National Grid – Residential Active Demand Reduction Demonstration Project

MA EEAC – Demand Reduction Sub-Committee
February 23, 2017
What are we testing?

- Impact of calling DR events using Direct Load Control of Wi-Fi devices (right now T-stats) for Residential customers
- Testing various thermostats and their kW impacts before, during, and after DR events
- Marketing Message testing
- Primary motivation for customers to participate
- Participation rates during DR events
2016 Demonstration Results
1,782 thermostats were enrolled as of Sep 30, 2016
- 1414 RHR devices
- 368 CS devices

Very high retention rate, less than 0.25% left the program

Enrollment increases closely correlated with marketing efforts

Enrollment Targets

<table>
<thead>
<tr>
<th>Year</th>
<th>Wifi Tstats Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>6,000</td>
</tr>
<tr>
<td>2017</td>
<td>15,000</td>
</tr>
<tr>
<td>2018</td>
<td>40,000*</td>
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RHR = Rush Hour Rewards
CS = Connected Solutions
BYOT = Bring your own thermostat
HES = Home Energy Solutions
* Dependent on Wifi Tstat sales continuing
Thermostats in the CS plan participate differently than thermostats in the RHR plan.

No evidence of event fatigue over the summer in either plan.

No correlation in opt-outs based on day of the week, event frequency; some indication opt-outs correlated event temperature and event duration.

Note: Aggregated thermostat performance across all events.
Typical Event Impact Savings

Characteristic Demand Impact of DR Event

- **Pre-cooling** increases usage before a DR event
- **Post-event recovery** increases usage after a DR event
- During a DR event the savings declines over time
- **DR event reduces** demand and energy

Note: Pre-cooling was enabled for some Nest and Honeywell thermostats.
Per Device Impact Savings

- Avg outdoor temp greater on RHR events and larger setback (3° vs 2° F) leading to greater savings compared to CS
- Honeywell had higher demand savings than Ecobee, which could be explained by pre-cooling
- ATE and TOT most similar for Ecobee and Honeywell since CS had fewer opt-outs than RHR

**Note:** Average treatment effect (ATE) includes all active participants; treatment of the treated (TOT) includes only full participants
Per Event Impact Savings

Total Demand Savings by Event

**PRELIMINARY FINDINGS**

Note: Sum of average demand savings (inc. MA & RI Tstats) x number of active MA participants for each event for each thermostat type.
Customer Satisfaction

More than 85% of participants indicated “likely” or “very likely” to continue in 2017.

Customer surveys also collected suggestions to improve the DR program.

Likelihood to Participate in 2017 Program

- 1 = Very Unlikely
- 2 = Neutral
- 3 = Neutral
- 4 = Very Likely
- 5 = Very Likely

Note: Results from post-season survey. CS 110 responses. RHR 183 responses.
<table>
<thead>
<tr>
<th>Key Findings</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Marketing</td>
<td>• Email campaigns were effective but there was a high percentage of ineligible customers</td>
</tr>
<tr>
<td>Enrollment</td>
<td>• Enrollment experience can be improved by refreshing website design and automating screening, where possible</td>
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<tr>
<td>Event Notification</td>
<td>• Customers want more flexible notification options</td>
</tr>
<tr>
<td>Connectivity</td>
<td>• Connectivity was not monitored throughout the DR season and varied considerably by thermostat model</td>
</tr>
<tr>
<td>Opt Out</td>
<td>• Opt out rates varied by thermostat model, primarily driven by “serial opt-outers”.</td>
</tr>
<tr>
<td>Impacts</td>
<td>• Average demand savings of 0.4-0.5 kW per thermostat</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>• 85-90% of customers would participate in similar programs in the future</td>
</tr>
</tbody>
</table>
What's Next

- Scale BYOT
- Increase cross-program promotion
- New Wi-Fi enabled device integration
  - Nov 2016 - Launch Washers and Dryers
  - Q1 2017 - Launch Hybrid Hot Water heaters
  - Q2 2017 - Electric Hot Water Heaters, Mini-splits and Smart Window AC

Modify program based on learning from the first year

- Program design – incentives, outreach strategy
- Events – number, length, trigger criteria
- Enrollment process and customer engagement
- Online portal and mobile features

Additional testing

- DR ready homes in New Construction
- Geo targeting events
- Geo targeting marketing
Path 1 - Connected Solutions

- Using a territory specific WA DA LMP* of $49 ~126 hours of events

Path 2 - Nest Rush Hour Rewards

- Using a territory specific WA DA LMP* of $62 ~64 hours of events

Event Rules

- One event per day, maximum length 4 hours
- In a day where the price is over the trigger price for more than 4 hour, the event will be structured around the highest price hour.
- Trigger price needs to persist over 1 hour to call an event
- Minimum length of event is 2 hours for Connected Solutions. Nest Rush Hour Rewards events are 4 hours long
- June 1st and Sept 30th 10 am and 8 pm, on weekdays and non-holidays
Path 1: Connected Solutions

DR Events
- Summer events
  - Max 168 hours per season
  - Max. one 4 hour event per day
- Enrollments
  - DRMS Platform calls events
  - Automate device control
  - Reporting

DRMS Platform
- Powered by WeatherBug Home

Customers

In-home devices & appliances
- Online Portal
- Mobile App
- Summer EE Optimization
- Score Cards
- Honeywell
- ecobee
- Washers and Dryers
- Hot Water Heaters
- Mini Splits

$25 to enroll $25 participation/yr
- Email notification 2 hours prior
- Pre Cooling
- Automatic device control
- Schedule Adjustments by 2 °F
Path 2 – Rush Hour Rewards

Summer events
Max 60 hours per season
Max. one 4 hour event per day
Three events per week

DR Events

DRMS Platform calls events

DRMS Platform

Nest Platform

Powered by WeatherBug Home

$40 for participation
Email and app notification
2 hours prior
Pre Cooling
Automatic device control
Schedule Adjustments by 3 °F

Customers

Online Portal
Mobile App
Summer EE Optimization
Marketing Efforts

- Manufacturer emails to existing customers (ecobee, Honeywell and Nest)
- Home Energy Assessments
- National Grid marketing emails to customers
2016 – ISO-NE System
National Grid – C&I
Active Demand Reduction Demonstration Project

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Demonstration Project Specifics

Purpose of Connected Solutions: C&I
Determine if National Grid can cost effectively run a C&I DR program for transmission and distribution system benefits.

Details about Connected Solutions: C&I

Program Level Details

• A maximum of 40 MW DR assets will be registered into the program.

Eligible Customer Details

• Must be a National Grid Electric Customer
• Minimum 50 kW Curtailment
• Customer must be on a interval commercial rate (G-3 , G-2 if upgraded)
• Curtailment caused by natural gas or diesel generators is not eligible
• Existing FCM participants or those already under contract to participate are not eligible
What are Customers Signing up For?

When can we call events?
- Summer (June, July, August, September)
- Weekdays
- Not Holidays
- Between 11am and 5pm

How will customers be notified of events?
- We will notify the CSPs the day before we plan to have an event. The CSPs will notify the customers. Typically by email, text, and/or voicemail

How long do events last?
- Events will last from 1 to 4 hours
- Events will be in even hour increments. (From 2 to 4pm, not 1:15 to 2:15pm)

We plan to call 5 to 10 events per summer

CSP = Curtailment Service Provider
What are the Incentives?

Choose how you receive incentives

- Your Business
- Other Electric Customer
- Curtailment Service Provider
- Incentive Payment
- Performance Measurement Boundary

Payment Choice A

$ → [Circle]

Your business will receive the incentive directly based on your performance.

Payment Choice B

$ → [Square] → [Four Circles]

You have joined other companies that have elected to have the incentive paid to the Curtailment Service Provider based upon the aggregate performance of the entire group.

In both scenarios Curtailment Service Providers will be responsible for installing the equipment or developing the procedures that allow a customer to curtail load when called. It will be up to you and your Curtailment Service Provider to decide how the incentive from National Grid will be shared.

Saving energy is even more rewarding.

When you curtail electricity use during demand response events, you can receive these two incentives:

<table>
<thead>
<tr>
<th>Capacity Payment</th>
<th>Performance Payment</th>
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<td>$20 per kW per year</td>
<td>$0.75 per kWh during events</td>
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For example, if you curtailed an average of 100 kW of electricity over a summer that had 20 hours of demand response events, the incentive National Grid would make available would be:

\[ 100kW \times \frac{$20}{kW} + 100kW \times \frac{$0.75}{kWh} \times 20hr = $3,500 \]

(National Grid will pay this amount directly to the customer, or to the Curtailment Service Provider depending on the Payment Choice.)
What is the Target?

Source: Piette, M (2016), New Directions in Demand Response – Slide 17, Presented October 21, 2016
Why Would a Customer be Interested?

Customer Benefit per kW Curtailed

- National Grid Incentive
- Shared Revenue from ISO Markets
- Manage Monthly Demand
- Manage ICap Value
- Energy Market

Stacking of Revenue Streams or Savings

- $230
- $140
- $120
- $100
- $80
- $60
- $40
C&I Demand Response Timeline

2016
- RFQ Published
- Out for Bids
  - 3.5 weeks
- Review bids and select CSPs
  - 4 weeks

August
- September
- October
- November
- December

2017
- Start Enrolling Customers

January
- February
- March
- April
- May
- June
- July
- August
- September

2018
- Continue 2018 Customer Enrollments
- DR Events

Next Year - 2018
- Enroll customers for 2018 Program
- Continue 2018 Customer Enrollments
- DR Events
Appendix
Marketing Tools

Flyer

Website

Analytics