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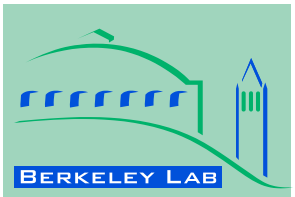

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Poster:
Evaluation of evolving residential electricity tariffs

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Disclaimer

Evaluation of evolving residential electricity tariffs

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ABSTRACT: Residential customers in California's Pacific Gas and Electric (PG&E) territory have seen several electricity rate structure changes in the past decade. This poster:

- examines the history of the residential pricing structure and key milestones,
- summarizes and analyzes the usage between 2006 and 2009 for different baseline/climate areas,
- discusses the residential electricity Smart Meter roll out, and
- compares sample bills for customers in two climates under the current pricing structure and also the future time of use (TOU) structure

Table 1. Breakdown of the PG&E baseline areas, population, and baseline quantities for customers who receive both natural gas and electric.

Baseline Area	Residential Customers		Baseline Quantity (kWh/day)	
	%	1000's	summer	winter
P(valley-inner)	3.58%	178	16.5	12.9
Q (coastal)	0.08%	5	8.3	12.6
R (valley-outer)	10.63%	532	18.1	12.3
S (valley-inner)	16.45%	823	16.5	12.7
T (coastal)	24.05%	1203	8.3	9.8
V (coastal)	1.08%	54	9.6	11.1
W (valley-outer)	5.10%	255	19.4	11.4
X (hill/mount.)	37.62%	1881	12.1	12.6
Y (hill/mount.)	1.28%	64	12.2	13.3
Z (hill/mount.)	0.14%	7	8.8	11.6

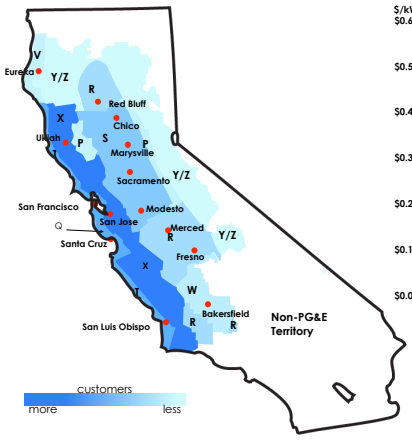

Figure 1. Map of PG&E baseline territories in California as of 2010.

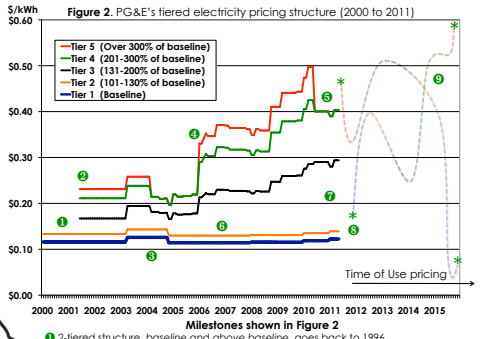

Figure 2. PG&E's tiered electricity pricing structure (2000 to 2011)

Milestones shown in Figure 2

1. 2-tiered structure, *baseline* and *above baseline*, goes back to 1996.
2. 5-tiered structure begins in summer of 2001.
3. Relative stability of T1 and T2 mainly due to rate cap imposed by California Assembly Bill 1X, introduced during the California energy crisis to protect residential customers from fluctuations in the wholesale market.
4. Rate hikes in the upper tiers used to transition from analog meters to Smart Meters.
5. Decrease in upper tiers for "summer relief".
6. Beginning of Smart Meter installations in Nov-2006.
7. The phasing out of price protection offered to T1 and T2 by AB1X coincides with decreases in T3 through T5.
8. Transition to TOU pricing due to start in May 2011.
9. Estimated TOU transition complete by end of 2014.

* Increases/decreases are abstract representation of TOU rates only.

How to read Table 2

The ***normalized customer*** usage is calculated as the total usage consumed in each tier (kWh/a) in each of the four aggregated areas divided by the number of customers in the same areas.

For each baseline's **average *normalized customer***, the consumption (kWh/a) and % change from one year to the next is shown.

For any given year, the sum of the usage in all tiers multiplied by the number of customers in the aggregated baseline area equals the total amount of electricity sold to the residential sector.

Tariffs are colour coded and generally are increasing both through time and tiers.

Usage by tiers and annual usage are indicated by the width of the bars.

Results

Coastal: even with increasing tier pricing over time, the tiered consumption of the average customer remained relatively stable, and with the largest percent change in T5. One possible explanation for this is that since the coastal climate is mild and with lower baseline, that the usage cannot be easily reduced, i.e., demand is inelastic.

Hills/Mountain: similar to coastal, the largest consumption reduction happens in T5, however, the gains in the lower tiers are inconsistent.

Valley-Inner and Valley-Outer: usage noticeably declines as the T4 and T5 prices increase between 2006 and 2009; and during the same period, usage increases in T1 and T2.

Limitations and caveats of historical analyses

- Lack of long-term data.
- No monthly data; usage examined at the yearly level.
- Potential summer peaks and behaviour volatility not visible.
- Special customer classes (ex: those with medically necessary increased baselines, those who qualify for discounted rates, etc) were included as part of the examined population.

Table 2. Summary and analysis of historical tier prices, **average *normalized customer*** usage in different tiers, and % changes for 2006-2009. Baseline territories are aggregated into four areas that share similar characteristics: coastal, hills/mountain, valley-inner, and valley-outer.

Baseline Area	Year	Tier 1 Tariff $/kWh	Tier 1 Usage kWh/a	Tier 1 %Δ	Tier 2 Tariff $/kWh	Tier 2 Usage kWh/a	Tier 2 %Δ	Tier 3 Tariff $/kWh	Tier 3 Usage kWh/a	Tier 3 %Δ	Tier 4 Tariff $/kWh	Tier 4 Usage kWh/a	Tier 4 %Δ	Tier 5 Tariff $/kWh	Tier 5 Usage kWh/a	Tier 5 %Δ	Total Ann. Usage kWh/a	Total Ann. Usage %Δ
Coastal (Q, T, V)	2006	$0.114	2680		$0.130	488		$0.230	687		$0.322	390		$0.371	312		4557	
	2007	$0.114	2655	-1	$0.130	486	-1	$0.226	687	0	$0.315	391	0.5	$0.362	331	6.2	4550	-0.1
	2008	$0.116	2653	-0	$0.131	480	-1	$0.247	674	-2	$0.354	378	-3	$0.411	333	0.6	4518	-0.7
	2009	$0.115	2672	0.7	$0.131	484	0.8	$0.261	678	0.6	$0.381	376	-1	$0.443	340	2.2	4550	0.7
Hills/Mount. (X, Y, Z)	2006	$0.114	3793		$0.130	707		$0.230	986		$0.322	565		$0.371	427		6479	
	2007	$0.114	3760	-1	$0.130	700	-1	$0.226	969	-2	$0.315	540	4.5	$0.362	393	-8	6361	-1.8
	2008	$0.116	3782	0.6	$0.131	705	0.7	$0.247	976	-1	$0.354	544	0.7	$0.411	396	0.8	6402	0.6
	2009	$0.115	3814	0.8	$0.131	712	1	$0.261	979	0.3	$0.381	531	-2	$0.443	372	-6.1	6408	0.1
Valley-Inner (P, S)	2006	$0.114	4386		$0.130	855		$0.230	1256	-	$0.322	753		$0.371	450		7700	
	2007	$0.114	4350	-1	$0.130	836	-2	$0.226	1203	-4	$0.315	678	-10	$0.362	360	-20	7427	-3.6
	2008	$0.116	4439	2.1	$0.131	856	2.3	$0.247	1226	1.9	$0.354	677	-0	$0.411	340	-5.7	7537	1.5
	2009	$0.115	4527	2	$0.131	874	2.2	$0.261	1238	1	$0.381	657	-3	$0.443	309	-9	7606	0.9
Valley-Outer (R, W)	2006	$0.114	4604		$0.130	879		$0.230	1304		$0.322	802		$0.371	448		8036	
	2007	$0.114	4542	-1	$0.130	868	-1	$0.226	1278	-2	$0.315	754	-6	$0.362	386	-14	7829	-2.6
	2008	$0.116	4633	2	$0.131	885	1.9	$0.247	1290	0.9	$0.354	743	-1	$0.411	361	-6.6	7912	1.1
	2009	$0.115	4736	2.2	$0.131	916	3.5	$0.261	1327	2.9	$0.381	740	-0	$0.443	337	-6.7	8056	1.8

INTRODUCTION OF RESIDENTIAL SMART METERS:

One of the necessary steps towards the implementation of Time of Use (TOU) tariffs for the residential sector is the installation of Smart Meters, or the retrofitting of existing meters with network communications infrastructure. There are currently 3.8 million electrical residential Smart and 1.3 million analog meters in service in the PG&E territory.

Customer discontent with Smart Meters

- Smart Meters are inaccurate and lead to higher bills.
- Safety and privacy issues (EMF or RF, hacking of usage data).

Table 3 shows the preliminary analyses of ~2700 complaints regarding PG&E's Smart Meter program. While preliminary, the analyses suggest that despite the vocal complaints from thousands of customers, the Smart Meters are accurate.

	2008	2009	2010
Utility	12	258	1021
Customer	0	65	604
Compromise	1	32	86
Unresolved	2	1	85
Unrelated	3	98	436
Total	18	454	2232

Table 3. Smart Meter complaint rulings

Projected range of annual PDP bill impacts are shown in Figure 4 below. Approximately 55% of the residential customers will have an **annual** bill savings when on TOU pricing compared to the current 5-tier pricing. Approximately 45% will see annual increases.

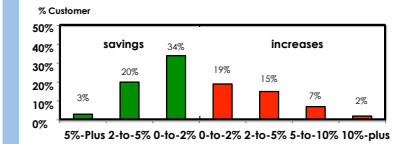

Figure 4. PDP bill impacts compared to 5-tier rates.

5-TIER PRICING V.S. TOU PRICING (*Peak Day Pricing* and *Peak Time Rebate*): Most customers will transition from 5-tier pricing to Peak Time Rebate (PTR) then to Peak Day pricing (PDP), unless they opt out back to PTR. The default will be PDP, with real-time pricing due to start in 2020.

5-Tier pricing

- Tier 1 equals ~60% of the historical average usage, in **kWh/day**, of customers in baseline areas
- Monthly bills are the sums of daily usage which may be comprised of electricity purchased at multiple tiers
- no TOU differentiation

Peak Day Pricing (PDP)

- "Peak days" may be in summer or winter
- Between 9 and 15 peak days per year, and only between 14:00h and 19:00h
- based on the 5-tiers
- TOU charges and credits possible

Peak Time Rebate (PTR)

- similar to PDP but incentives only
- no penalties if the customer does not shed load during an event
- will be the default tariff for those who opt-out of PDP

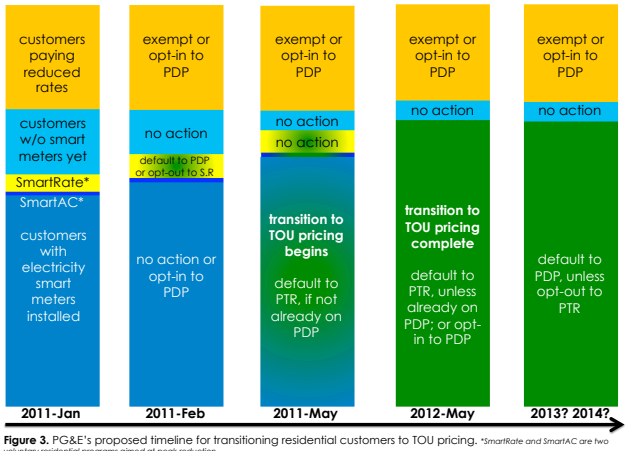

Figure 3. PG&E's proposed timeline for transitioning residential customers to TOU pricing. **SmartRate and SmartAC are two voluntary residential programs aimed at peak reduction.*

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