



2009 Impact Evaluation of Pacific Gas and Electric's SmartRate Program

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What is SmartRate?

- SmartRate is the largest residential dynamic pricing program in the country.
- SmartRate is an overlay on existing tariffs that prices electricity during peak periods significantly higher than the otherwise applicable price on up to 15 days, known as SmartDays.
- Event days can be called from May 1st through October 31st and notification is provided by 3 pm the day prior to an event.
- During non-event hours from June 1st to September 30th, customers get a rate discount.
- The event window is fixed from 2-7 pm for residential customers.
- Customers had several options for receiving notification (e.g., phone, email), including not being notified.

Tariff Design

- During critical peak periods, residential customers pay an incremental 60 ¢/kWh
- Customers with low income are eligible to receive lower rates for electricity use (CARE)
- For June through September:
 - A credit of ~3 ¢/kWh applies to all usage other than peak-period usage on SmartDays
 - An additional credit of ~1 ¢/kWh on usage 200% or more above the baseline kWh

Customer Type	% of Baseline Usage	Approximate Maximum Monthly Usage in Tier (kWh)	E-1 Price (¢/kWh)	SmartRate Rate Discount (¢/kWh)	Average E-1 Price Based on Mid-Tier Usage (¢/kWh)	Average Smart Rate Price for non-event periods (¢/kWh)	SmartRate Price during Event Periods (¢/kWh)	Peak to Off-Peak Price Ratio (¢/kWh)
non-CARE customers	100%	582	11.5	3	11.6	8.6	68.6	8.0
	130%	757	13.1	3	11.8	8.8	68.8	7.8
	200%	1,164	24.7	3	14.7	11.7	71.7	6.1
	300%	1,746	35.4	4	20.2	16.2	76.2	4.7
	>300%	>1,746	41.0	4	25.1	21.1	81.1	3.8
CARE customers	100%	582	8.3	3	8.3	5.3	65.3	12.3
	200%	1,164	9.6	3	8.7	5.7	65.7	11.5
	>200%	>1,164	9.6	4	9.1	5.1	65.1	12.8

Marketing

- The primary marketing channel for SmartRate was direct mail
- Experimented a variety of marketing strategies: from an initial offer of a \$50 Visa gift in 2008 to no incentives at all for several of the 2009 promotional campaigns.
- Customers were offered first-year bill protection to mitigate risk aversion.

Program Enrollment

- May 2008: SmartRate launched in Bakersfield & greater Kern County
- End of 2008 program year: >10,000 customers enrolled
- May 2009: enrollment expanded in # customers and geographical region.
- End of September 2009: >22,000 customers enrolled
 - In 2009, SmartRate offered to SmartAC (i.e., AC Cycling) customers the first time.
 - Significantly higher enrollment rate with this group than non-SmartAC customers.
 - Approx. 4,700 customers in both SmartRate and SmartAC.
 - About 30% of SmartRate customers provided no notification information or outdated information
- June 2010: approx. 24,000 customers enrolled

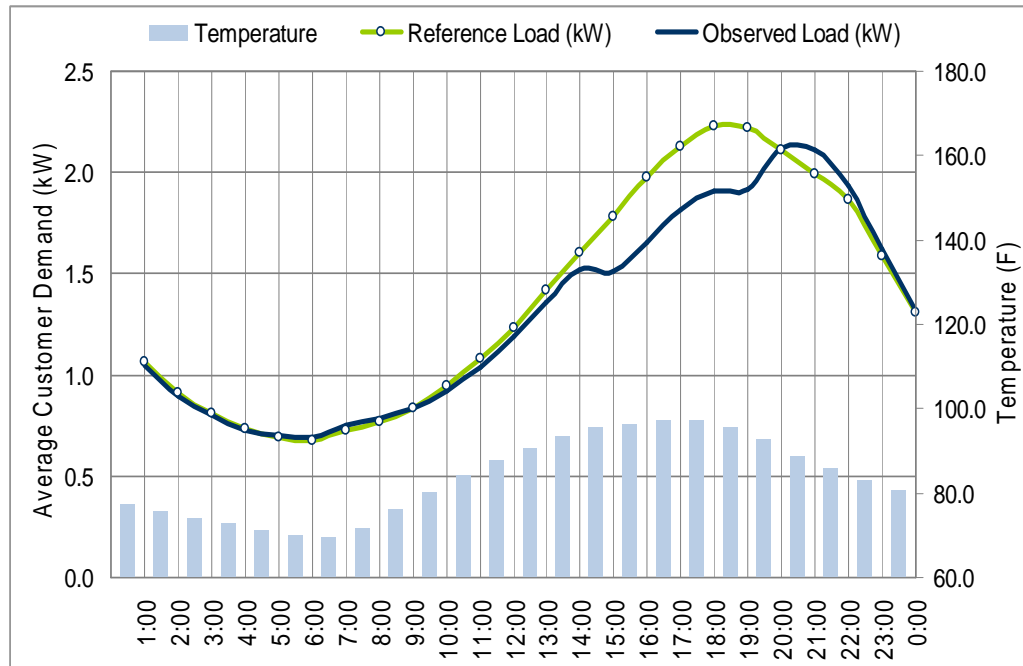
Load Impact Evaluation—PY 2008

- PG&E's 2008 load impact (LI) evaluation received nationwide interest. It addressed a number of important policy issues:
 - 1) LI on the 3rd day of a consecutive-event day periods are higher than on prior days, which contradicted assumptions that customer response would decline significantly across multiple days.
 - 2) The average LI across 9 event days for the regular (i.e., non-CARE) customers was about 23%, without any enabling technology, which contradicts the assumptions made by many that customers will not provide significant LI without automating technology.
 - 3) CARE customers participate in a higher rate and provide statistically significant load LI, although with lower reductions than the average non-CARE customers.

Load Impact Evaluation—PY 2009

- Assess the LI across a wide spectrum of climate zones.
- Assess the LI across 15 event days, most of which involve cooler temperatures than those underlying the 2008 results.
- Assess the LI of the incremental AC load control on SmartDays based on customers who are dually enrolled in both SmartRate and SmartAC.
- Assess the persistence of load impact across multiple years for customers in SmartRate in 2008 and 2009.

Load Impacts—Average Hourly Load Reduction (1)



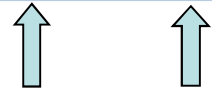
- Ave. load impact across 5 hr:
-- 0.31 kW or 15%
- Highest % load drop: 2 – 4 pm
- Lowest % load drop: 6 – 7 pm

Hour Ending	Reference Load (kW)	Observed Load (kW)	Load Impact (kW)	%Load Reduction	Weighted Temp (F)
13:00	1.42	1.36	0.05	3.7%	91.0
14:00	1.60	1.52	0.09	5.3%	93.5
15:00	1.78	1.51	0.27	15.3%	95.5
16:00	1.97	1.65	0.32	16.3%	96.7
17:00	2.13	1.81	0.32	14.9%	97.3
18:00	2.23	1.91	0.32	14.4%	97.1
19:00	2.22	1.91	0.30	13.7%	95.7
20:00	2.12	2.12	0.00	-0.1%	92.7
21:00	2.00	2.11	-0.11	-5.6%	88.9
22:00	1.86	1.93	-0.07	-3.8%	85.9
23:00	1.59	1.62	-0.03	-2.2%	83.2
0:00	1.31	1.32	-0.01	-0.6%	80.8
	Reference Energy Use (kWh)	Observed Energy Use (kWh)	Change in Energy Use (kWh)	% Daily Load Reduction	Cooling Degree Hours (Base 75)
Daily	32.71	31.16	1.56	4.8%	130.9

Load Impacts—Average Hourly Load Reduction (2)

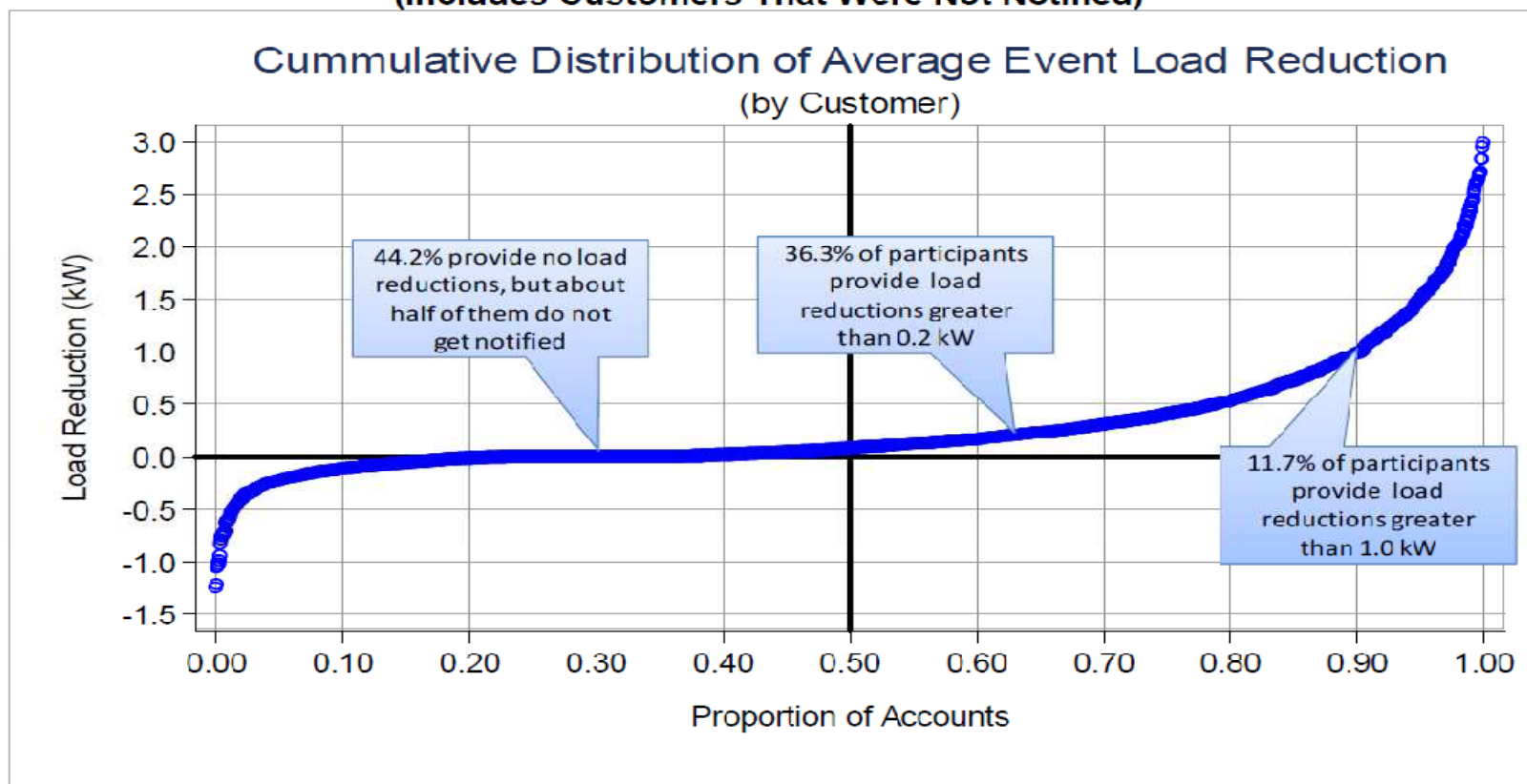
**Residential SmartRate Average Hourly Load Reduction for Event Period by Event Day
(All Enrolled Participants)**

Date	Day of Week	Enrolled participants	Avg. Reference Load	Avg. Estimated Load with DR	Avg. Load Reduction	Percent Load Reduction	Aggregate Load Reduction	Daily Minimum Temperature	Daily Maximum Temperature
			(kW)	(kW)	(kW)	(%)	(MW)	(°F)	(°F)
29-Jun-09	M	10,892	2.70	2.26	0.44	16.2%	4.8	76.8	105.4
30-Jun-09	T	10,975	2.33	2.02	0.32	13.6%	3.5	77.2	100.7
13-Jul-09	M	11,449	1.93	1.66	0.27	13.9%	3.1	67.2	94.5
14-Jul-09	T	11,462	2.31	1.99	0.32	13.8%	3.6	70.4	99.7
16-Jul-09	Th	11,488	2.59	2.21	0.37	14.4%	4.3	74.4	102.8
21-Jul-09	T	11,558	2.31	2.03	0.28	12.2%	3.3	72.1	98.4
27-Jul-09	M	12,299	2.49	2.13	0.35	14.3%	4.4	73.6	101.8
10-Aug-09	M	16,741	2.12	1.79	0.33	15.6%	5.5	71.2	97.6
11-Aug-09	T	17,177	2.06	1.80	0.26	12.7%	4.5	70.8	95.5
18-Aug-09	T	19,182	1.85	1.59	0.26	14.1%	5.0	66	94.6
27-Aug-09	Th	20,779	1.82	1.52	0.29	16.1%	6.1	64.3	95.5
28-Aug-09	F	20,903	1.95	1.64	0.32	16.2%	6.6	68.1	96.9
2-Sep-09	W	20,966	1.97	1.67	0.30	15.3%	6.3	70.6	96.8
10-Sep-09	Th	21,163	1.79	1.48	0.31	17.2%	6.5	65.5	94.9
11-Sep-09	F	21,200	1.90	1.58	0.32	17.0%	6.9	68.8	94.8
Total	N/A	15,882	2.08	1.77	0.31	15.0%	5.0	69.7	97.4



Distribution of Load Impacts

Residential SmartRate Distribution of Individual Customer Average Event Load Reduction (Includes Customers That Were Not Notified)



- Program's cost-effectiveness can be dramatically improved in the future by targeting the high-responders and encouraging low responders to participate in the SmartAC program.

Effect of Event Notification (1)

Comparison of Load Impacts Between Notified and Un-notified SmartRate Customers

Date	Enrolled participants	Participants for whom notification was attempted	Number notified about event	% Notified	Notified Customers		All Customers	
					Avg. Impact (kW)	% Load reduction	Avg. Impact (kW)	% Load reduction
29-Jun-09	10,892	10,168	8,726	80.11%	0.59	20.8%	0.44	16.2%
30-Jun-09	10,975	10,200	8,620	78.54%	0.43	17.7%	0.32	13.6%
13-Jul-09	11,449	10,439	8,845	77.26%	0.38	18.8%	0.27	13.9%
14-Jul-09	11,462	10,461	8,780	76.60%	0.45	18.7%	0.32	13.8%
16-Jul-09	11,488	10,478	8,853	77.06%	0.53	19.5%	0.37	14.4%
21-Jul-09	11,558	10,522	8,870	76.74%	0.40	16.3%	0.28	12.2%
27-Jul-09	12,299	11,249	9,556	77.70%	0.50	19.0%	0.35	14.3%
10-Aug-09	16,741	15,650	13,608	81.29%	0.43	19.7%	0.33	15.6%
11-Aug-09	17,177	16,079	14,010	81.56%	0.34	16.3%	0.26	12.7%
18-Aug-09	19,182	18,034	15,874	82.75%	0.33	17.7%	0.26	14.1%
27-Aug-09	20,779	19,578	17,264	83.08%	0.37	20.0%	0.29	16.1%
28-Aug-09	20,903	19,689	17,277	82.65%	0.40	20.1%	0.32	16.2%
2-Sep-09	20,966	19,810	17,290	82.47%	0.39	19.1%	0.30	15.3%
10-Sep-09	21,163	19,978	17,449	82.45%	0.39	21.4%	0.31	17.2%
11-Sep-09	21,200	20,012	17,501	82.55%	0.41	21.2%	0.32	17.0%
Total	15,882	14,823	12,835	80.81%	0.41	19.2%	0.31	15.0%

- Customers can choose how to be notified and how many times to be notified for an event.
- 19% of the customers were not notified.
- Average load impact increases from 15% to 19% if only the notified customers are included.

- The average load impact and percent load reduction rise with the number of successful notifications

Effect of Event Notification (2)

- A positive correlation between percent load reduction and the number of successful notifications.

**Average SmartRate Load Impacts and Percent Load Reductions
by Number of Successful Notifications**

Date	One		Two		Three		Four	
	Avg. Impact	% Impact	Avg. Impact	% Impact	Avg. Impact	% Impact	Avg. Impact	% Impact
29-Jun-09	0.38	14.7%	0.71	23.1%	1.21	36.9%	1.49	43.7%
30-Jun-09	0.27	11.8%	0.54	21.1%	0.80	28.1%	1.33	53.2%
13-Jul-09	0.23	12.3%	0.48	22.4%	0.75	32.4%	0.92	37.3%
14-Jul-09	0.28	12.5%	0.59	23.2%	0.76	27.3%	1.52	40.8%
16-Jul-09	0.34	13.5%	0.62	22.1%	0.99	32.6%	1.55	41.8%
21-Jul-09	0.25	10.8%	0.54	21.0%	0.58	22.2%	0.96	39.5%
27-Jul-09	0.29	11.3%	0.67	24.7%	0.86	31.5%	1.13	42.2%
10-Aug-09	0.26	12.6%	0.51	21.9%	0.79	32.0%	1.07	47.5%
11-Aug-09	0.19	9.6%	0.39	18.0%	0.70	30.4%	0.68	36.6%
18-Aug-09	0.20	11.0%	0.40	20.5%	0.62	31.4%	0.64	35.7%
27-Aug-09	0.23	13.5%	0.42	21.6%	0.68	33.5%	0.75	41.0%
28-Aug-09	0.26	13.9%	0.43	21.0%	0.71	33.8%	0.94	42.7%
2-Sep-09	0.24	12.2%	0.46	22.1%	0.66	31.1%	0.89	41.7%
10-Sep-09	0.28	15.9%	0.40	21.6%	0.65	34.1%	0.98	49.6%
11-Sep-09	0.27	14.4%	0.45	22.9%	0.73	34.0%	1.00	48.2%
Total	0.26	12.8%	0.48	21.8%	0.74	31.7%	0.94	43.0%

- More notifications cause more load impacts?

Load Impacts of Low Income Participants (1)

- Low income customers, self-reported, are eligible for CARE program (California Alternate Rates for Energy) and will receive lower rates than non-CARE customers for each tier.
- Higher participation rate, but average load reduction.
 - Residential population on CARE: 24%
 - SmartRate population on CARE: >50%
 - CARE average load reduction: 7.5%
 - Non-CARE average load reduction: 23%
- CARE customers are consistently less price responsive across all regions.

Load Impacts of Low Income Participants (2)

Q: Are low income customers *inherently* less price responsive?

A: Lower percentage load drop does *not* necessarily imply that low income customers are inherently less price responsive.

Two factors can affect load impacts:

1) central A/C ownership—a strong driver of load drop.

- 53% CARE customers with AC vs. 64% non-CARE customers with AC

2) Event notification.

- 70% CARE customers directly notified vs. 83% non-CARE customers received notification

Effect of AC Ownership on Load Impacts (1)

SmartRate Load Impacts by Central Air Conditioning Ownership Likelihood, Temperature and CARE Status

CARE Status	Central AC Likelihood	90-95 (F)		95-100 (F)		100-105 (F)		Total ^[1]	
		Impact (kW)	%	Impact (kW)	%	Impact (kW)	%	Impact (kW)	%
Non-CARE	0-25%	0.18	23.1	0.17	22.7	-	-	0.17	22.9
	25-50%	0.15	10.7	0.26	19.3	0.23	13.5	0.26	18.3
	50-75%	0.25	13.5	0.33	16.8	0.27	10.6	0.32	15.2
	75-100%	0.66	27.1	0.75	28.1	0.92	28.1	0.77	28.1
	Total	0.37	22.2	0.54	24.1	0.64	21.9	0.54	23.5
CARE	0-25%	0.1	10.7	0.17	18.9	-	-	0.13	14.2
	25-50%	0.07	4.8	0.07	4.2	0.12	5.9	0.08	4.5
	50-75%	0.15	7.2	0.15	6.6	0.21	7.8	0.16	7
	75-100%	0.35	13.5	0.37	13.4	0.49	14.7	0.39	13.7
	Total	0.14	8.2	0.16	7.5	0.23	9	0.17	7.8
ALL	0-25%	0.15	17.5	0.17	21	-	-	0.16	19.1
	25-50%	0.08	5.5	0.11	6.9	0.13	6.7	0.11	6.8
	50-75%	0.19	9.4	0.22	10.4	0.23	8.8	0.22	10
	75-100%	0.57	23.1	0.65	24.2	0.8	24.4	0.67	24.2
	Total	0.25	14.7	0.34	15.6	0.41	15.1	0.34	15.4

[1] Total includes all days, including those below 95 (F). Low central AC likelihood participants experienced events in cooler days

Effect of AC Ownership on Load Impacts (2)

- SmartAC customers can reduce 15% – 30% of the house load, depending on the weather conditions. (Higher the temperature, more the load drop.)
- Many SmartRate customers provide more than 30% of load drop on their own (i.e., without participating in SmartAC).
- Incremental load drop unlikely from typical responders in dual participation, but automation helps non-responders.

Percent of SmartRate Customers Exceeding Percentage Reduction Thresholds
(Includes Customers Not Notified)

Event Date	AC likelihood	Share of accounts providing load reductions greater than					
		0%	10%	20%	30%	40%	50%
Standard Tariff Participants	0-25%	68.3%	60.2%	42.5%	30.6%	18.8%	11.8%
	25-50%	62.9%	48.6%	41.9%	30.5%	19.0%	14.3%
	50-75%	62.6%	51.2%	42.8%	34.7%	26.3%	19.5%
	75-100%	70.8%	63.1%	53.4%	46.4%	38.1%	30.5%
	Total	67.3%	57.8%	47.4%	38.8%	29.5%	22.5%
Low Income (CARE) Participants	0-25%	45.8%	36.4%	22.0%	15.3%	9.3%	5.1%
	25-50%	42.2%	27.4%	17.5%	12.3%	8.7%	4.5%
	50-75%	46.3%	32.6%	25.8%	18.8%	14.2%	9.3%
	75-100%	56.8%	45.1%	32.7%	22.8%	15.4%	13.0%
	Total	46.5%	33.3%	23.8%	17.0%	12.1%	7.9%
All Participants	0-25%	59.5%	51.0%	34.5%	24.7%	15.1%	9.2%
	25-50%	47.1%	32.5%	23.3%	16.7%	11.2%	6.9%
	50-75%	53.0%	40.2%	32.7%	25.3%	19.1%	13.5%
	75-100%	67.2%	58.5%	48.1%	40.4%	32.3%	26.0%
	Total	57.0%	45.7%	35.7%	28.0%	20.9%	15.3%

Effect of AC Ownership on Load Impacts (3)

Limitations to the conclusions about dual participants in SmartRate and SmartAC

- 1) The data is for the hotter climate regions. Conclusions may or may not hold in the cooler regions.
- 2) A disproportionately high percentage (60%) of the dual participants are on CARE.
- 3) 80% of the dual participants received a programmable thermostat, while PG&E plans to offer primarily control switches to residential SmartAC customers in the near future.

Summary

- SmartRate enrollment doubled in 2009, even with only direct mail marketing.
- An average of 15% load reduction was achieved across 15 event days, with 0.31 kW per customer, or 5 MW on the program level.
- 44% of the customers provided no load drop, half of who were not notified. Excluding the un-notified customers, the average load drop increases from 0.31 kW to 0.41 kW.
- Load drop increased with the number of notifications. Causality is yet to be confirmed.
- Low income customers had a higher enrollment rate, but a lower percentage load response—only 1/3 of the non-CARE customers. Does not imply CARE customers are inherently less responsive.
- Customers who own an AC provide much more load drop than customers who don't.
- Enabling technology helps low responders.



For any questions or for copies of the reports, feel free to contact

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