

A wide-angle photograph of the Golden Gate Bridge in San Francisco, California. The bridge's iconic red-orange towers and suspension cables are prominent against a clear blue sky. The bridge spans across the blue waters of the Golden Gate Strait, with rolling hills and a distant tower visible in the background. A semi-transparent green and blue banner is overlaid on the lower portion of the image, containing the title and author information.

SCE Save Power Days: 2017 Load Impact Evaluation

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May 4, 2018

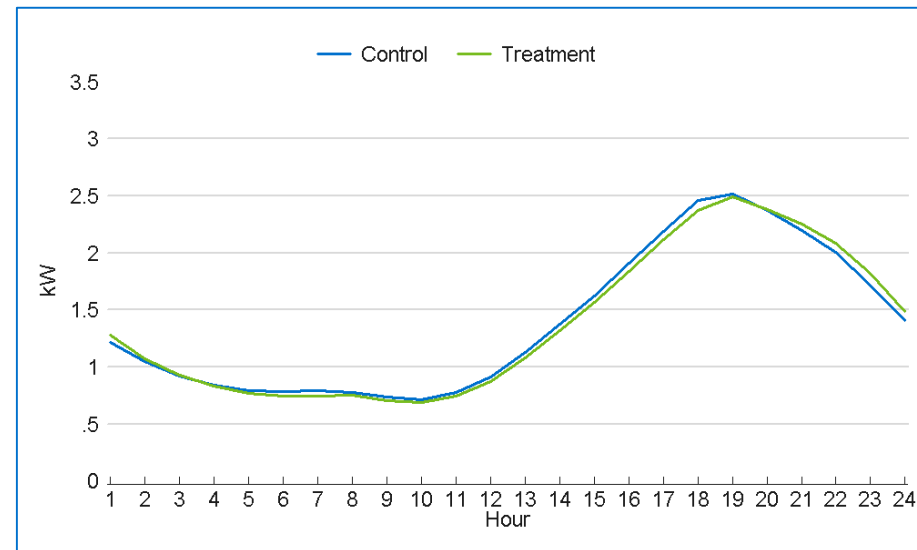
SCE Save Power Days (SPD) Program Description

- To avoid confusion with SDP, this presentation will refer to SPD as PTR
- In 2017, SCE could call PTR events on a **day-ahead basis year-round** on **non-holiday weekdays**.
- Starting in 2017 there was only one program option: enabling technology
- Customers with approved programmable communicating thermostats (PCT), are eligible to earn a total incentive of **\$1.25** per kWh
- Bill credit is calculated based on 2 to 6 PM load reduction below customer-specific reference level (CSRL)
 - The CSRL is defined as the average 2:00 PM through 6:00 PM usage for the highest three (3) of five (5) previous weekdays, excluding PTR event days and holidays. Customers with event period usage below their CSRL receive PTR credits.
- 15 Events in 2017
 - First event 6/19, last event 9/5

Ex Post Methodology

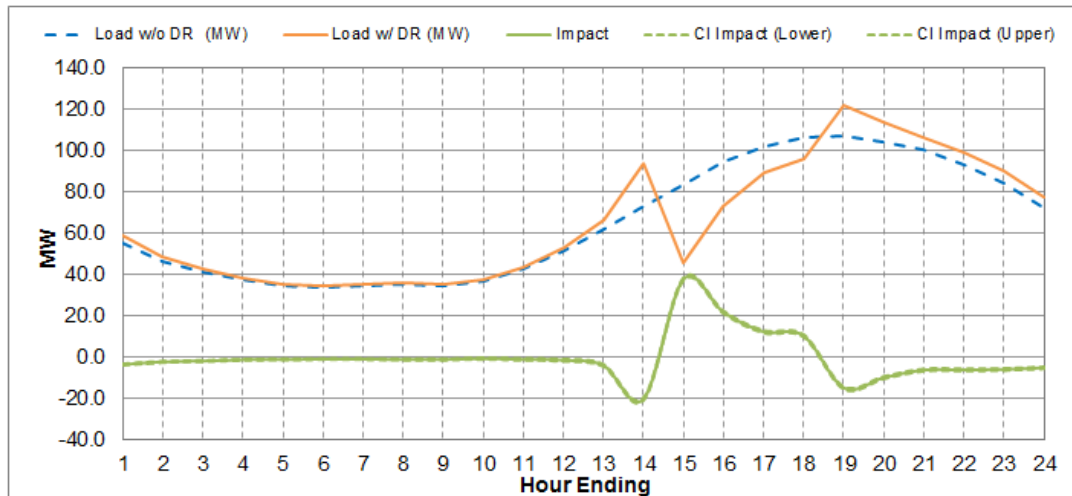
- Developed impact estimates using matched control group
 - Selected control groups using propensity score match to find customers with load shapes most similar to PTR customers on hot, non-event weekdays
 - Performed matching within specific customer segments (A bank, CARE status, dual enrollment)
 - Used difference-in-difference fixed effects regression model which estimates the impact by subtracting differences between control and treatment customers on hot non-event days from differences between groups on event days

Matched Control Group on Hot, Non-event Weekdays



Ex Post Impacts – SCE & CAISO System Peak

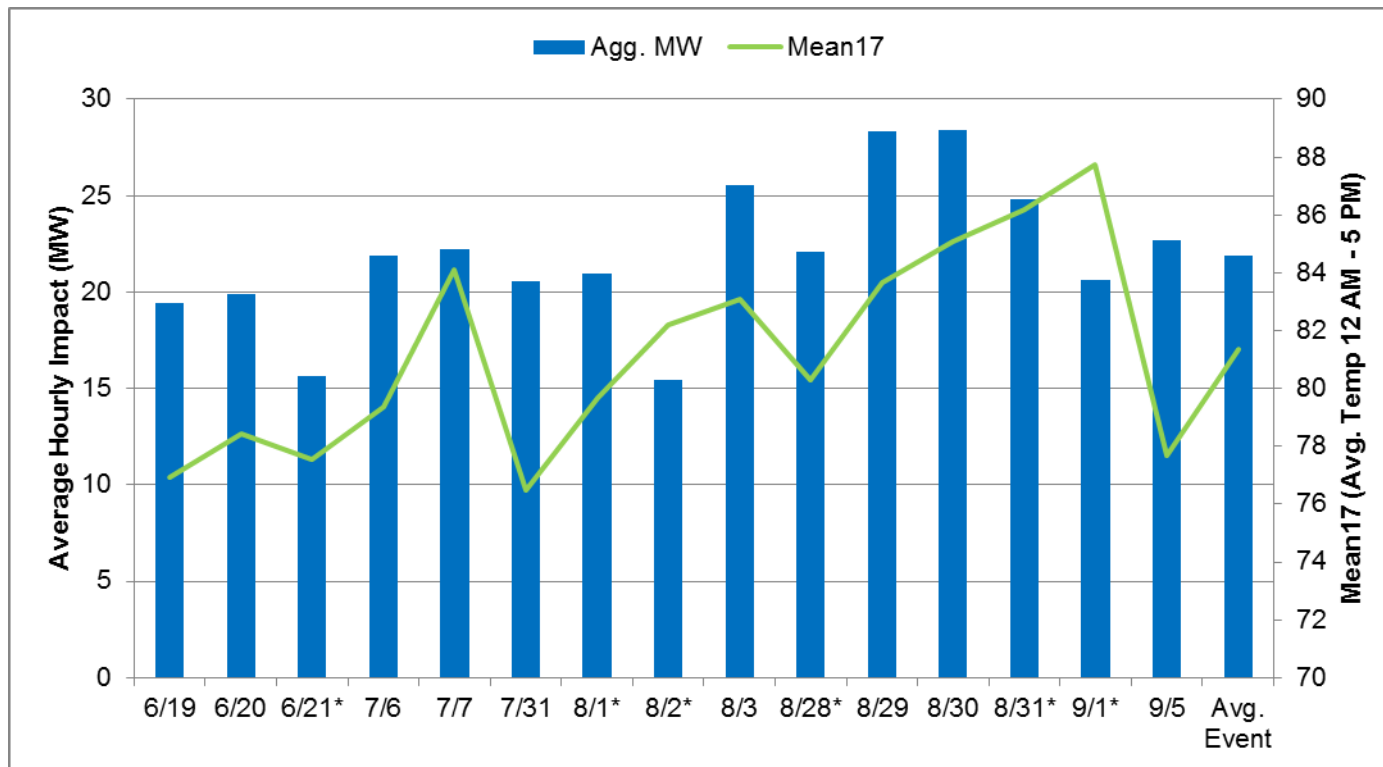
- September 1, 2017 3 - 4 PM: 21.8 MW of total load reduction at the hour of CAISO and SCE system peak
 - 32.8k customers called
 - 21.8 MW represents 23% load reduction of 73 MW of reference load
- Temperature reached 100°F



Event Date	Hour Ending	Load Impact (MW)
9/1/2017	15	37.9
	16	21.8
	17	12.4
	18	10.4

Ex Post Impacts

- SCE called 15 events in 2017
- On average, 34,120 participants provided aggregate impact of 21.9 MW
- Average customer reduced demand by 0.64 kW during event period (2 - 6 PM)



* Indicates PTR events that overlap with SDP events

Comparison to 2016 Evaluation Estimates – Ex Post

- Program grew rapidly from 8,000 in 2016 to nearly 40,000 at end of 2017
- Impacts lower in 2017, even when removing events with dispatch issues
- Decrease in impacts likely due to changing PTR population
 - Greater proportion of users with average load less than 1 kW
 - Shrinking dually-enrolled population

Measure	Year		
	2016	2017	2017 Events in ex ante Model
Avg. Reference Load (kW)	2.29	2.31	2.23
Avg. Load Impact (kW)	0.75	0.64	0.66
% Load Impact	32.8%	27.8%	29.5%
Avg. Event Temperature	90.6	89.8	89.3
Heat Buildup (Avg. °F, 12 AM to 5 PM)	80.0	81.4	80.4

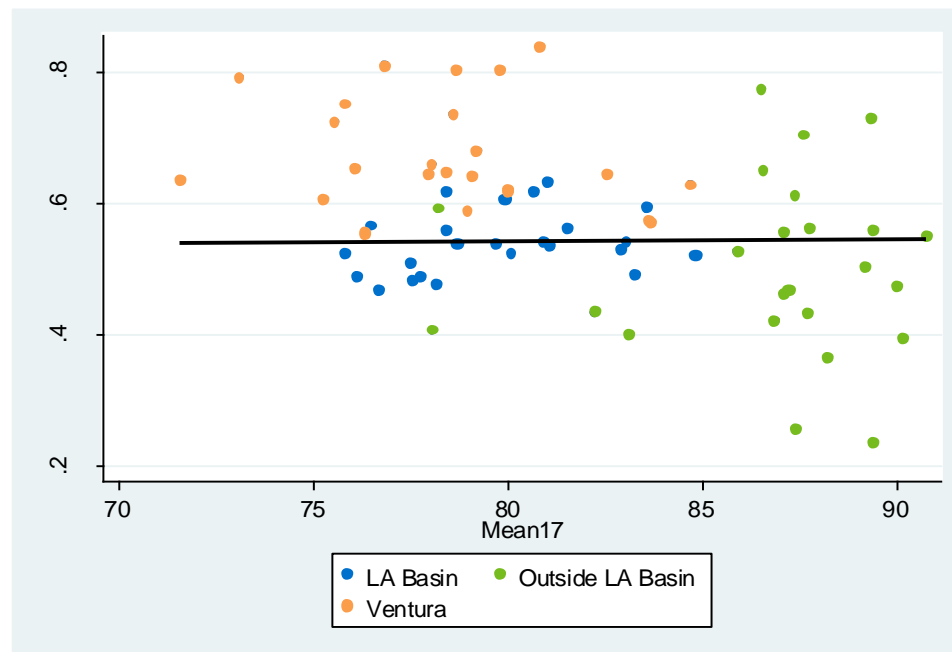
Ex Ante Methodology

Ex ante estimates are developed using a multi-step process:

- 1) Developed ex post estimates for 2017 using matched control group methodology
- 2) Estimated regression models that relate 2016 and 2017 ex post load impacts in each hour from 2 – 6 PM to average temperatures from midnight to hour of interest (e.g. “Mean17,” etc.) on event day
- 3) Use regression model output to predict hourly impacts on monthly system peak days and a typical event day under ex ante weather conditions
- 4) Used similar method to estimate reference loads
- 5) Adjusted ex ante impact estimates to apply to RA window: 1 - 6 PM for summer and 4 - 9 PM for winter

Ex Ante Methodology

- Scatterplot illustrates ex ante model for HE 17 (ex post impact vs. *Mean17*)
- Ex ante modeling dataset includes population-weighted load impact estimates for each LCA
- Three 2017 events were not included due to dispatch issues and proximity to holiday weekends
- Extremely hot, holiday weekend event days likely led to greater override rates

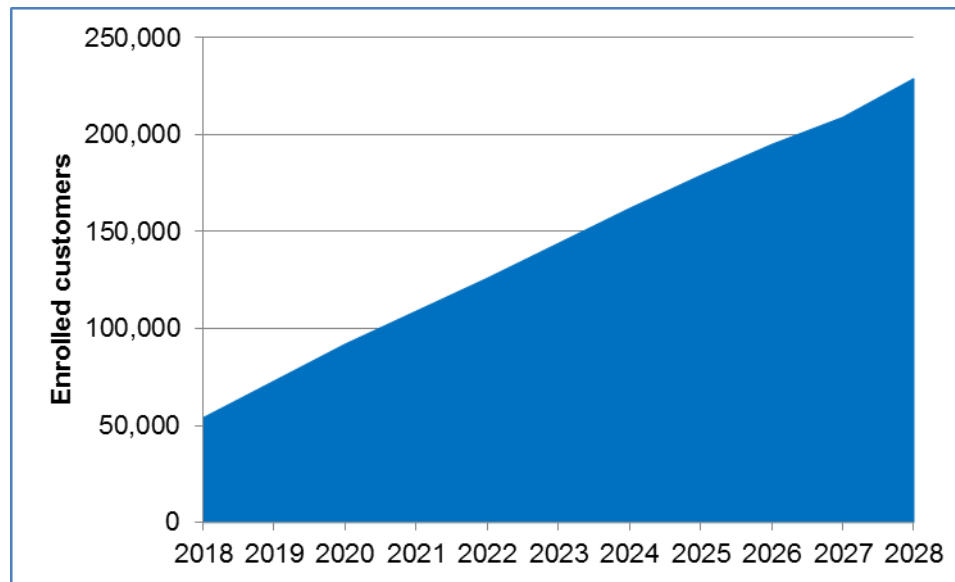


Changes to PTR program in 2018

- Starting in 2018, customers will no longer be permitted to be dually enrolled in both SDP and PTR
- Dispatch hours expanded to 11 AM – 8 PM
 - 4 hour maximum event
- Notice will be given 20 minutes prior to event start
 - Disallows pre-cooling

Enrollment expected to increase from 2018-2028

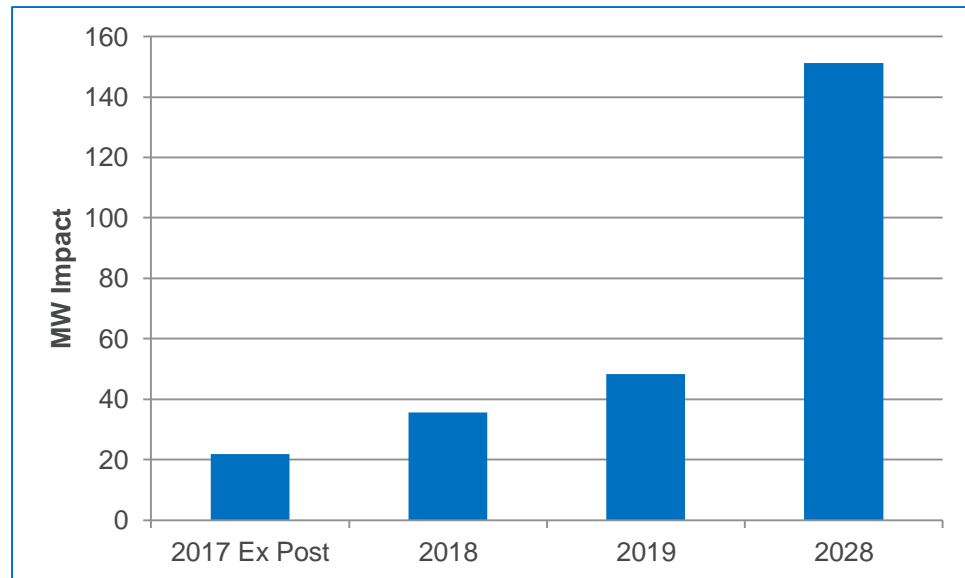
- 54k enrolled customers expected in 2018 and 229k by 2028
- SCE plans to market the program year-round beginning in 2019



Ex Ante Impacts (1-in-2 SCE Weather)

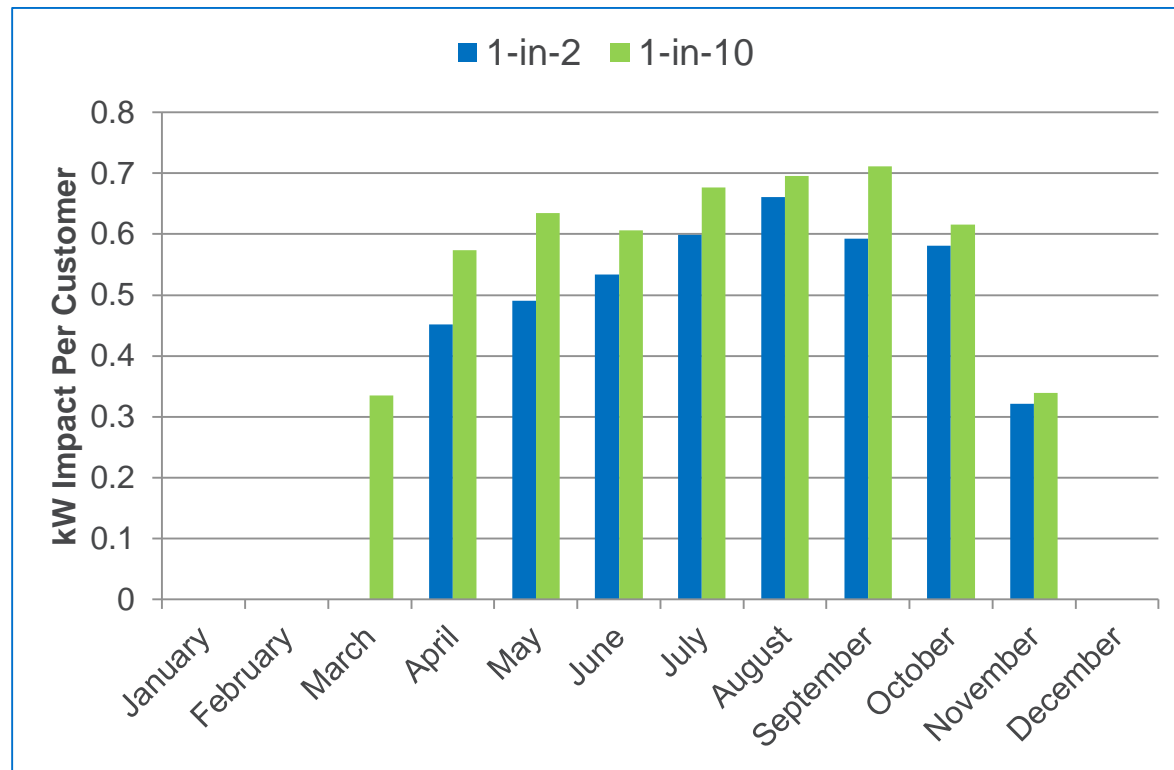
- Assumption: per-customer impacts remain constant from year to year
- Aggregate impacts gradually increase from 2018 to 2028 due to increase in enrollment
- Expected impacts are similar under CAISO weather conditions, and slightly higher under 1-in-10 weather year conditions

Program Year	Enrollment	kW Impact per Customer	Aggregate MW Impact
2017 Ex Post	34,120	0.64	21.9
2018	54,000	0.66	35.7
2019	73,000	0.66	48.2
2028	229,000	0.66	151.3



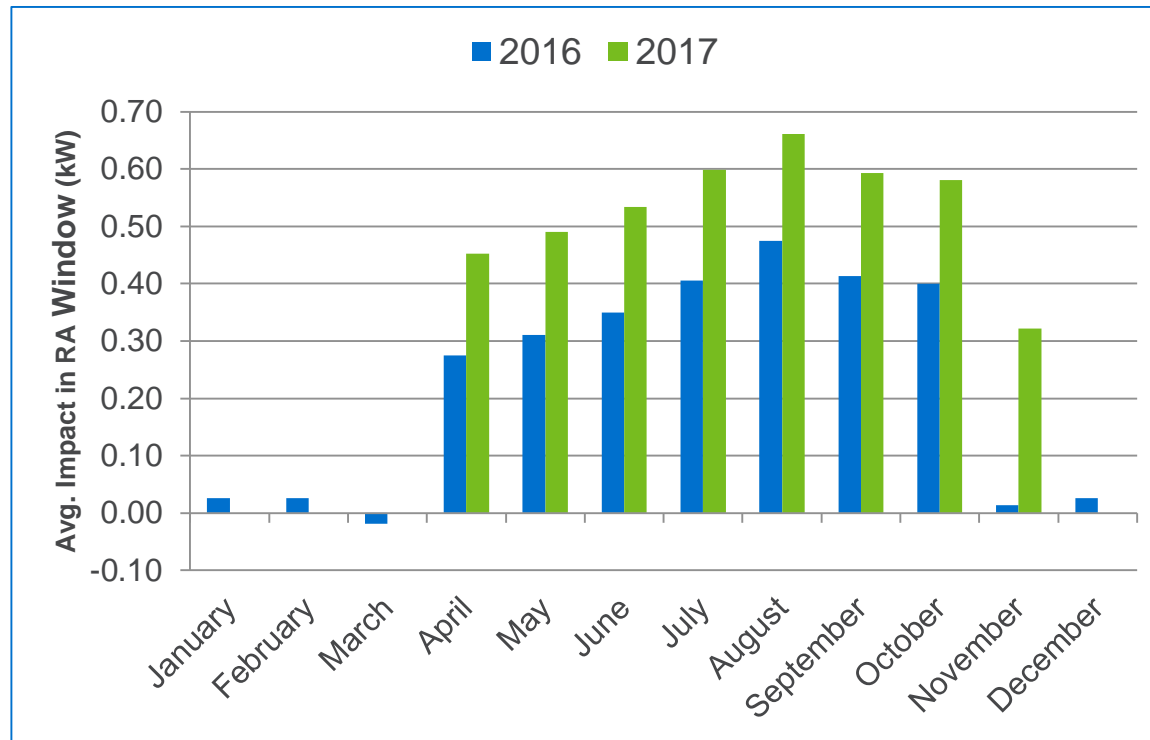
Ex Ante Impacts (SCE Weather)

- Per-customer impacts are expected to be greatest in August under 1-in-2 conditions and September under 1-in-10 conditions



Comparison to 2016 Evaluation Estimates – Ex Ante Forecast SCE 1-in-2 Monthly Peak

- Summer impacts increase substantially due to changes in available dispatch hours and lack of pre-cooling



Recommendations and Conclusions

- **Market program to larger residential customers:**
 - Likely to have greater AC usage to curtail

- **Call events under varying circumstances:**
 - **Variety of time periods:** help establish relationship between load impacts and time of day
 - **Territory-wide in addition to by sub-LAP:** ensure broadly applicable ex post impacts available to develop robust ex ante impacts
 - **Variety of weather conditions:** calling events on cooler summer days will provide valuable data points for ex ante estimation

- **Vendors provide override information:**
 - Help identify conditions under which customers opt out of events



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For comments or questions, contact:

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PTR ex post load impact estimates by customer category for the average event (2-6 PM)

Customer Category		Number of Customers	Avg. Reference Load (kW)	Avg. Load w/DR (kW)	Avg. Load Impact (kW)	% Load Impact	Agg. Load Impact (MW)	Heat Buildup (Avg. °F, 12 AM to 5 PM)
Average kW	Greater than 1 kW	15,185	3.28	2.42	0.86	26.3%	13.1	81.4
	Less than 1 kW	18,936	1.53	1.07	0.47	30.4%	8.8	83.3
CARE Status	CARE	3,250	2.57	2.05	0.53	20.5%	1.7	79.8
	Non-CARE	30,871	2.28	1.62	0.65	28.7%	20.2	84.2
LCA	LA Basin	27,322	2.23	1.62	0.62	27.6%	16.8	81.1
	Outside LA Basin	687	2.12	1.50	0.62	29.2%	0.4	81.2
	Ventura	6,112	2.66	1.90	0.76	28.7%	4.7	85.7
SONGs Region	Neither	18,169	2.41	1.75	0.67	27.6%	12.1	81.6
	South Of Lugo	10,369	2.46	1.77	0.69	27.9%	7.1	82.0
	South Orange County	5,583	1.68	1.20	0.48	28.7%	2.7	83.6
SDP Enrollment	Dually enrolled	5,851	2.35	1.62	0.73	31.1%	4.3	82.4
	PTR-Only	29,440	2.21	1.57	0.64	29.0%	18.9	80.3
Sub-LAP	SCEC	15,167	2.71	1.95	0.75	27.8%	11.4	81.2
	SCEN	1,326	2.57	1.73	0.84	32.8%	1.1	85.5
	SCEW	12,848	1.72	1.25	0.47	27.3%	6.0	87.9
	SCHD	589	2.12	1.48	0.64	30.2%	0.4	75.1
	SCLD	1,581	2.95	2.08	0.87	29.5%	1.4	86.2
	SCNW	2,610	2.39	1.77	0.61	25.7%	1.6	96.1
All Customers		34,120	2.31	1.66	0.64	27.8%	21.9	81.4