Evaluation of 2015 SDG&E Commercial Thermostat Program

2016 PLMA Spring Conference

Smart Thermostat Interest Group Workshop

Prepared by:

Josh Schellenberg, Principal

Dan Thompson, Project Analyst

April 18, 2016

Overview

1. Program Overview
2. Demand Response Analysis and Results
3. Energy Savings Analysis and Results
4. Discussion

Nexant

Reimagine tomorrow.

Program Overview

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

- Smart thermostat installations used for AC load control demand response in SDG&E's service territory
- 1,243 small and medium business (SMB) customers (11,292 thermostats) participated in 2015 DR events
- 1,079 commercially managed residential customers (1,130 thermostats) participated in 2015 DR events
- New enrollment is expected to increase the number of participants by 17% to nearly 3,000 over the next three years (roughly 17,000 thermostats)
- Two primary load control strategies: 50% cycling, 4-degree setback
- SMB participants are the focus of this presentation

2015 program evaluation objectives

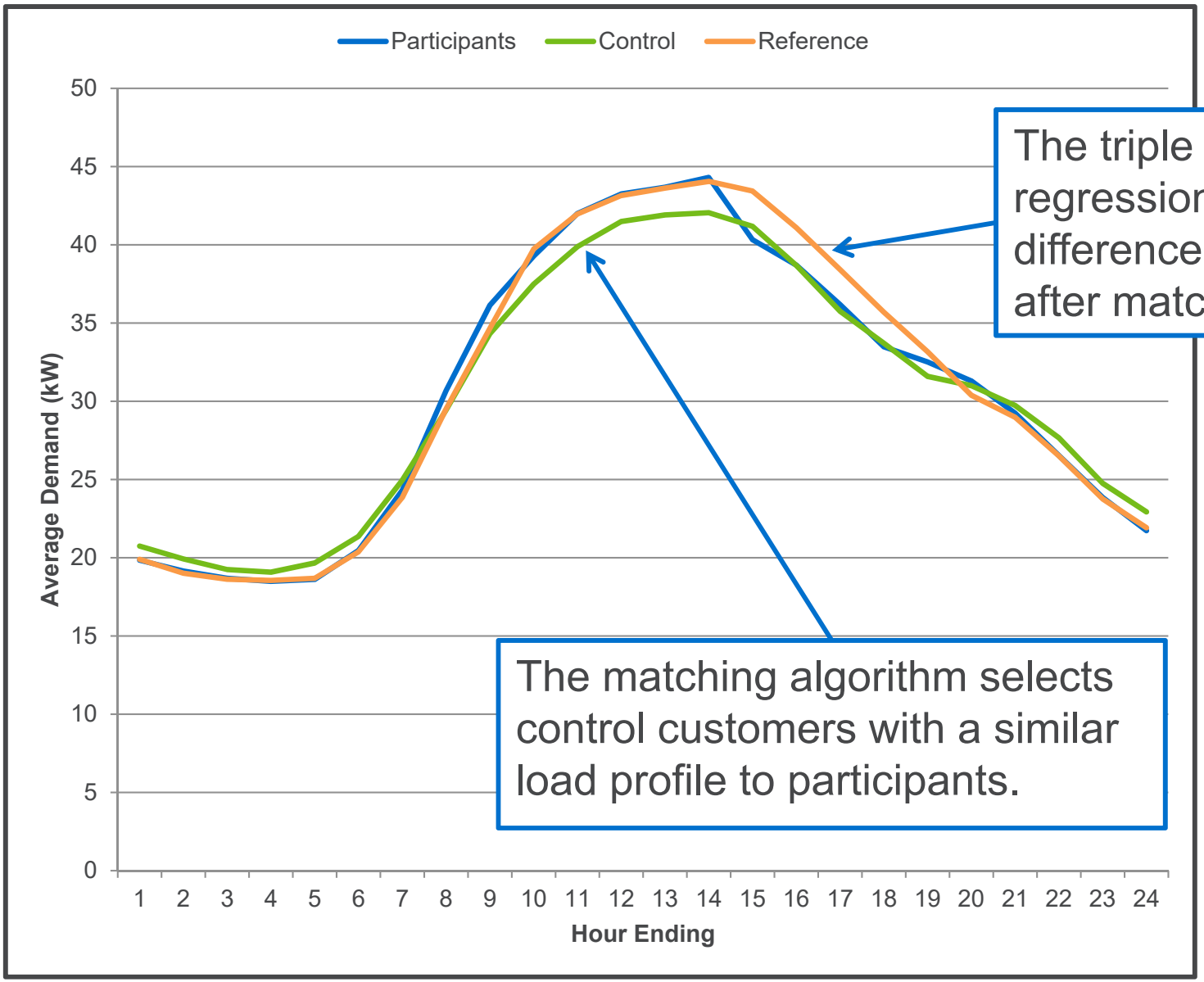
- The primary evaluation objectives were to:
  - Estimate hourly ex post load reductions for the 4 DR event days in 2015 (aggregate, per-customer, and per-device levels)
  - Estimate and compare ex post load reductions by cycling strategy, industry and climate zone
  - Forecast 2015–2026 thermostat program ex ante load impacts for a 1-in-2 and 1-in-10 weather year by month (aggregate, per-customer level, and per-device levels)
- A secondary objective was to assess the energy savings that the smart thermostats delivered

Nexant

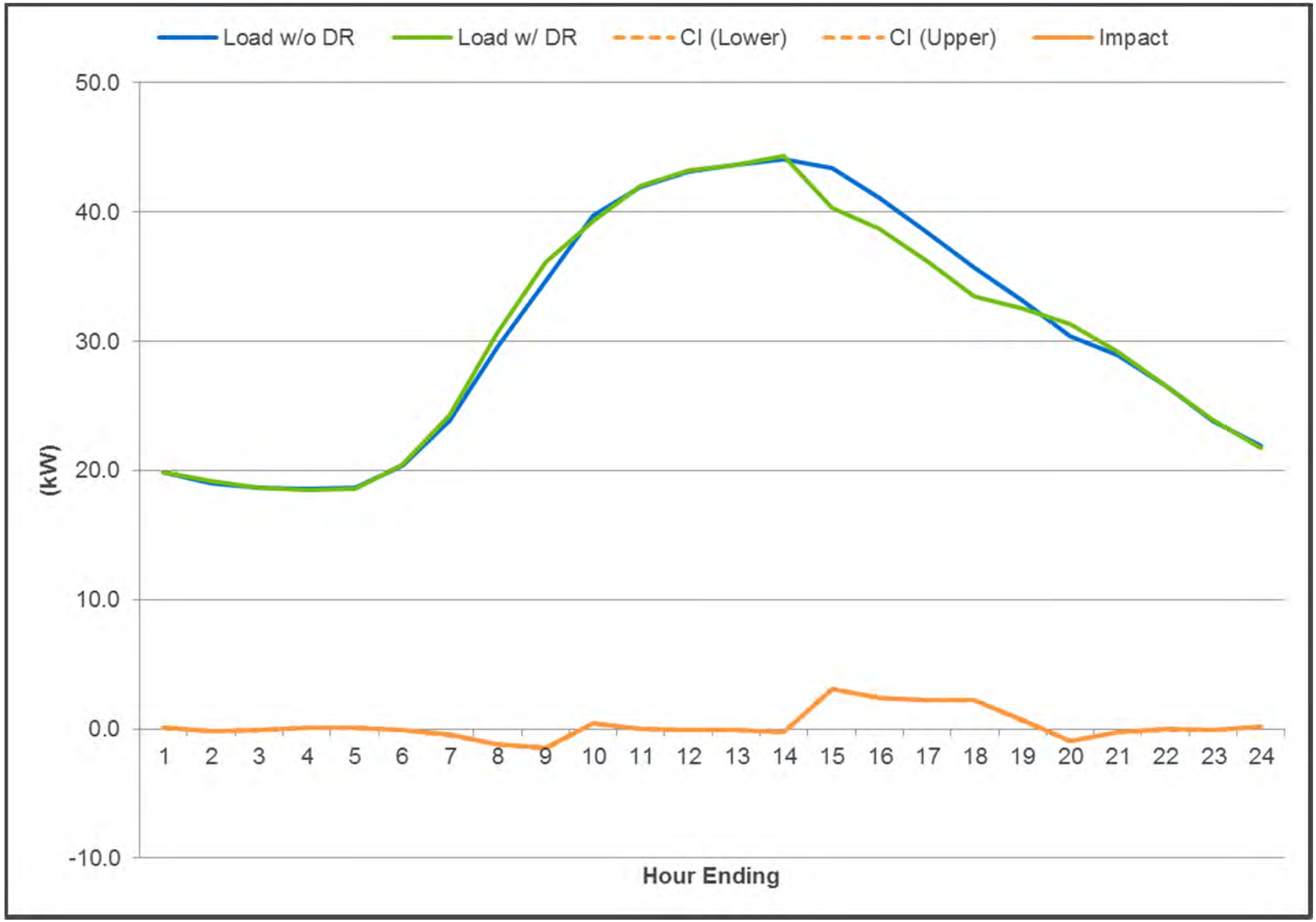
Reimagine tomorrow.

Demand Response Analysis and Results

Impacts estimated using matching with triple differences regression



The average 2015 event day impact was 2.49 kW per customer and 0.27 kW per thermostat

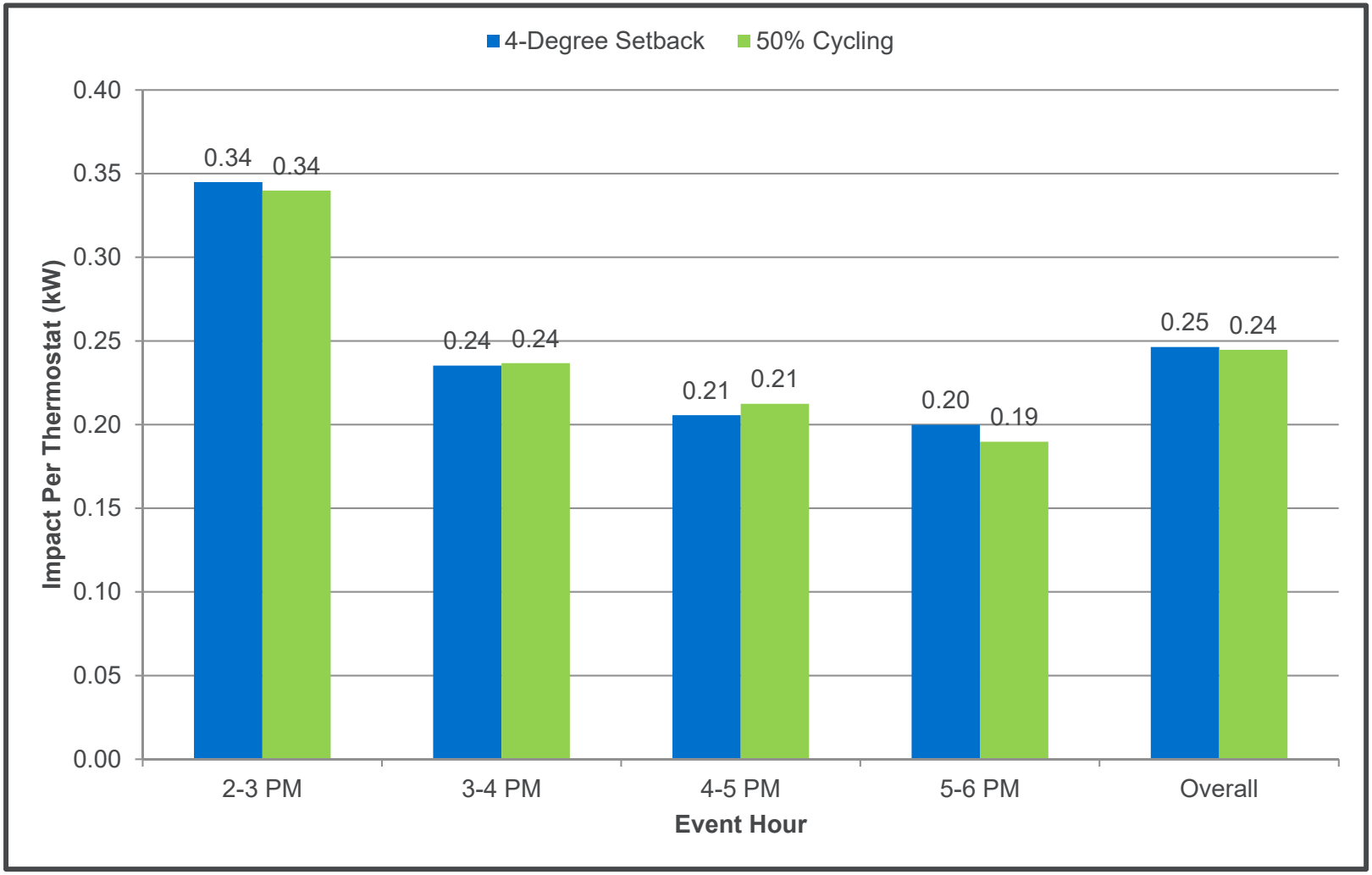


2015 impacts ranged from 0.16 kW to 0.33 kW per thermostat

Date	Enrolled Participants	Total Number of Thermostats	Avg. Reference Load (kW)	Avg. Load Reduction (kW)	Percent Load Reduction (%)	Aggregate Load Reduction (MW)	Avg. Thermostat Impact (kW)	Mean17 (F)
Aug 28, 2015	1,243	11,292	37.1	1.4	3.8%	1.8	0.16	82.2
Sep 9, 2015	1,243	11,292	40.9	2.5	6.2%	3.1	0.28	86.5
Sep 10, 2015	1,243	11,292	41.4	3.0	7.2%	3.7	0.33	85.2
Sep 11, 2015	1,243	11,292	39.2	3.0	7.7%	3.7	0.33	82.6
Average Event	**1,243**	**11,292**	**39.7**	**2.5**	**6.3%**	**3.1**	**0.27**	**84.1**

- 3 of the 4 events were called on consecutive days from September 9th through September 11th, yet impacts remained consistent
- On average, the smart thermostats delivered a 6.3% reduction in whole-building load (3.1 MW) during event hours (2 to 6 PM)

2015 impacts per thermostat throughout the event hours were very similar for each load control strategy

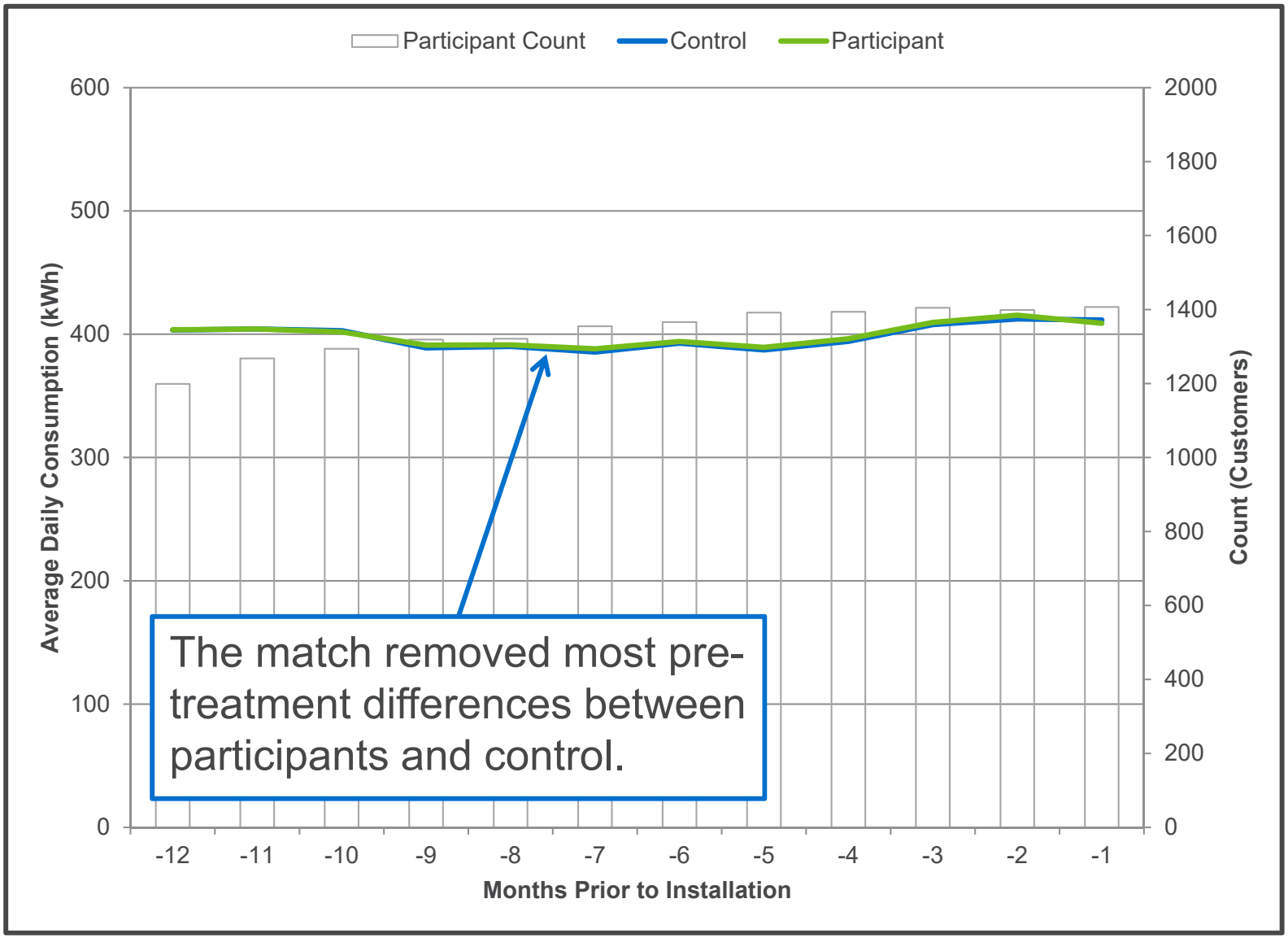


Smart thermostats delivered the largest impacts for retail customers; hotels underperformed relative to other industries

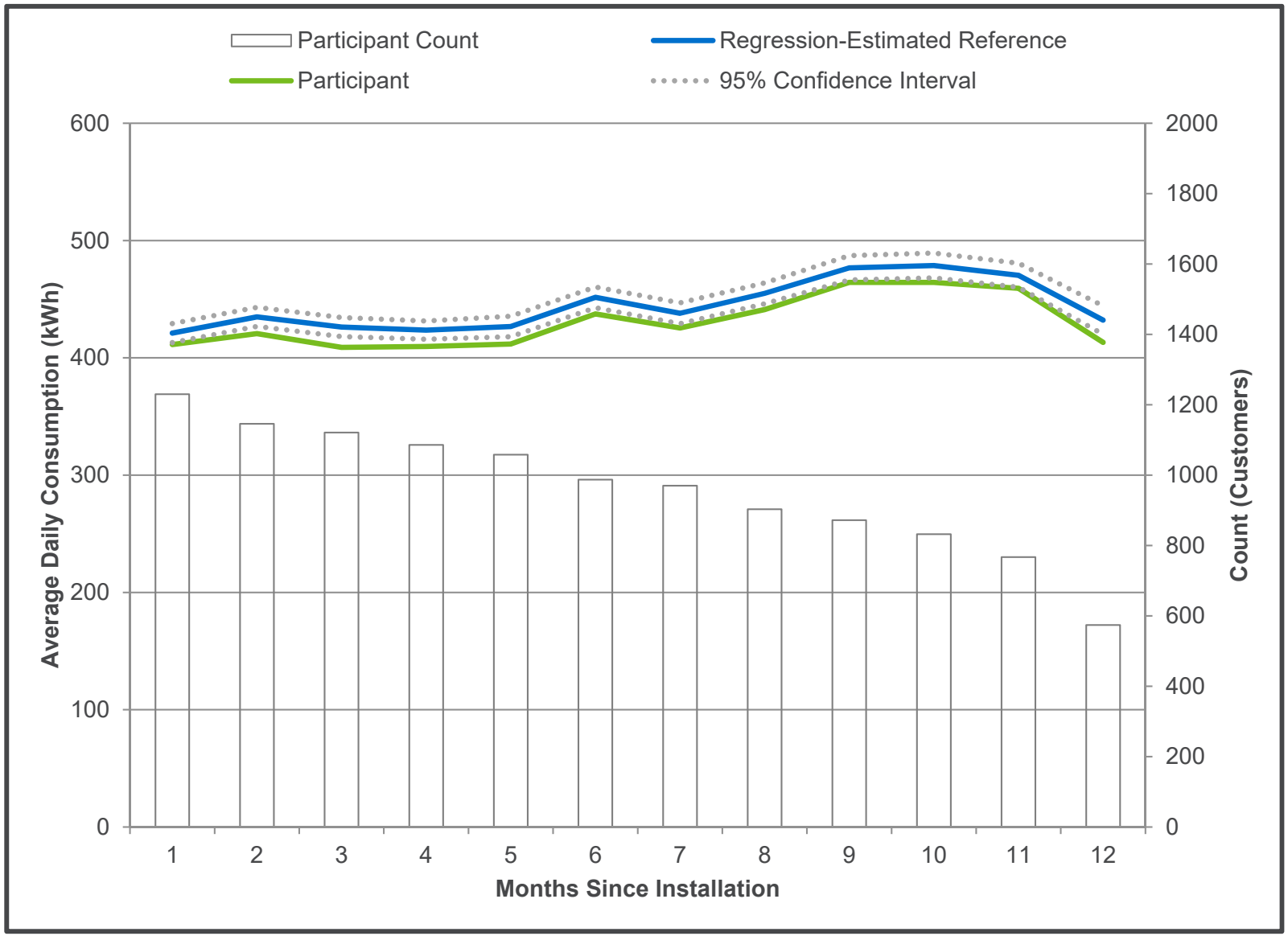
Industry	Enrolled Participants	Total Number of Thermostats	Avg. Reference Load (kW)	Avg. Load Reduction (kW)	Percent Load Reduction (%)	Aggregate Load Reduction (MW)	Avg. Thermostat Impact (kW)	Mean17 (F)
Hotels	75	3,176	148.0	1.0	0.7%	0.1	0.02	83.9
Institutional/Government	247	2,225	33.6	2.3	7.0%	0.6	0.26	84.3
Offices, Finance, Restaurants, Services	545	2,646	24.7	1.7	6.8%	0.9	0.34	84.0
Retail Stores	84	267	23.4	1.5	6.2%	0.1	0.46	83.9
Schools	140	2,215	58.8	5.4	9.1%	0.8	0.34	85.1
All Industries	**1,243**	**11,292**	**39.7**	**2.5**	**6.3%**	**3.1**	**0.27**	**84.1**

Energy Savings Analysis and Results

Energy savings analysis was conducted using statistical matching on pre-treatment usage and difference-in-differences



Energy savings ranged from 2% to 4% of whole-building electricity usage, 1.7 kWh per day per thermostat (620 kWh per year)



Energy savings in the peak period (2-6 PM) during the summer on non-event weekdays by industry

Industry	Enrolled Participants	Total Number of Thermostats	Avg. Reference Load (kW)	Avg. Load Reduction (kW)	Percent Load Reduction (%)	Avg. Thermostat Impact (kW)	95% Confidence Interval	
							Lower	Upper
Hotels	65	1,827	85.0	1.9	2.3%	0.07	-0.08	0.22
Institutional/ Government	224	2,107	29.5	1.4	4.7%	0.15	0.02	0.28
Offices, Finance, Restaurants, Services	474	2,428	23.1	0.9	3.8%	0.17	0.03	0.32
Retail	75	244	21.7	-0.2	-1.0%	-0.07	-0.44	0.31
Schools	132	1,933	34.1	-1.7	-5.0%	-0.12	-0.29	0.06

Nexant

Reimagine tomorrow.

Discussion

Nexant
Reimagine tomorrow.

For comments or questions, contact:

Josh Schellenberg
Principal
jschellenberg@nexant.com

Dan Thompson
Project Analyst
dthompson@nexant.com

Nexant, Inc.
101 Second St., 10th Floor
San Francisco, CA 94105
415-369-1000