

Appendix D: Using PRISM to Develop Dynamic Pricing Tariffs

Quantifying the Benefits of Dynamic Pricing In the Mass Market

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The Brattle Group

Prepared for:

Edison Electric Institute

January 2008

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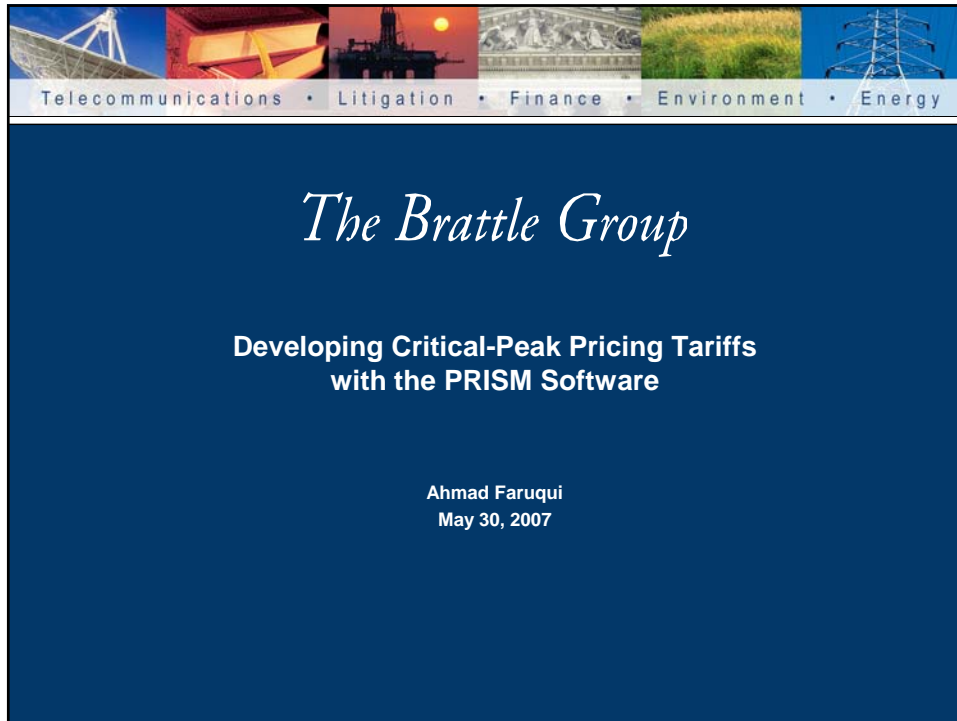
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Developing Critical-Peak Pricing Tariffs with the PRISM Software

Ahmad Faruqui
May 30, 2007

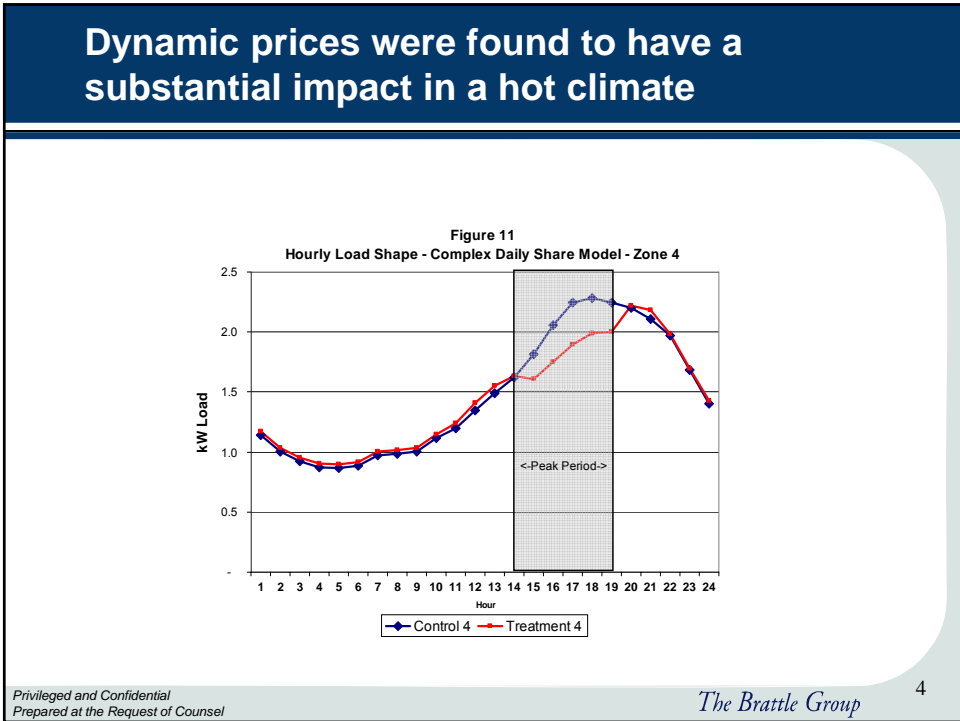
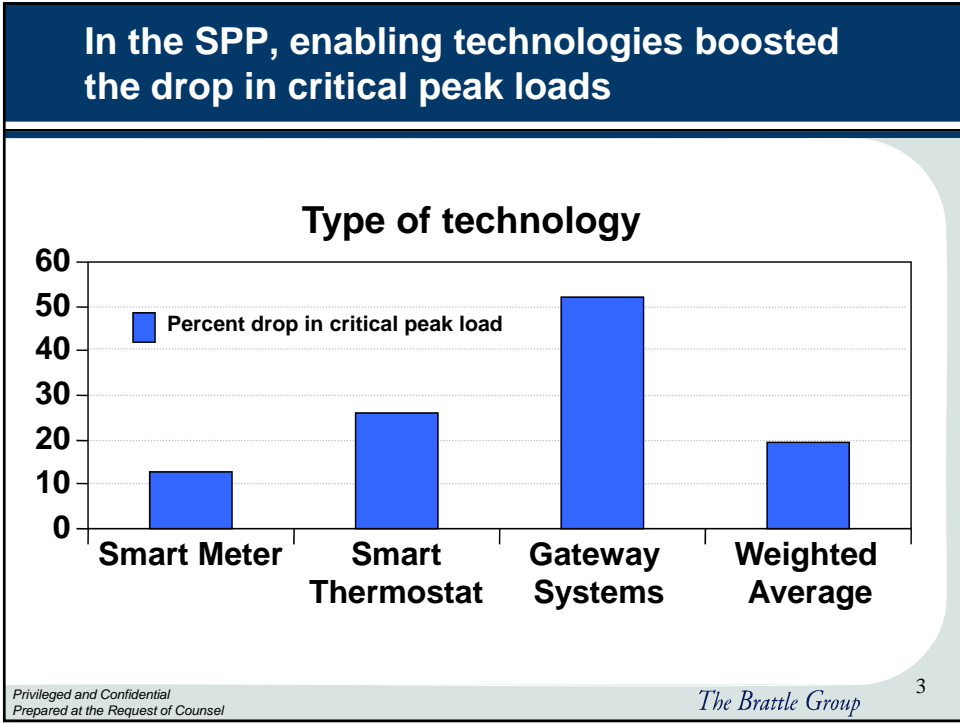
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What is the PRISM software?

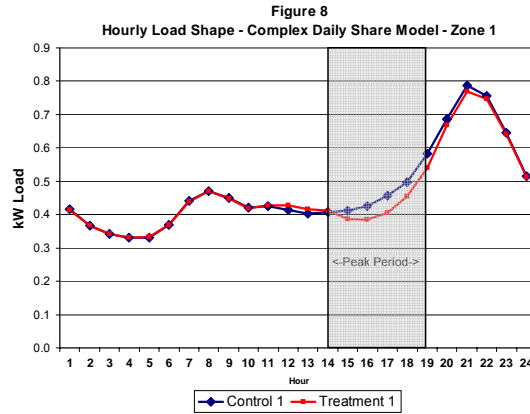
- PRISM (pricing impact simulation model) can be used to develop the impact of different rate designs on utility load shapes
- It contains demand functions for peak and off-peak electricity consumption
- These functions are based on customer responses during California's three-year experiment (SPP) with 2,500 residential and small commercial and industrial customers
- The model can be calibrated for other service areas

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They had a modest but statistically significant impact even in a mild climate

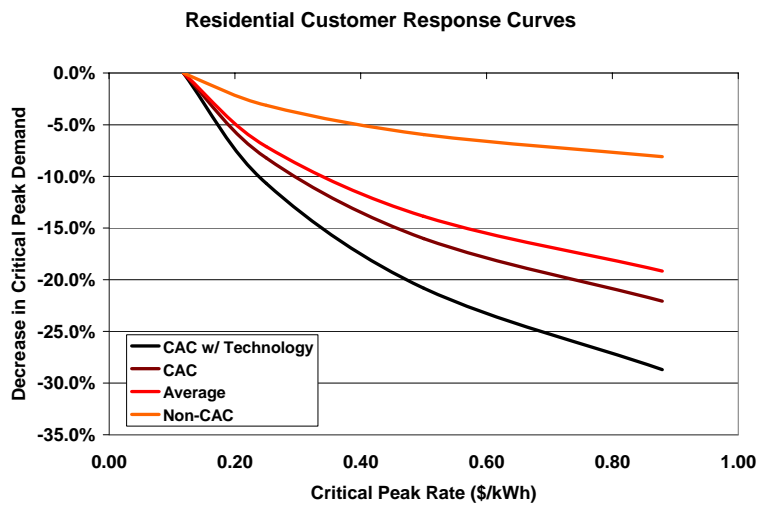


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PRISM codifies the observed price responses and lets them vary by customer

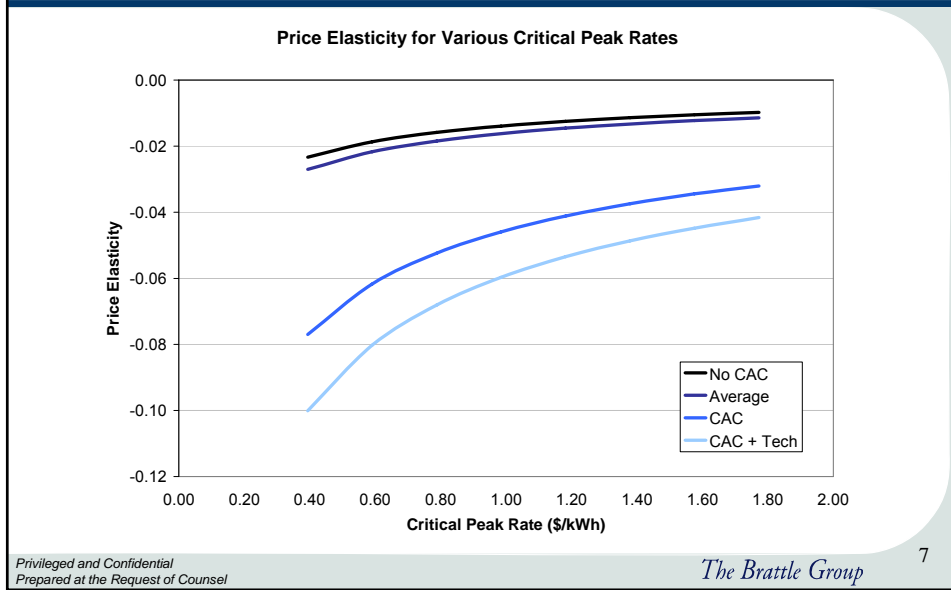


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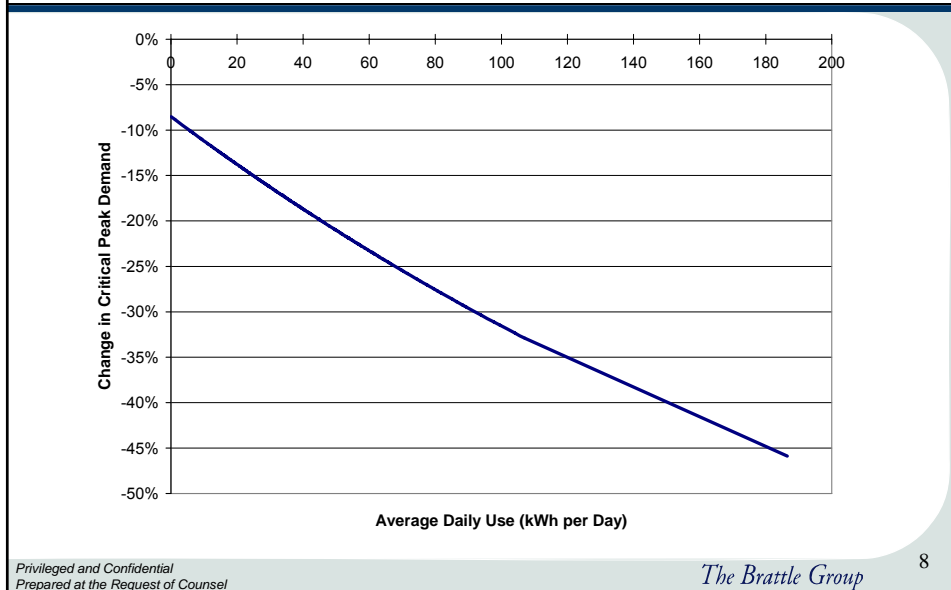
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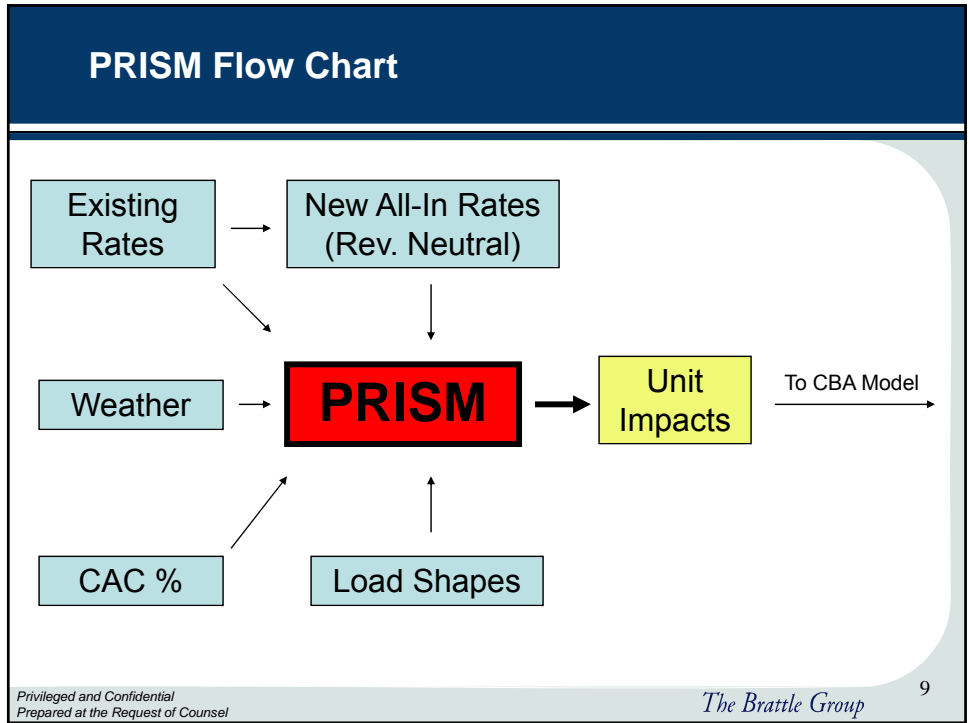
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PRISM contains a variety of price elasticity functions



Within PRISM, as average daily use increases, so does the level of demand response





An illustration using PRISM

- The next several slides illustrate how PRISM can be used to assess demand response and quantify its financial benefits
- To give the illustration some realism, the data are mocked-up to resemble a mid-Atlantic utility

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First, the existing tariff has to be expressed as an all-in rate

To calculate the all-in rate:

1. The customer charge is divided by average monthly consumption and expressed as \$/kWh
2. The customer charge rate and the distribution rate are added to the generation rates

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Then the CPP rate has to be developed, ensuring revenue neutrality and the creation of benefits for customers

Current Residential Rate vs. Cost-Based CPP/TOU All-In Rate

Hour of Day	Current Rate (\$/kWh)	Critical Peak (\$/kWh)	New Rate (\$/kWh)
0 - 13	\$0.14807	-	\$0.11312
14 - 19	\$0.14807	\$0.90934	\$0.14824
20 - 24	\$0.14807	-	\$0.11312

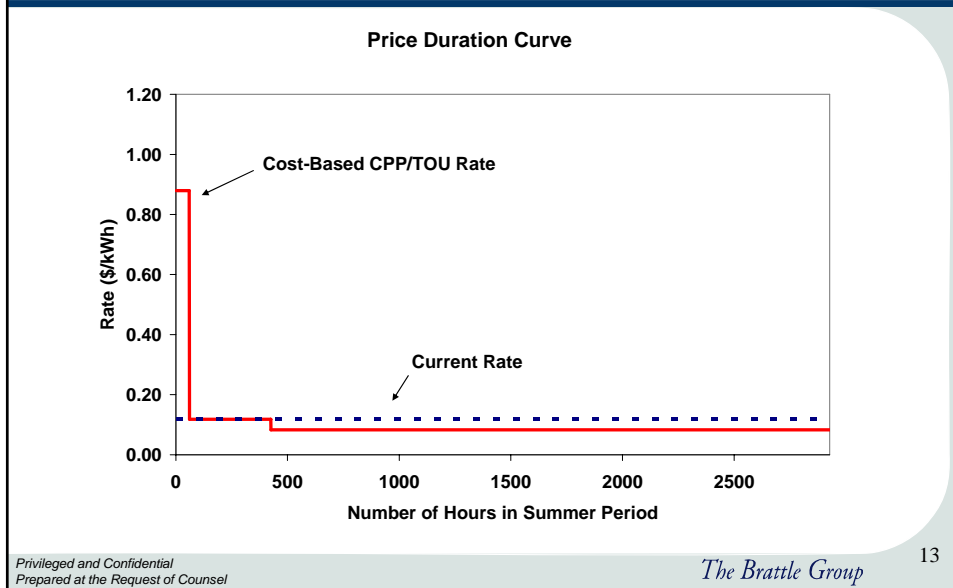
Note: The C&I rate differs slightly due to differences in the customer charge and distribution charge, and to maintain revenue neutrality

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For a vast majority of summer hours, the customer will be at a rate that is lower than the current rate; this creates opportunity for bill savings



Third, the CPP market needs to be defined

Two groups of customers

- Residential
- Small Commercial and Industrial

The residential market can be segmented into three customer types

- Central Air-Conditioning (CAC) with enabling technology (11% of existing customer base)
- CAC without enabling technology (67%)
- No CAC (22%)

Additional assumptions about potential CPP market

Annual Growth Rates

- Residential: 1% per year
- Commercial: 2.6% per year

AMI Rollout Schedule

Year	Mid-Year % of Total Customer Base
2008	0%
2009	8%
2010	38%
2011	80%
2012	100%

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Results from PRISM

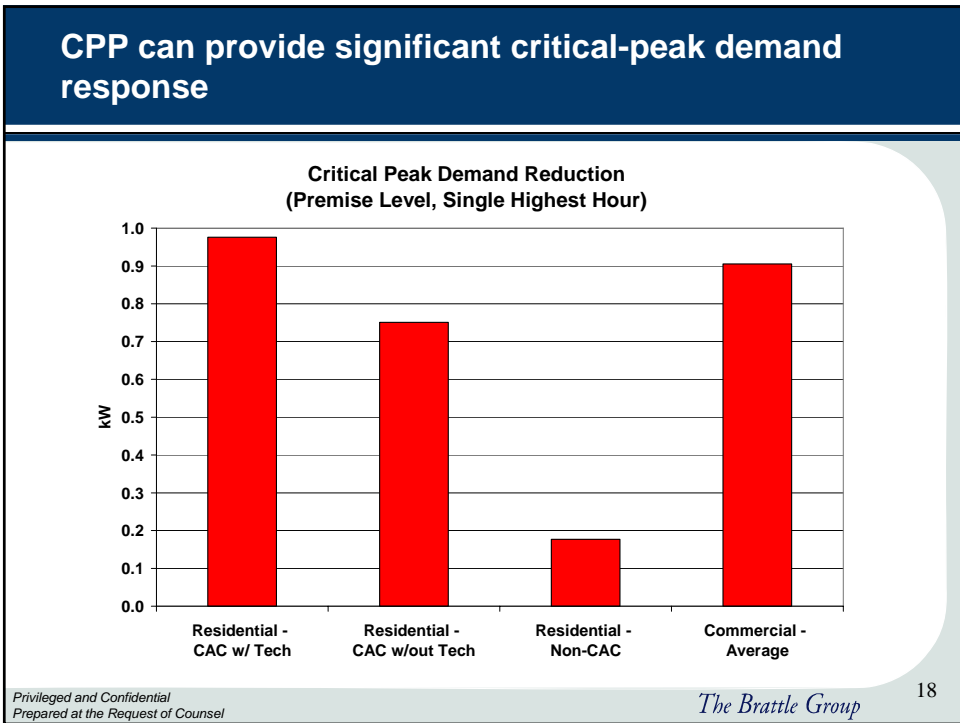
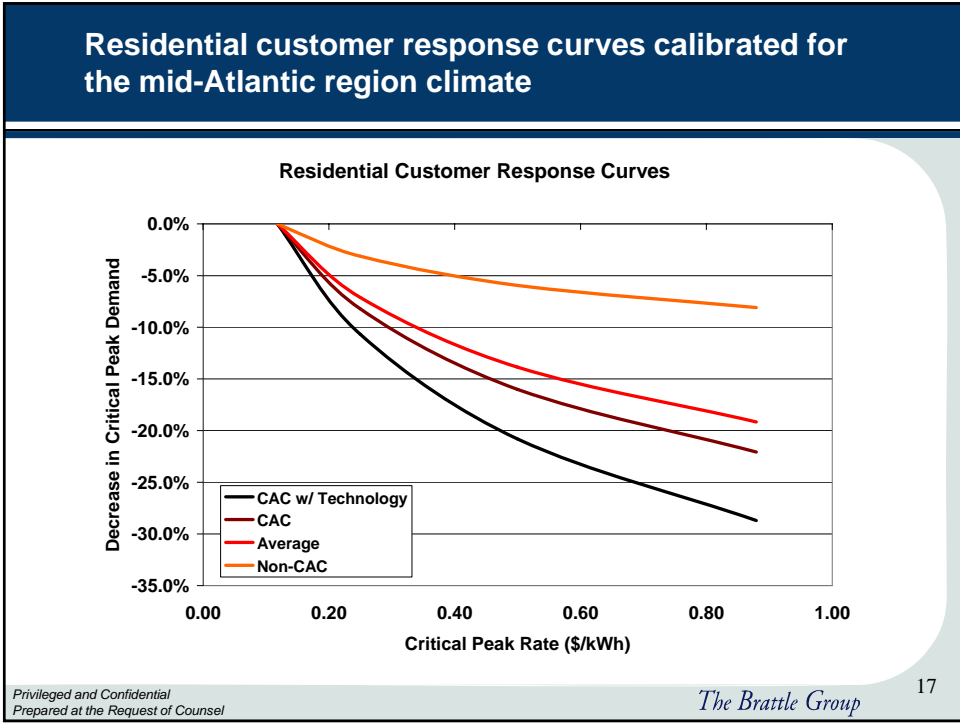
Results are presented on two levels

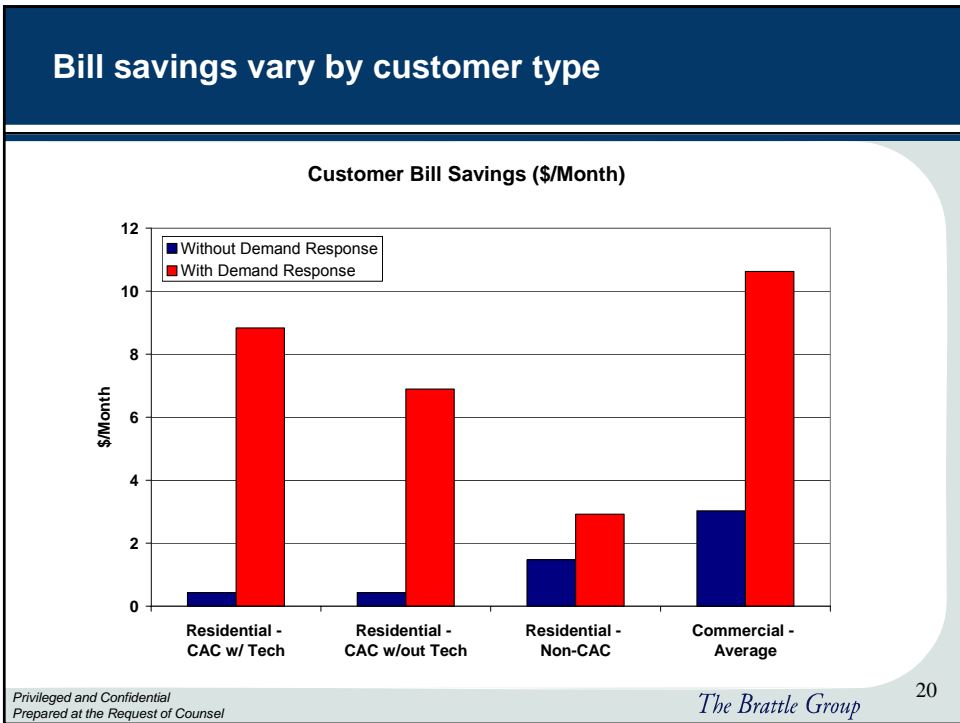
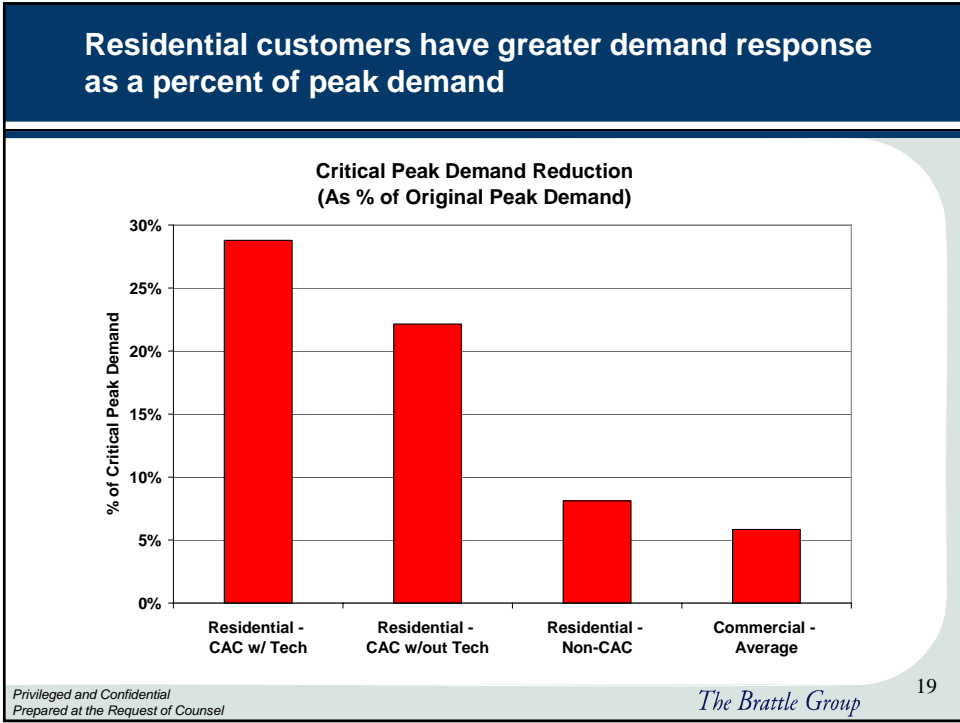
- Individual customer impacts
- System-wide impacts

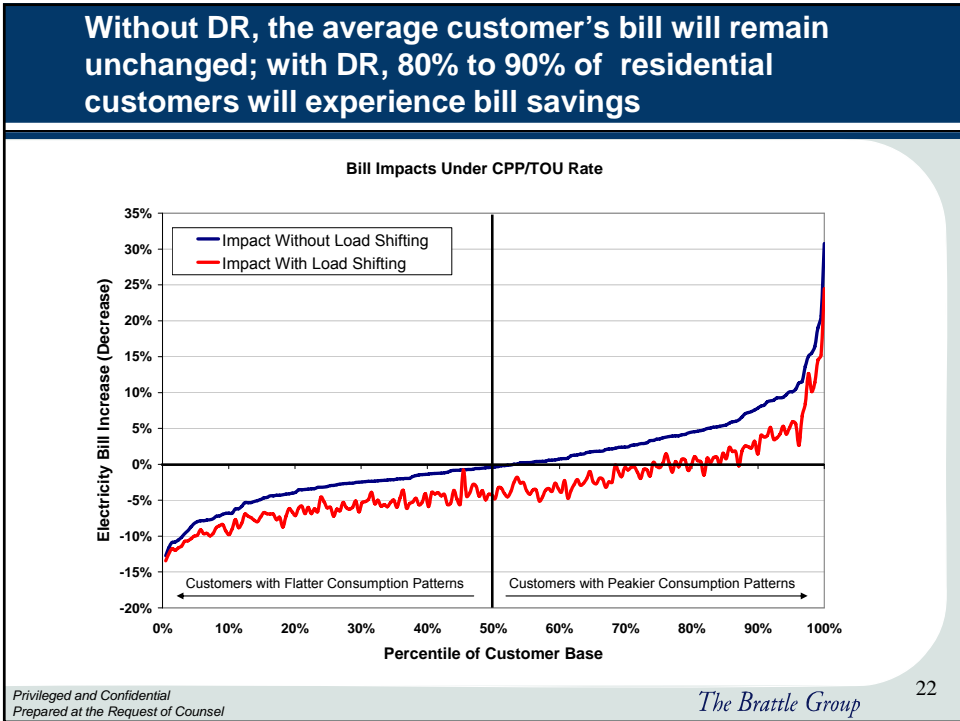
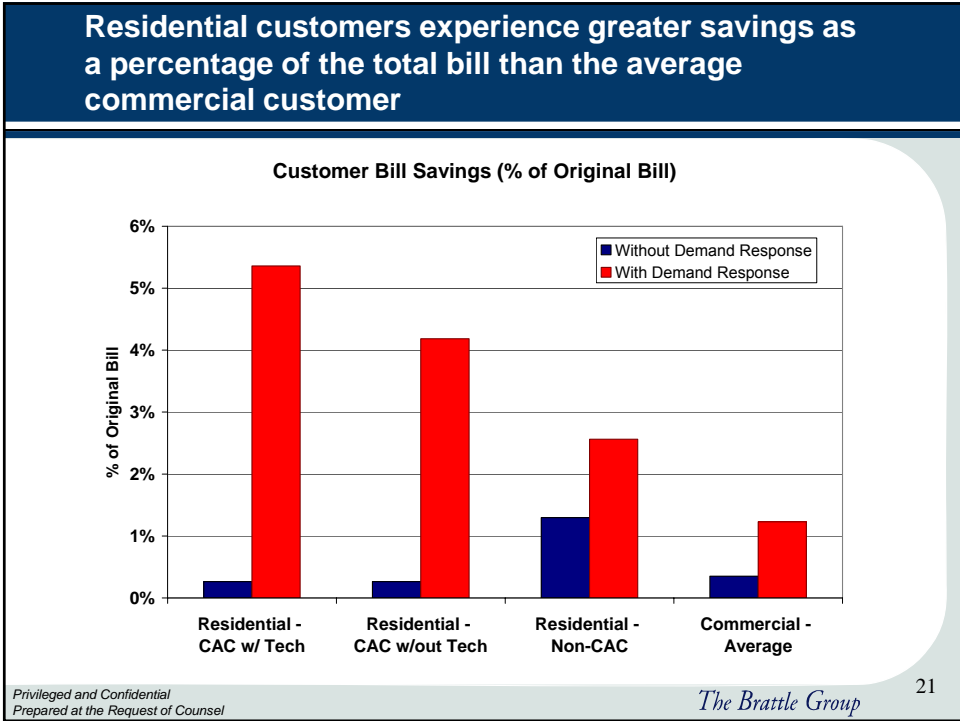
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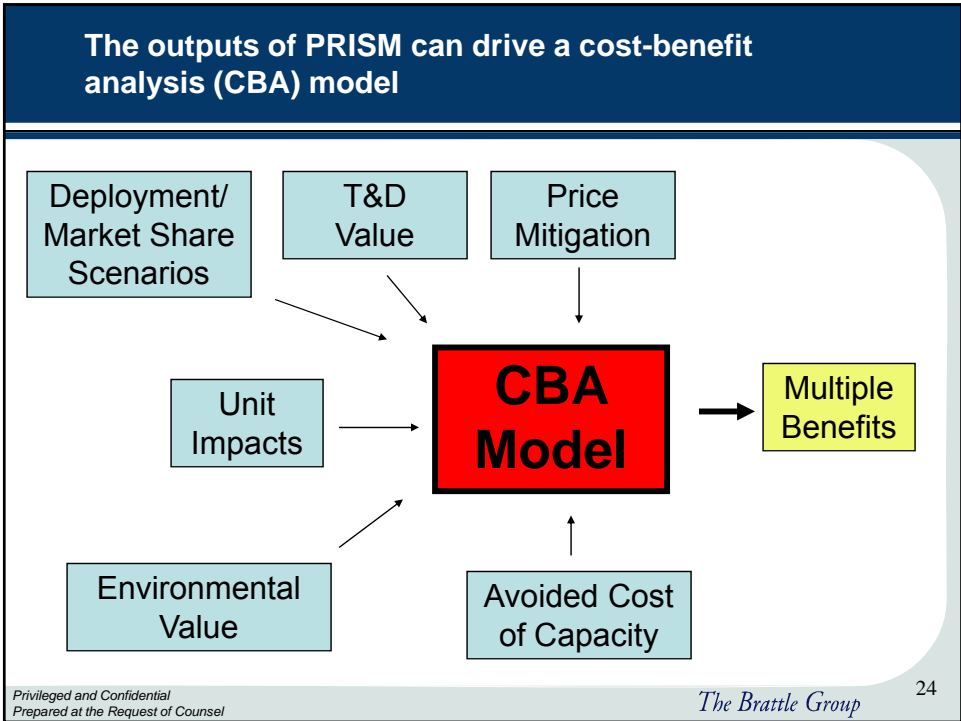




There are several ways of enhancing the customer appeal of CPP

- Providing an upfront, one-time cash incentive for participating customers
- Providing an ongoing, monthly cash payment akin to that given to the customers who are on load control
- Changing the rate design so it is revenue neutral for peakier-than-average customers
 - This will yield bill savings to a majority of customers even in the absence of load shifting
- Using a two-part rate where the first part is revenue neutral

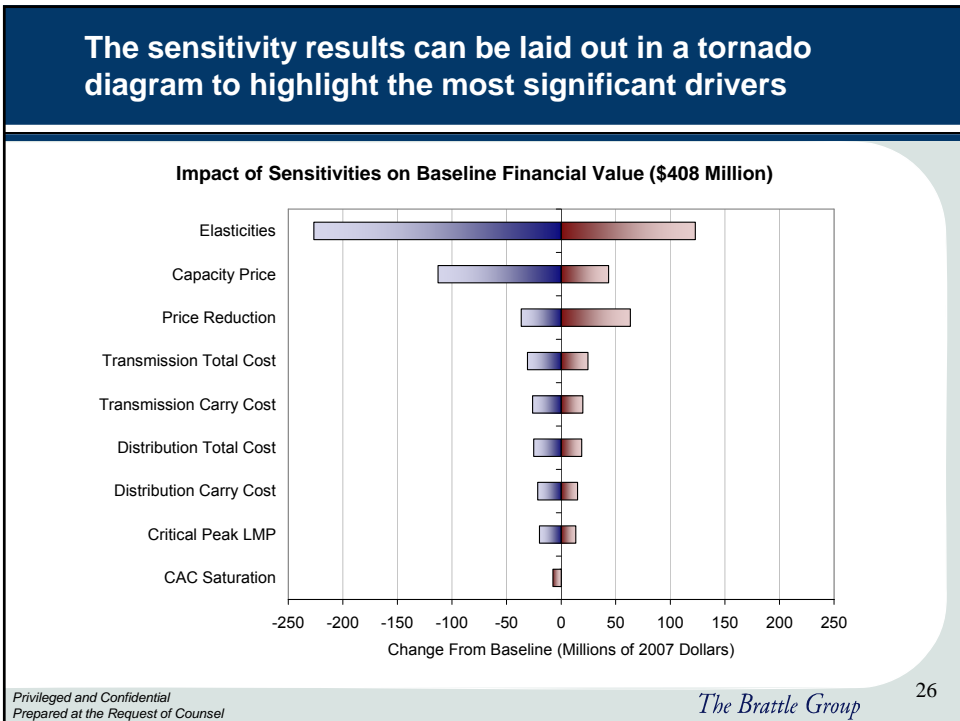
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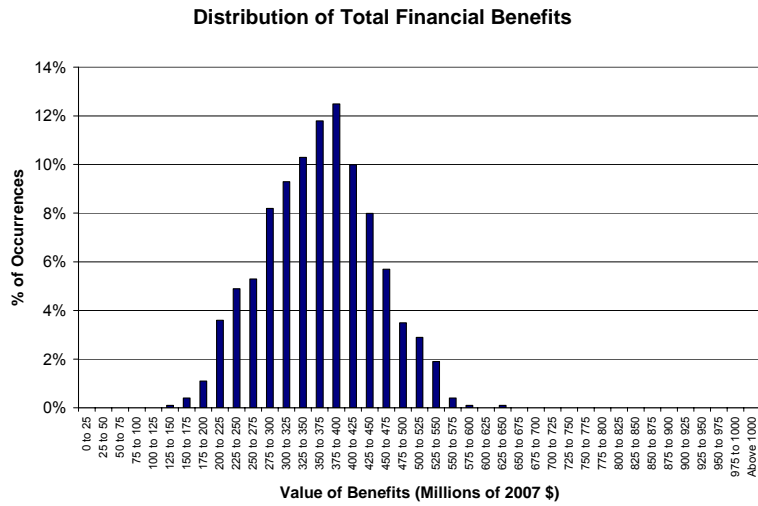
Once a baseline case has been evaluated, CBA allows for the rapid execution of sensitivities

Variable	Mode	Min	Max
Total Cost of Distribution System	\$10.59/kW-year	Decreased 50%	Increased 50%
Total Cost of Transmission System	\$17.50/kW-year	Decreased 50%	Increased 50%
CAC Saturation	78%	68%	83%
Price Elasticities	As calculated by PRISM	Decreased 50%	Increased 25%
Transmission carry cost	12%	7%	17%
Distribution carry cost	12%	7%	17%
Critical peak LMP (used in Price Mit. Calculation)	293	Decreased 25%	Increased 25%
Expected critical peak LMP decrease, given 1% decrease in critical peak demand	1%	0.5%	2.0%
Capacity price, beginning in 2011	\$47.45/kW-year	\$22.63/kW-year	58.00/kW-year

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A Monte Carlo simulation can be used to derive a probability distribution of financial benefits

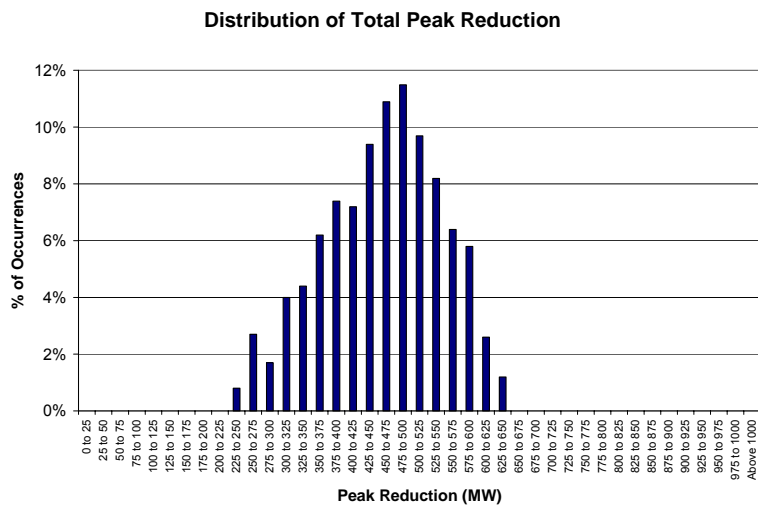


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And also yield a distribution of DR impacts



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