacts for each of the events because there were only 14 thermostats that participated in the events, and in each event, even fewer thermostats recorded valid data. The logs from these 14 thermostats do not contain enough data to model baseline usage for the events separately.

Table 3-5. Window AC Demand Response Impact

	Per-Thermostat Reduction (kW)	Participating Thermostats	Program Impact (kW)
Overall Events	0.04	14	0.60

The thermostat logs for the participants with window AC collect energy usage data, so we were able to model demand directly. Figure 3-14 shows the kW load for window AC units during an average event.

Figure 3-14. Overall Hourly Event Day Usage with Baseline



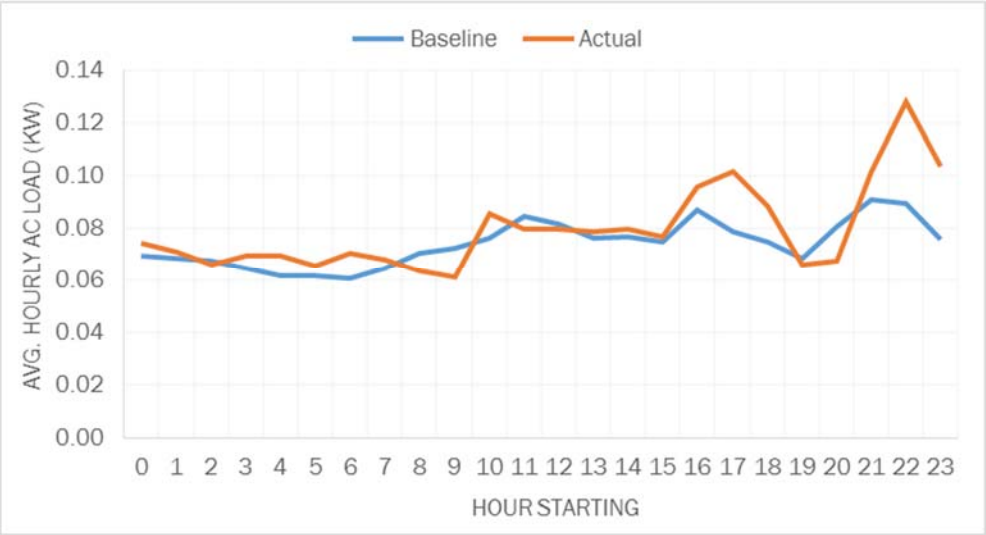
Model Validation

As with the central AC analysis, the primary method for evaluating the validity of a linear fixed effects model is to compare actual, logged load to the baseline load predicted by the model. When actual and baseline are similar, especially on non-event days with weather like the event days, it shows that the model is effectively estimating the baseline.

Figure 3-15 shows the actual mean window AC load on a non-event day versus the baseline load estimate from the model. This baseline does not match nearly as well as the one for central AC. The primary reason for this is that logs from the thermostats of 14 participants do not provide enough data, especially since many record zero usage on most days. The degree to which the model makes accurate predictions partially depends on which of the 14 thermostats happens to be running on a particular day. From this graph, and those of other non-event days that are not included here, it appears that the baseline tends to underestimate afternoon usage. If this is the case, the demand response impact estimates in Table 3-5 may be biased, resulting in an underestimate of impacts.

Given the small number of thermostats that could be included in the analysis, the impact estimates should be regarded as provisional. Future impact evaluations will help establish a firmer estimate for average impact.

Figure 3-15. Non-event Day Baseline versus Actual AC Load



4. Window AC Rebate and Recycling Evaluation

This section presents evaluation results for the DemandLink window AC rebate and recycling components of the SRP pilot. The 2015 evaluation included the following analyses, presented in this section:

- A review of participation in the DemandLink window AC rebate and recycling programs
- A gross impact analysis of rebates for the purchase of new ENERGY STAR® window AC units
- A gross impact analysis of window AC recycling rebates

We also developed a methodology and collected participant survey data to estimate attribution for the window AC rebate and recycling programs. However, due to the small number of participants in these programs and the even smaller number of survey respondents (one in 2015 and eight to-date for the window AC rebate; one in 2015 and seven to-date for window AC recycling), we have not developed net impact results. If participation in this program component increases, we will implement the methodology and conduct the net impact analysis after future waves of the DemandLink participant survey, when more survey responses are available.

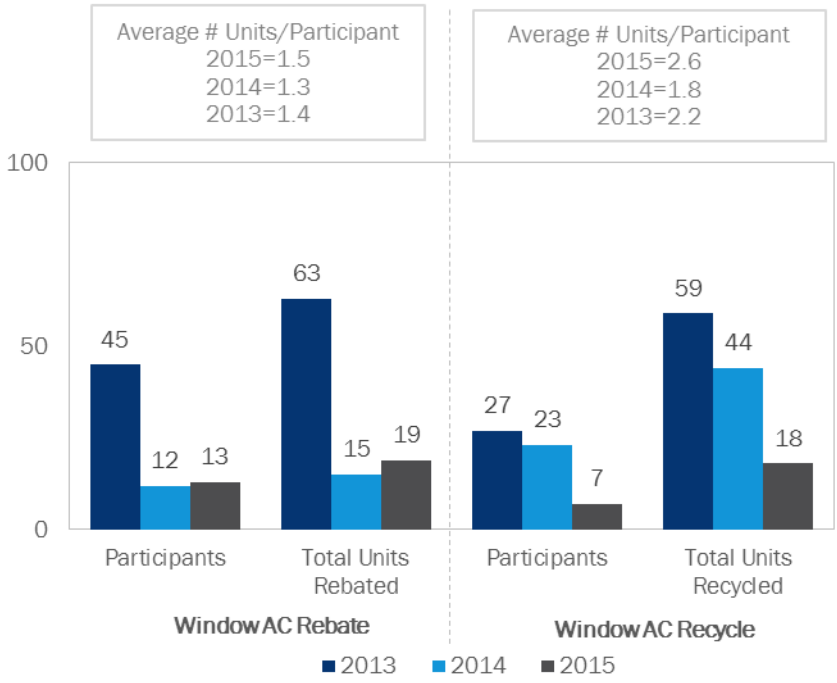
4.1 Window AC Participation

In 2015, the DemandLink Window Air Conditioner Rebate and Recycling programs ran from May 1 to November 1. National Grid offered customers in Tiverton and Little Compton a $50 rebate for the purchase of up to four qualifying new window AC units ("window AC rebate") and a $25 rebate for each of up to four window ACs they recycled ("window AC recycling").

Overall, 16 unique customers in the pilot area participated in the window AC programs in 2015, installing 19 new ENERGY STAR® units and recycling 18 old units.

Figure 4-1 illustrates participation and equipment counts in the pilot area during the active program period, 2013 through 2015. The rebate program exceeded 2015 projections to provide rebates for 10 new ENERGY STAR® rated units while the recycling program fell slightly short of projections to provide rebates for 25 recycled units to customers on substation feeders. In addition, while participation in the rebate program increased slightly compared with 2014, participation in the recycling program continued to decline.

Figure 4-1. Window AC Rebate and Recycling Program Participation in SRP Pilot Communities (2013-2015)



National Grid promotes these two programs in tandem, with one application for both rebates. As shown in Table 4-1, the majority of participants (56%) only received a rebate for an ENERGY STAR® unit, while 19% only recycled one or more old units and 25% took part in both programs. Although a similar share participated in both programs as did in 2014, a smaller share participated in the recycling program and larger share participated in the rebate program. On average, customers who participated in both programs recycled more units through the program than they purchased with the rebate.

Table 4-1. Unique Participants, 2015

Program Component	2014				2015			
	Number of Participants	% Participants	Avg. # units rebated	Avg. # units recycled	Number of Participants	% Participants	Avg. # units rebated	Avg. # units recycled
ENERGY STAR® Rebate Only	5	18%	1.4	n/a	9	56%	1.6	n/a
Recycle Only	16	57%	n/a	2.1	3	19%	n/a	2.3
Both	7	25%	1.1	1.4	4	25%	1.3	2.8
Total	28	100%	1.3	1.9	16	100%	1.5	2.6

4.2 Window AC Rebate and Recycling Gross Impact Analysis

Per the evaluation plan, we estimated window AC rebate and recycling gross impacts for 2015 and the pilot-to-date by applying the per unit savings value developed in support of the 2014 Annual Evaluation Report to equipment counts from the program tracking database.[29]

Summary of Per Unit Savings and Total Ex-Post Savings for Window ACs

Table 4-2 summarizes the ex-post per-measure savings for rebated and recycled window ACs as well as the 2015 total ex-post gross savings for the DemandLink window AC programs. For the 37 measures incented in 2015, the ex-post gross energy savings are 3.68 MWh and the ex-post gross demands savings are 2.60 kW.

Table 4-2. Ex-post Gross Savings for Recycled and Rebated Window AC Units –2015

	Per-measure Savings			Total Ex-Post Savings	
Measure	kWh	kW	Quantity	kWh	kW
Rebated Window AC	17.35	0.012	19	330	0.23
Recycled Window AC			18	3,355	2.37
Recycled WAC (no replacement)	*238.44*	*0.168*	*13*	*3,100*	*2.19*
Recycled WAC (with replacement)	*51.09*	*0.036*	*5*	*255*	*0.18*
Total Window AC			37	3,685	2.60

Table 4-3 summarizes the ex-post per-measure savings for rebated and recycled window ACs as well as total ex-post gross savings for the DemandLink window AC programs to-date. For the 221 measures incented to-date, the ex-post gross energy savings are 23.57 MWh and the ex-post gross demands savings are 16.64 kW.

Table 4-3. Ex-post Gross Savings for Recycled and Rebated Window AC Units – 2013-2015

	Per-measure Savings			Total Ex-Post Savings	
Measure	kWh	kW	Quantity	kWh	kW
Rebated Window AC	17.35	0.012	97	1,683	1.19
Recycled Window AC			121	21,170	14.94
Recycled WAC (no replacement)	*238.44*	*0.168*	80	19,075	13.46
Recycled WAC (with replacement)	*51.09*	*0.036*	41	2,095	1.48
Total Window AC			218	22,853	16.13

[29] For more details on the methodology used to develop per unit savings values for window AC rebates and recycling, see *2014 Annual Evaluation Report*, by Opinion Dynamics Corporation, dated August 10th, 2015.

5. Small Business Analysis

This section presents evaluation results for the Small Business Direct Install Program (SBDI). The 2015 evaluation included the following analyses, presented in this section:

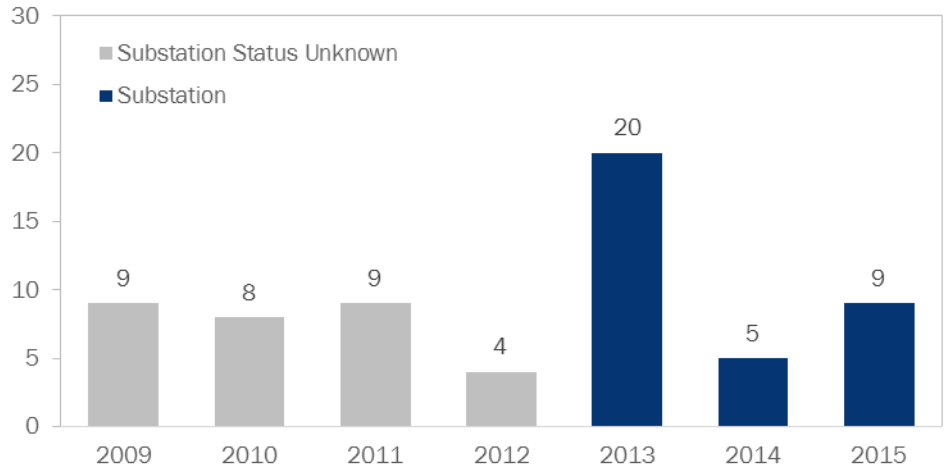
- A review of participation in the SBDI Program
- The SBDI impact analysis, including development of ex ante gross and net load impacts from the installation of SBDI measures

5.1 Participation Summary

In 2015, there were 426 commercial accounts on the Tiverton substation.[30] The majority of these customers (92%) are small commercial customers. SRP pilot efforts focus on these small commercial customers, with a goal of increasing participation in the SBDI Program and the DemandLink Program. Commercial customers are included in Demand Link marketing and outreach, although marketing materials are not explicitly tailored to small business customers.

In 2015, 26 Tiverton and Little Compton small businesses participated in the SBDI program, including 9 substation customers and 17 non-substation customers. While the number of substation participants (9) is almost twice that achieved in 2014 (5), it is less than half the high of 20 reached in 2013.

Figure 5-1. Annual Small Business Audits in SRP Pilot Communities



5.2 Small Business Impact Analysis

The Small Business impact analysis provides a verification of ex ante coincident peak load impacts from measures installed through the SBDI Comprehensive Efficiency Program in the pilot area and estimates the

[30] For the purpose of this analysis, accounts are classified as commercial based on their rate code. Some of these accounts may not be customers who are capable of participating in programs or reducing load, such as cell phone towers.

share of those impacts that is attributable to the SRP pilot efforts (i.e., that would not have occurred if only the statewide program had been available). The impact analysis consists of two main efforts:

1. **Estimate gross load impacts based on ex ante savings.** Based on the SBDI program database, we determined measure installations among Tiverton substation customers during the evaluation period (August 16, 2012 – December 31, 2015) and assigned ex ante gross load impacts (savings) to all measures installed.

2. **Estimate the incremental SBDI participation rate among Tiverton and Little Compton participants relative to (a) past participants and (b) participants in nearby communities.** We conducted a database analysis of historical and SRP pilot period participation in the SBDI Program, to compare participation rates in SRP communities with participation rates in comparison communities, both before and during the SRP pilot. The resulting incremental participation rate provides a measure of attribution for the SRP pilot.

We then applied the evaluated incremental participation rate to the ex ante gross savings to determine load impacts that are attributable to the SRP pilot. The following subsections summarize these analyses.[31]

5.2.1 SBDI Gross Load Impacts

To determine the gross load impacts in the SRP pilot area from the installation of SBDI Program measures, we applied National Grid's 2015 Rhode Island-specific summer diversity factors to the demand impacts in the SBDI tracking database for measures installed on the substation during the pilot period (August 16, 2012 through December 2015).[32] We used the following formula:

*Peak Load Reduction (kW) = Total Gross kW Reduction * Summer Diversity Factor*

The table below shows the quantities and resulting peak kW load impacts for all installations in the substation area during each year of the pilot period as well as for the pilot-to-date. Total impacts for 2015 installations are 19.0 kW, more than double the 9.2 kW estimated for 2014 installations, but down almost 70% from the 57.9 kW achieved from 2013 installations. There were no installations during 2012, although two audits were completed (the associated installations occurred in 2013).

Total cumulative gross impacts for the pilot-to-date are 86.1 kW. The vast majority of these savings comes from lighting measures (98%) with LED bulbs accounting for 62% and linear fluorescent accounting for 19% of total impacts.[33]

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[31] The SBDI impact analyses are analogous to the EnergyWise Impact Analysis presented in Sections 2.2 and 2.3, except that the EnergyWise analysis also included a survey-based attribution analysis, which was combined with the incremental participation analysis to develop an overall "take rate" for the SRP pilot. Incremental impacts for the SBDI Program are based on an incremental participation analysis only.

[32] We consider August 16th 2012, rather than March 1st 2012, to be the pilot start date for the SBDI Program because marketing in the pilot communities for this program component did not begin until mid-August.

[33] Our review of SBDI data found inconsistencies in the labeling of several lighting measures, where the measures were categorized as CFLs or HID lighting, but the detailed measure description identified them as LEDs. In the final dataset, received on May 10, 2016, all such measures were consistently labeled and categorized as LEDs. However, we question the accuracy of this final categorization as it means that as early as 2013, the bulk of installed program measures were LEDs, with only three CFLs installed over the entire

Table 5-1. SBDI Installed Measures and Ex Ante Gross Peak Load Reduction: August 2012-2015

Measure Category	Total Measure Quantity [a]				Total Peak Load Reduction (kW)			
	2013	2014	2015	Pilot to Date	2013	2014	2015	Pilot to Date
LED Bulbs	982	12	305	1,299	44.2	0.9	8.7	53.7
Linear Fluorescent Lighting	320	89	10	419	12.7	3.2	0.7	16.6
Custom Lighting	-	-	2	2	-	-	8.4	8.4
HID Lighting	-	10	6	16	-	1.3	0.8	2.1
Custom Refrigerator Lighting	-	2	-	2	-	1.1	-	1.1
LED Refrigerated Case Lighting	4	9	-	13	0.2	0.6	-	0.8
Occupancy Sensors	22	5	-	27	0.6	0.0	-	0.6
LED Exit Signs	11	5	8	24	0.3	0.1	0.1	0.6
CFLs	-	-	3	3	-	-	0.3	0.3
Non-HVAC Motors/Drives	-	7	-	7	-	0.7	-	0.7
Fan Control	-	3	-	3	-	0.4	-	0.4
Door Heater Control	-	3	-	3	-	0.2	-	0.2
Novelty Cooler Shutoff	-	8	-	8	-	-	-	-
Custom Motors/Drives	-	1	-	1	-	0.6	-	0.6
Vending Machines	4	-	-	4	-	-	-	-
Custom Hot Water	1	-	-	1	-	-	-	-
TOTAL	1,344	154	334	1,832	57.9	9.2	19.0	86.1

[a] Quantity and savings by year are based on installation date and include projects with audits after 8/15/2012 and invoice dates through 12/31/2015.

It should be noted that this analysis simply applies summer diversity factors to demand impacts tracked in the SBDI participant database; it does not include a review of the reasonableness of the summer diversity factors or the demand savings, nor a verification of measure installation and persistence. As such, these gross load impacts should be considered ex ante impacts, rather than ex post impacts.

three-year period. While we believe that some of these measures might not be categorized correctly, we have no reason to believe this affects the accuracy of the ex ante load impacts presented in this section.

5.2.2 SBDI Incremental Participation Rate

Incremental participation is the increase in SBDI participation in the pilot area that would not have happened without the pilot. To determine incremental participation, we employed a difference-in-differences approach:

- First, we compared the participation rate in Tiverton and Little Compton during the evaluation period (i.e., the pilot-to-date: August 16, 2012 – December 31, 2015) to participation in the pilot area during the baseline period (i.e., January 1, 2009 – August 15, 2012).[34]
- Second, we compared the difference in participation in Tiverton and Little Compton with the difference in participation in a matched comparison region during the same time period. This analysis essentially controls for market trends, i.e., changes in program participation that would have occurred even without the pilot.

The matched comparison towns are Narragansett, North Kingstown, South Kingstown, Bristol, Barrington and Warren. These are the same towns selected as comparison towns for the EnergyWise incremental participation analysis (see Section 2.3.1). The methodology for selecting these comparison towns is documented in a prior evaluation report.[35] To confirm that these towns are also suitable comparison towns for the small business analysis, we compared the number of establishments by employment size class between the SRP communities and the comparison towns. Based on this comparison, we believe that the comparison towns selected for the EnergyWise analysis are also suitable for the small business analysis.

Because the pilot and comparison groups are different in terms of (a) numbers of accounts and (b) their pre-pilot participation rates, the comparison is made in terms of a percentage increase between the pre-pilot and pilot periods, rather than a change in the number of participants. We calculate the percentage change in participation as follows:

$$\%\ Change\ in\ Participation = \frac{Annual\ Participation_{Pilot\text{-}to\text{-}Date}}{Annual\ Participation_{Pre\text{-}Pilot}}$$

Based on tracking data for the SRP pilot area and the comparison towns, we find an increase in annual participation of 146.8% for the pilot area and of 22.4% for the comparison towns.

Table 5-2. Change in Participation – Pilot Area and Comparison Towns

	Pilot Area	Comparison Towns
# Participants Pre-pilot (per year)	8	90
# Participants Pilot-to-Date (per year)	20	110
% Change	146.8%	22.4%

The "lift" or incremental change attributable to the pilot is 146.8% - 22.4% or a 124.4% increase. This number can be applied to the pilot area baseline period count (8 participants/year) to show that 10 participants are incremental. Without the pilot, we would have expected to see a 22% increase in participation in the pilot

[34] Note that this analysis includes both substation and non-substation participants in Tiverton and Little Compton as information on which of the pre-pilot participants are on the substation was not available at the time of this report.

[35] Opinion Dynamics Corporation. *National Grid Rhode Island System Reliability Procurement Pilot:2012-2013 Focused Energy Efficiency Impact Evaluation*. May 12, 2014.

group (or 2 expected audits), i.e., an increase from 8 to a total of 10 annual audits. Instead we saw 20 audits per year – of these half, or 10, can be considered incremental, or attributable to the pilot program. We can calculate the "incremental participation rate" as the percentage of audits that are incremental: 10 / 20 = 50%. Figure 5-2 summarizes these results.

Figure 5-2. Incremental Participation in Pilot Communities (Average Annual Participation, 8/16/2012 – 12/31/2015)

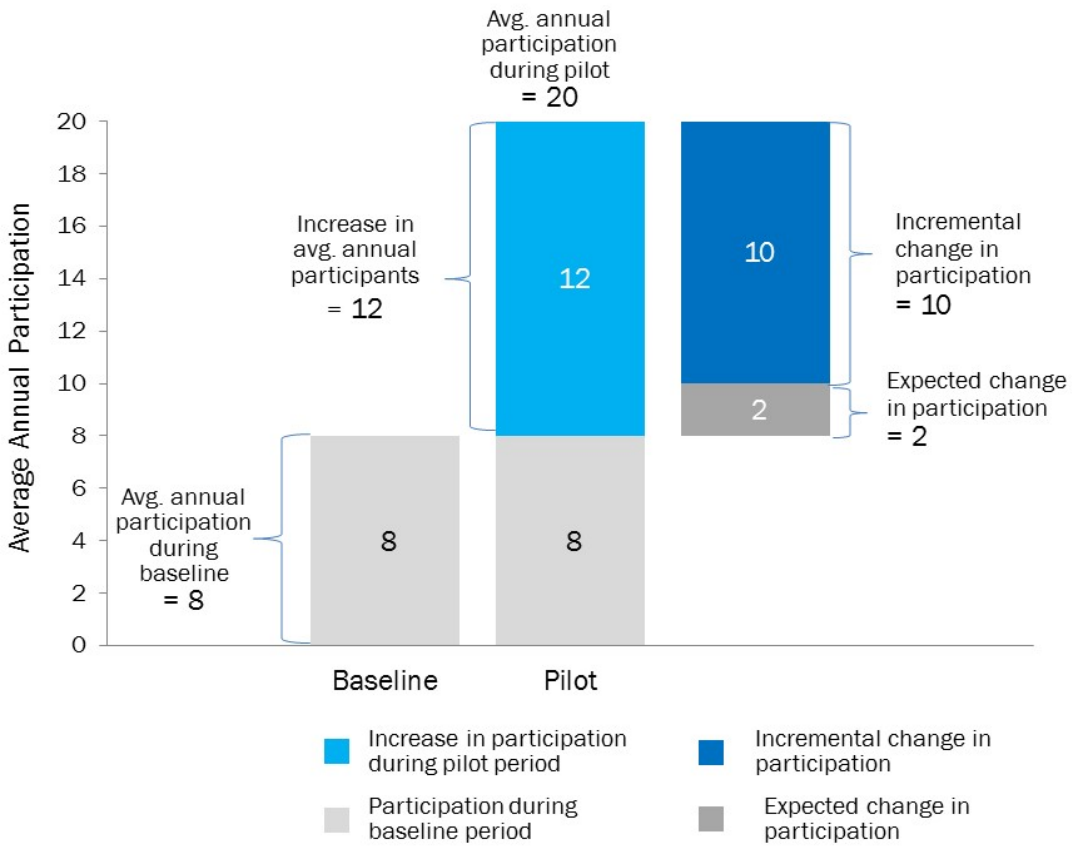
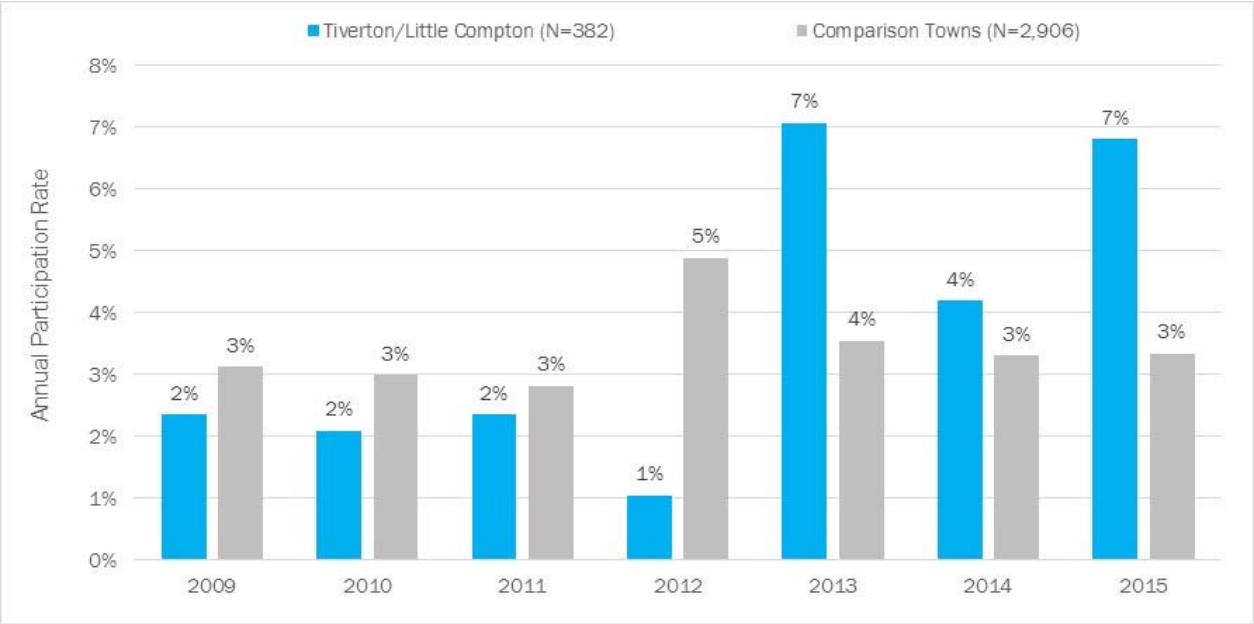


Figure 5-3 below shows participation rates in the pilot communities and the comparison towns for each year of the baseline and pilot periods. As shown in this figure, the comparison communities did not experience the same increase in participation during the pilot period as the SRP communities. Similar to the EnergyWise program (see Section 2.3.1), we see a drop in the participation rate differential in 2014 and an increase again in 2015. [36]

[36] Note that this analysis includes both substation and non-substation participants in Tiverton and Little Compton as information on which of the pre-pilot participants are on the substation was not available at the time of this report.

Figure 5-3. SBDI Participation Rates[a] in SRP Pilot and Comparison Towns, 2009-2015



[a] Calculated as the number of unique participants in each year divided by the US Census count of business establishments with fewer than 50 employees. We selected a cut-off of 50 employees as a proxy for SBDI eligibility criteria.

5.2.3 Incremental SRP Load Impacts

The estimated incremental participation rate for the pilot to date is 50%. Applying this rate to the measure-level gross impact results, we estimate that the program has achieved incremental summer peak load savings totaling 43.1 kW. Table 5-3 presents the incremental impacts for each measure category.

Table 5-3. 2012-2015 SBDI Incremental Load Impacts by Measure Category, 2012-2015

Measure Category	Incremental Peak Load Reduction (kW)
LED Bulbs	26.9
Linear Fluorescent Lighting	8.3
Custom Lighting	4.2
HID Lighting	1.0
Custom Refrigerator Lighting	0.6
LED Refrigerated Case Lighting	0.4
Occupancy Sensors	0.3
LED Exit Signs	0.3
CFLs	0.2
Non-HVAC Motors/Drives	0.4
Fan Control	0.2
Door Heater Control	0.1
Novelty Cooler Shutoff	-
Custom Motors/Drives	0.3
Vending Machines	-
Custom Hot Water	-
TOTAL	43.1

6. Leads Analysis

SRP leads are customers who have expressed interest in one or more SRP program offerings (through inbound requests or outbound telemarketing) but have not yet participated in that program offering. This section presents a discussion of SRP leads, based on an analysis of tracking data compiled by RISE and RAM as well as a telephone survey with customers who were SRP leads in 2014 and 2015.

In 2015, 555 customers on substation feeders expressed interest in the EnergyWise Program or one of the three components of the DemandLink Program (the Wifi Programmable Controllable Thermostat, the EnergyStar Window Air Conditioner Rebate, and the Window Air Conditioner Recycling Rebate).

The vast majority (81%) of 2015 SRP leads were interested in the EnergyWise Program. Interest in the other SRP programs was much lower with 15% of leads interested in the DemandLink Programmable Controllable Thermostat Program, 6% interested in the Window AC Rebate Program, and 4% interested in the Window AC Recycling Program. Overall, there were fewer leads for each program compared to 2014, especially for the three components of the DemandLink program.

Table 6-1. 2015 Customer Interest by Program

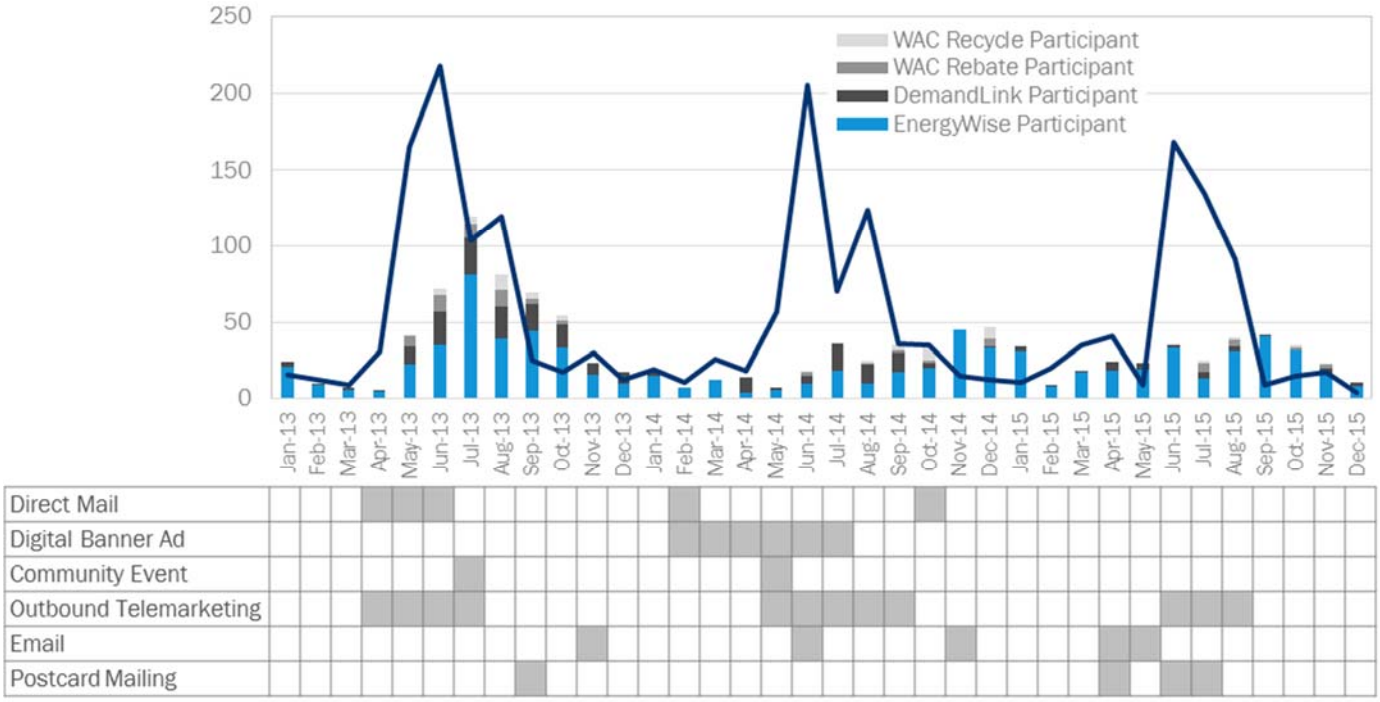
SRP Program	2014 Leads		2015 Leads	
	Count	% [a]	Count	% [a]
EnergyWise Program	526	84%	450	81%
DemandLink Programmable Controllable Thermostat Program	173	28%	84	15%
DemandLink Window AC Rebate Program	76	12%	31	6%
DemandLink Window AC Recycling Program	69	11%	20	4%
Total Leads (Any Program)	**628**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

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

Of the 555 leads, 364 (66%) were new leads who had not expressed interest in any of the four program components prior to 2015.

Heightened lead activity continued to follow increases in marketing efforts in the spring and early summer of 2015. Figure 6-1 shows that June through August 2015 were the busiest months for leads, with 394 customers (71%) expressing interest during that period, while participation was strongest in June, August, and September.

Figure 6-1. Program Leads in SRP Pilot Communities (2013-2015)



Of the 364 customers who were new SRP leads in 2015, 44% participated in one or more programs in 2015. This level of same-year participation is slightly lower than in 2012 and 2013 (56% and 48%, respectively) but higher than 2014 (36%). In addition, a handful of customers who first expressed interest in 2012, 2013, and 2014 but had not participated in those years, participated in one or more program in 2015, indicating that for some customers there is a significant lag time between first expressing interest in the program and taking action.

Table 6-2. Conversion Rates Lead for Any Program

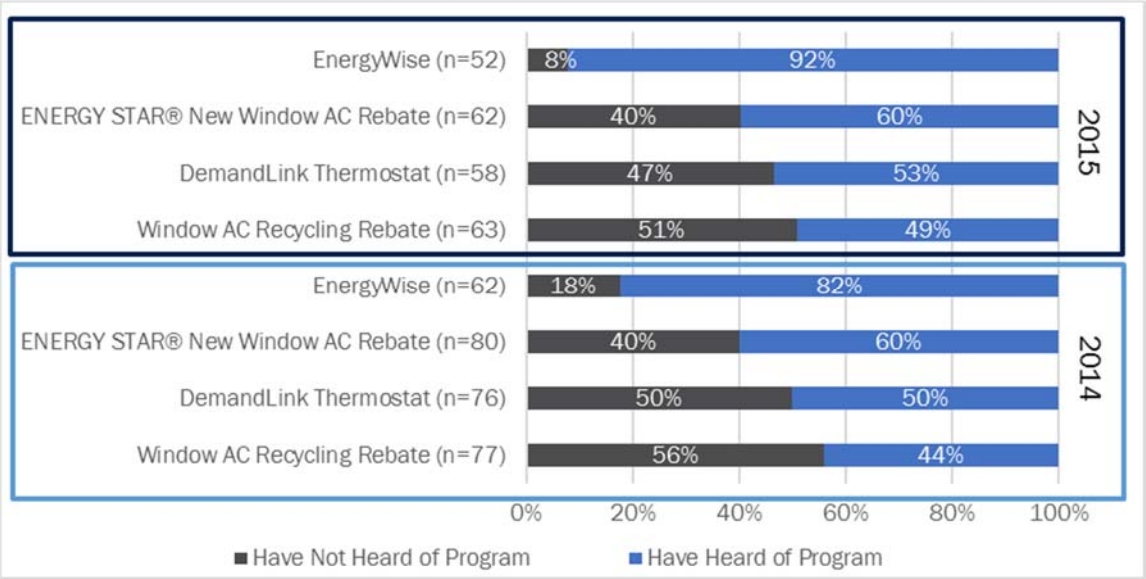
Year First Became a Lead for Any Program [a]	New Leads	Participated in One or More Program [b]				
		2012	2013	2014	2015	Not Yet
2012	174	56%	16%	1%	3%	24%
2013	725	-	48%	7%	3%	42%
2014	483	-	-	36%	12%	52%
2015	364	-	-	-	44%	56%

[a] Conversion rates were calculated counting a customer as a lead only in the first year they expressed interest in the program. Lead counts have been updated relative to prior SRP evaluation reports and now include substation customers only.
[b] Conversion rate calculation uses participant counts based on account number.

Based on a telephone survey fielded with SRP leads, which included both substation and non-substation customers, the majority of leads who have not yet participated in any part of the SRP pilot are aware that National Grid offers energy efficiency programs to help households save energy (88%). More than 9 out of 10 (92%) SRP leads in 2015 have heard of the EnergyWise Program. This is a slight increase compared to 2014 (82%), although not statistically significant at 90% confidence. Sixty percent of 2015 leads have heard of the

WAC rebate, and close to half have heard of the Demand Link Thermostat Program and the Window AC Recycling Program, respectively. Figure 6-2 summarizes the awareness of SRP leads with the various components of the pilot and compares 2014 and 2015 responses.

Figure 6-2. Awareness of Specific Programs by Non-Participants



Few leads (28%) are aware that energy efficiency programs offered through National Grid are funded through a surcharge on the electric bills of Rhode Island customers. For the majority of leads (69%) awareness of the surcharge does not influence their likelihood of future program participation. Only 24% of leads report being more likely to participate knowing about the surcharge, while 6% report being less likely to participate.

The following subsections present additional information collected from SRP leads through our telephone survey. This survey was fielded in January 2016 with 2015 leads and had previously been fielded with 2014 leads. Due to the small number of leads in some of the programs and the resulting small number of response, most of the following analyses combine responses from the 2014 and 2015 surveys.

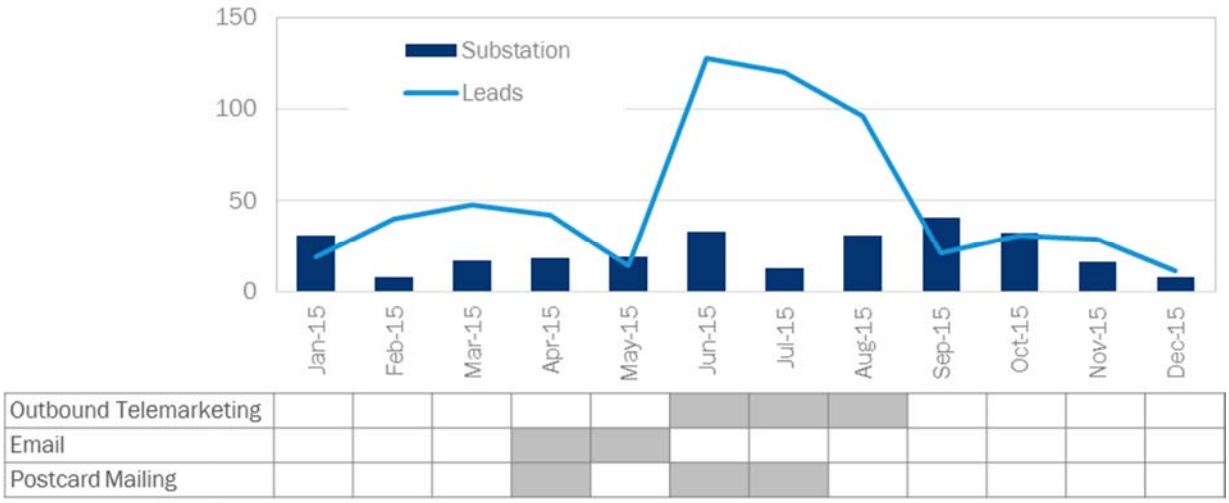
6.1 EnergyWise Leads

The vast majority of SRP leads in 2015 (450, or 81%) are leads for the EnergyWise Program. Most of these leads were new leads in 2015 (331, or 74%).

Leads Activity and Conversion

June through August were the busiest months for lead activity, with 313 customers expressing interest (70% of the annual total) during that period. Lead activity peaked in June with 121 leads (27%).

Figure 6-3. EnergyWise Leads in SRP Pilot Communities (2015)



Of the 331 new leads in the EnergyWise Program in 2015, 48% participated in the program in 2015, a higher level of same-year participation compared to 2014, but on par with prior years. In addition, 14% of customers who first expressed interest in the program in 2014 and 5% and 4% of those who first expressed interest in 2012 and 2013, respectively, became program participants in 2015.

Table 6-3. EnergyWise Conversion Rate (2012-2015)

Year First Became a Lead for EnergyWise [a]	New Leads	EW Participant				
		2012	2013	2014	2015	Not Yet
2012	173	53%	18%	1%	5%	22%
2013	615	-	47%	7%	4%	42%
2014	466	-	-	35%	14%	52%
2015	331	-	-	-	48%	52%

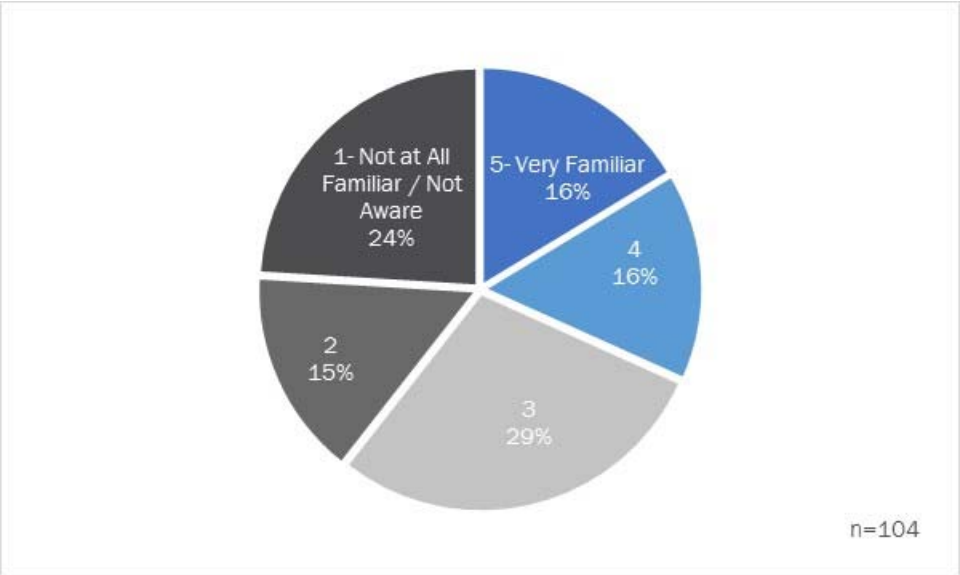
[a] Conversion rates were calculated counting a customer as a lead only in the first year they expressed interest in the program.

Survey Findings

Program Awareness and Familiarity

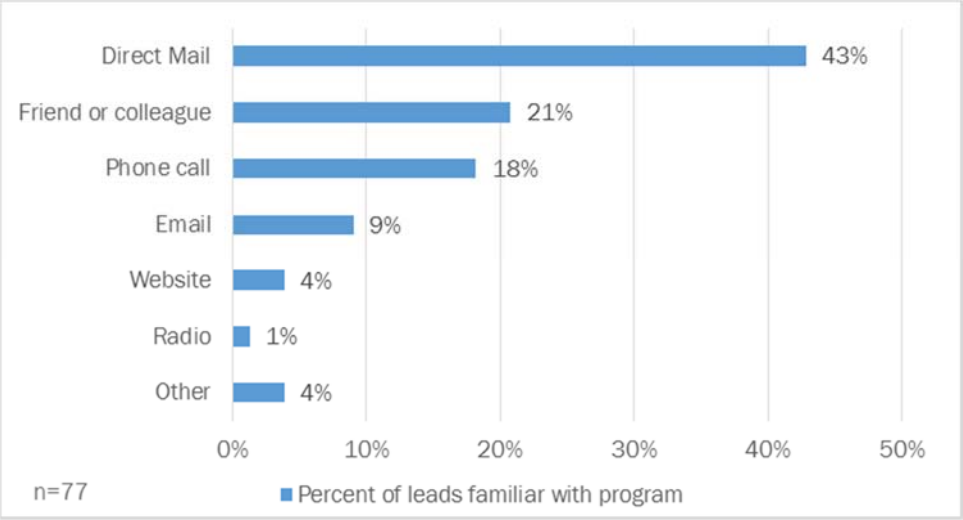
Based on our telephone survey, only 24% of all EnergyWise leads are either unaware of the program or not at all familiar with it (a rating of 1 on a scale of 1 to 5). Overall, the mean familiarity rating is 2.8. About a third of leads (32%) rate their familiarity a four or a five.

Figure 6-4. Familiarity with EnergyWise Program – 2014/2015 Leads



EnergyWise leads most often learn 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%).[37]

Figure 6-5. How Leads First Heard About EnergyWise Program – 2014/2015 Leads

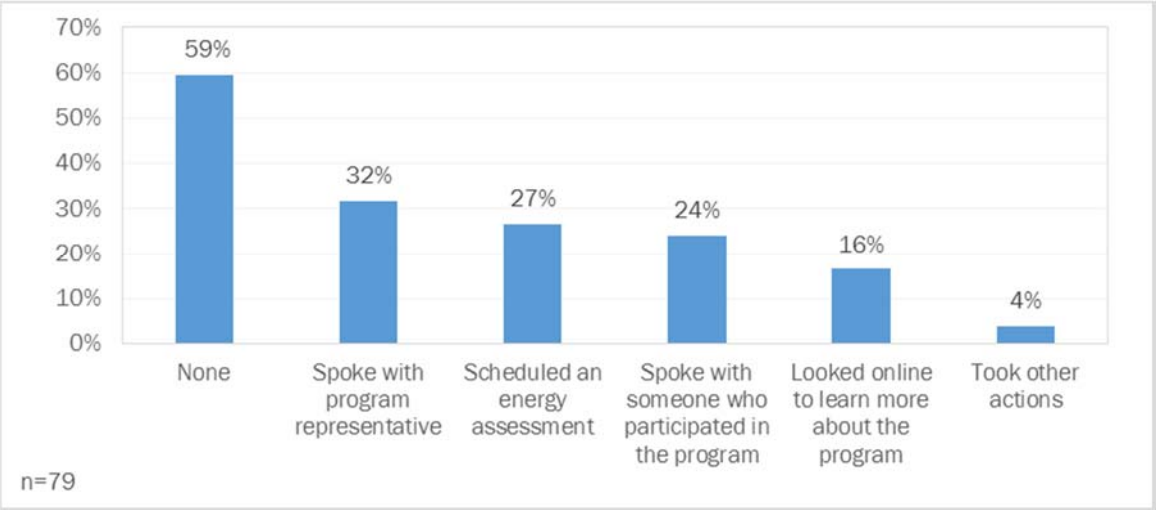


[37] Asked of leads with at least some familiarity with the EnergyWise Program (a rating of 2 or higher, on a scale of 1 to 5).

Actions Taken

EnergyWise leads most often report having taken no further action towards receiving an EnergyWise assessment since they first learned about the program (59%). Those who did take 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%).[38] 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 have already participated, this indicates good success in getting interested customers into the program.

Figure 6-6. Type of Actions Taken Since Learning of the EnergyWise Program – 2014/2015 Leads



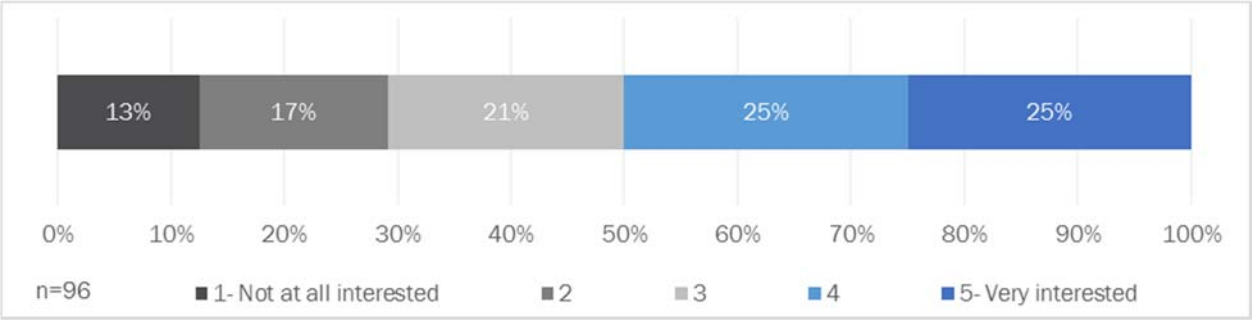
Interest in Program Participation

Only 22% of EnergyWise leads have ever had an energy assessment at their current home, and over half of those assessments (56%) took place five or more years ago. This indicates an opportunity for the EnergyWise Program to reach a new audience among its customers.

In addition, interest in having an energy assessment is high: Half of EnergyWise leads (50%) state that they are interested in completing an energy assessment through the EnergyWise program (a rating of 4 or 5, on a scale of 1-5, where 5 means "very interested"). Interest is slightly higher among those not familiar with the program (64%) compared to those with some familiarity (45%), although the difference is not statistically significant at 90% confidence. Only 13% of all EnergyWise leads report they are not at all interested in participating in the program.

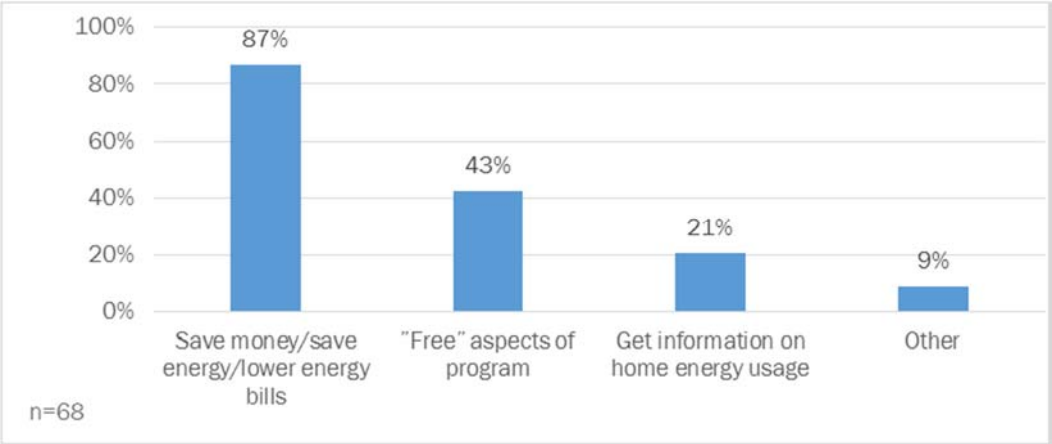
[38] Asked of leads with at least some familiarity with the EnergyWise Program (a rating of 2 or higher, on a scale of 1 to 5).

Figure 6-7. Interest Level of Leads with the EnergyWise Program – 2014/2015 Leads



The opportunity to save energy and money are 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, are also attractive program attributes (43%). Getting information on home energy usage is of less interest (21%).

Figure 6-8. Why Leads Are Interested in the EnergyWise Program – 2014/2015 Leads

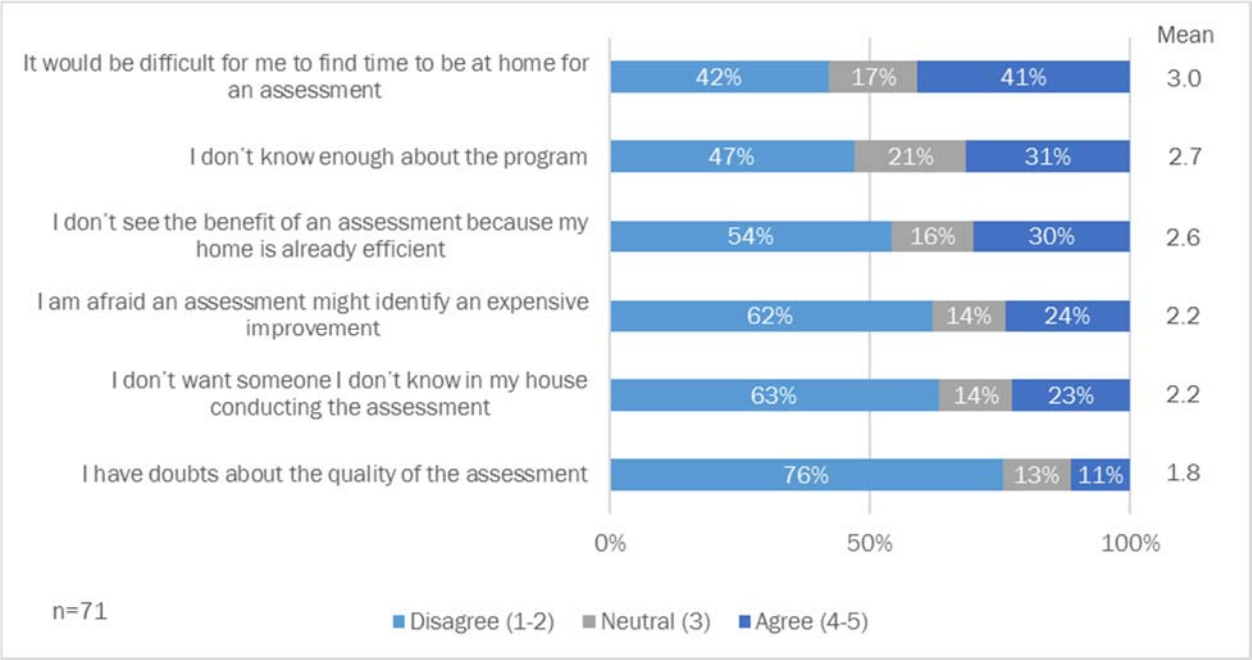


Barriers to Participation

EnergyWise leads were asked to rate their level of agreement with a series of statements regarding barriers to participation in the EnergyWise Program. Leads rated their level of agreement with each statement on a scale from 1 to 5, where 1 means "I very much disagree" and 5 means "I very much agree". A rating of 4 or 5 is considered agreement with the statement while a rating of 1 or 2 is considered disagreement.

The perception of difficulty scheduling the energy assessment at a time convenient for the customer is the largest self-reported barrier to participation in the EnergyWise Program: 41% of EnergyWise leads agree with the statement "it would be difficult for me to find time to be at home for an assessment". Less than a third agree with the statements "I don't know enough about the program" (31%), "I don't see the benefit of an assessment because my home is already efficient" (30%), "I am afraid an assessment might identify an expensive improvement" (24%), and "I don't want someone I don't know in my house conducting the assessment" (23%). Doubts about the quality of the assessment is a barrier for very few (11%) of EnergyWise leads. Figure 6-9 summarizes these results.

Figure 6-9. Barriers to EnergyWise Program Participation – 2014/2015 Leads



Overall, 59% of EnergyWise leads strongly agree (a rating of 5) with at least one of the barrier statements. Conversely, 20% do not agree with any of the statements (a rating of 3 or less).

A number of respondents also provided additional barriers to participation in the EnergyWise Program. The most common barrier offered by respondents was that the home was a seasonal or second home (7%), resulting in either difficulty of meeting an inspector for the assessment or the belief that energy usage is too low to make participation worth it. Another 4% reported being a renter.

A number of EnergyWise leads also reported difficulty scheduling an appointment. Notably, of EnergyWise participants that have tried to schedule an assessment but have not actually scheduled it, 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.

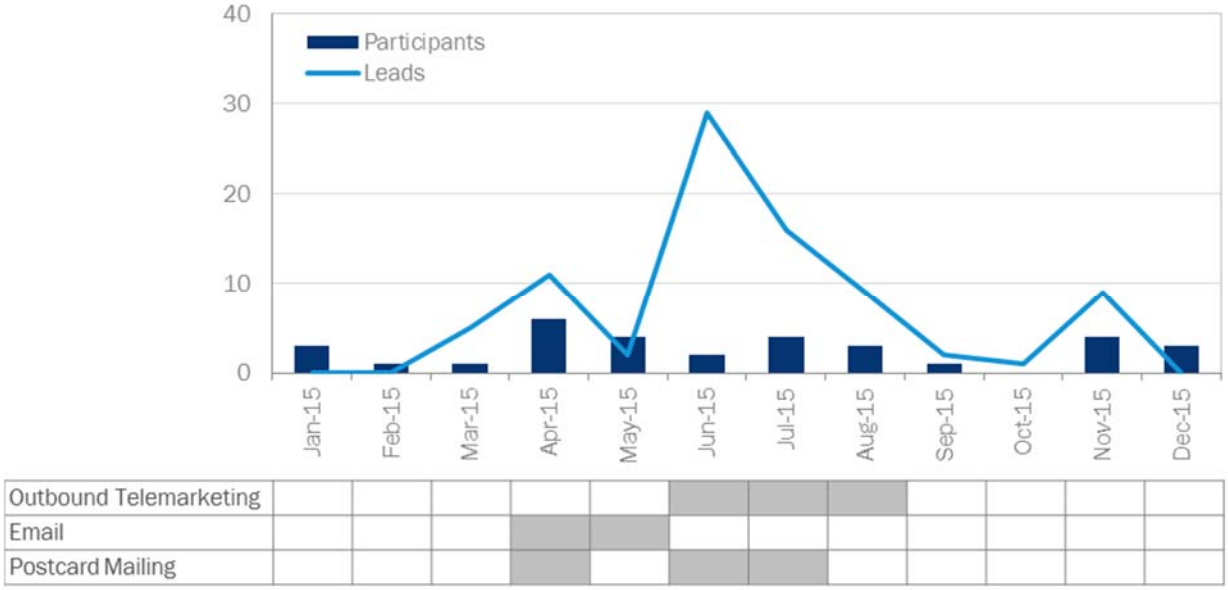
6.2 DemandLink Programmable Controllable Thermostat Leads

About one in ten SRP leads (84, or 15%) are leads for the DemandLink Thermostat Program. The majority of these leads were new leads in 2015 (81%).

Leads Activity and Conversion

The busiest months for leads were June and July, with 46 customers (45%) expressing interest during those two months. This peak in lead activity coincides with the outbound calls placed by the program implementation team and the second wave of postcards. Another, smaller, peak occurred in April, coinciding with the first wave of postcards and an email blast.

Figure 6-10. DemandLink Programmable Controllable Thermostat Leads in SRP Pilot Communities (2015)



Of the 68 customers who were new leads in the DemandLink Thermostat Program in 2015, 32% participated in the program in 2015. In addition, 3% of customers who first expressed interest in the program in 2014, participated in 2015.

Table 6-4. DemandLink Programmable Controllable Thermostat Program Conversion Rate (2013-2014)

Year First Became a Lead for DemandLink Programmable Thermostat Program[a]	New Leads	DemandLink PCT Program Participation Year			
		2013	2014	2015	Not Yet
2013	270	40%	3%	0%	56%
2014	148	-	30%	3%	67%
2015	68	-	-	32%	68%

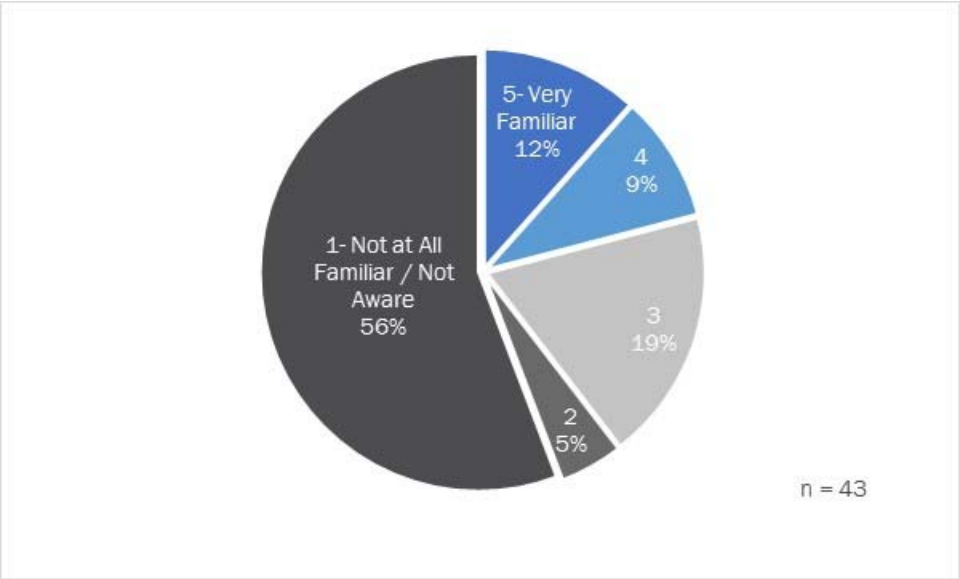
[a] Conversion rates were calculated counting a customer as a lead only in the first year they expressed interest in the program.

Survey Findings

Program Awareness and Understanding

More than half of DemandLink Thermostat leads (56%) are either unaware of the program or not at all familiar with it (a rating of 1 on a scale of 1 to 5). Overall, the mean familiarity rating is 2.2, lower than the 2.8 mean familiarity rating for the EnergyWise Program (significant at a 95% confidence level). Only 12% of DemandLink Thermostat leads are very familiar with the program.

Figure 6-11. Familiarity with DemandLink Thermostat Program – 2014/2015 Leads



For those DemandLink Thermostat leads who were familiar with the program and who had not already scheduled an equipment installation appointment, we asked questions probing their awareness of several key aspects of the pilot program.[39] 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.

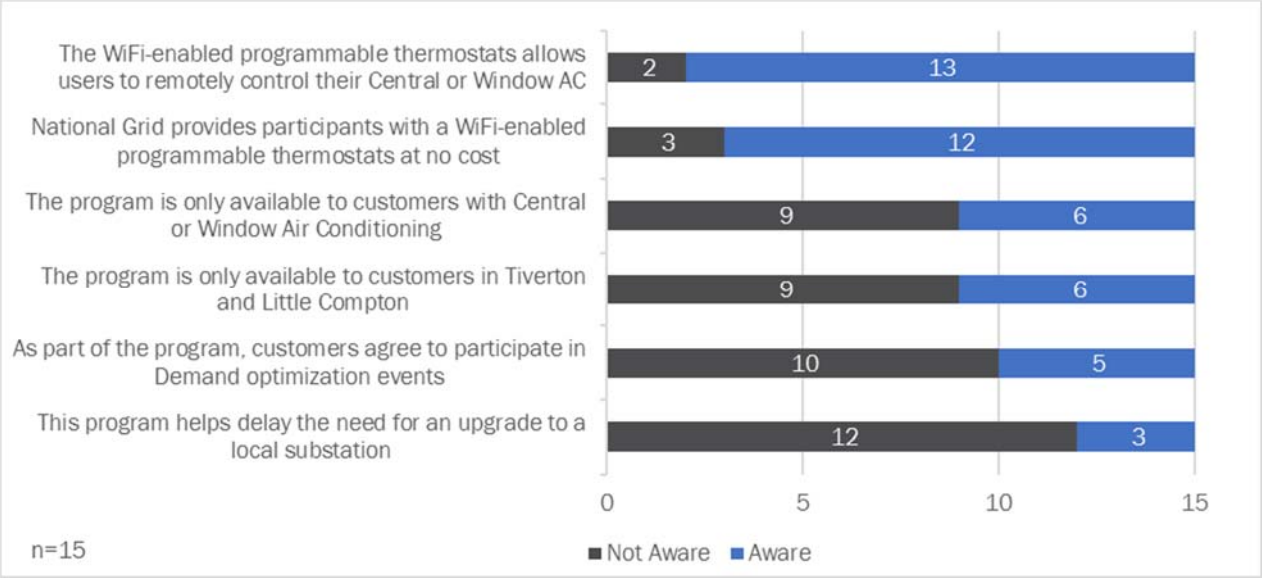
Out of the program aspects asked about in the survey, customers were least aware that the program helps delay the need for an upgrade to a local substation (3 respondents). This suggests that the program's attempts to emphasize benefits to the community – begun in 2014 with the marketing message of *"Good for you. Good for our community. Good for everyone."* – have not yet fully taken hold among potential program participants.[40]

[39] Of the 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.

[40] Awareness levels were the same for 2014 leads and 2015 leads: 2 out of 10 interviewed 2014 leads and 1 out of 5 interviewed 2015 leads were aware that the program helps to delay the need for substation upgrades.

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

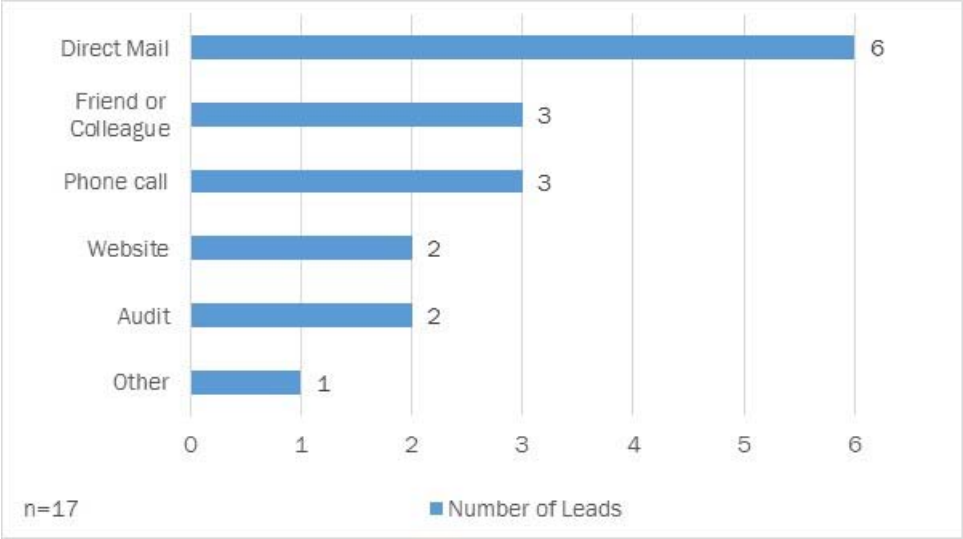
Figure 6-12. Leads' Understanding of DL Thermostat Program – 2014/2015 Leads



DemandLink Thermostat leads most often learn about the program through National Grid direct mailings (6 of 19 interviewed leads).[41] Only 2 of 19 leads learned about the program through the website. Both findings are similar to how EnergyWise leads report learning about the EnergyWise program.

[41] Asked of leads with at least some familiarity with the DemandLink Thermostat Program (a rating of 2 or higher, on a scale of 1 to 5).

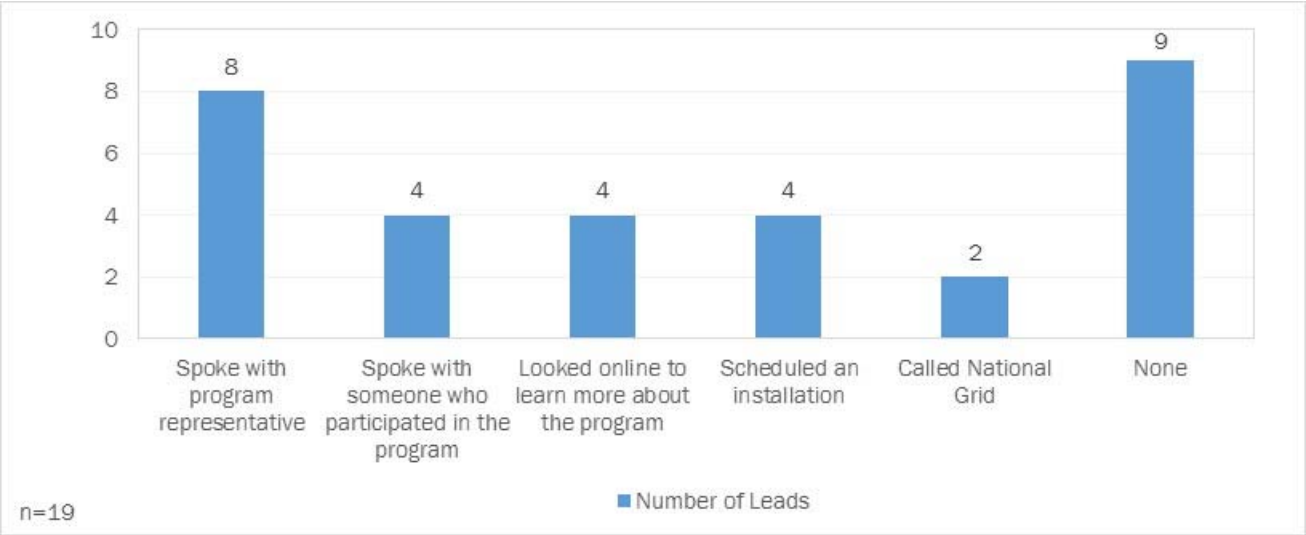
Figure 6-13. How Leads Heard About DemandLink Thermostat Program – 2014/2015 Leads



Actions Taken

More than half of the DemandLink Thermostat leads (10 out of 19 respondents) have taken actions towards program participation since they first learned about the program.[42] The most common action was speaking with a program representative (8 respondents). Other actions included speaking with someone who has participated in the program, looking online, and scheduling an appointment (4 respondents each).

Figure 6-14. Actions Taken Since Learning of the DemandLink Thermostat Program – 2014/2015 Leads

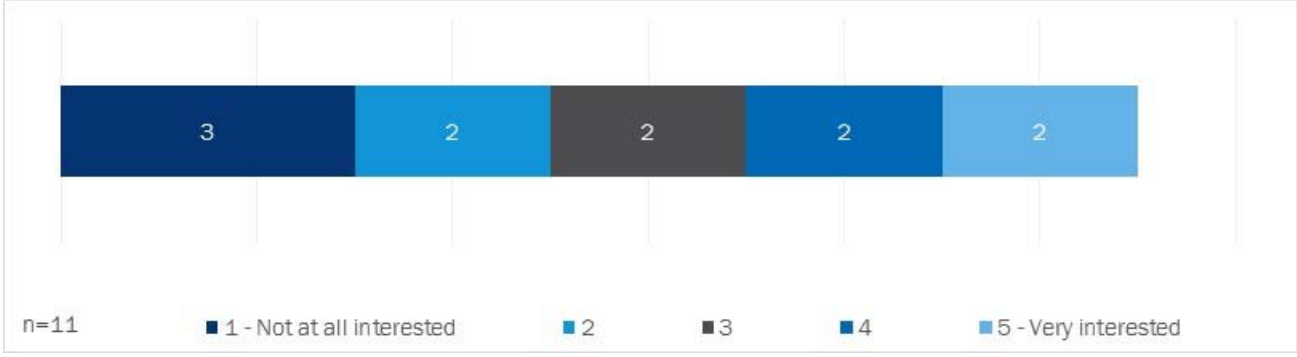


[42] Asked of leads with at least some familiarity with the DemandLink Thermostat Program (a rating of 2 or higher, on a scale of 1 to 5).

Interest in Participation

The level of interest in the DemandLink Thermostat Program among interviewed 2015 leads is mixed. Almost equal numbers reported interest levels from not at all interested to very interested.

Figure 6-15. Interest Level of 2015 Leads



For all 2015 DemandLink leads who were interested in participating in the program (n=6),[43] saving energy and money is the primary reason for their interest. The free equipment and the ability to remotely monitor or control their heating and cooling equipment were other reasons, each mentioned by two respondents.

Barriers to Participation

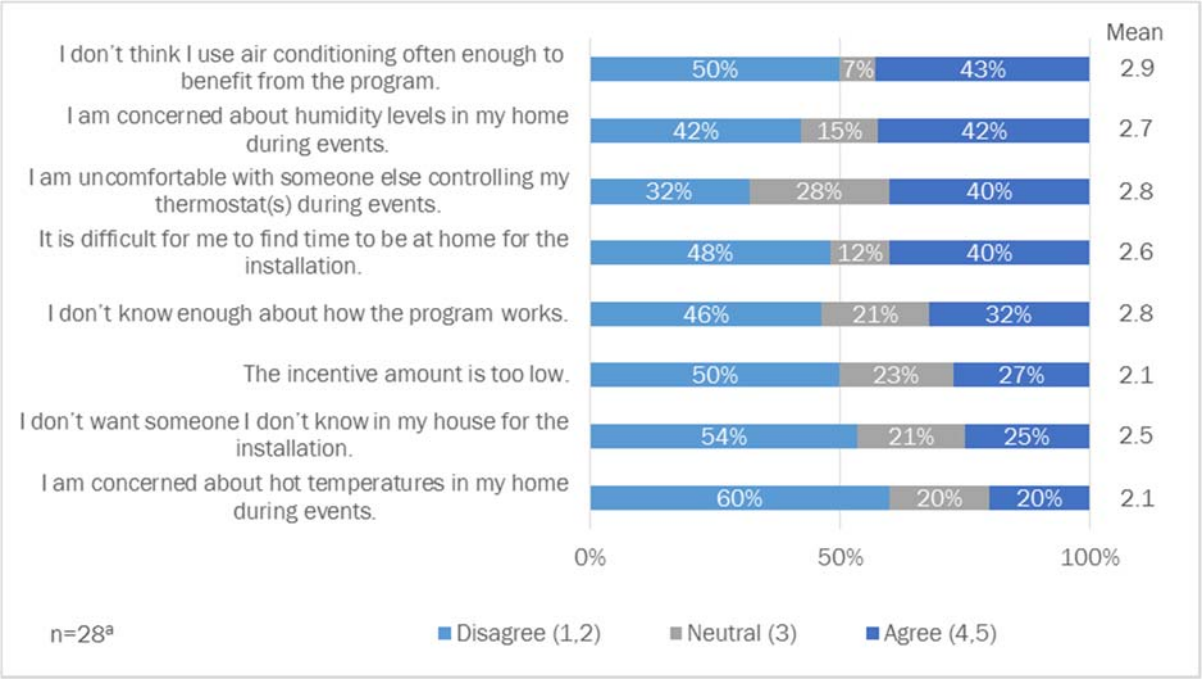
DemandLink Thermostat leads were asked to rate their level of agreement with a series of statements regarding barriers to participation in the program. Leads rated their level of agreement with each statement on a scale from 1 to 5, where 1 means "I very much disagree" and 5 means "I very much agree". A rating of 4 or 5 is considered agreement with the statement while a rating of 1 or 2 is considered disagreement.

DemandLink Thermostat leads most often agree with the statement "I don't think I use air conditioning enough to benefit from the program" (40%). Other commonly cited barriers include concern about humidity levels during events (39%), discomfort about having someone else control their thermostats (37%), and difficulty being home for the installation (37%). Figure 6-16 summarizes these responses.

Overall, more than two-thirds of DemandLink leads (70%) strongly agree (a rating of 5) with at least one of the barrier statements, indicating that the program has to overcome strong skepticism among potential participants. Conversely, only 13% do not agree with any of the statements (a rating of 3 or less).

[43] "Interested" is defined as a rating of 3, 4 or 5, on a scale of 1 to 5.

Figure 6-16. Barriers to DemandLink Thermostat Program Participation – 2014/2015 Leads



[a] The number of responses for some of the barrier statements is less than 30 due to the exclusion of "don't know" responses and refusals.

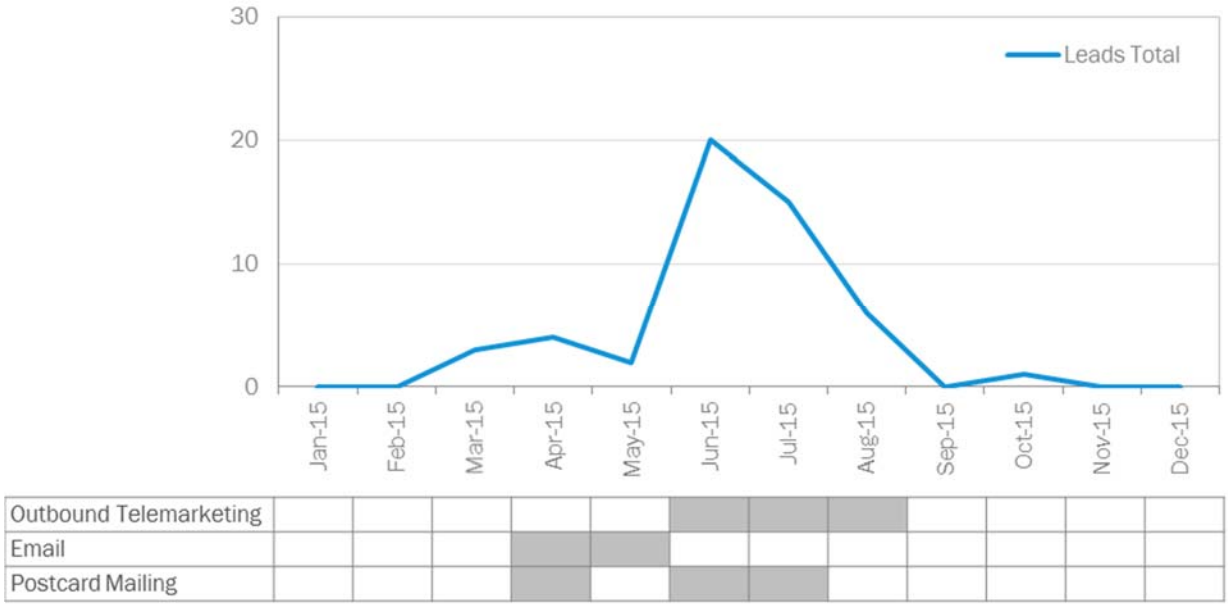
6.3 Window AC Rebate and Recycling Leads

In 2015 there were 31 leads for the Window AC Rebate Program and 20 for the Window AC Recycling Program, for a combined total of 51 leads for either of the two programs (down 65% from 148 in 2014 and 70% from 173 in 2013). Overall, 38 unique customers were interested in one or both of the programs.

Leads Activity and Conversion

June through August were the busiest months for leads with 42 leads (81%) occurring during that period.

Figure 6-17. Window AC Rebate and Recycling Leads in SRP Pilot Communities (2015)



Of the 31 customers who expressed interest in the Window AC Rebate Program in 2015, 19% also participated in 2015. In addition, 2% of 2013 leads and 1% of 2014 leads participated in 2015. For the Window AC Recycling Program, only two of the 20 customers (10%) who expressed interest in 2015 also participated in 2015. In addition, 1% of 2013 leads and 3% of 2014 leads participated in 2015.

Table 6-5. Window AC Rebate Conversion Rate (2013-2015)

Year Customer Expressed Interest in Window Air Conditioning Program [a]	New Leads	Window Air Conditioning Program Participation Year			
		2013	2014	2015	Not Yet
Window AC Rebate					
2013	101	24%	3%	2%	71%
2014	76	-	12%	1%	87%
2015	31	-	-	19%	81%
Window AC Recycling					
2013	71	27%	4%	1%	68%
2014	69	-	29%	3%	68%
2015	20	-	-	10%	90%

[a] Conversion rates were calculated counting a customer as a lead only in the first year they expressed interest in the program.

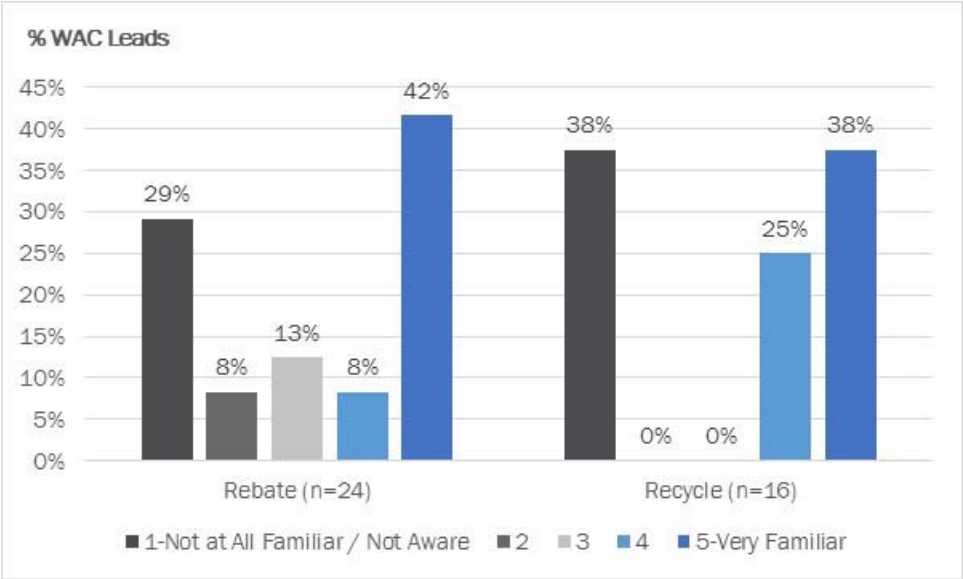
Survey Findings

Of all 2014 and 2015 SRP leads only 7% were leads for the Window AC Rebate Program and 6% were leads for the Window AC Recycling Program. As a result, few leads in these programs were targeted by our DemandLink leads survey and even fewer responded to it (24 for the rebate program and 16 for the recycling program).

Awareness and Interest

Leads in the recycling program are either not aware or not at all familiar with the program (38%) or they have a relative high level of familiarity (a rating of 4 or 5, on a scale of 1 to 5). For the rebate program, interviewed leads reported varying levels of familiarity; the most common response was that they are very familiar with the program.

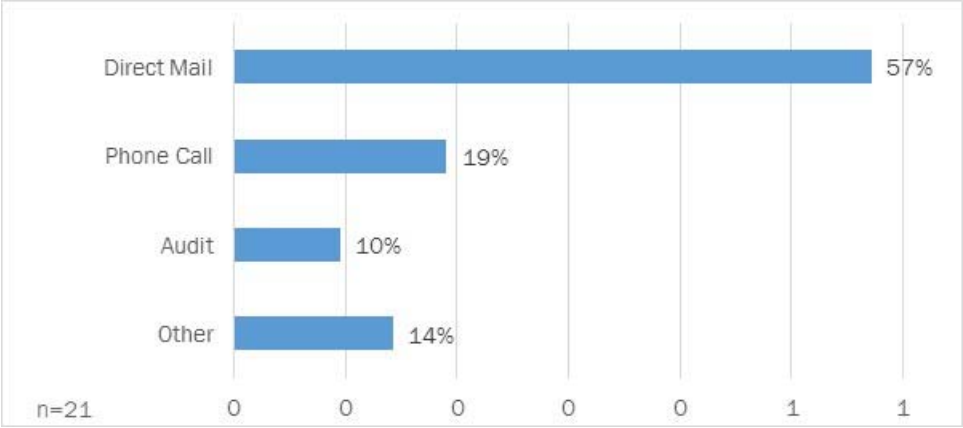
Figure 6-18. Awareness/Familiarity with SRP Window AC Programs – 2014/2015 Leads



More than half of window AC rebate and window AC recycling leads (57%) report first hearing about the programs through direct mailings from National Grid; another 19% first heard about the programs 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.[44]

[44] Of those with at least some familiarity with the program, i.e., a rating of 2 or higher on a scale of 1 to 5.

Figure 6-19. How Leads Heard About SRP Window AC Programs – 2014/2015 Leads



Actions Taken

Window AC leads in 2015 were slightly more active in taking steps towards participation in the program compared to 2014 leads: While only one lead reported taking any steps in 2014, two out of eight window AC rebate leads and three out of six window AC rebate leads in 2015 took steps. Leads in 2015 most often spoke with a program representative or looked online for more information. One lead had already submitted an application but noted that pick up of the recycled unit had not yet happened, despite several calls to the pick-up company.

Likelihood to Participate

Of the interviewed 2014 and 2015 window AC rebate leads (n=24), 54% report being either somewhat likely or very likely to purchase a window AC in the coming year. Almost all of these likely purchasers (93%) claim that they are very likely to purchase an ENERGY STAR® rated unit and that they are somewhat or very likely to apply for a rebate through National Grid.

Of the 16 interviewed leads in the window AC recycling program, one reported not using window AC and one reported that they had already submitted an application to National Grid to receive the rebate. Of the remaining leads (n=14), 71% report being somewhat likely or very likely to remove a window AC in the coming year, and all of these likely disposers of old window ACs report being somewhat or very likely to recycle the unit through the SRP program.

Appendix A. EnergyWise Evaluation – Additional Details

Incremental Participation Rate for 2015

Based on tracking data for the SRP pilot area and the comparison towns, we find an increase in 2015 EnergyWise participation of 349% for the pilot area and 94% for the comparison towns.[45]

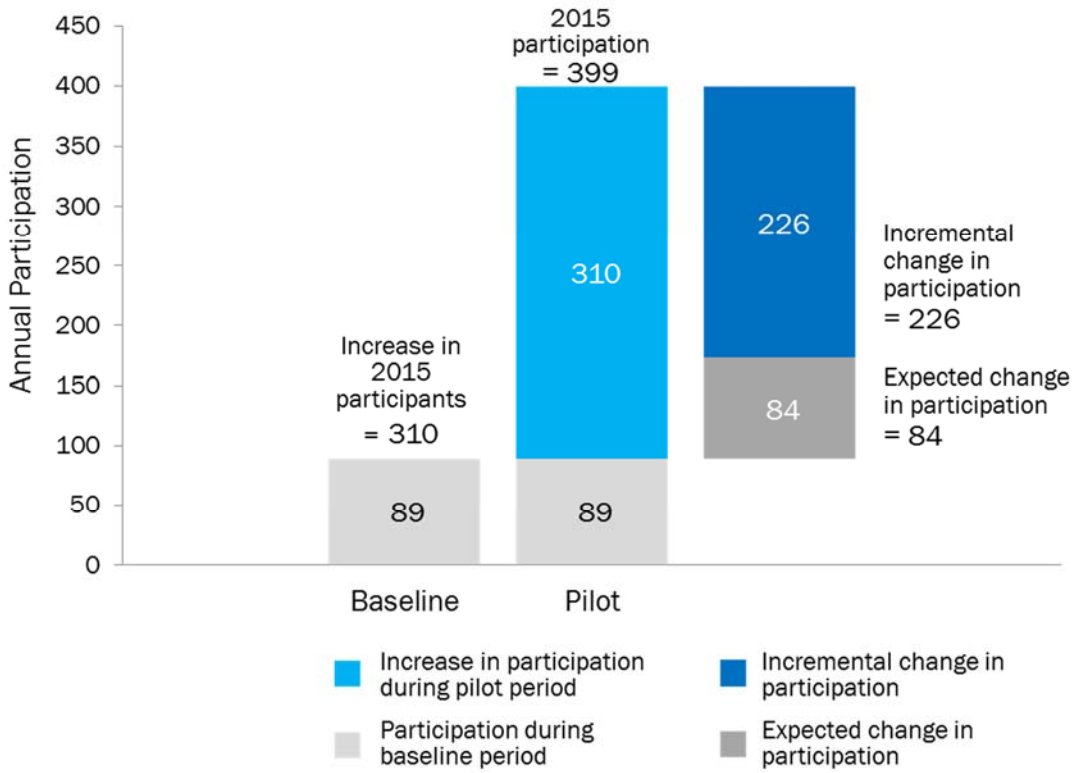
Table A–1 Increase in Participation – Pilot Area and Comparison Towns 2015

	Pilot Area	Comparison Towns
# Participants Pre-pilot (per year)	89	707
# Participants 2015	399	1,372
% Increase	349%	94%

The "lift" or incremental change attributable to the pilot is 349% - 94% or a 254% increase. This number can be applied to the pilot area baseline period count (89 participants/year) to show that 226 participants are incremental. Without the pilot, we would have expected to see a 94% increase in participation in the pilot group (or 84 expected audits, for a total of 173 annual audits). Instead we saw 399 audits in 2015 – of these, 226 can be considered incremental, or attributable to the pilot program. We can calculate the "incremental participation rate" as the percentage of audits that are incremental: 226 / 399 = 57%.

[45] Note that this analysis includes both substation and non-substation participants in Tiverton and Little Compton as information on which of the pre-pilot participants are on the substation was not available at the time of this report.

Figure A-1. Incremental Participation in Pilot Communities – 2015



SRP Attribution Based on EnergyWise Participant Survey

The formula used to calculate SRP attribution is:

*SRP Attribution = Average SRP Influence * EnergyWise NTG Ratio*

We define the two components of SRP attribution as follows:

- The *Average SRP Influence* factor represents the influence that SRP marketing efforts had on participants' decision to have a home energy assessment conducted. We based this factor on responses to the online survey. We used a multi-step approach to estimating the *Average SRP Influence* factor:
  - Step 1: Determine respondent recall of SRP and statewide marketing materials
  - Step 2: Determine maximum influence scores for SRP and statewide materials on decision to complete the energy assessment (respondent-level)
  - Step 3: Calculate share of influence attributable to SRP marketing versus statewide marketing (respondent-level)
  - Step 4: Calculate overall influence of SRP marketing on decision to have assessment (respondent-level)

- Step 5: Calculate program-wide *Average SRP Influence* score as the average of the overall SRP influence scores across all respondents

- The *EnergyWise NTG Ratio* represents the share of audit program participants that would not have installed the direct install measures without the audit. It is based on the RI TRM.

By calculating the SRP attribution as the product of these two components we take into account that free-ridership can occur at two steps: (1) some participants would have had the energy assessment independent of SRP-specific marketing and (2) some participants would have installed the direct install measures independent of the energy assessment.

Below, we provide additional detail on each of these five steps and present a few examples of participant responses and the resulting influence scores.

Step 1: Determine recall of SRP-specific and statewide marketing materials

During the pilot period, customers in the pilot towns were exposed to both SRP-specific and statewide marketing materials. The online survey provided participants with a series of images and descriptions of marketing materials from both the SRP-specific and statewide marketing campaigns and asked them if they recalled seeing, hearing, or receiving each item.

Step 2: Determine maximum influence scores for SRP-specific and statewide materials on decision to complete the energy assessment

If respondents could recall a marketing piece, the online survey asked them to rate the level of influence it had on their decision to complete the home energy assessment (using a scale of 1 to 5, where 1 was "Not at all influential" and 5 "Very influential").

We used the highest influence rating a respondent gave to any of the SRP-specific materials to generate the SRP influence rating. Similarly, we used the highest influence rating a respondent gave to any of the statewide materials to generate the statewide influence rating. For example, if a respondent recalled seeing three SRP-specific marketing materials and rated the influence they had on their decision to complete the home energy assessment a two, a three, and a five, respectively, on the five-point scale we assigned the maximum SRP influence of five.

We then converted the highest self-reported influence rating for each campaign into an *SRP Influence Score* using the table below.

Table A-2. Conversion and Influence Rating to % Influence Score

Self-Reported Influence Rating[a]	% Influence Score
1- Not at all Influential	0%
2	25%
3	50%
4	75%
5- Very Influential	100%

[a] Respondents who did not recall any SRP-specific or any statewide materials, respectively, received an influence score of 0%.

The result of this step is an SRP-specific influence score and a statewide influence score for each survey respondent.

Step 3: Calculate share of marketing influence attributable to SRP-specific efforts

Because both statewide and SRP-specific materials could have influenced a participant to have the energy assessment done, we then determined the share of overall marketing influence attributable to the SRP-specific marketing materials.

$$\textit{Share Attributable to SRP} = \frac{\textit{SRP Influence Score}}{\textit{SRP Influence Score} + \textit{Statewide Influence Score}}$$

Step 4: Calculate overall influence of SRP marketing on decision to have energy assessment

In this step, we apply each respondent's SRP share of marketing influence attributable to SRP (developed in Step 3) to the *SRP Influence Score* (developed in Step 2) to calculate the *Overall SRP Marketing Influence* score. This score represents the influence of SRP materials, net of the influence of statewide materials, on the respondent's decision to have an energy assessment conducted.

*Overall SRP Marketing Influence = Share of Influence attributable to SRP * SRP Influence Score*

Step 5: Calculate program-wide *Average SRP Influence* score

We then average the *Overall SRP Marketing Influence* scores developed in Step 4 across all respondents to derive the program-wide *Average SRP Influence* score.

Examples

Below we provide a few scenarios that illustrate the calculation of respondent-level influence scores.

Table A-3. Respondent-Level Influence Score Scenarios

Scenario	Step 2: Influence Score		Step 3: SRP Share of influence	Step 4: Overall SRP Marketing Influence
	SRP	Statewide		
Recalls SRP marketing materials only, or says statewide materials had little or no influence on decision to participate. The entire marketing influence is attributable to SRP-specific efforts. The overall SRP influence is equal to the SRP influence score.	100%	0%	100%	100%
	75%	0%	100%	75%
	50%	0%	100%	50%
Recalls both SRP and statewide materials and rates influence of both campaigns equally. SRP and statewide materials are equally responsible for marketing influence, and SRP share of marketing influence is 50%. The overall SRP influence is equal to half of the SRP influence score.	100%	100%	50%	50%
	75%	75%	50%	38%
	50%	50%	50%	25%
Recalls both SRP and statewide materials and rates SRP materials as more influential in decision. A greater share of influence is attributable to SRP than statewide materials.	100%	50%	67%	67%
	75%	50%	60%	45%
Doesn't recall SRP marketing materials or says they had little or no influence on decision to participate. No overall SRP influence, independent of influence of statewide materials.	0%	0%	0%	0%
	0%	25%	0%	0%

EnergyWise Load Impact Estimation

For each EnergyWise measure category, we calculated load impacts as the total quantity of measures installed in the pilot area, multiplied by coincident peak kW savings:

*Peak kW Savings = Quantity * kW Reduction per Unit * Summer Diversity Factor*

To develop incremental SRP load impacts, we then multiplied total peak kW savings by the take rate. The following are key inputs into this analysis:

A. **Measure category:** The EnergyWise participation data included a measure category for each installation record. Peak savings are not assigned in the participation database, and therefore must be assigned based on deemed factors.
B. **Pilot Quantity:** Measure quantity comes from the program tracking data. We assigned measures installed in Tiverton and Little Compton to the 2015 SRP pilot period based on the paid date, to match how National Grid counts savings in each year. We assigned measures to the Tiverton substation based on lists of account numbers on subfeeders 33-34 provided by National Grid.
C. **Peak kW Reduction Factors:** National Grid provided a set of deemed load reduction values and diversity factors for each EnergyWise measure category. The factors that National Grid provided are the same load assumptions that National Grid is currently using for cost-effectiveness tests of the EnergyWise Single-Family program in Rhode Island. Since these assumptions are specific to the EnergyWise Program, they may differ from assumptions for analogous measures in the 2015 Rhode Island TRM (that other programs offer).
D. **Take Rate:** The take rate is the percentage of measure installations that can be attributed to the SRP Pilot efforts – i.e., measure installations that would not have occurred in the absence of SRP Pilot marketing efforts. We used an incremental participation analysis and EnergyWise survey results to estimate a pilot take rate for the EnergyWise Program. (See discussion in Section 2.3 above.)

The following table shows gross kW reduction assumptions and summer peak diversity factors for EnergyWise measures.

Table A-4. EnergyWise 2015 Load Impact Factors

Measure Category	Gross kW Reduction per unit	Summer Diversity Factor	Average Peak Summer Load Reduction (kW)
LED Bulb	0.052	0.13	0.007
CFL	0.045	0.13	0.006
Indoor Fixture	0.066	0.13	0.009
Torchiere	0.088	0.13	0.011
Outdoor fixture	0.095	0.00	0.000
Smart Strip	0.016	0.73	0.012
Refrigerator Rebate	0.095	1.00	0.095
Refrigerator Brush	0.005	1.00	0.005
Programmable Thermostat - Electric Heat	0.180	0.20	0.036
Programmable Thermostat - Non-Electric Heat	0.231	1.00	0.231
Weatherization - Electric Heat	0.832	0.20	0.166
Weatherization - Gas Heat	0.134	0.20	0.027
Weatherization - Oil Heat	0.179	0.20	0.036
Ventilation – Other	0.000	0.00	0.000
AC Timer	0.000	0.00	0.000
Aerator - Electric Heat	0.007	1.00	0.007
Aerator -Non-Electric Heat	0.000	0.58	0.000
HPWH 50 Gallon - Electric Heat	0.370	0.58	0.215
HPWH 50 Gallon - Non-Electric Heat	0.370	0.47	0.174
HPWH 80 Gallon - Electric Heat	0.370	0.58	0.215
HPWH 80 Gallon - Non-Electric Heat	0.370	0.47	0.174
DHW Pipe Wrap/Insulation - Electric Heat	0.016	1.00	0.016
DHW Pipe Wrap/Insulation - Non-Electric Heat	0.000	1.00	0.000
Low Flow Showerhead - Electric Heat	0.033	1.00	0.033
Low Flow Showerhead - Non-Electric Heat	0.000	0.58	0.000

Appendix B. DemandLink Evaluation – Additional Details

Impact Methodology for Demand Response Impact Analysis

Opinion Dynamics used regression modeling combined with day matching to estimate the demand response load impacts for window AC participants and runtime reduction for central AC participants. The load impact for central AC events are then calculated by multiplying the runtime reduction by the mean full load demand, to arrive at the demand response attributable to the event. We describe our regression modeling and day matching methods below.

Model Specification

We used a linear fixed-effects regression (LFER) modeling approach for the demand response impact analysis. This model accounts for the time-invariant, household-level factors affecting energy use without measuring those factors and entering them explicitly in the models. These factors are contained in a household-specific intercept, or the constant term in the regression equation.

We selected the regression model specification to predict referential load during event days to address specific event day characteristics. The model incorporates weather variables with weather as the major predictor of energy consumption. Cooling degree hours (CDH) with base 65 is included in the model as the primary weather variable. The model also includes the hour of the day, as time of day is highly predictive of usage. Terms for month, day of week, morning load, and month by hour further correct for differences between the event day and the non-event days used as comparison days for the model.

As is standard practice for demand response impact analysis, we tested many models. We selected the final models based on fit with actual usage, especially during the hours leading up to the event. This is necessary because there are unique situations applicable to the program area that may influence the counterfactual, which we tested through this approach. We judged the ultimately selected model fit primarily on replication of actual usage during non-event hours, especially the hours before the event, so there is a high level of confidence in the reference points during event hours.

We fit separate regressions for each event for central AC, using the same model specification. We combined events for window AC due to the limited consumption data available. The linear fixed-effects regression (LFER) model specification is as follows:

Equation B-1. Regression Model

$$kw_{it} = \alpha_o + \alpha_i + \beta_{event} \cdot Event + \sum_{h=1}^{23} \beta_{hour\ h} \cdot Hour_h + \sum_{h=1}^{23} \beta_{event\ hour\ h} \cdot Event \cdot Hour_h +$$

$$\beta_{CDH} \cdot CDH_t + \beta_{mornload} \cdot MornLoad_i + \sum_{h=1}^{23} \beta_{mornload\ hour\ h} \cdot Hour_h \cdot MornLoad_i + \varepsilon_{it}$$

Where:

α_o = Overall intercept

α_i = Participant specific intercept

ε_{it} = Error term

Event = Indicator variable for event day

Hour = Set of 23 indicator variables for the hours of the day

Month = Set of 3 indicator variables for the months of the program (June-Sept)

Day = Set of 4 indicator variables for the day of week (Monday-Friday)

CDH = Base 65 cooling degree hours

MornLoad = The mean load for participant i for the hours of 1 am through 11 am for the day

In addition to the model selected, we tested other variables and interactions for possible inclusion in the model specification. These included:

- CDH^2 – Cooling degree hours squared
- HDH – Heating degree hours
- Day – Day of the week
- Month – Month of the peak season, May through September
- Month by Hour – The interaction of month and hour of the day (adjusts for differences in average hourly load across months)
- Month by HDH – The interaction of month and HDH (adjusts for differences in average weather response across months)
- Day by Hour – The interaction of day of week and hour of the day (adjusts for differences in average hourly load across days of the week)
- Event by CDH – The interaction of event and CDH (adjusts for different hourly load on event days based on weather)

These terms do not appear in the final model specification, as the variables and interactions already in the model are effective at correcting for differences in the actual usage and the modeled usage for non-event hours that serve as comparison. It is very important that the final model correctly replicate load during non-event hours, so the counterfactual baseline usage during the event is reliable. It is also important to remove terms and interactions that do not improve the actual and baseline model fit, as they will unnecessarily increase variance in the estimates.

Day Matching

Not all days are included in the data used in the regression model. Including cool days, when air conditioning is not used, does not add useful information for modeling what happens on the hottest days, when events are called. For each event day, we used Mahalanobis distance matching to select the nine non-event days that best matched the hourly weather profile of the event day. Mahalanobis distance matching minimizes the

difference between the event and non-event day temperatures at each hour, corrected for the measured variation in temperature at that hour and the correlation of the temperature between hours. In order to estimate baseline usage correctly, the matched days need to cover the range of temperatures experienced on event days. Figure B-1 shows the hourly temperature on event days (blue) and non-event days (red). Several event days were hotter than all non-event days by about five degrees. It was thus not possible to create a set of matched days that included the full range of event-day temperatures. We created the best matches possible given the available data. Figure B-2 shows the hourly temperature on each event day and matched day.

Figure B-1. Event Day and Non-event Day Temperature Profiles

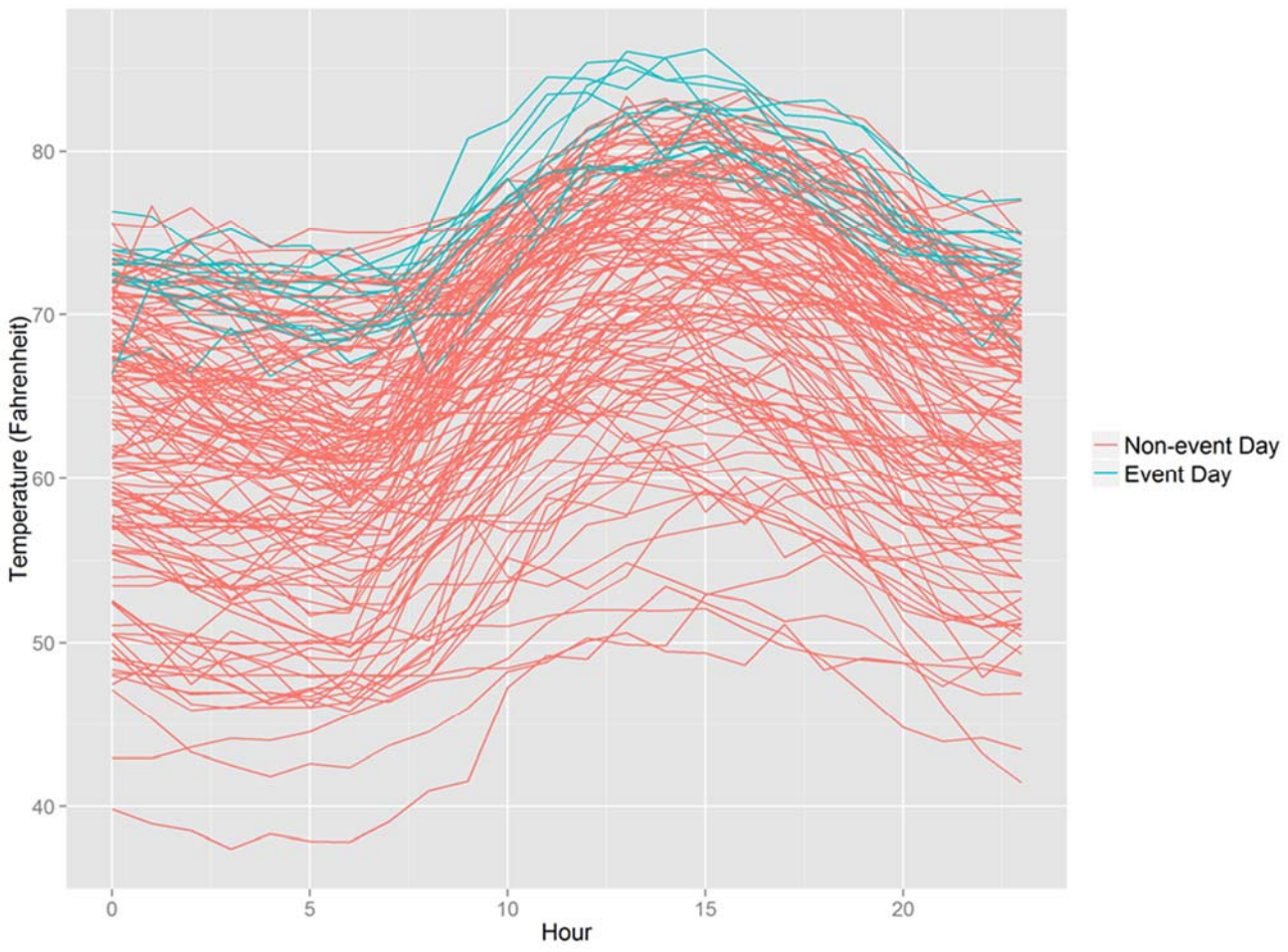
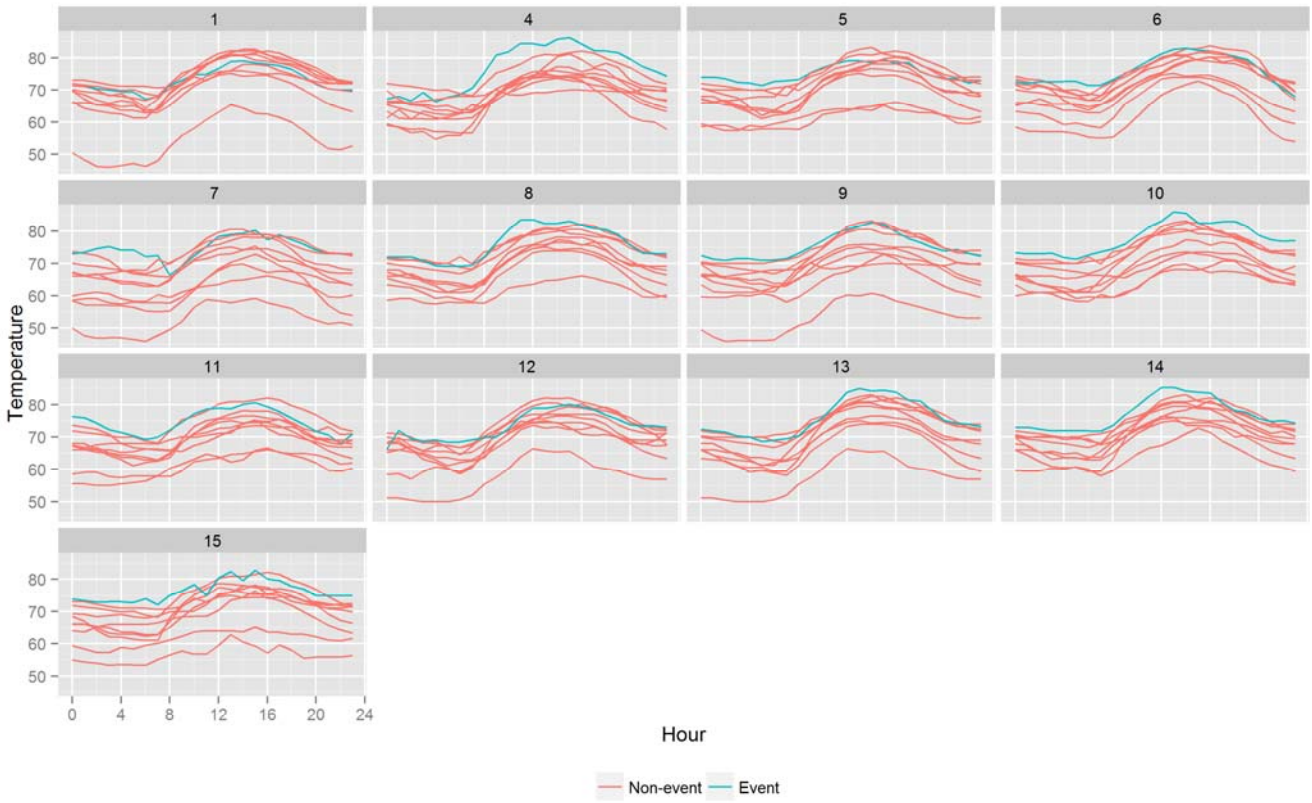


Figure B-2. Event Day and Matched Day Temperature Profiles



Tracking Data and Thermostat Logs

The tracking data contains information about 270 Tiverton and Little Compton households that participated in the SRP DemandLink Program, including 254 substation households and 16 non-substation households.[46] Some of the homes have more than one thermostat: Homes with central AC have 229 thermostats, while the homes with window AC have 150 thermostats.

We received thermostat logs for 228 thermostats controlling central AC. Of these, logs for 55 thermostats contained no or abnormal AC runtime data during the event days, so we removed them from the analysis. We received logs for 148 thermostats controlling window AC. Only 22 of these logs contained any non-missing data, and only 14 contained any non-zero usage that could be associated with window AC usage during the peak season. Table B-1 shows the number of thermostats installed, as well as the number of thermostat logs received and used in our analysis.

[46] Note that our demand response event model includes both substation and non-substation households. However, to estimate pilot impacts, per-thermostat savings are applied to substation households only.

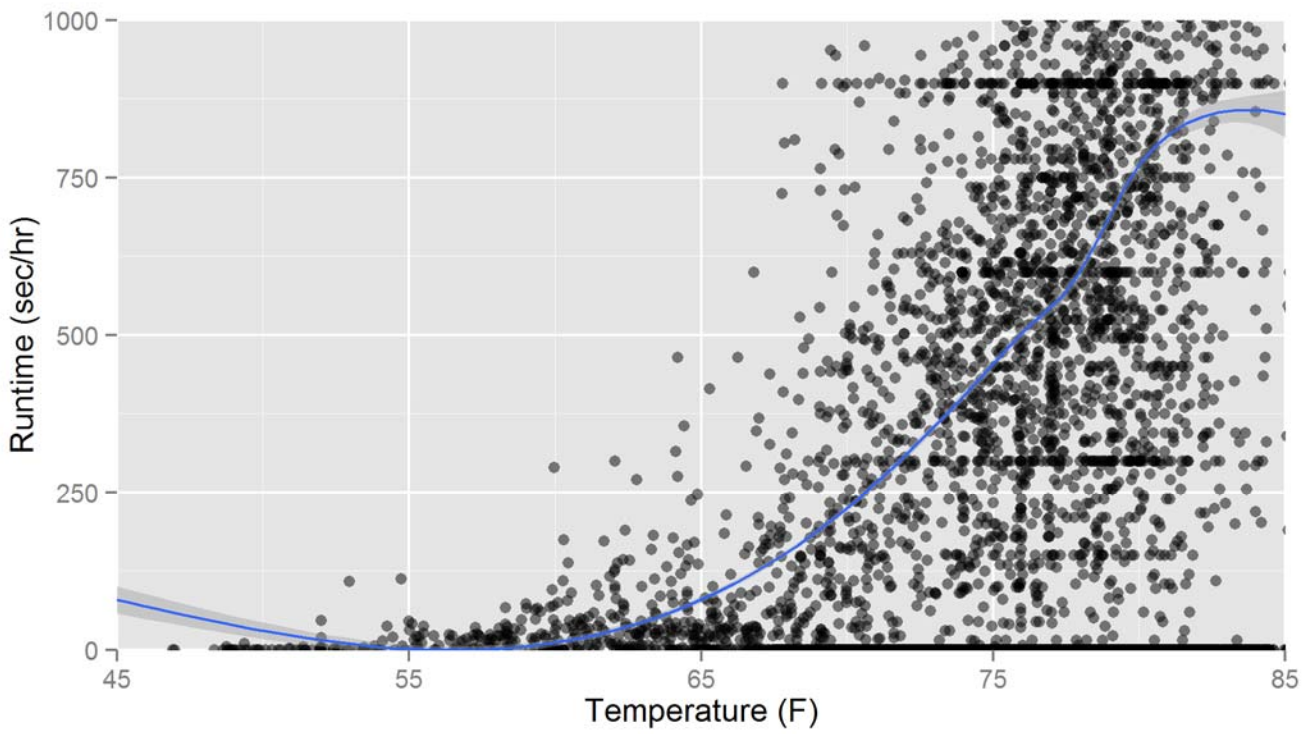
Table B-1. Thermostat Counts

	Installed Thermostats	Thermostat Logs	Final Data
Central AC	229	228	173
Window AC	150	148	14

Weather Data

Opinion Dynamics gathered weather data from the National Oceanic and Atmospheric Administration's National Climactic Data Center, which houses the Integrated Surface Database of hourly weather measurements from thousands of locations across the country. We used participant addresses to geocode the locations of all participants, and found that the weather station at the Newport State Airport was the closest to all pilot participants. We downloaded the hourly weather data from that station for 2014 and 2015 and merged it with the thermostat logs. We then calculated cooling degree hours with an outdoor base temperature of 65 degrees for use in the model. We chose 65 degrees as the base temperature because 65 degrees is approximately the point at which participants start using their central AC units during summer afternoons. Figure B-3 shows the average runtime versus temperature for peak season afternoons between noon and 8 p.m. Based on the modeled line, it appears that we could use either 60 or 65 degrees as a base for cooling degree hours, but we chose 65 as that temperature is more standard.

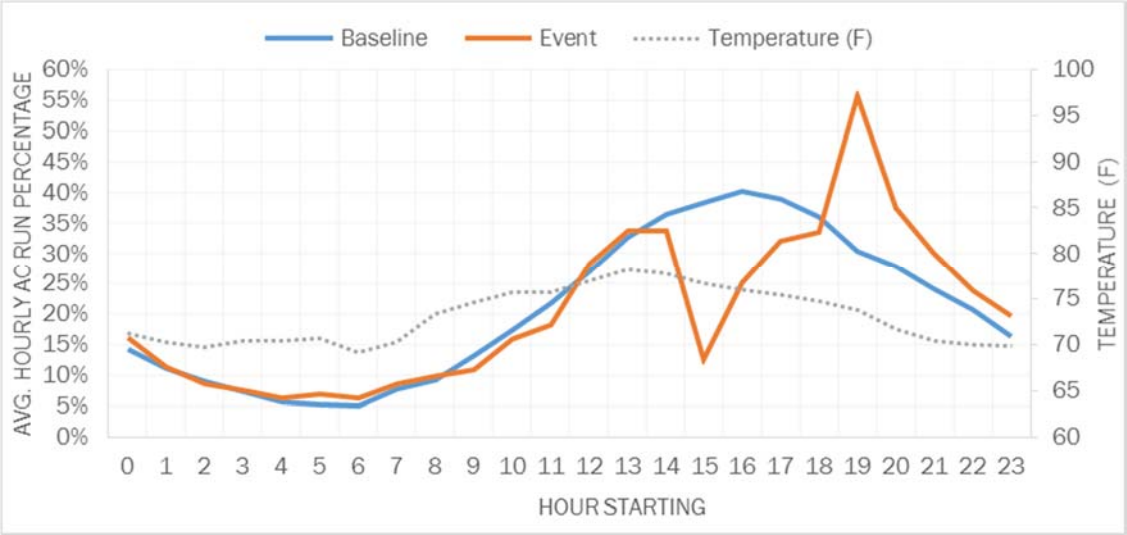
Figure B-3. Mean Central AC Runtime versus Temperature for Peak Season Afternoons



Individual Event Results – Central AC

The figures in this section show the runtime percentage along with the baseline used to calculate demand impacts for each of the 13 demand response events, called in 2015, that were included in the analysis.[47]

Figure B-4. Central AC Event 1 (July 13, 2015, 3-7pm)



[47] As described in Section 3.3, the July 20 and 21 events were dropped from the analysis due to the runtime gaps observed just before the start of these events.

Figure B-5. Central AC Event 4 (July 29, 2015, 3-7pm)

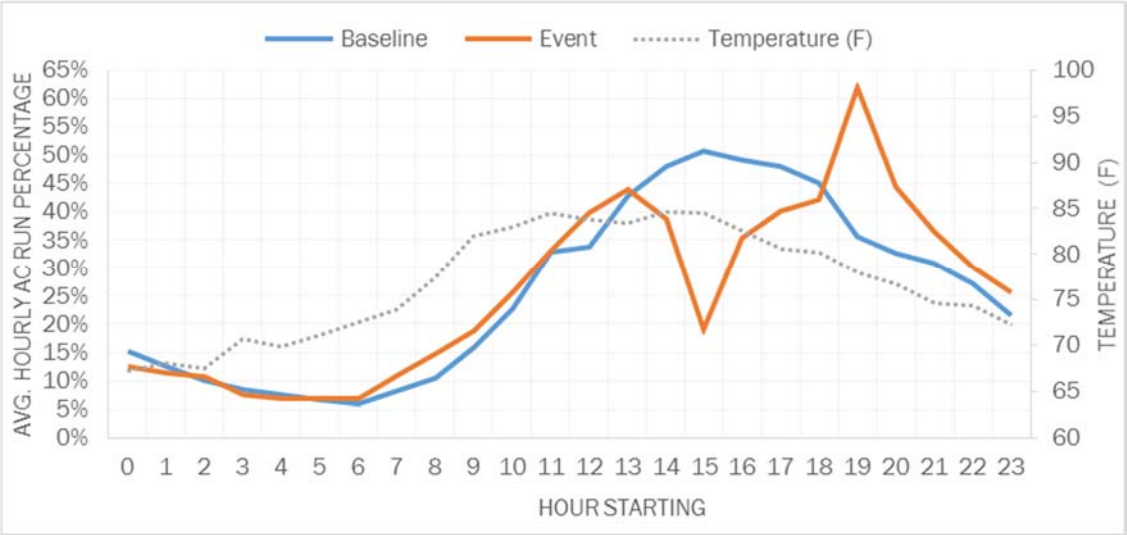


Figure B-6. Central AC Event 5 (July 30, 2015, 3-7pm)

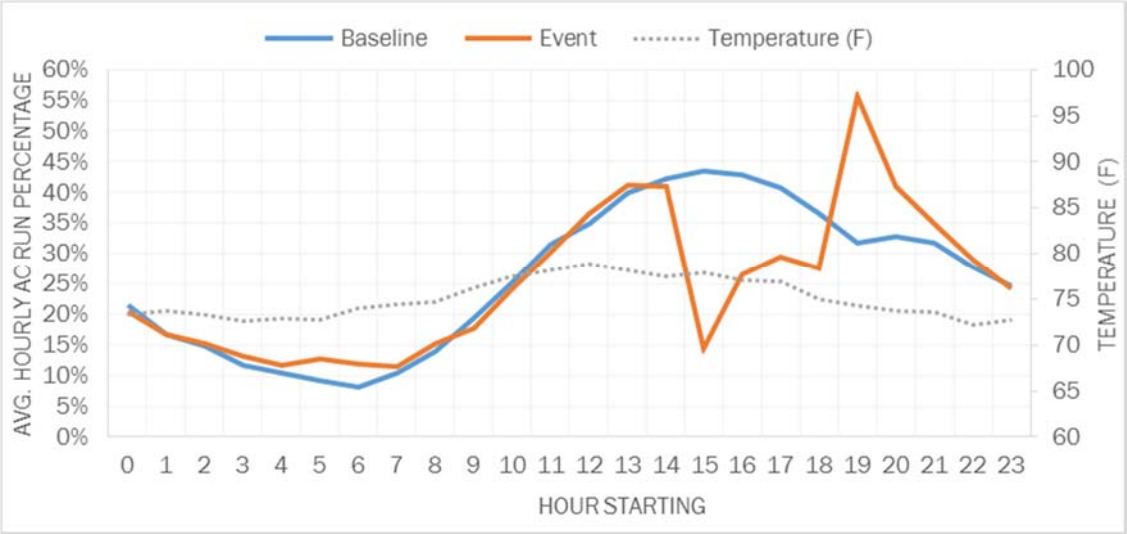


Figure B-7. Central AC Event 6 (July 31, 2015, 3-7pm)

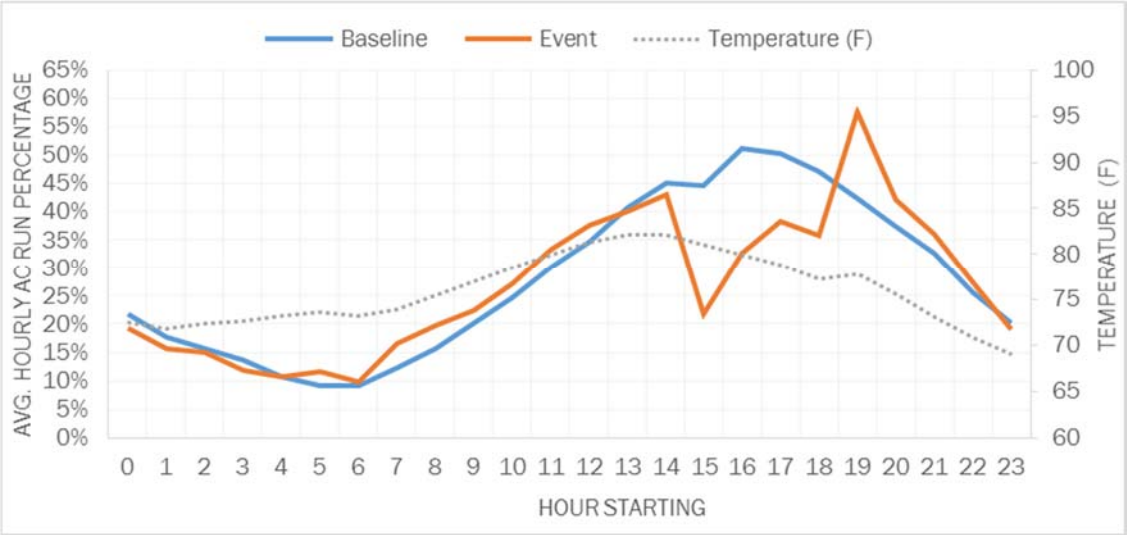


Figure B-8. Central AC Event 7 (August 4, 2015, 2-6pm)

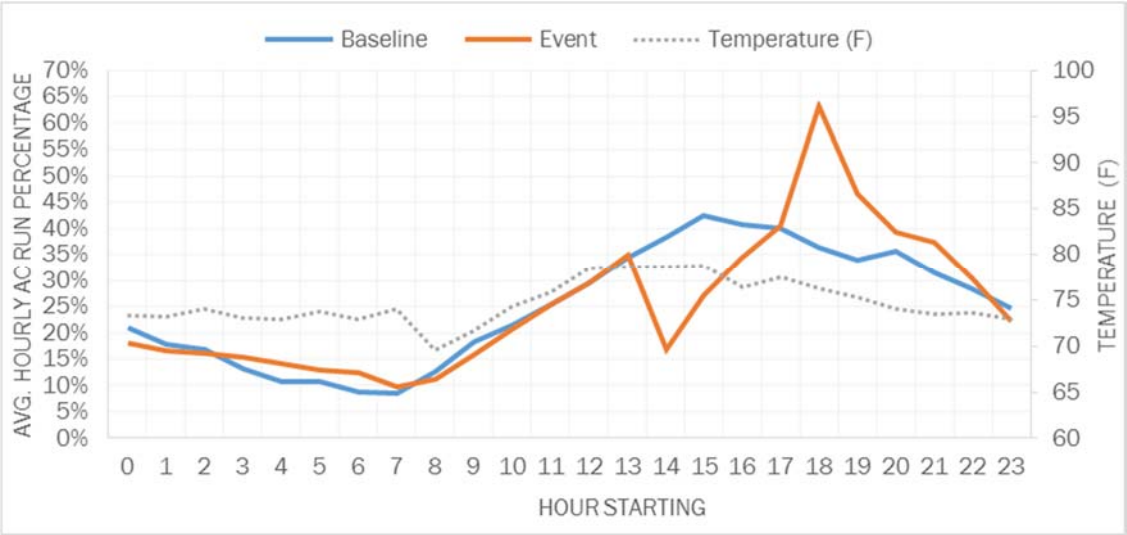


Figure B-9. Central AC Event 8 (August 17, 2015, 3-7pm)

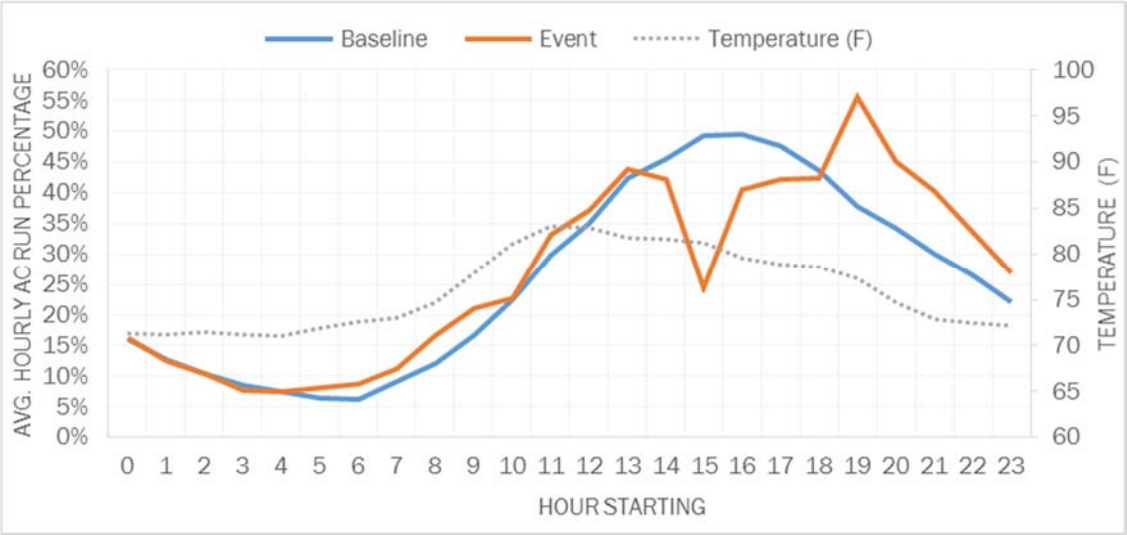


Figure B-10. Central AC Event 9 (August 18, 2015, 3-7pm)

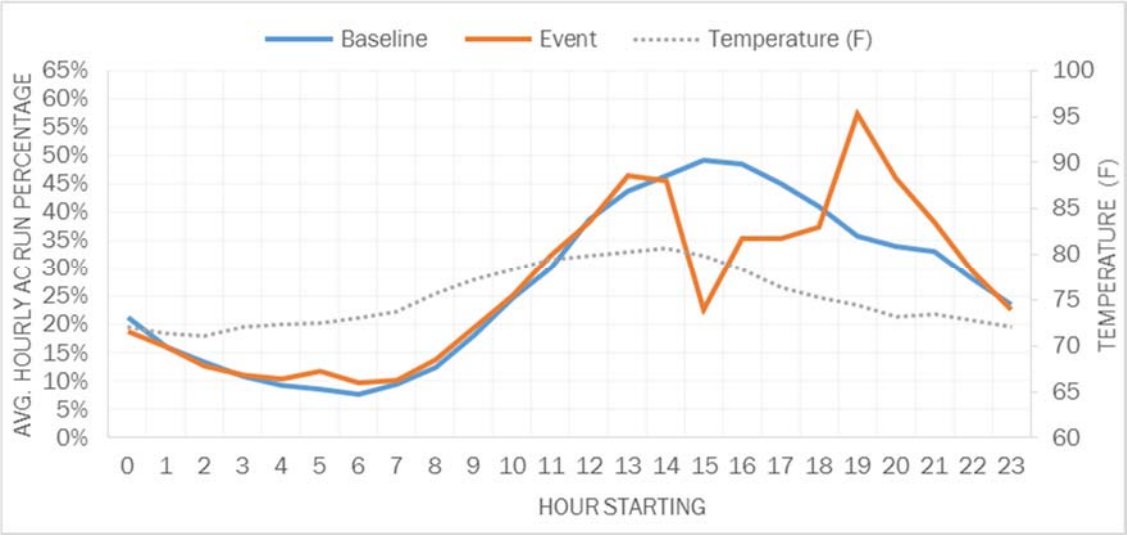


Figure B-11. Central AC Event 10 (August 31, 2015, 3-7pm)

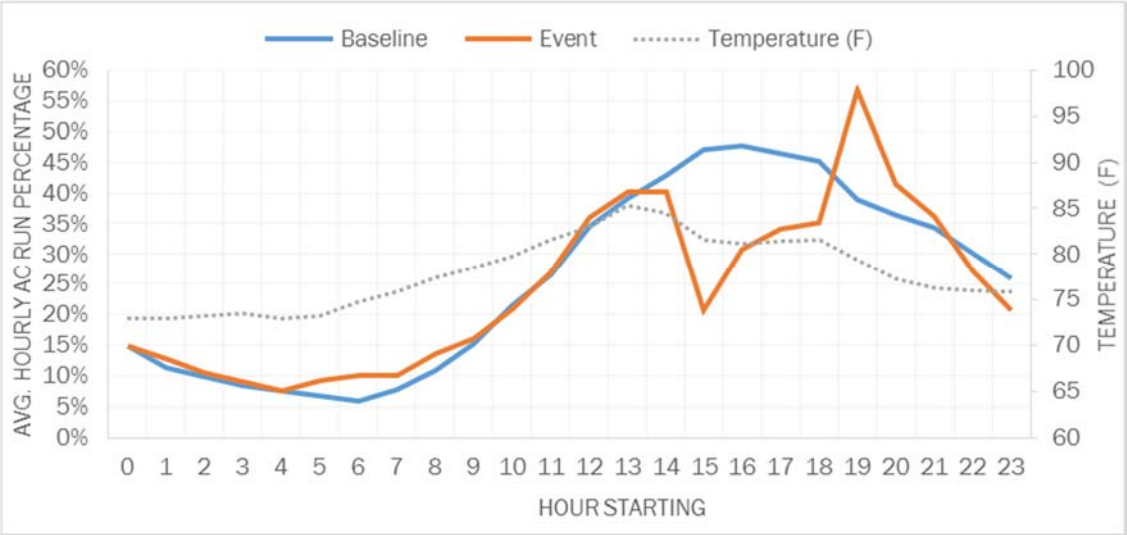


Figure B-12. Central AC Event 11 (September 1, 2015, 3-7pm)

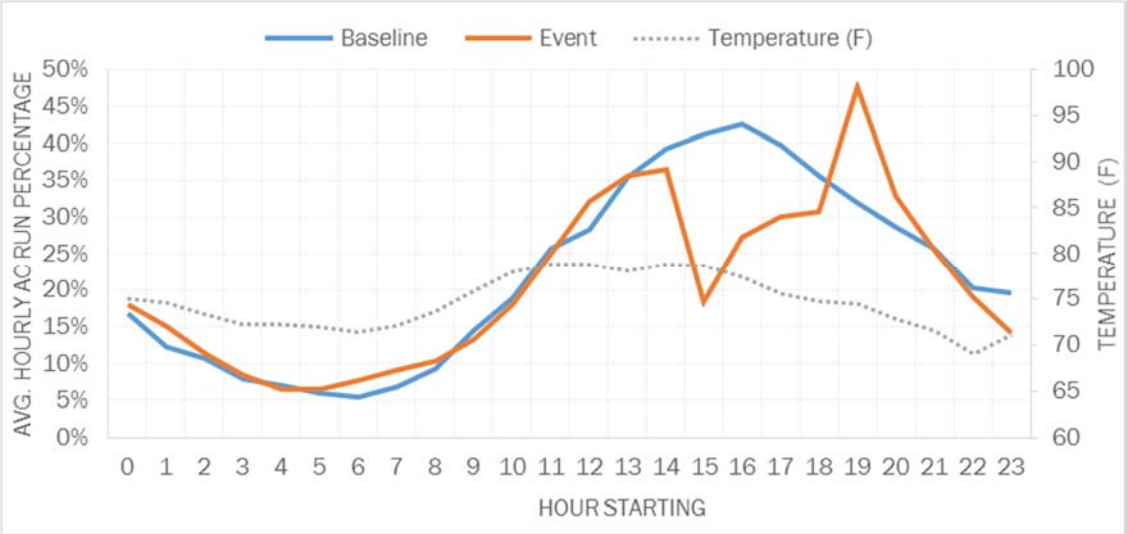


Figure B-13. Central AC Event 12 (September 2, 2015, 3-7pm)

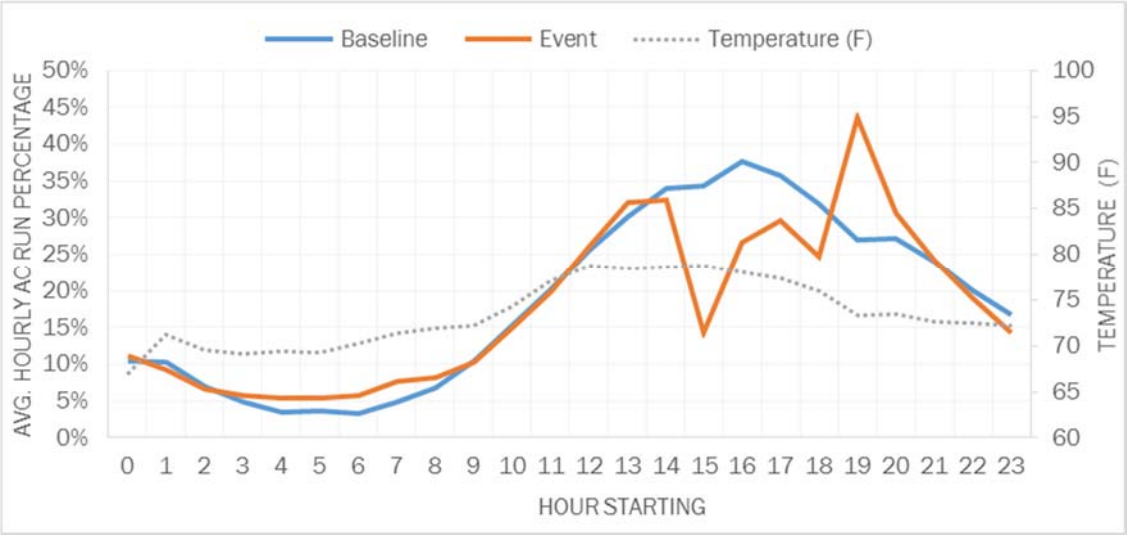


Figure B-14. Central AC Event 13 (September 3, 2015 3-7pm)

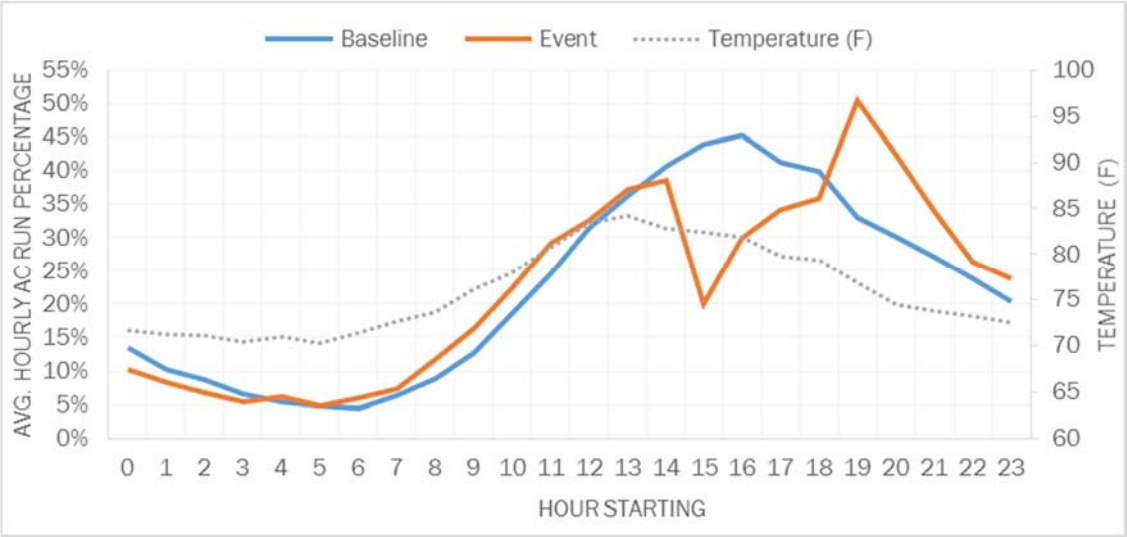


Figure B-15. Central AC Event 14 (September 8, 2015, 4-8pm)

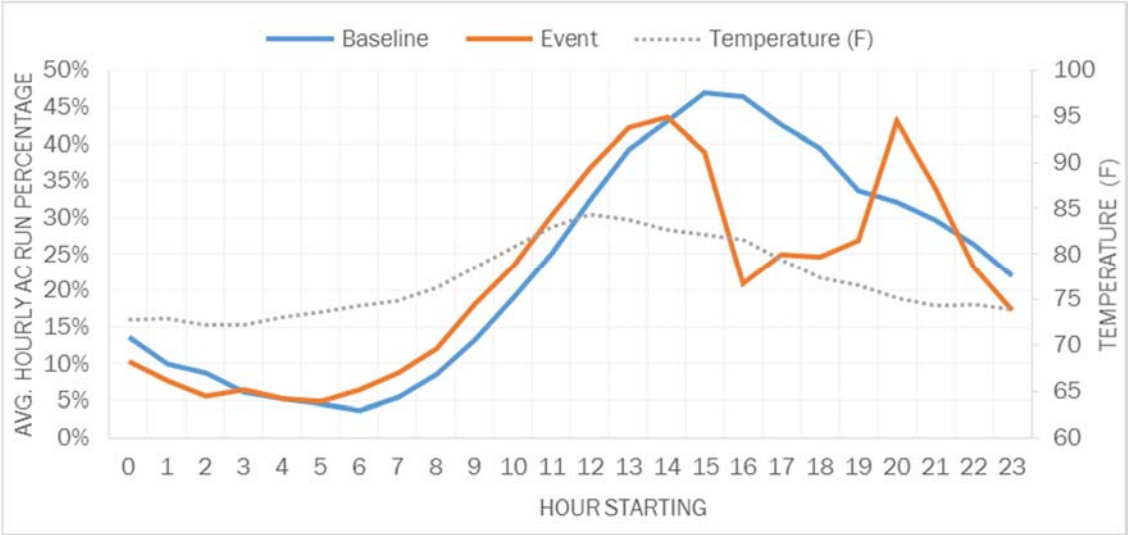
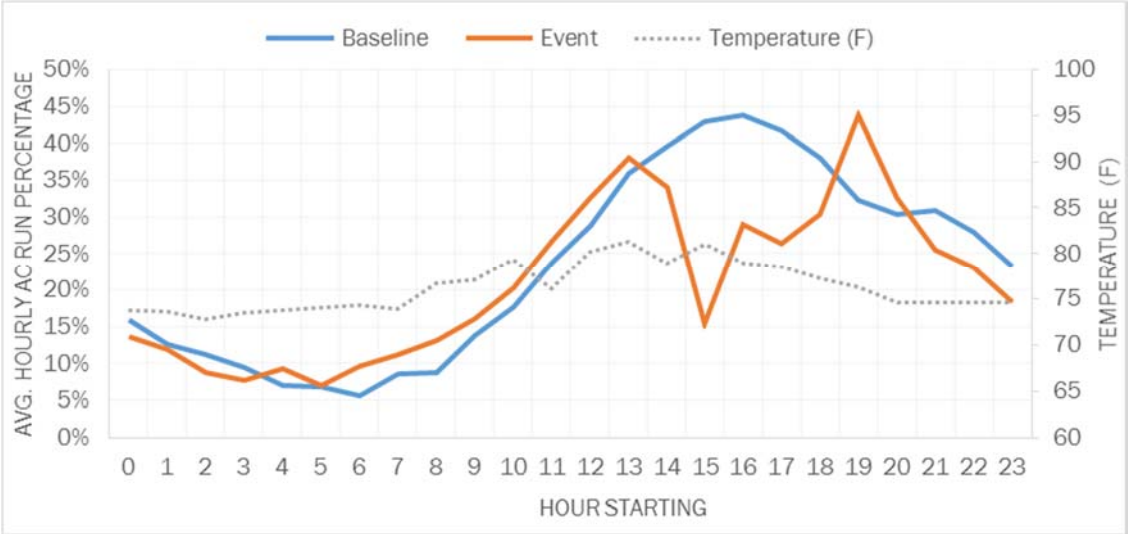


Figure B-16. Central AC Event 15 (September 9, 2015, 3-7pm)



Hourly Event Results

The table below provides hourly per-thermostat savings estimates and standard errors (SE) for each of the thirteen 2015 DR events that are included in our analysis. As is often the case with demand response programs, the first hour of the event achieved the highest savings, with an average of 0.87 kW across all events. Each subsequent event hour achieved smaller savings. The largest instantaneous per-thermostat reduction of the 2015 season occurred during the first hour of Event 4 (highlighted in blue). During that hour, the average load reduction by central AC thermostats was 1.17 kW.

Table B-1. Hourly DemandLink Impact Results

Event	Date	Time	Hour 1		Hour 2		Hour 3		Hour 4	
			kW	*SE*	kW	*SE*	kW	*SE*	kW	*SE*
Overall			0.87	*0.05*	0.55	*0.06*	0.35	*0.06*	0.20	*0.06*
1	Mon 7/13	3-7 pm	0.95	*0.09*	0.56	*0.10*	0.25	*0.11*	0.09	*0.11*
4	Wed 7/29	3-7 pm	1.17	*0.09*	0.51	*0.10*	0.29	*0.10*	0.11	*0.11*
5	Thur 7/30	3-7 pm	1.08	*0.08*	0.60	*0.08*	0.41	*0.10*	0.34	*0.09*
6	Fri 7/31	3-7 pm	0.85	*0.08*	0.68	*0.08*	0.44	*0.09*	0.42	*0.08*
7	Tue 8/4	2-6 pm	0.79	*0.08*	0.56	*0.09*	0.23	*0.08*	-0.02	*0.10*
8	Mon 8/17	3-7 pm	0.92	*0.09*	0.34	*0.11*	0.19	*0.10*	0.05	*0.10*
9	Tue 8/18	3-7 pm	0.98	*0.10*	0.49	*0.11*	0.36	*0.10*	0.14	*0.10*
10	Mon 8/31	3-7 pm	0.97	*0.09*	0.62	*0.10*	0.46	*0.11*	0.37	*0.10*
11	Tue 9/1	3-7 pm	0.84	*0.09*	0.57	*0.09*	0.37	*0.10*	0.18	*0.08*
12	Wed 9/2	3-7 pm	0.74	*0.08*	0.41	*0.09*	0.22	*0.10*	0.26	*0.08*
13	Thur 9/3	3-7 pm	0.88	*0.09*	0.57	*0.09*	0.26	*0.10*	0.15	*0.11*
14	Tue 9/8	4-8 pm	0.94	*0.11*	0.65	*0.10*	0.55	*0.10*	0.25	*0.10*
15	Wed 9/9	3-7 pm	1.02	*0.09*	0.55	*0.11*	0.57	*0.10*	0.28	*0.10*

Appendix C. Survey Sampling and Dispositions

EnergyWise Participant Survey

The EnergyWise participant survey asks respondents about marketing efforts that took place in the six months prior to their participation. The sampling unit for the EnergyWise Participant Survey was the unique program participant. The population included 312 program participants who participated in the EnergyWise Program between January and September 2015, including both substation and non-substation participants. We removed 16 records with duplicate email addresses, 33 participants without email addresses, 9 participants who did not install any EnergyWise measures, 9 who were included in the sample for the DemandLink Participant Survey, and 24 who were Solarize RI participants. The final sample frame consisted of 221 unique participants. We attempted to complete the survey with all 221 participants (census attempt).

The table below shows the final disposition for the EnergyWise participant survey, fielded between January 5, 2016 and January 28, 2016. Out of the 221 e-mail invitations, two were undeliverable due to invalid e-mail addresses. The final response rate, calculated as the number of completes divided by the eligible sample, was 20%.

Table C-1. EnergyWise Participant Survey Response Rates

	n
Total Sample	221
Undeliverables	2
Refused (replied but refused)	1
Eligible Sample	219
Completes	43
Response Rate (Completes/Eligible Sample)	20%

DemandLink Participant Survey

The sampling unit was the unique program participant. In addition to customers who participated between January and September of 2015, the survey frame included customers who entered the DemandLink Thermostat Program in 2014 but who had not previously responded to the DemandLink Participant Survey. We included these 2014 participants due to the small volume of new program participants in 2015. The population included 98 participants in the DemandLink Thermostat Program, the Window AC Rebate Program, and/or Window AC Recycling Program in 2014 and 2015, including both substation and non-substation participants. After removing two with duplicate phone numbers and six who were also Solarize RI participants, the final sample frame consisted of 90 unique participants (58 who participated in 2014 and 32 who participated in 2015). This survey was fielded between December 9 and December 29, 2015.

The table below shows the final disposition for the DemandLink participant survey. We completed a total of 31 interviews, resulting in a response rate of 39% and cooperation rate of 76%.

Table C-2. DemandLink Participant Survey Response Rates

	n
Completed Interviews (I)	31
Partial (P)	0
Refusal and break off (R)	10
Non-Contact (NC)	17
Other (O)	0
Unknown Eligibility Non-Interview (U)	24
Non-eligible (E)	6
Total Phone Numbers Used	90
Response Rate	39%
Cooperation Rate	76%

The response rate and cooperation rate are calculated as follows:

$$AAPOR\ \ Response\ Rate3\ (RR3) = \frac{I}{\big(I + R + P + NC + O + (e * U)\big)}$$

Where:

$$e = \frac{(I + R + P + NC)}{(I + R + P + NC + E)}$$

$$Cooperation\ Rate = \frac{I}{(I + P + R)}$$

Table C-3 below summarizes the program components in which the 90 unique program participants participated. Due to the small number of window AC rebate and recycling participants in our sample, and a desire to avoid questionnaire fatigue, we asked participants who took part in both the DemandLink Thermostat Program and one or both of the window AC programs, only window AC-related questions.

Table C-3. Program Participation Summary for Sample Development

	Unique Participants		
Programs Participated In	Overall	Entered Program in 2015	Entered Program in 2014
DemandLink Thermostat Only	58	23	35
DemandLink Thermostat + WAC Recycle + WAC Rebate	1	-	1
DemandLink Thermostat + WAC Rebate	1	1	-
DemandLink Thermostat + WAC Recycle	1	-	1
WAC Recycle + WAC Rebate	8	3	5
WAC Recycle Only	13	1	12
WAC Rebate Only	8	4	4
Total	90	32	58

SRP Leads Survey

The sampling unit for the SRP Leads survey was the unique customer. The population included 723 customers who – according to RISE and RAM databases – were leads for at least one of the four program offerings between January and September of 2015, including substation and non-substation customers. We removed customers who already participated in all programs they were a lead for as well as duplicate records, Solarize participants, and customers with invalid phone numbers. The final sample frame consisted of 365 unique customers who were leads for at least one of the four program offerings.

The table below shows the final disposition for the DemandLink Leads Survey. We completed a total of 99 interviews, resulting in a response rate of 29% and a cooperation rate of 69%.[48]

Table C-4. DemandLink Leads Response Rates

	n
Completed Interviews (I)	99
Partial (P)	1
Refusal and break off (R)	43
Non-Contact (NC)	181
Other (O)	1
Unknown Eligibility Non-Interview (U)	13
Non-eligible (E)	23
Total Phone Numbers Used	361
Response Rate [a]	29%
Cooperation Rate [b]	69%

$$^{a}AAPOR\ \ Response\ Rate3\ (RR3) = \frac{I}{(I+R+NC+O+(e*U))}$$

$$Where: e = \frac{(I+R+P+NC)}{(I+R+P+NC+E)}$$

$$^{b}Cooperation\ Rate = \frac{I}{(I+P+R)}$$

[48] While we completed 99 interviews with SRP lead, we only included 64 respondents in our analysis. The other 35 reported having participated in the program between the time of the leads data pull and the implementation of the survey. Those respondents therefore no longer qualified as program leads.

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