2017 SDG&E Residential SCTD Evaluation
PROGRAM OVERVIEW - SCTD

» Free programmable communicating thermostats (PCTs) with DR-enabling technology
  • Began in 2014

» Bring Your Own Thermostat (BYOT)
  • Began in December 2016
  • $75 total incentive
  • Nest or ecobee thermostat

» Dual enrollment in PTR program encouraged, but not required in order to receive DR incentive ($1.25/kWh)

» 2 p.m. – 6 p.m.

» 4 degree thermostat setback only

<table>
<thead>
<tr>
<th>Hours of Availability</th>
<th>Hours of Actual Use</th>
<th>No. of Available Dispatches</th>
<th>No. of Actual Dispatches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Event Length of 4 Hours</td>
<td>12 hours</td>
<td>No Maximum</td>
<td>3 times</td>
</tr>
</tbody>
</table>
METHODOLOGY

» Compared participant and reference hourly residential loads

» Reference loads calculated from matched control groups of non-program participants

» Control groups selected via Stratified Propensity Score Matching
  • One stage of matching using interval data

» Logistic regression model to estimate probability of participation
METHODOLOGY

» Impact models based on aggregate hourly residential loads for opt-in alert groups and matched controls

» Final model specifications included variables for hour, day of the week, month, cooling degree hours (CDH65), event indicators, enrollment status, and dummy variables for event days

\[
kWh_t = \beta_0 + \sum_d \beta_1^d \times DOW_d + \sum_m \beta_2^m \times Month_m + \sum_h \beta_3^h \times Hour_h + \sum_d \sum_h \beta_4^{h,d} \times Hour_h \times DOW_d + \sum_m \sum_h \beta_5^{h,m} \times Hour_h \times Month_m + \beta_6 \\
\times CDH65 + \sum_h \beta_7^h \times Hour_h \times CDH65_h + \sum_{e=1,2,3} \sum_h \beta_8^{h,e} \times Hour_h \times Event_e \\
+ \sum_{e=1,2,3} \sum_h \beta_9^{h,e} \times Hour_h \times Event_e \times InactivePart \\
+ \sum_{e=1,2,3} \sum_h \beta_{10}^{h,e} \times Hour_h \times Event_e \times ActivePart + \varepsilon_t
\]
## RESULTS – SCTD

<table>
<thead>
<tr>
<th>Event Date</th>
<th>Mean Active Participants</th>
<th>Mean Reference Load (kW)</th>
<th>Mean Observed Load (kW)</th>
<th>Mean Impact (kW)</th>
<th>% Load Reduction</th>
<th>Aggregate Load Reduction (MW)</th>
<th>Mean °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday, August 31st, 2017</td>
<td>17,588</td>
<td>1.87</td>
<td>1.26</td>
<td>0.61</td>
<td>32.8%</td>
<td>10.79</td>
<td>91.1</td>
</tr>
<tr>
<td>Friday, September 1st, 2017</td>
<td>17,645</td>
<td>2.22</td>
<td>1.60</td>
<td>0.62</td>
<td>27.8%</td>
<td>10.87</td>
<td>96.0</td>
</tr>
<tr>
<td>Saturday, September 2nd, 2017*</td>
<td>12,948</td>
<td>2.44</td>
<td>2.06</td>
<td>0.38</td>
<td>15.7%</td>
<td>4.98</td>
<td>95.1</td>
</tr>
<tr>
<td>Average 2017 Event**</td>
<td>17,617</td>
<td>2.05</td>
<td>1.43</td>
<td>0.62</td>
<td>30.1%</td>
<td>10.84</td>
<td>93.6</td>
</tr>
</tbody>
</table>

* One BYOT contractor did not signal this event.
**An average of 2017 weekday events only.
RESULTS – SCTD

Average 2016

Average 2017

2016 Average

kWh

°F

1:00 3:00 5:00 7:00 9:00 11:00 13:00 15:00 17:00 19:00 21:00 22:00 24:00

2:00 4:00 6:00 8:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00 24:00

Observed kWh
Reference kWh
Temperature
RESULTS – SCTD BY THERMOSTAT SOURCE

Free Thermostats

BYOTs

Observed kWh | Reference kWh | Temperature

Observed kWh | Reference kWh | Temperature
RESULTS – SCTD DUALY ENROLLED IN PTR

2017 Average
8,179 participants
SCTD 0.67 kW (31.5%)
PTR 0.05 kW (4.5%)
EX ANTE METHODOLOGY

» Data sources

• 2017 ex post regression model results
• 10-year enrollment forecast
• SDG&E and CAISO weather scenarios

1. Calculate per participant average reference loads, observed loads, and load impacts

2. Combine results for the different weather scenarios with forecast of enrolled participants to generate the total program impacts
EX ANTE ENROLLMENT FORECAST

SCTD - Free  SCTD - BYOT
### EX ANTE – SCTD

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BYOT</td>
<td>Typical Event Day</td>
<td>Aug 2018</td>
<td>1.86</td>
<td>1.22</td>
<td>0.65</td>
<td>34.8%</td>
<td>6,949</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aug 2027</td>
<td>1.89</td>
<td>1.29</td>
<td>0.60</td>
<td>31.2%</td>
<td>18,479</td>
<td>11.1</td>
</tr>
<tr>
<td>Free</td>
<td>Typical Event Day</td>
<td>Aug 2018</td>
<td>1.81</td>
<td>1.34</td>
<td>0.47</td>
<td>25.8%</td>
<td>19,355</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aug 2027</td>
<td>1.83</td>
<td>1.45</td>
<td>0.38</td>
<td>20.8%</td>
<td>37,909</td>
<td>14.4</td>
</tr>
<tr>
<td>All</td>
<td>Typical Event Day</td>
<td>Aug 2018</td>
<td>1.82</td>
<td>1.31</td>
<td>0.52</td>
<td>28.3%</td>
<td>26,304</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aug 2027</td>
<td>1.85</td>
<td>1.40</td>
<td>0.45</td>
<td>24.3%</td>
<td>56,388</td>
<td>25.4</td>
</tr>
</tbody>
</table>
# EX ANTE / EX POST COMPARISON – SCTD

<table>
<thead>
<tr>
<th>Participant Segment</th>
<th>Control Strategy</th>
<th>Weather Year</th>
<th>Day / Type</th>
<th>Average Hourly Reference Load (kW)</th>
<th>Average Hourly Observed Load (kW)</th>
<th>Average Hourly Impact (kW)</th>
<th>Percent Load Reduction</th>
<th>Average °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYOT</td>
<td>1-In-2</td>
<td>August System Peak Day</td>
<td>2.01</td>
<td>1.34</td>
<td>0.67</td>
<td>33.4%</td>
<td>88.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex Post</td>
<td>Ex Post Average Event Day</td>
<td>2.36</td>
<td>1.67</td>
<td>0.69</td>
<td>29.2%</td>
<td>92.7</td>
<td></td>
</tr>
<tr>
<td>SCTD - All</td>
<td>Free</td>
<td>August System Peak Day</td>
<td>1.98</td>
<td>1.49</td>
<td>0.49</td>
<td>24.7%</td>
<td>90.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex Post</td>
<td>Ex Post Average Event Day</td>
<td>2.15</td>
<td>1.63</td>
<td>0.52</td>
<td>24.2%</td>
<td>94.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ALL</td>
<td>August System Peak Day</td>
<td>1.99</td>
<td>1.45</td>
<td>0.54</td>
<td>27.1%</td>
<td>90.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex Post</td>
<td>Ex Post Average Event Day</td>
<td>2.18</td>
<td>1.64</td>
<td>0.54</td>
<td>24.7%</td>
<td>93.6</td>
<td></td>
</tr>
</tbody>
</table>
THANK YOU