



SDG&E Commercial Thermostat Evaluation

DRMEC 2017 Spring Workshop

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Reimagine tomorrow.



Agenda

- Program overview
- Ex post methodology
- Ex post results
- Ex ante methodology
- Ex ante results
- Ex post results by segments (time permitting)
- SCTD energy savings (time permitting)

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The San Diego Gas & Electric (SDG&E) Commercial Thermostat program is a growing AC load control program

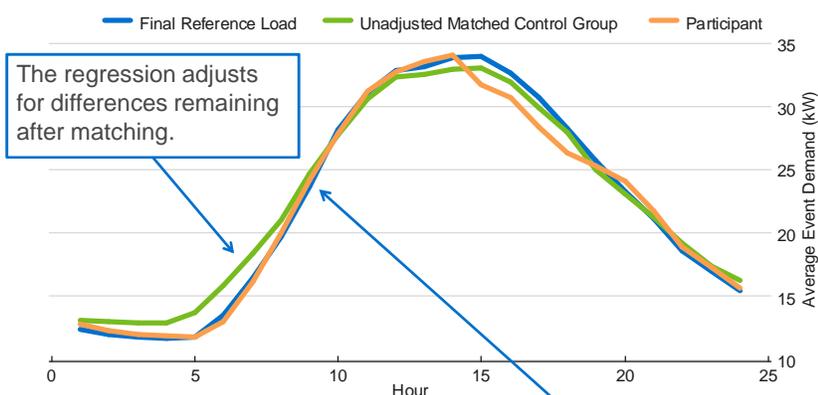
- Smart thermostat installations are used for AC load control demand response in SDG&E's service territory on CPP days
- 1,724 small and medium business (SMB) customers (12,829 thermostats) participated in the 2016 CPP event day
- 884 commercially managed residential customers (905 thermostats) participated in the 2016 CPP event day
- Roughly half of SCTD customers are dually enrolled in CPP
- Any participant can override the load control at any point

Hours of Availability	Hours of Actual Use	Number of Available Dispatches	Number of Actual Dispatches
72 hours	4 hours	18 events	1 event

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Impacts were estimated using matching with difference-in-differences regression and same-day adjustment

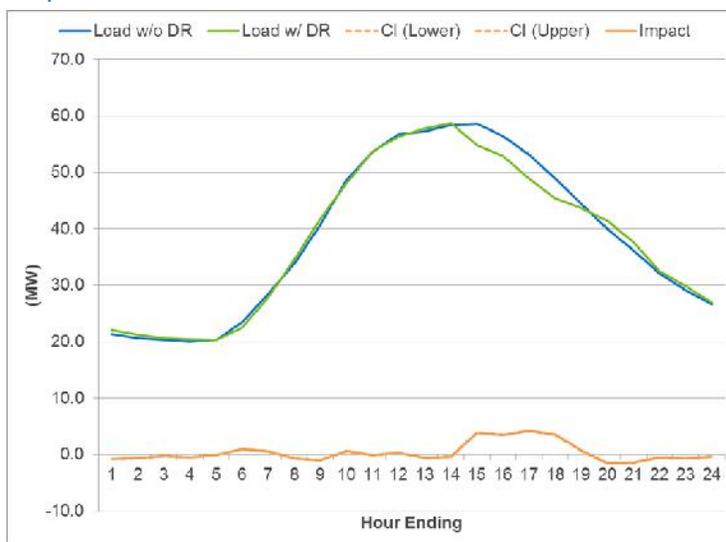


The matching algorithm selects control customers with a similar load profile to participants.

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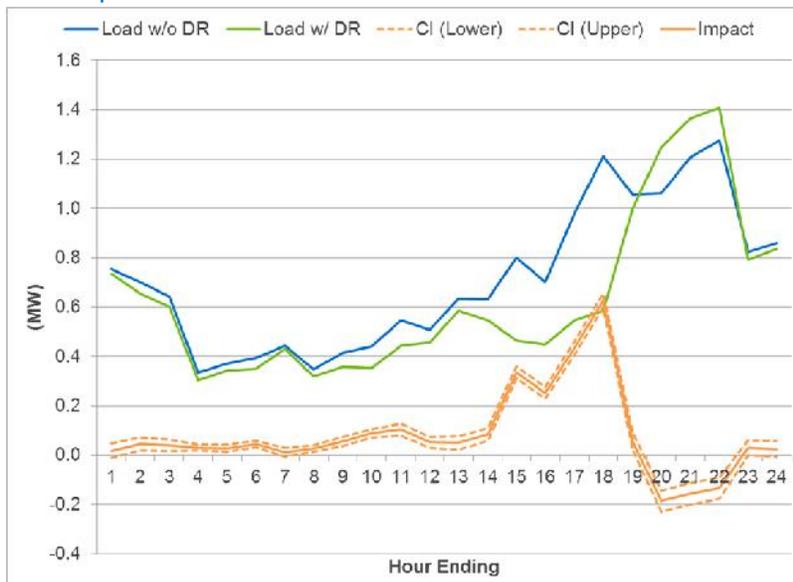
The single 2016 event day impact was 2.2 kW per customer and 0.3 kW per thermostat for commercial customers



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The single 2016 event day impact was 0.47 kW per customer and 0.46 kW per thermostat for residential customers

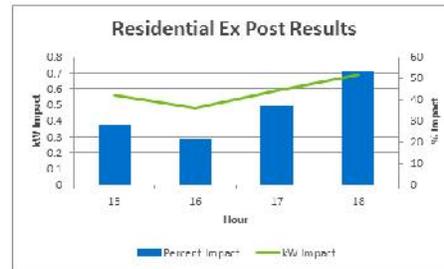
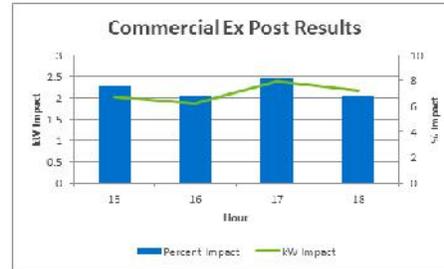


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The per thermostat impacts for commercial customers remained relatively constant in percent terms after the first event hour

- Commercial impacts ranged between 6-8% throughout the event
- Residential impacts increased over time
- While residential percent impacts are very large, the per-customer impacts are less than 1kW
 - Reflects the higher relative amount of load used for cooling in residential accounts
- SDG&E system peak occurred on 9/26 between 5-6pm.
 - Impacts were 4.15 MW
- Commercial Thermostat program was not dispatched on 7/27 CAISO system peak



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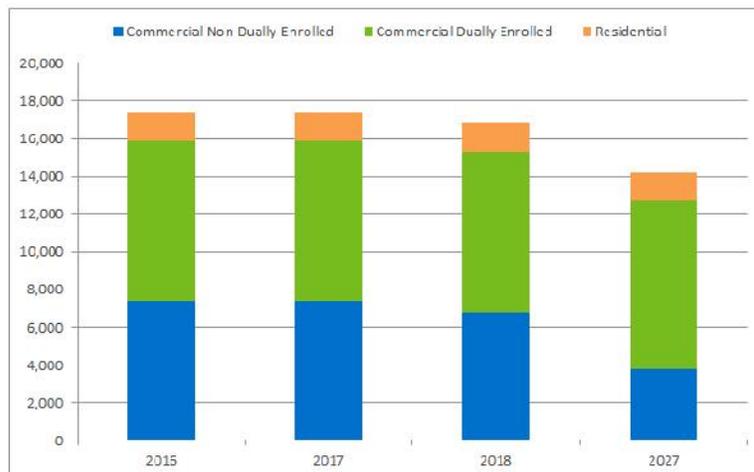
Ex Ante impacts were calculated using 2016 per-thermostat impacts

1. Ex post estimates were developed with the key output being the average per-thermostat impact (0.3 kW)
2. Regression models were estimated that relate hourly usage to weather
3. Ex post impacts were scaled using the ratio of cooling degree day values from ex post to the ex ante weather scenarios for each day type, month and weather year
 1. This addresses the fact that no impacts would be observed on days cool enough that the thermostat would not be operating
 2. Also addresses that impacts will be higher on hotter days

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The SCTD program has flat to declining growth in thermostats over the forecast horizon



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The per-customer impacts are expected to remain relatively stable over time

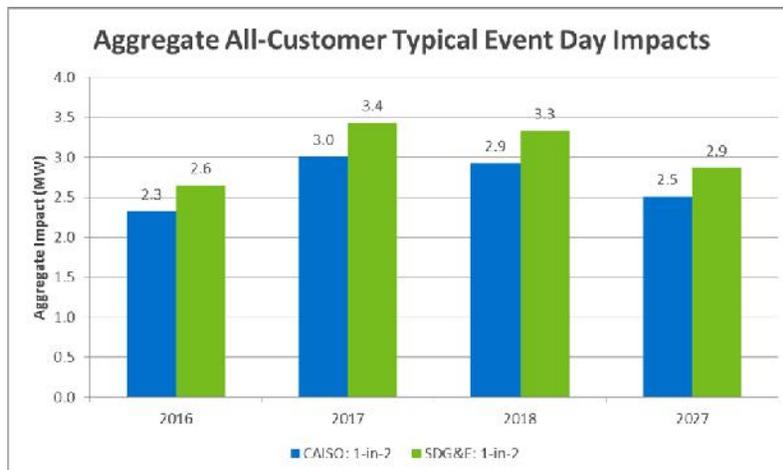


- The CAISO 1-in-2 typical event day is hotter than the SDG&E 1-in-2 typical event day
- The per-customer impact changes over time due to small changes in the customer mix
- Graph shows total program average customer impacts
- Including residential and all commercial customers

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Enrollment changes and customer mix drive aggregate impacts



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The aggregate ex post and ex ante impacts increased from the 2015 evaluation to the 2016 evaluation

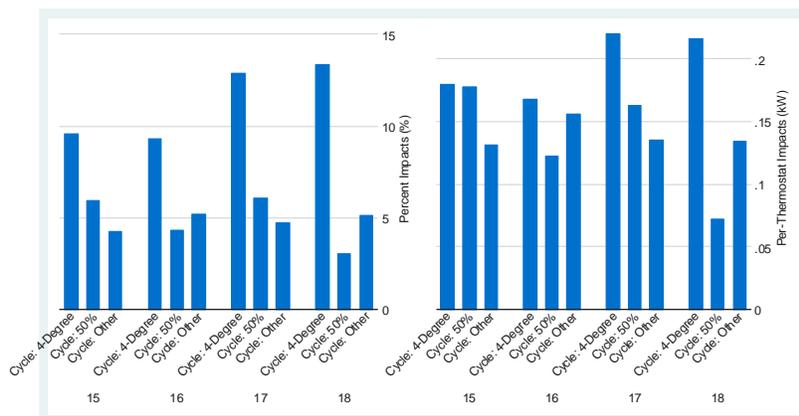
	Evaluation Year	Aggregate Impact (MW)	Thermostats Enrolled	Mean17	Avg. Event Temp
Ex Post	2015	3.1	12,422	84.1	91.7
	2016	4.2	13,735	81.6	98.6
Ex Ante (2018) Typical Event Day SDG&E 1-in-10 Scenario	2015	3.5	16,746	77.3	85.4
	2016	4.8	16,800	79.1	87.6

- Aggregate ex post impacts increased by 1.3x from 2015 to 2016 due to:
 - 10% increase in enrolled thermostats
 - 7 degree increase in average event temperatures
- Ex ante estimates for 2018 increased from the 2015 to the 2016 evaluation due to:
 - Higher 2016 ex-post impacts
 - 2 degree increase in average event-window temperatures driving higher CDD values

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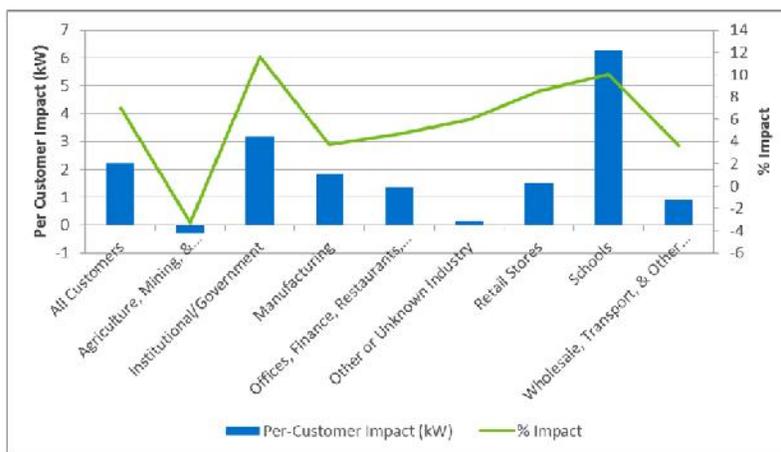
2016 impacts per thermostat throughout the event hours were very similar for each load control strategy, but percent impacts were higher for 4-degree setback



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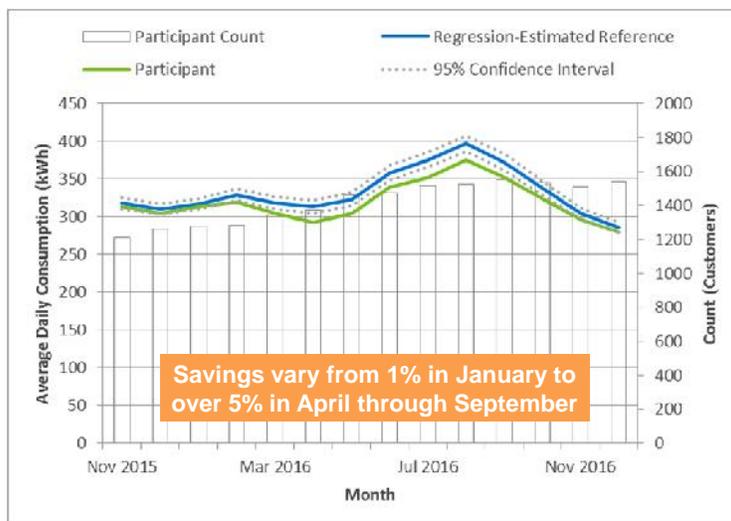


Industries varied greatly in their ability to deliver impacts (commercial customers only)



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Electricity savings increased to 4.5% in 2016, reaching nearly 800 kWh/thermostat (from 3% and 600 kWh in 2015)



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