Adjusting TOU Rates Today For California's Grid of Tomorrow

How and Why PG&E is Modifying its Residential TOU Periods and Pricing to Reflect Growing Solar & Wind Integration

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2015 National Town Meeting
Washington, DC

May 28, 2015

The Agenda

Part 1 PG&E: The Basics

Part 2 We've Been Here Before: Four Decades of Time Varying Rates

Part 3 Snapshot of Time Varying Rates Today: Look How Far We've Come

Part 4 Planning for Tomorrow: Pricing for 2020 and Beyond

PG&E: The Basics

Incorporated in 1905, San Francisco-based PG&E is one the largest combined utilities in the US

Total Customers Served = 15 million

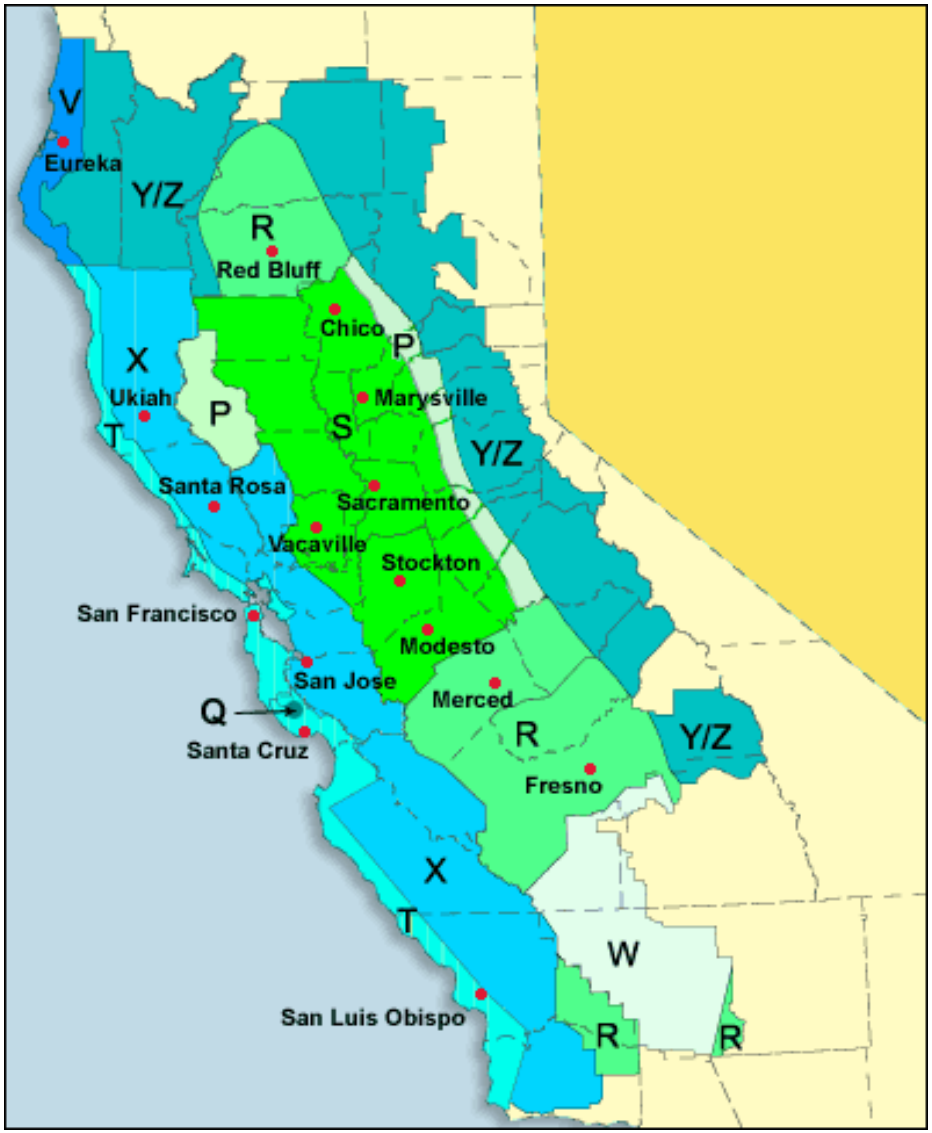
- Electric Customers = 5.4 million
- Natural Gas Customers = 4.3 million

Service Area = 70,000 sq. miles

- Electric Distribution Lines = 141,000 miles
- Electric Transmission Lines = 19,000 miles
- Gas Distribution Pipeline = 42,000 miles
- Gas Transmission Pipeline = 6,400 miles

Electric SmartMeter™ Installations = 5.14 million

- Demand Response Programs = 8
- Time Varying Pricing Programs/Rates = 12

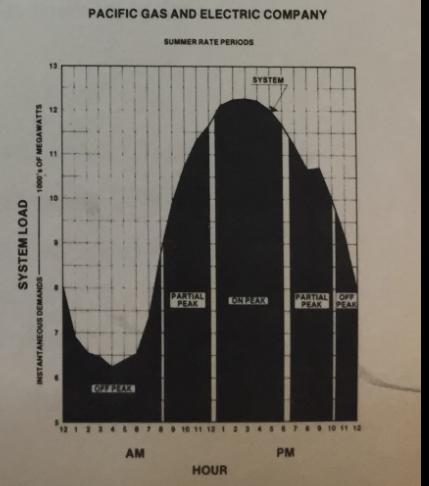


Turning Back the Clock

A QUICK LOOK AT THE EARLY DAYS OF
TOU RATES AT PG&E

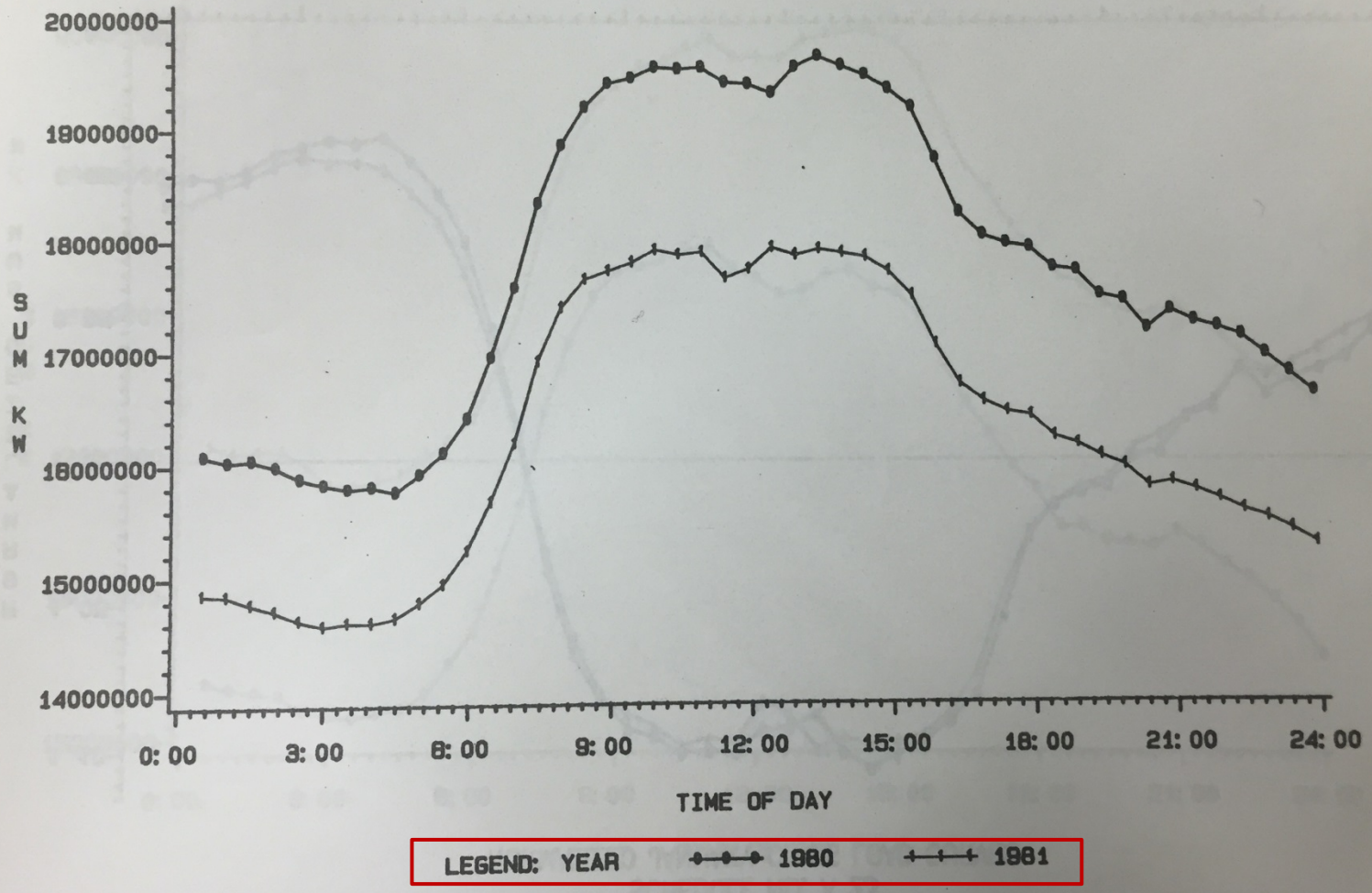
PACIFIC GAS AND ELECTRIC COMPANY
LOAD MANAGEMENT STUDIES

TIME OF USE RATES
for
VERY LARGE CUSTOMERS:
The first year experience



Rate Department
Research Section
March 31, 1978

PACIFIC GAS AND ELECTRIC COMPANY
SCHEDULE NO. A 23
JANUARY CLASS LOAD CURVES



This variable is used in a regression identical to the one run for the relative average peak demand variable. The equation to be estimated is:

$$(2)\quad A23DEM_i = B_0 + B_1 \times SUMMER_i + B_2 \times WINTERTOU_i + B_3 \times SUMMERTOU_i + e_i$$

Where: A23DEM = relative maximum peak demand; and all other variables are the same as in Equation (1).

The regression results are:

PARAMETER	COEFFICIENT	T-STATISTIC
B_0	1.225	128.6
B_1	.059	3.9
B_2	-.029	-2.4
B_3	-.043	-2.9

R^2 = .569 $\bar{R}^2$ = .528 F(3,32) = 14.1
Durbin-Watson = 1.81 Standard Error = .027

The parameters can be interpreted in the same manner as for Equation (1).

This regression shows a statistically significant reduction in the relative noncoincident maximum peak-period demands. The reduction averages 3.3% in summer and 2.3% in winter.

Fast Forward 40 Years

PG&E'S CURRENT PORTFOLIO OF
TIME VARYING RATES

PG&E's Time Varying Rates Today

Enrollment & Load Impact *Forecast* for August 2015

Non-Residential Customers			
Time-of-Use Rates	Enrollment	Impacts (MW)	Peak Period (Summer)
Small	370,000	48	
Medium	93,000	55	12pm - 6pm
Large	10,000	202	
Total	**473,000**	**305**	
Critical Peak Pricing	Enrollment	Impacts (MW)	Event Window
Small	151,000	7	
Medium	20,000	6	2pm - 6pm
Large	2,000	46	
Total	**173,000**	**59**	

Residential Customers			
Time-of-Use Rates	Enrollment	Impacts (MW)	Peak Period (Summer)
NEM*	52,000	0	1pm - 7pm
Non-NEM	58,000	10	12pm - 6pm
Total	**110,000**	**10**	
Critical Peak Pricing	Enrollment	Impacts (MW)	Event Window
	136,000	40	2pm - 7pm

Source: PG&E's April 1, 2015 DR Portfolio Executive Summary; Enrollments and impacts based on the August 2015 ex ante forecast under 1-in-2 system conditions. Enrollment figures have been rounded for simplicity. For residential TOU, there are Net Energy Metered ("NEM", i.e. solar) customers on both the 1pm-7pm and 12pm-6pm TOU rates. The latter rate has been closed to new customers since 2009, so all new NEM customers are enrolled on the former rate (i.e. 1pm – 7pm). For simplicity in the table, all NEM customers are bucked into the rate with the 1pm-7pm peak period, although there are legacy NEM customers enrolled in the 12pm – 6pm rate.

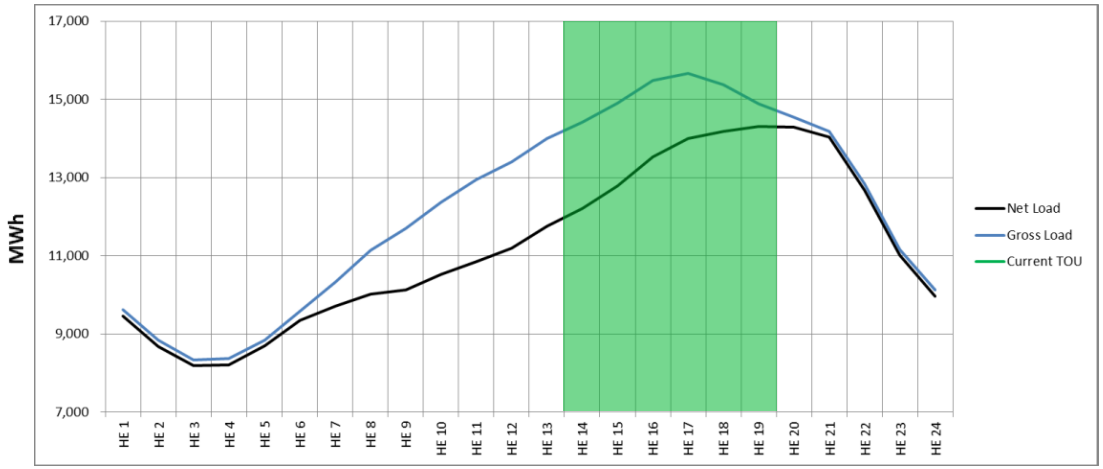
Designing a Residential TOU Rate for 2020

MEETING THE NEEDS OF BOTH
THE CUSTOMER AND THE GRID

Problem Overview:
Two main problems create need to change TOU period

Problem 1: Due to renewables, PG&E's net load peak is shifting to later in the day

Forecasted Load – 7/20/2020



Problem 2: PG&E's current residential TOU offering is confusing and out of alignment with future expected peak load

Summer

- **Sunday** Part-Peak 5-8PM
- Weekday Part-Peak 10AM-1PM
- **Weekday Peak 1PM-7PM**
- Weekday Part-Peak 7PM-9PM
- **Saturday** Part-Peak 5-8PM

Winter

- Weekday Part-Peak 5-8PM

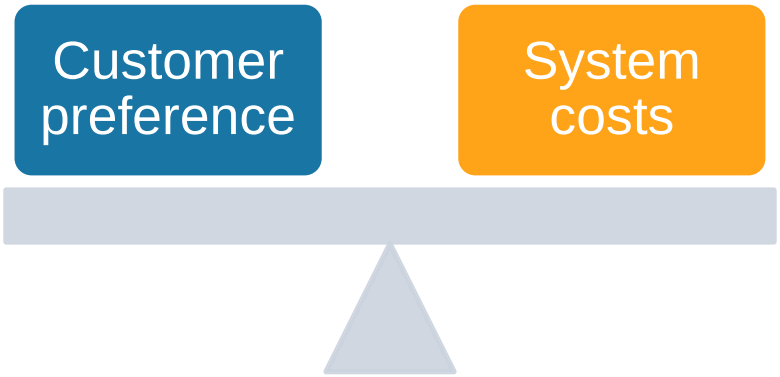
New TOU period must shift later and reduce confusion

Source: TOU Period Evaluation 04 30 2014 Presentation, data from Energy Procurement

PG&E's 2015 RDW Proposal

Balance customer preference with system costs

Objective: Propose new residential TOU periods and seasons

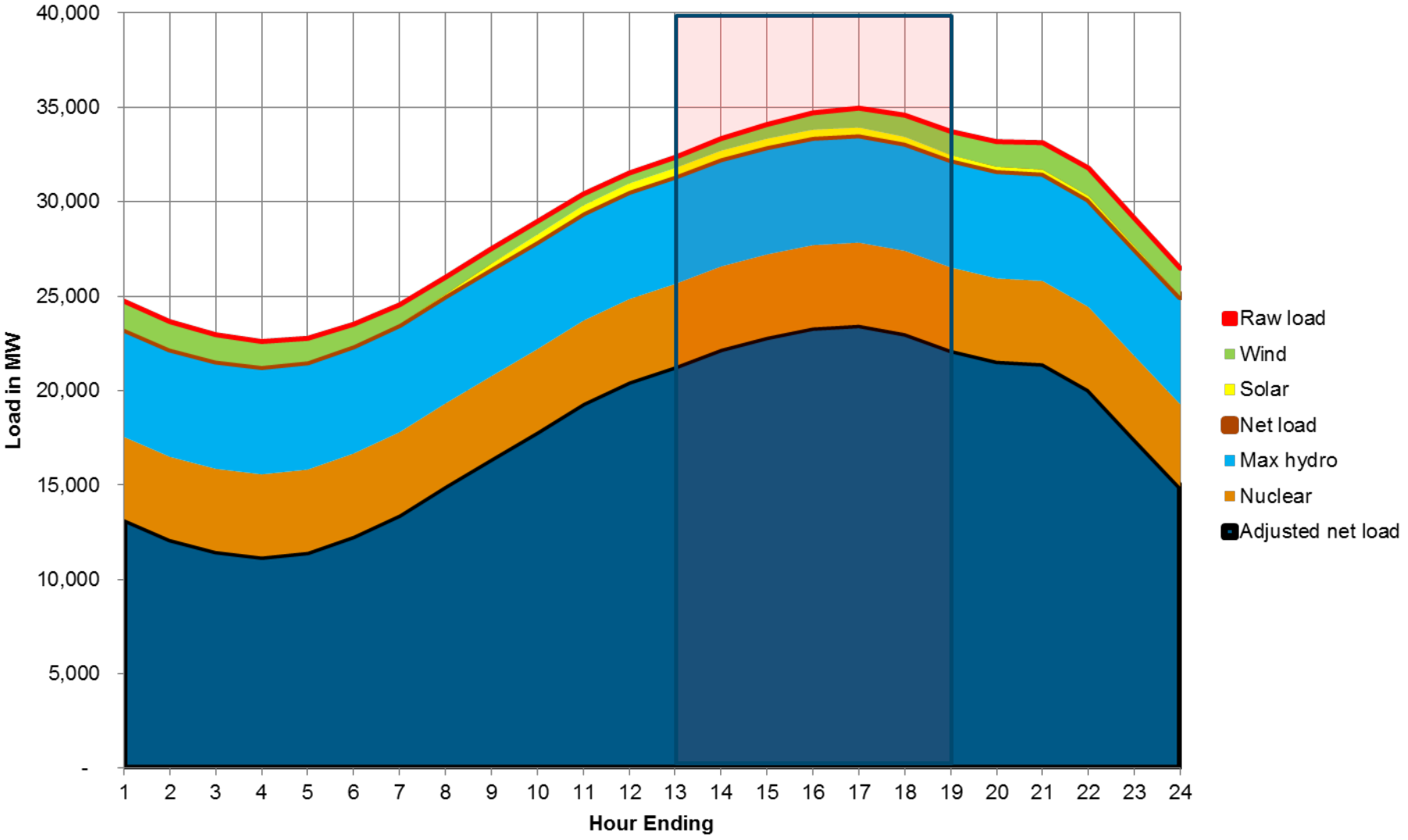


PG&E's Proposal in 2015 RDW:

- Limit the summer season to **four months (June - September)** which will adequately capture the highest cost hours. The rest of the calendar months should be considered winter months.
- Modify optional E-TOU rate to have a **5-hour peak period from 4 - 9 pm** on non-holiday weekdays for all seasons of the year (current rate's weekday peak is 1–7 pm)
- Four TOU periods: (1) Summer Peak, (2) Summer Off-peak, (3) Winter Peak and (4) Winter Off-peak.

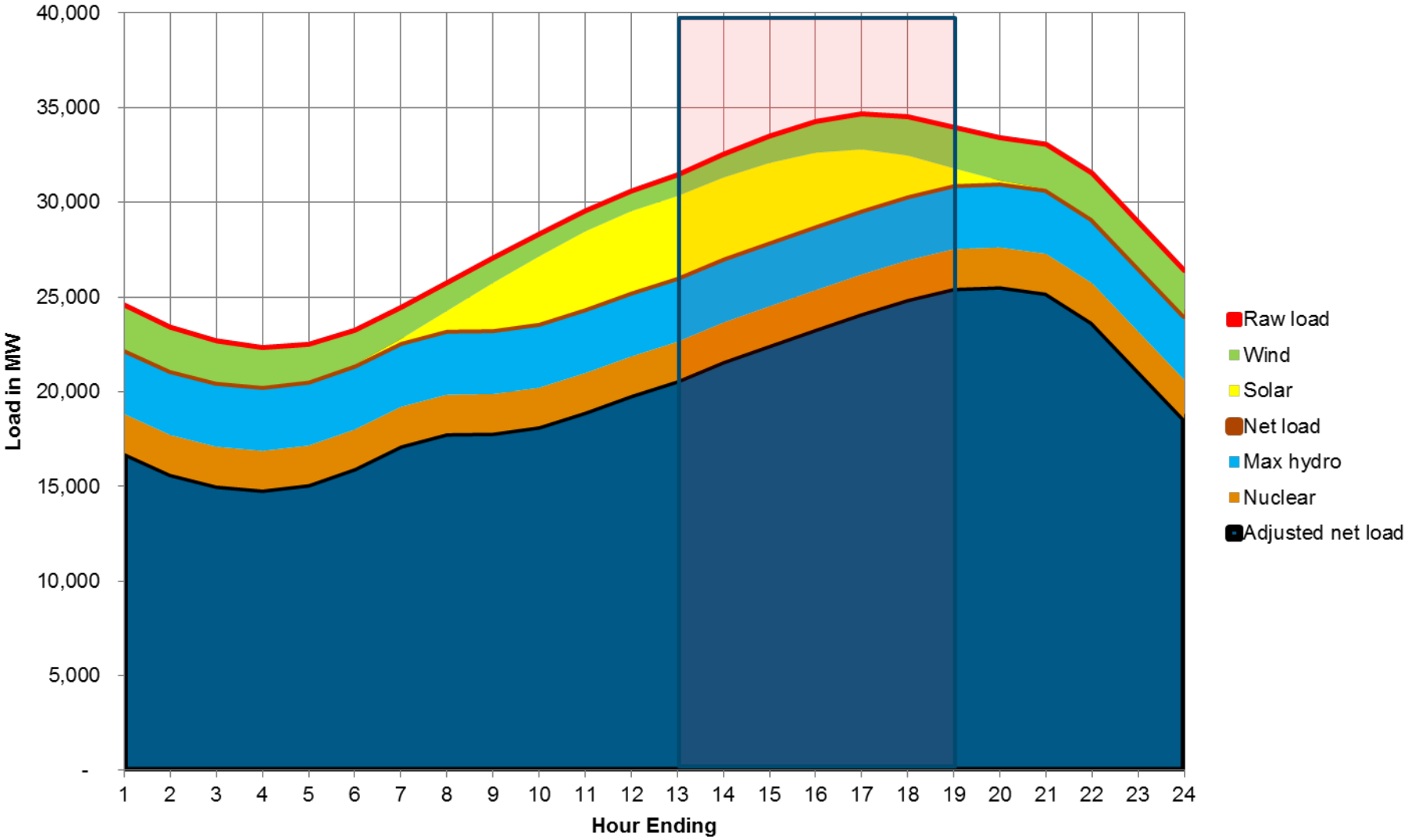
PG&E's Evolving Supply Mix and Load Shape

Recorded Summer 2011



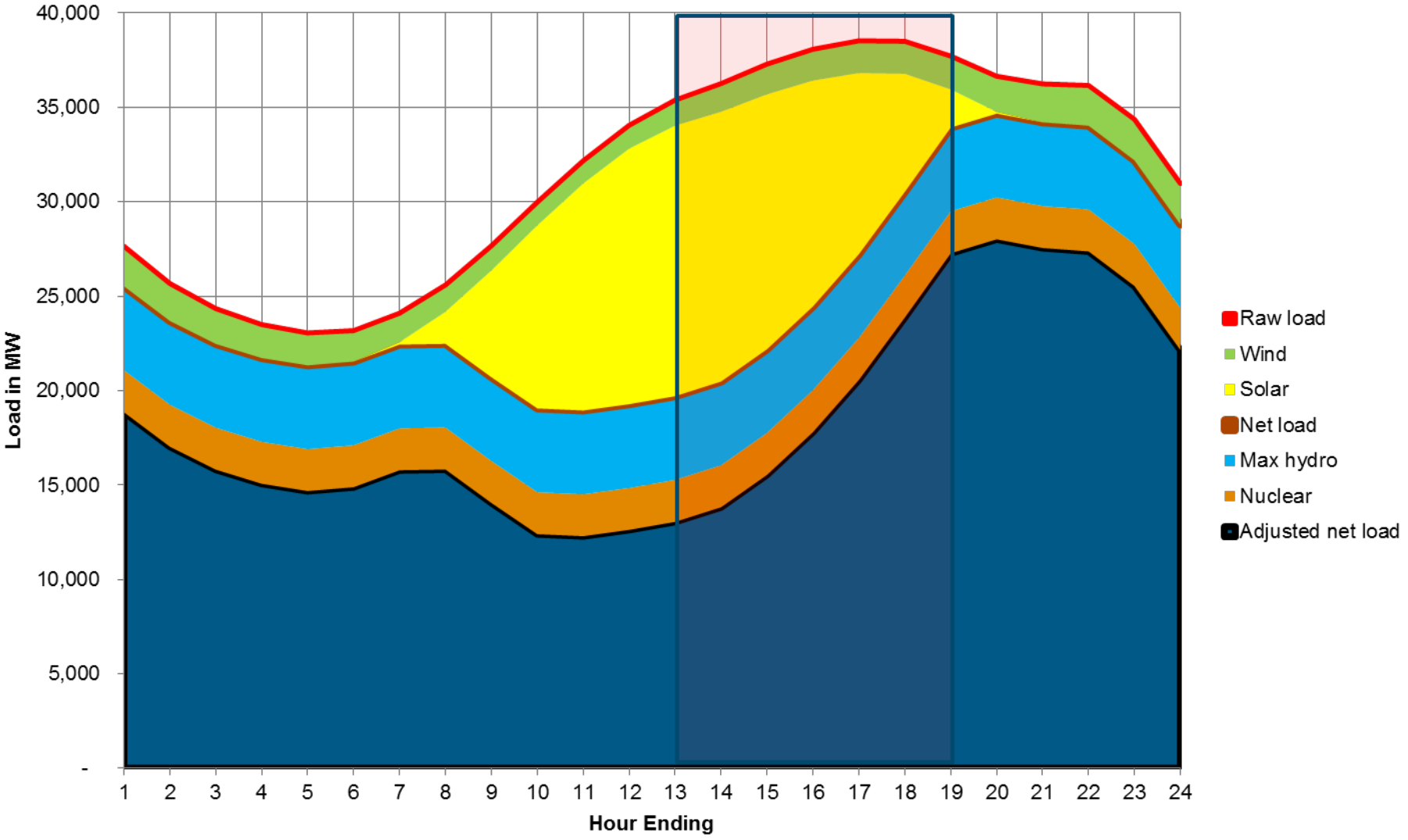
PG&E's Evolving Supply Mix and Load Shape

Recorded Summer 2014



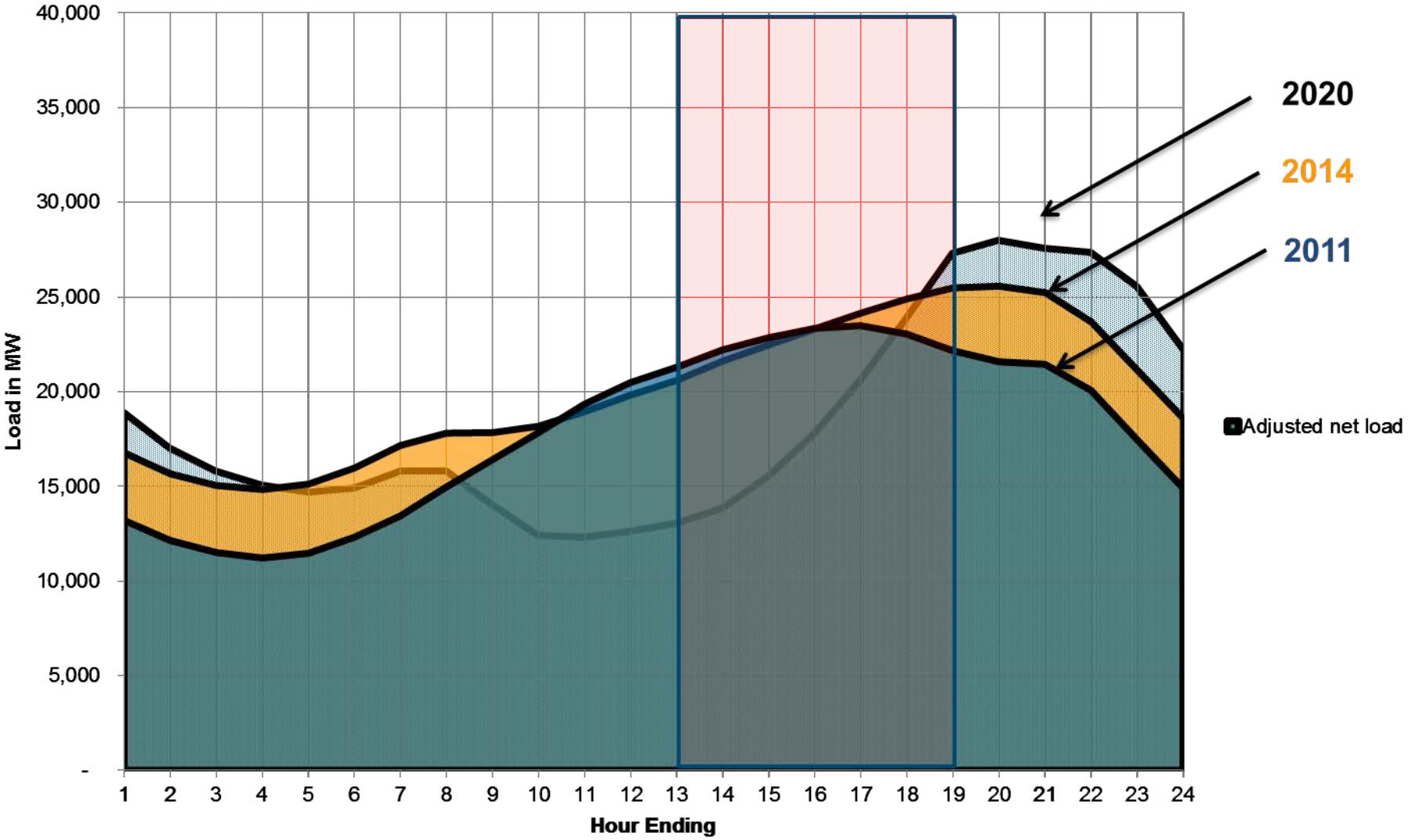
PG&E's Evolving Supply Mix and Load Shape

Forecasted Summer 2020



Significant Long Term Changes in *Adjusted Net Load*

2011 vs. 2014 vs. (forecasted) 2020

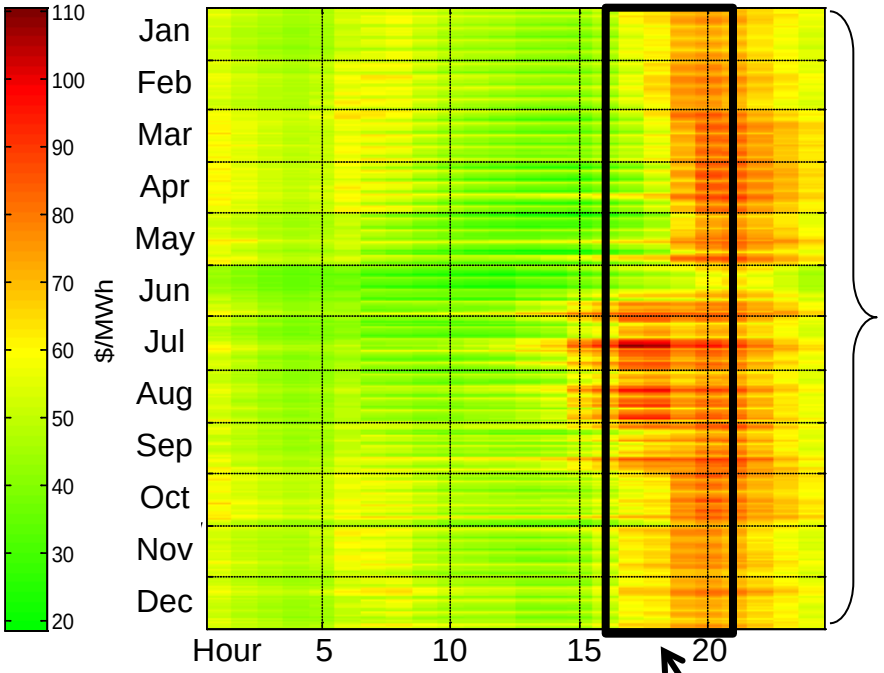


Generation Cost Modeling

All-year weekday evening TOU period captures expensive hours

1

2020 Day-ahead Generation



Expensive hours occur throughout the year.

New Proposed TOU Peak Period

2

Percent Count of The Highest Price Hours	Hours of the Highest Energy Price + Capacity Cost	
Hour of Day	**Top 250**	**Top 100**
12 AM -1 PM	1%	0%
1 PM - 2 PM	1%	0%
2 PM - 3 PM	2%	2%
3 PM - 4 PM	4%	3%
4 PM - 5 PM	7%	7%
5 PM - 6 PM	17%	18%
6 PM - 7 PM	22%	26%
7 PM - 8 PM	18%	20%
8 PM - 9 PM	17%	17%
9 PM - 10 PM	9%	7%
10 PM - 11 PM	3%	0%
11 PM - 12 AM	0%	0%

3

Weekdays capture over 80% of the most expensive hours

	Top 250	Top 100
Weekdays	84%	83%
Weekends	16%	17%

Most expensive hours are concentrated and easily captured

Source: Energy Procurement data

TOU Scenarios Analyzed

Peak period 4 PM – 9 PM throughout the year works best

Balanced two metrics: Percent of Top Hours Included and False Positive Rate.

Peak periods of over 5 hours yielded False Positive Rates above 15%

Thus, PG&E selected Scenario 8 (5-hour peak period from 4 to 9 pm).

Scenario	Peak Period Duration Weekday Non-Holiday Hours Only	Peak Start Hour	Peak End Hour	Percent top 250 hours in Peak Period	Percent top 100 hours in Peak Period	False Positive Rate, Top 250 hours Based	False Positive Rate, Top 100 hours Based
1	3 hour period	3 p.m.	6 p.m.	24.0%	25.0%	8.3%	8.5%
2	3 hour period	4 p.m.	7 p.m.	38.0%	43.0%	7.9%	8.3%
3	3 hour period	5 p.m.	8 p.m.	47.2%	51.0%	7.6%	8.2%
4	4 hour period	3 p.m.	7 p.m.	41.6%	46.0%	10.7%	11.2%
5	4 hour period	4 p.m.	8 p.m.	53.2%	58.0%	10.4%	11.1%
6	4 hour period	5 p.m.	9 p.m.	60.8%	64.0%	10.2%	11.0%
7	5 hour period	3 p.m.	8 p.m.	56.8%	61.0%	13.3%	14.0%
8	5 hour period	4 p.m.	9 p.m.	66.8%	71.0%	13.0%	13.9%
9	5 hour period	5 p.m.	10 p.m.	67.6%	71.0%	13.0%	13.9%
10	6 hour period	3 p.m.	9 p.m.	70.4%	74.0%	15.9%	16.8%
11	6 hour period	4 p.m.	10 p.m.	73.6%	78.0%	15.8%	16.7%
12	6 hour period	5 p.m.	11 p.m.	70.4%	71.0%	15.9%	16.8%
13	7 hour period	3 p.m.	10 p.m.	77.2%	81.0%	18.7%	19.6%
14	7 hour period	4 p.m.	11 p.m.	76.4%	78.0%	18.7%	19.7%
15	7 hour period	5 p.m.	Midnight	70.4%	71.0%	18.9%	19.7%
16	E-6 6 hour period	1 p.m.	7 p.m.	43.6%	48.0%	16.7%	17.1%
17	E-7 6 hour period	12 noon	6 p.m.	28.0%	27.0%	17.1%	17.3%

Customer Insights:
Customers desire choice and simplicity

Customer Priorities

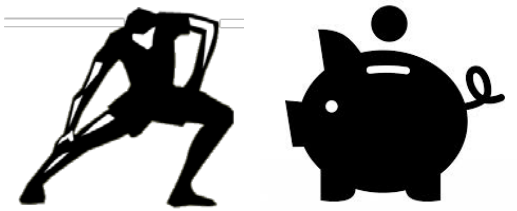
68% People want to take additional action to try to reduce their household's electricity bill



Reasons for TOU

42% People want a TOU period for flexibility

19% People want a TOU period to save money



Rate Confusion

21% People who *think* they are on TOU

3% People who *actually* are on TOU



Customers must accept and understand TOU offerings

Source: TOU Rate Development Conjoint Research Report Among Residential Customers, HINER & Partners, June 2014

TOU Rate Structure - Customer Preferences:
Conjoint Analysis

Choice exercise and conjoint analysis show willingness to trade off shorter peak period for lower price ratio.

2 Primary Customer Considerations: **Price** and **Peak Period Length**

	Choice Set 1		Choice Set 2		Choice Set 3	
	A	B	A	B	A	B
Price Ratio (peak to off-peak)	1.2	1.2	1.2 Lower	2.1 Higher	1.2 Lower	3.2 Higher
Peak Period Length (Hours)	5 Shorter	7 Longer	5	5	5 Longer	3 Shorter
Customer Preference	63%	37%	62%	38%	56%	44%
	Shorter Peak		**Lower Price Ratio**		**Lower Price Ratio / Longer Peak**	

Source: TOU Rate Development Conjoint Research Report Among Residential Customers, HINER & Partners, June 2014

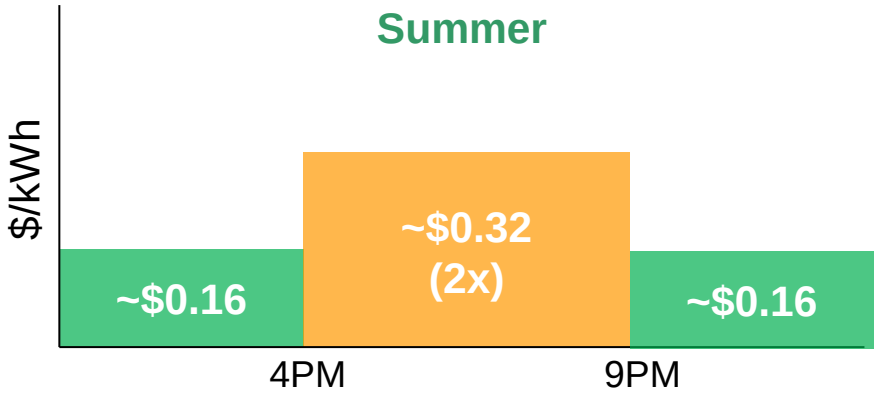
Residential TOU Period Proposal

Options Considered

LONG

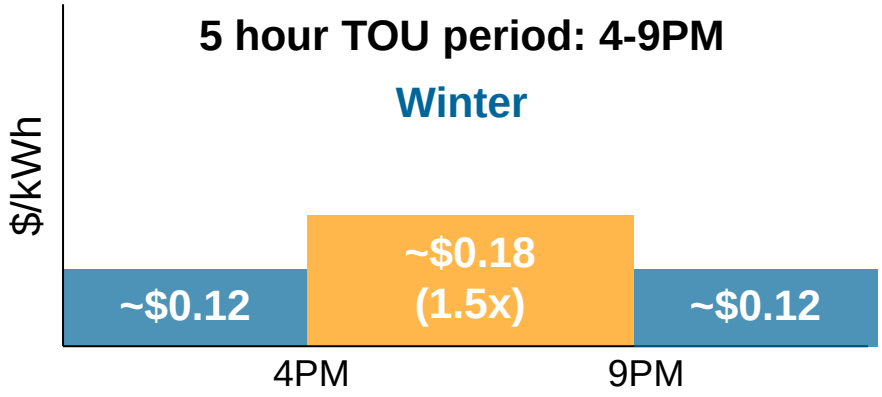
5 hour TOU period: 4-9PM

Summer



5 hour TOU period: 4-9PM

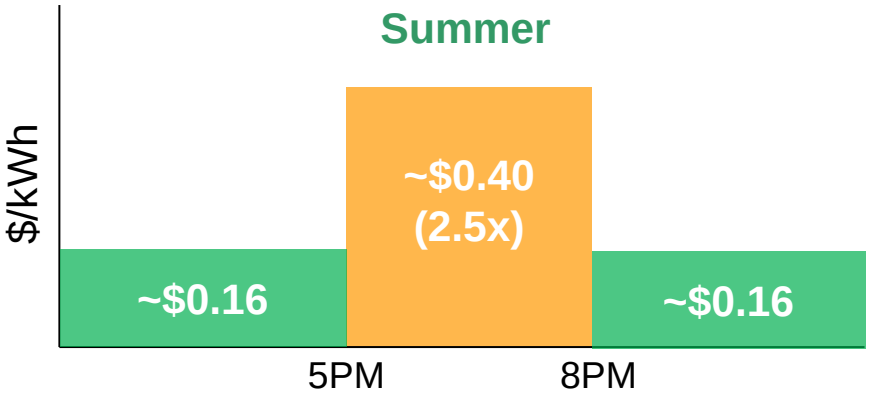
Winter



SHORT

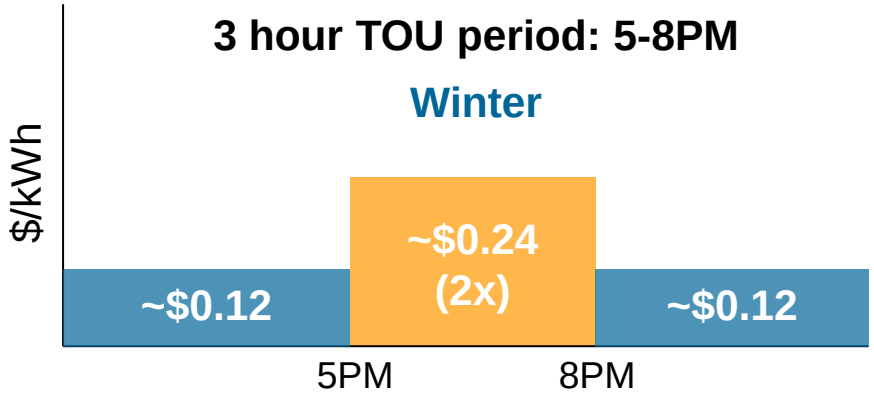
3 hour TOU period: 5-8PM

Summer



3 hour TOU period: 5-8PM

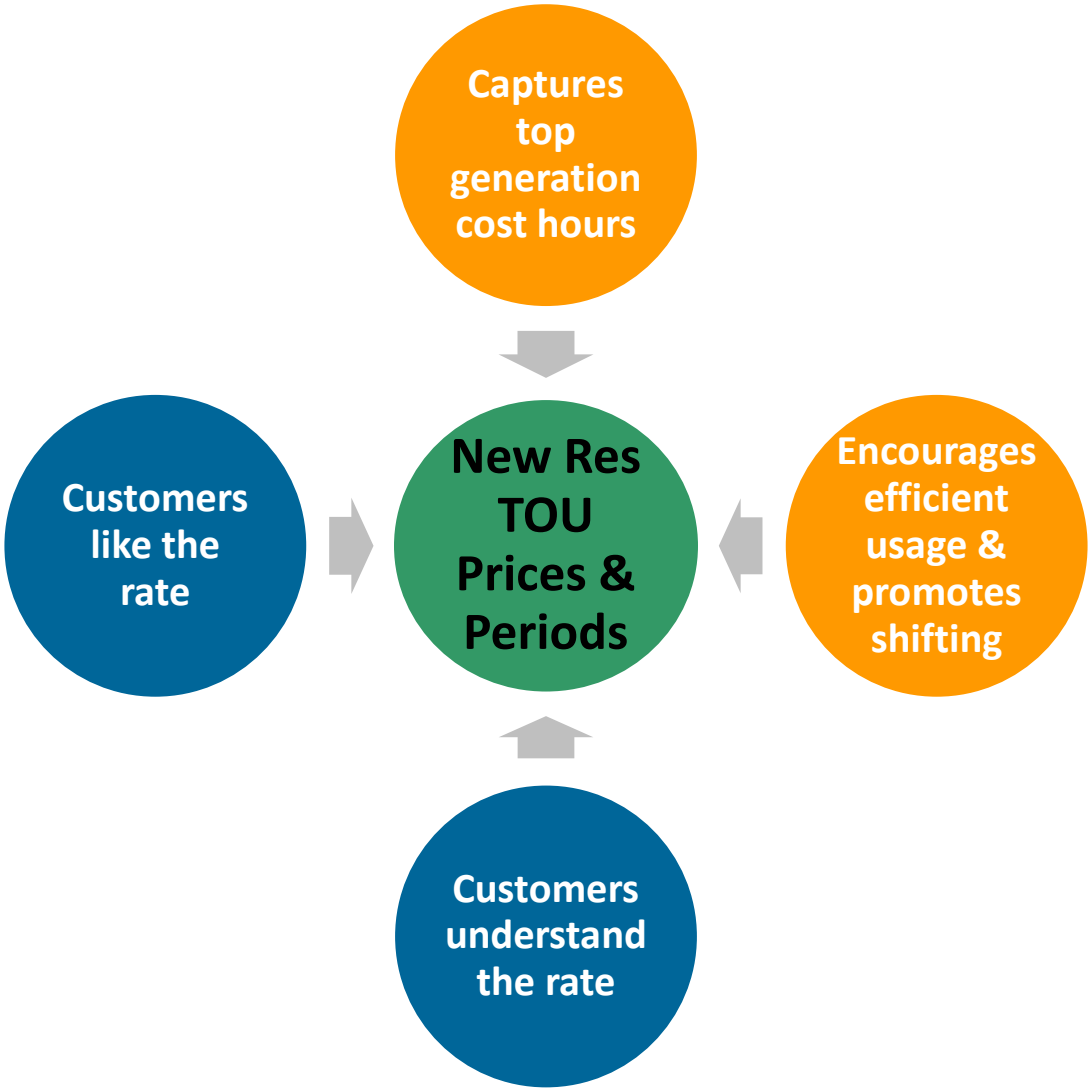
Winter



Choice of two simple TOU periods that align with most costly hours

PG&E's TOU Proposal Balances Customer & Grid Needs

Supported by Public Customer Research & Energy Modeling



Thank you!

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