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Peak Time Rebate vs. Critical Peak Pricing: A Distinction without a Difference?

Program 182: Understanding Electric Utility Customers
Electric Service Plan/Behavioral Program
Evidence Review Webcast

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September 9, 2014

2014 Research Results

Electric Service Plan/Behavioral Program Evidence Review

Topical summaries and interpretation of findings disseminated via webcast

1. Opt-in vs. Opt-out: Impacts Implications – July 29
   Presentation available to everyone at no charge (3002004318)
2. **Peak Time Rebate vs. Critical Peak Pricing: Which is Better? – September 9, 1:00 pm to 3:00 pm CDT *during advisory meeting and via webcast***
3. Customer Acquisition and Retention Costs – December 2, 2:00-3:30 pm EDT

Objectives

- **Summarize what we know about the advantages and limitations of two similar products designed to achieve the same effect on electricity demand**
  - Peak Time Rebate (PTR – aka Critical Peak Rebate)
  - Critical Peak Pricing (CPP)
- **Comparison Measures include:**
  - Product design goals
  - Implementation issues (billing vs. measuring impacts)
  - Empirical measures of program performance
- **How to determine what's best for your market and customers?**

Outline of Presentation

I. Policy goals that electricity pricing can help achieve

II. Basic dimensions of rate design

III. Design comparisons

IV. Estimating the customer baseline load for PTR

V. What have we learned from field trials?

VI. Summary of the debate

VII. How to assess which rate design is right for your company

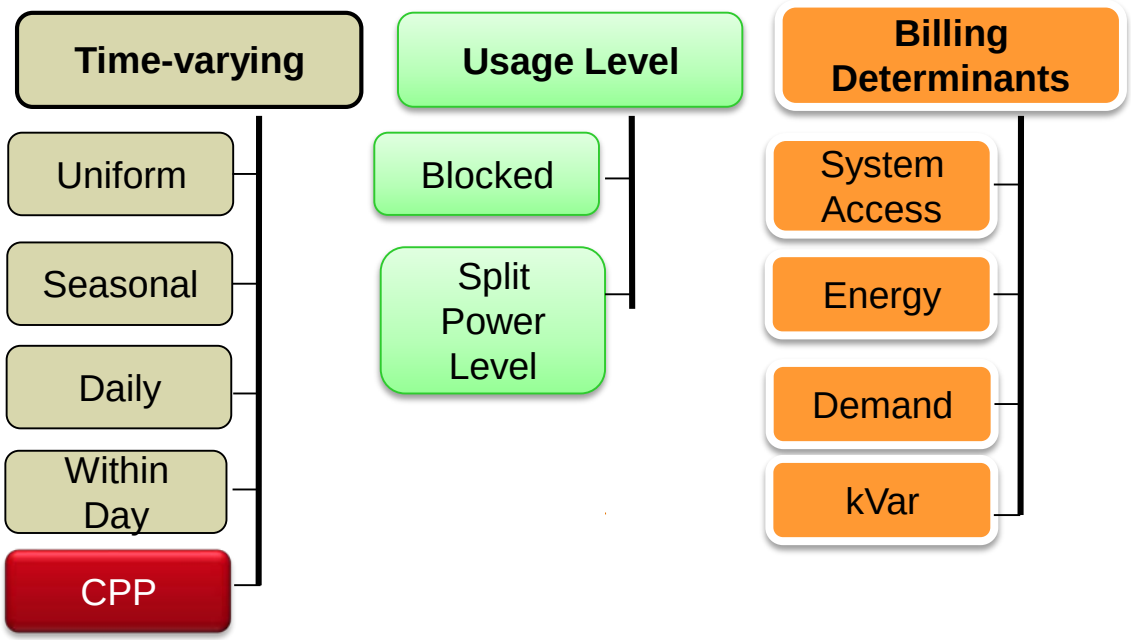
I. Policy goals that electricity pricing can help achieve

- **Promote conservation** (reduce kWh to save fuel & purchased power costs)
- **Reduce peak load** (reduce the need for capacity)
- **Promote load shifting** (reduce peak load and improve system load factor)
- **Maintain system reliability** (reduce load to avoid outages)
- **Promote *economic* efficiency** (reflect forward-looking marginal costs)
- **Produce revenues sufficient to cover costs**
- **Provide service at affordable rates**

CPP and PTR are primarily aimed at peak load reduction, load shifting, reliability

II. Basic Dimensions of Rate Design

Price Response Building Blocks



Demand Response Overlays and Options

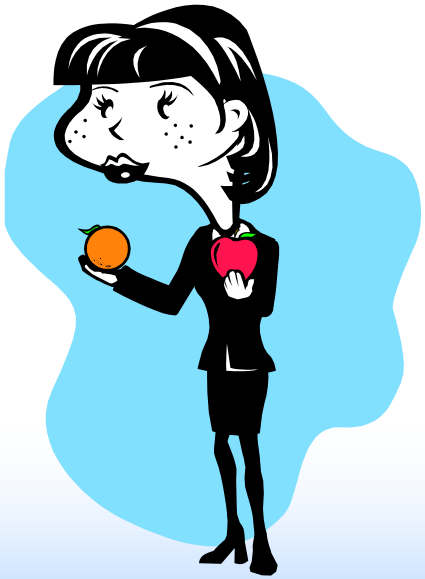
Product Overlays

- Direct Load Control
- Interruptible/Curtailable
- Peak Time Rebate

Hedging Options

- Price
- Quantity
- Price & Quantity

III. Design Comparisons



Design Features to be Compared

- Resource goal – what is the pricing structure designed to achieve?
- Event periods and definitions
- Event price – how derived?
- Technology required
- Financial design basis
- Customer bill impacts
- Need for a customer-specific baseline load (CBL)

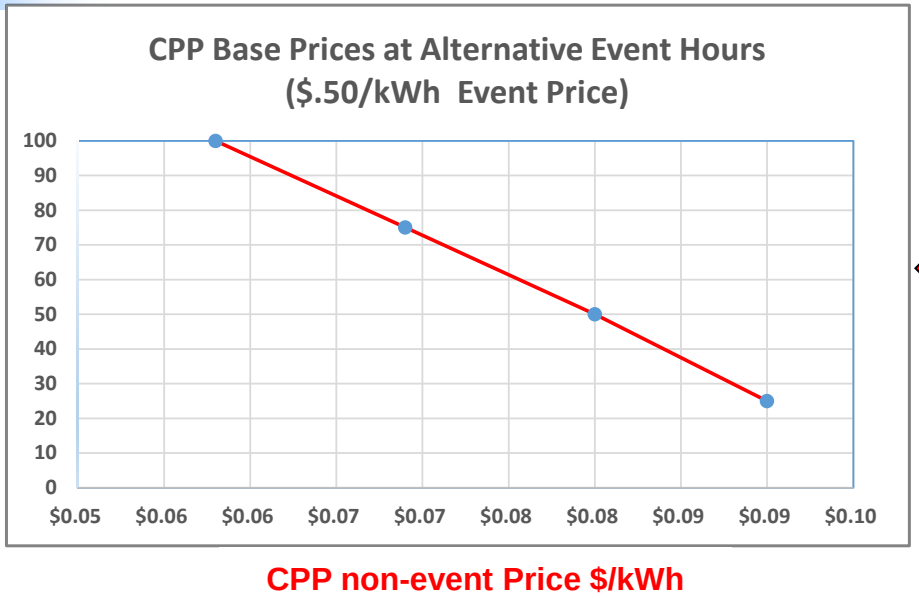
Design Feature Comparison (1)

Design Feature	CPP	PTR
Resource goal	• Situation-specific peak load reduction	Same
Definition of event periods	• Forecast of highest system peak hours in the year • Notice, duration and number of events defined in advance	Same
Event price	• Typically based on avoided cost of a peaking unit or customer outage costs • Price is typically posted in advance and applies to all events	Same

Design Feature Comparison (2)

Design Feature	CPP	PTR
Technology required for implementation	• Interval metering	• Interval metering plus back office settlement system
Financial basis for the rate design	• Revenue neutrality: Projected revenue from CPP events + revenues for all other hours = financial base case • Base rate adjusted downward to reflect the expected revenues from CPP events	• Estimation of the rebate is based on the value attributed to the load reduction • Does not require revenue neutrality • Does require a recovery mechanism to collect the cost of the rebates paid

CPP Design Tradeoffs

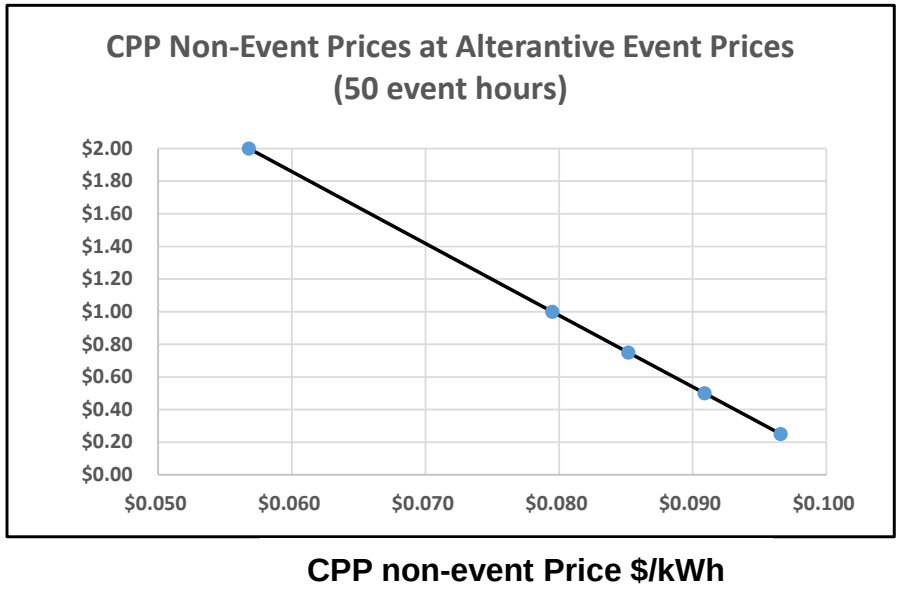


The larger the number of event hours, the lower the CPP non-event hour price

(Assumes $0.50/kWh event price and $0.10/kWh conventional rate price/kWh)

The higher the event price, the the lower the CPP non-event hour price

(Assumes 50 event hours and $0.10/kWh conventional rate price/kWh)



Example Rates – CPP v. PTR* (3)

Rate Component	Standard Rate	CPP	PTR
Basic Monthly Charge	$4.25	$4.25	$4.25
Non-CPP kWh	14.25 ¢/kWh	9.9 ¢/kWh	14.25 ¢/kWh
CPP or PTR Events	14.25 ¢/kWh	$1.05/kWh	• 14.25 ¢/kWh • **PTR rebate:** for all kWh below a customer baseline load (CBL), customer receives a rebate of $1.05/kWh.

*Standard and CPP Rates are for the Marblehead Municipal Light Department EnergySense CPP Pilot. In this example, the PTR rebate is assumed to be equal to the CPP event price.

Design Feature Comparison (4)

Design Feature	CPP	PTR
Customer bill impacts	• Can create winners and losers relative to standard rate w/o CPP • May require revenue adjustments if all events are not called (otherwise utility under-collects revenue)	• No losers (if customers don't respond, they aren't penalized) • Could create windfall gains due to how the CBL is defined
Perceived impact on individual customers	• Can be major in months when events are called	• None – It's an opportunity, not an obligation. Customers who don't respond don't see an impact on their bills.

CPP Creates Structural Winners and Losers

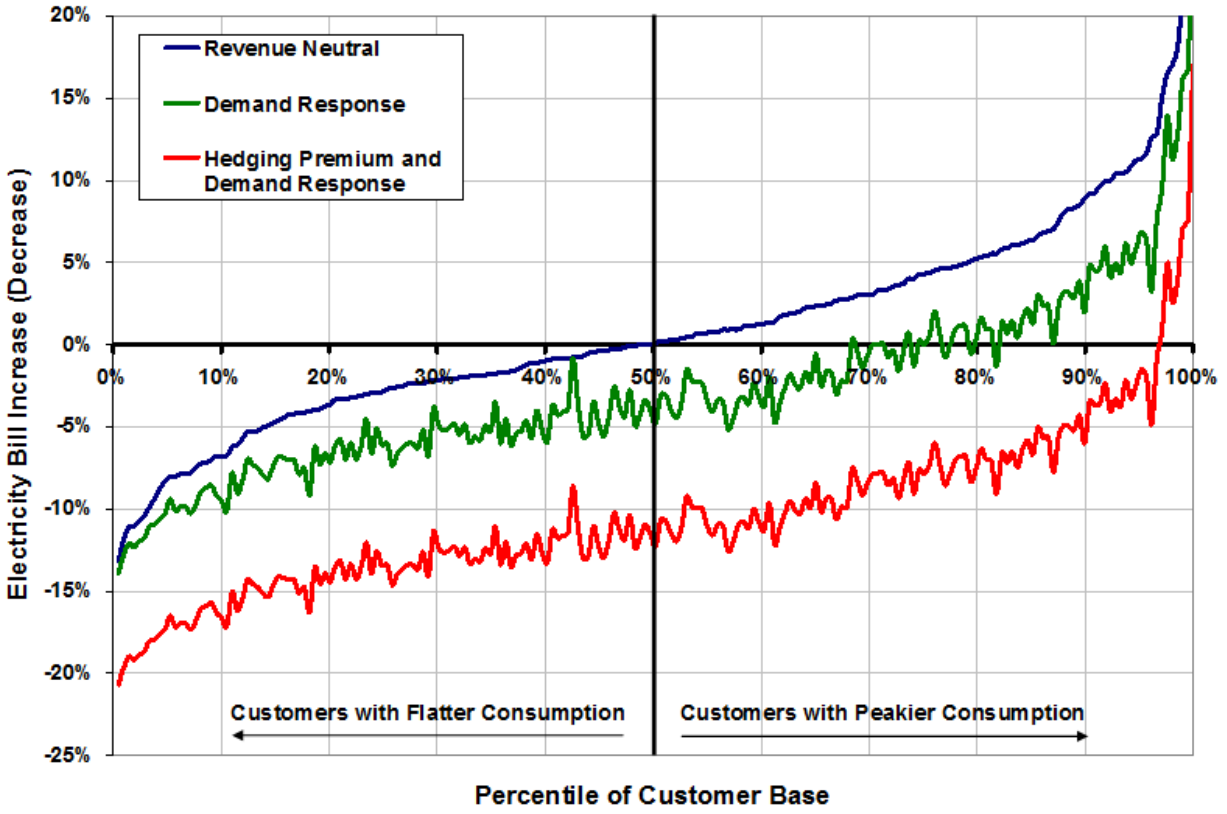


Figure 8: Distribution of Bill Impacts Due to Hypothetical CPP Rate

Source: Faruqui, A., Hledik, R., Neenan, B. September 2008, The Power of Dynamic Pricing; A Case Study of California. Prepared for LBL Demand Response Research Center .

IV. Estimating the Customer Baseline Load (CBL)

CPP vs. PTR: Estimating the Customer Baseline Load (CBL)

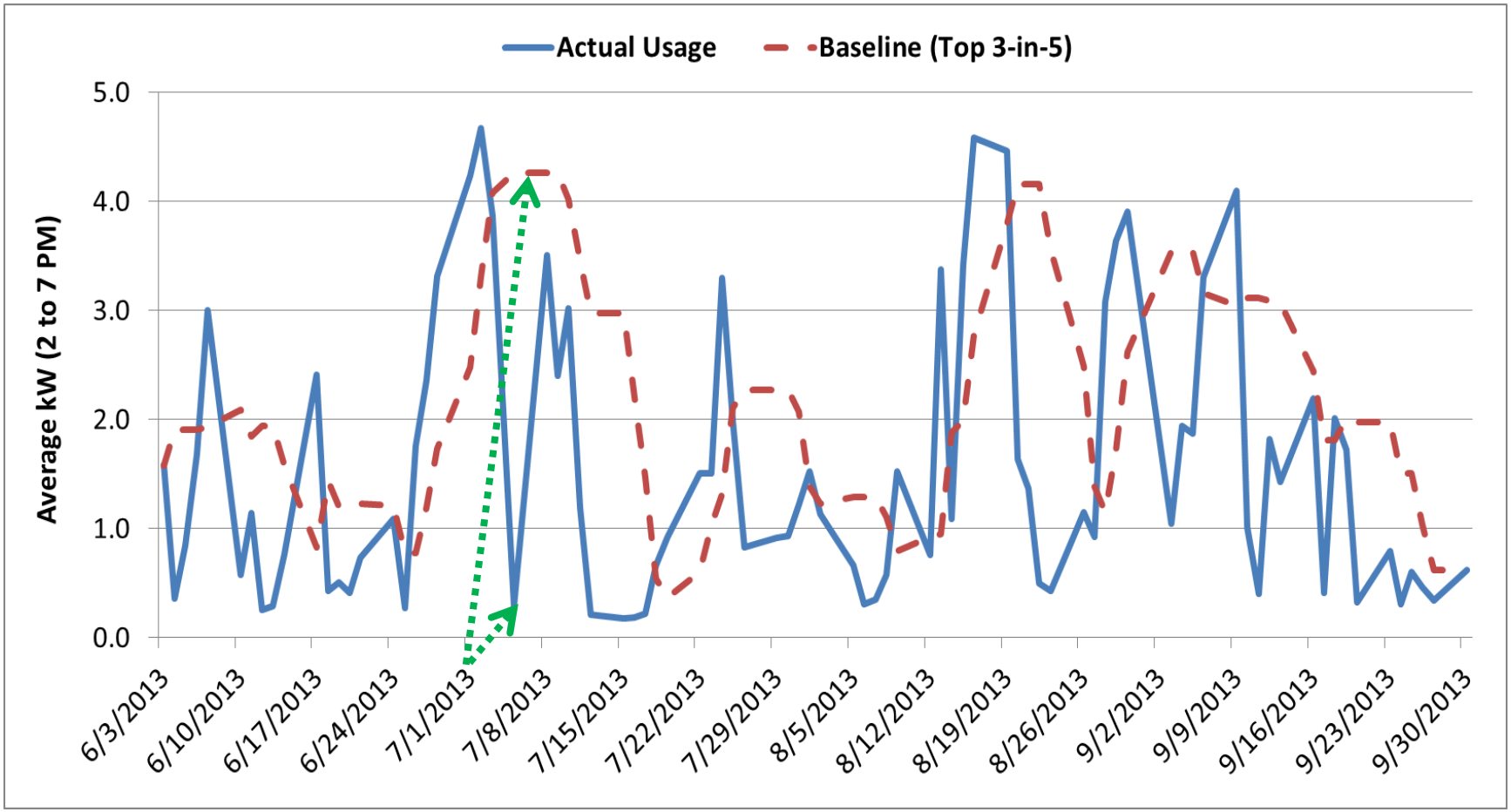
- **For the purpose of rendering a bill:**
  - CPP does not require a CBL for billing – all kWhs during an event are simply billed the CPP rate
  - PTR does require a CBL – an estimate of what the load otherwise would have been, but for calling the event
- **The need for a CBL:**
  - Is considered by some to be a major flaw in PTR relative to CPP
  - But is actually an issue for both CPP and PTR if the goal is to determine what the two rates actually deliver in terms of load reduction
- **The challenge with estimating the CBL:**
  - ***How do measure something you cannot directly observe - the counterfactual?***

Commonly Used CBL Methodologies*

- **Day matching adjustment**
  - Example: Average of 3 days with the highest loads in the last 5 eligible days (eligible days are days preceding the event that are non-event, non-holiday weekdays)
- **Weather matching adjustment**
  - Example: Average of 3 days with similar weather during the last 3 months
- **Use of adjustments**
  - Either day- or weather-matching plus adjustments based on the difference in energy use in the hours leading up to the event period for the baseline days and the day of the event

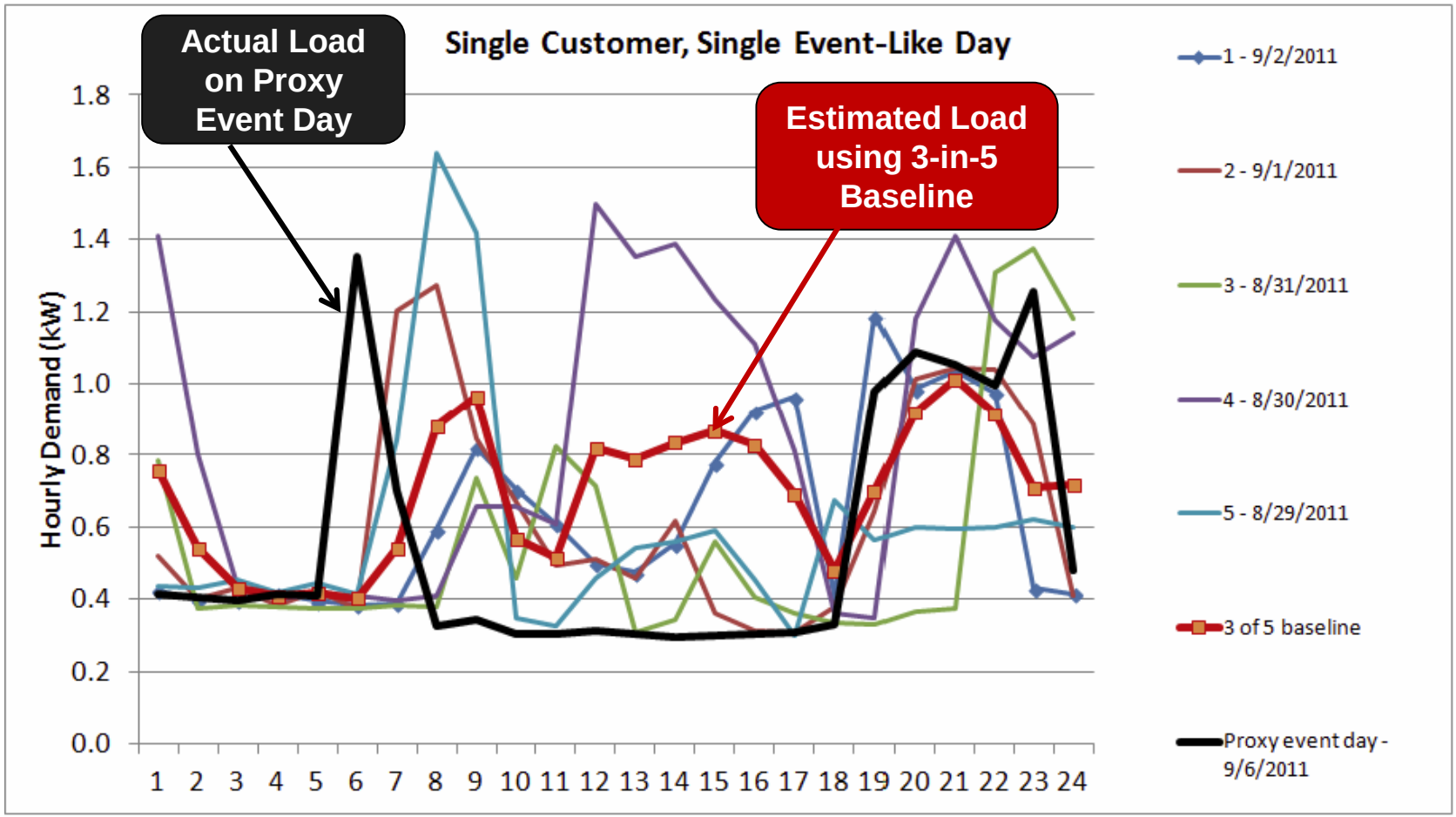
*Commonwealth Edison, "Customer Baseline Load, Direct Load Control, and Pre-Enrollment Research," Presentation to Smart Grid Advisory Council Meeting, Nov. 12, 1013, slide 5.

Individual Customer Loads Compared to Estimated CBL Using "Best Method" (Top 3-in-5) – Nonevent days



Josh Shellenberg, "Key Insights from California's Large-scale Implementations of Residential Dynamic Pricing," Western Load Research Association, Spring 2014 Meeting and Conference, April 9-11, 2014, San Francisco, CA, slide 14.

Accurately Estimating Loads for a Single Customer is very Difficult



Steve George, "Options for Reducing Peak Load," Michigan Retreat on Peak Shaving to Reduce Wasted Energy," Lansing Michigan, August 6, 2014. A 3-in-5 baseline is the three highest load days out of the preceding 5 eligible days. An eligible day is defined as a day preceding the event that is a non-event, non-holiday weekday.

V. What Have We Learned from Field Trials?

- Reviewed quality field trials completed in the past decade
- Opt-in and opt-out pilots considered separately
- Reviewed results for PTR, CPP and VPP (variable peak pricing, a variant of CPP)
- Focus is on reports that estimated elasticities of substitution as well as percentage load reductions

Selected Field Trials: References

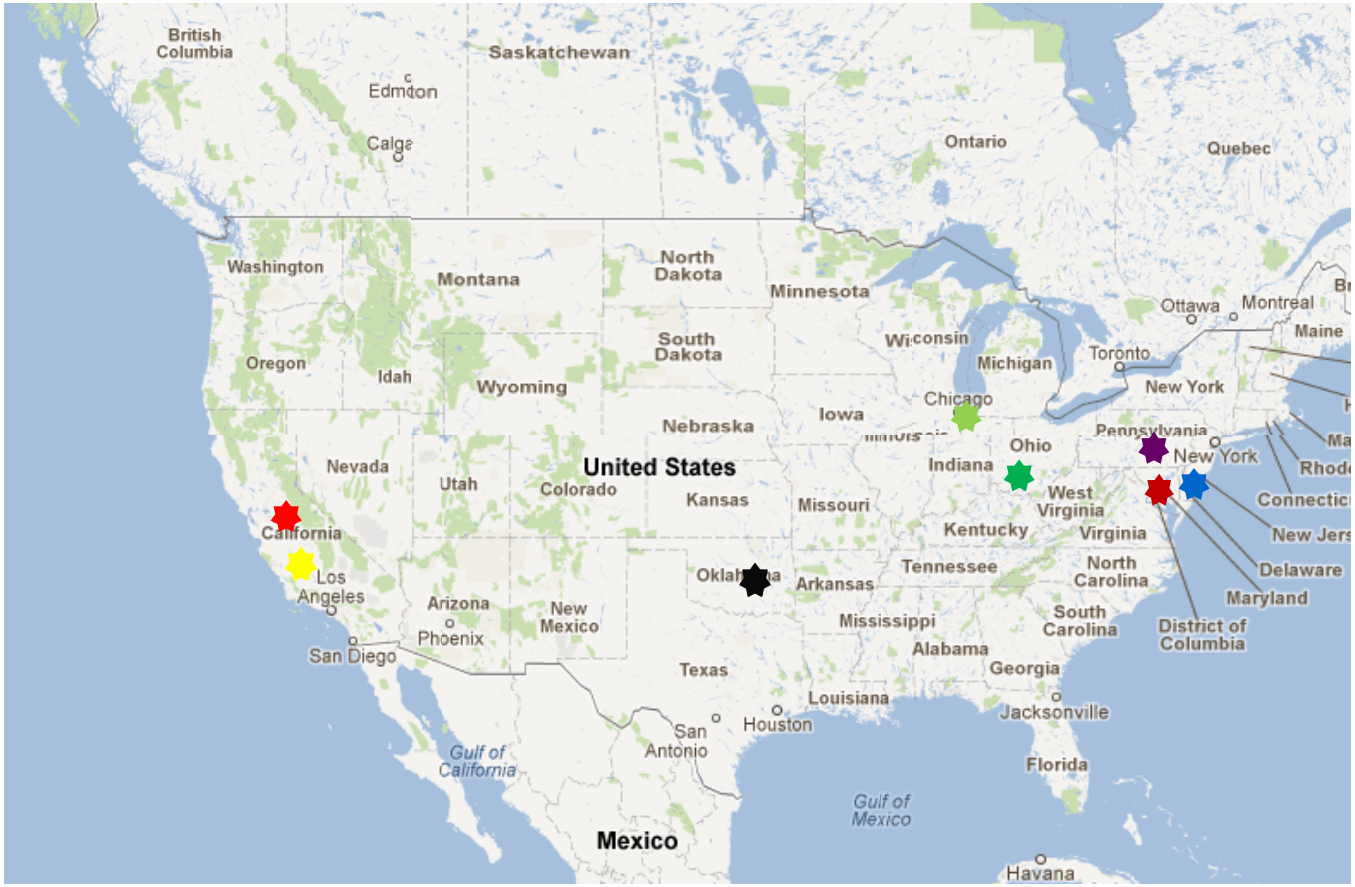
Opt-in Pilots

- Baltimore Gas and Electric (BG&E) *Smart Energy Pricing Pilot* (Baltimore, MD; summer 2008)
- *California Statewide Pricing Pilot* (CA-SPP) (Statewide; July 2003-Dec. 2004)
- Connecticut Light & Power (CL&P) *Plan-It Wise Energy Pilot* (Connecticut; June 1 - Aug. 31 2009)
- Oklahoma Gas & Electric (OG&E) Positive Energy Together® pilot (Norman, OK; June 1-Sept. 30 2010)
- Public Service Electric and Gas (PSE&G) myPower Pricing (New Jersey; summer 2006-summer 2007)
- FirstEnergy's Consumer Behavior Study: Preliminary Evaluation for the Summer 2012

Opt-out Pilots

- *ComEd Customer Application Program* (CAP) (Chicago, IL; June 2010-May 2011)
- Sacramento Municipal Utility District (SMUD) *Smart Pricing Options Pilot, Interim Load Impact Evaluation* (June 2012-Sept. 2013)

Selected Field Trials By Location



- SMUD
- California SPP
- CL&P
- ComEd CAP
- FirstEnergy
- PSE&G
- OG&E
- BG&E

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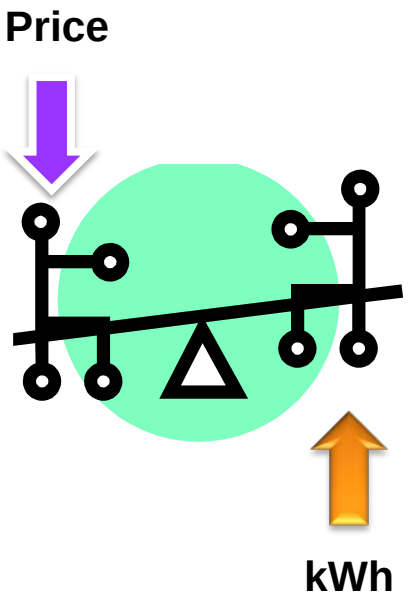
Definitions of Impacts

- **Load Impacts** – percent change in participant load during the peak (or event period) compared to the control group
- **Elasticity of Substitution** – measures shifting from peak to off-peak hours due to a 1% change in the ratio of off-peak to peak prices. (Normally reported as a positive number)



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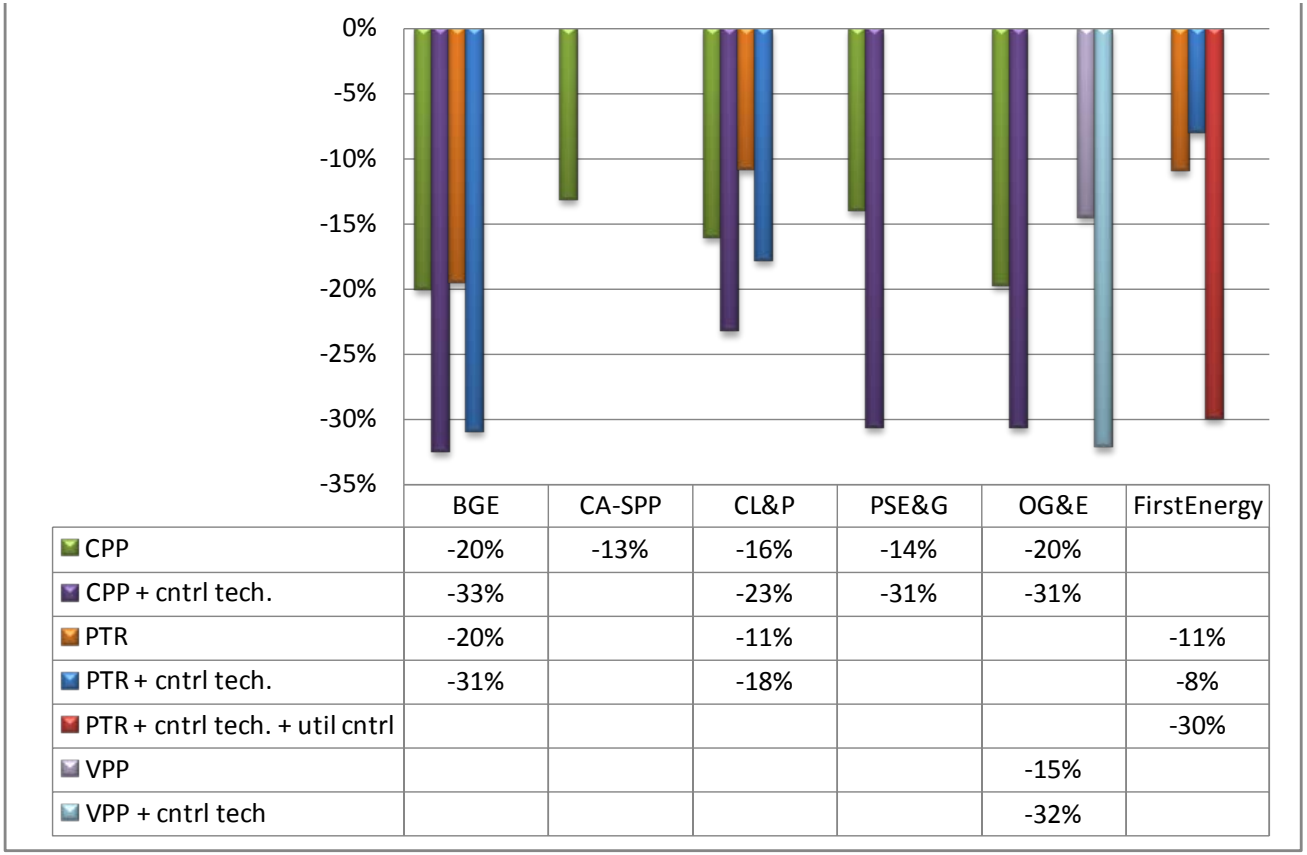
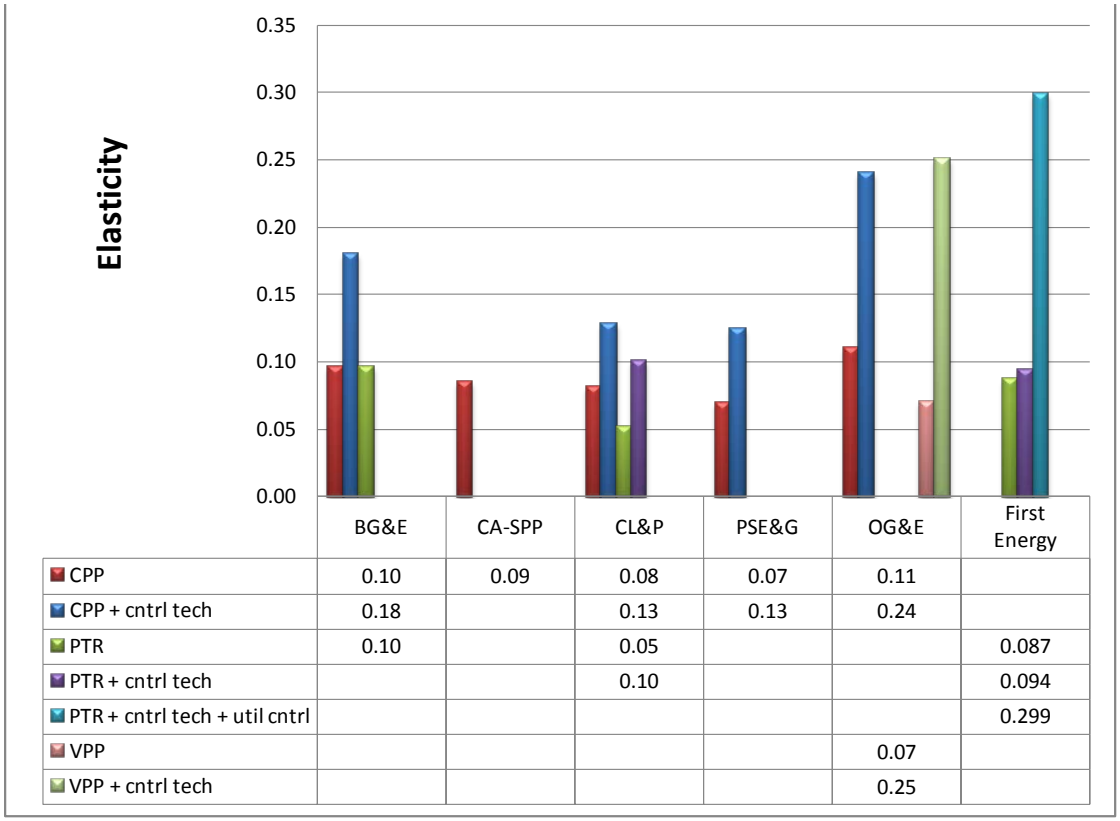
Percentage Load Reductions during Events (Opt-In Pilots)



	BGE	CA-SPP	CL&P	PSE&G	OG&E	FirstEnergy
CPP	-20%	-13%	-16%	-14%	-20%	
CPP + cntrl tech.	-33%		-23%	-31%	-31%	
PTR	-20%		-11%			-11%
PTR + cntrl tech.	-31%		-18%			-8%
PTR + cntrl tech. + util cntrl						-30%
VPP					-15%	
VPP + cntrl tech					-32%	

- Estimated load impacts vary by a factor of 4:1 across all utilities for these rates
- Adding control technology (which in most cases was a programmable communicating thermostat (PCT)) usually increases the impact by 25 to 100%

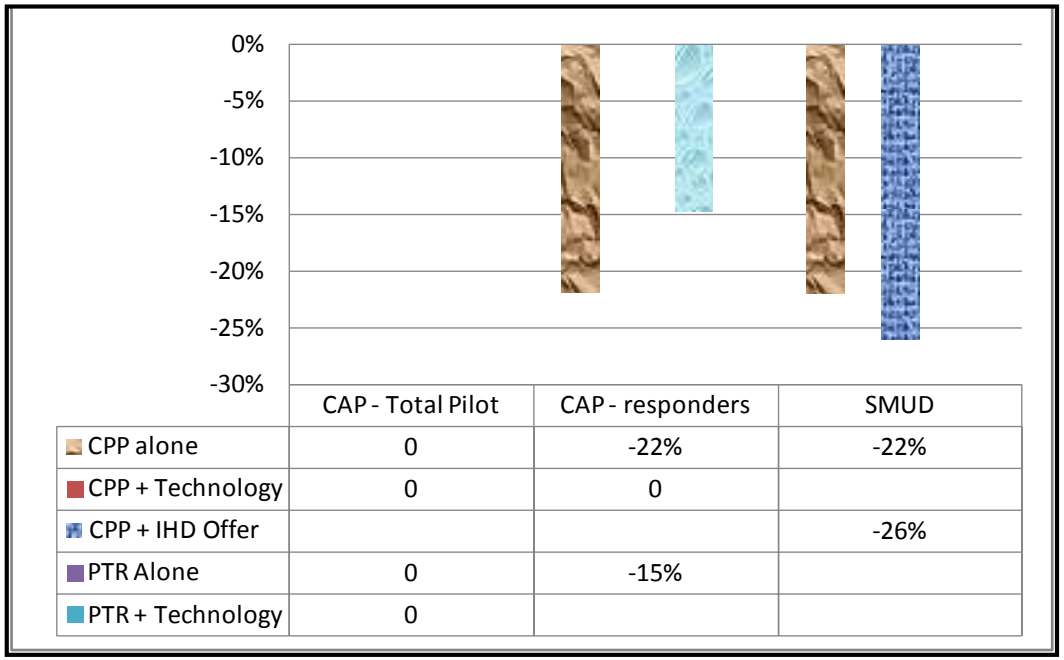
Elasticities of Substitution for Opt-In Pilots



	BG&E	CA-SPP	CL&P	PSE&G	OG&E	First Energy
CPP	0.10	0.09	0.08	0.07	0.11	
CPP + cntrl tech	0.18		0.13	0.13	0.24	
PTR	0.10		0.05			0.087
PTR + cntrl tech			0.10			0.094
PTR + cntrl tech + util cntrl						0.299
VPP					0.07	
VPP + cntrl tech					0.25	

- EoSs vary by a factor of 2:1 across most utilities for the same rate structure
- Adding control technology increases the EoS by 50 to 100%
- Adding control technology plus utility control increased the effect by 200%

Percentage Load Reductions during Events (Opt-Out pilots)



	CAP - Total Pilot	CAP - responders	SMUD
CPP alone	0	-22%	-22%
CPP + Technology	0	0	
CPP + IHD Offer			-26%
PTR Alone	0	-15%	
PTR + Technology	0		

- ComEd Pilot had high enrollment rates (98%) (i.e. only 2% opt-out rate); but no significant treatment-level load reductions (compared to the control group)
- However, a subset of ComEd treatment subjects (ranging from 4.8 to 10.2% of the total participant load) responded to events with load reductions ranging from -5.6 to -21.8%, consistent with response rates seen in opt-in treatments
- SMUD found 22-26% load reductions at the treatment level compared to the control group. Elasticities should be reported in the final SMUD report.

VI. Summary of the Debate

A Fight to the Finish in California? Nexant's View: CPP works; PTR Does Not

Argument*

- **CPP is like duct tape – it works in every situation**
  - Opt-in and default
  - With and without AC control
  - With and without balanced payment plans
  - For structural winners and losers (in the sense that, all can benefit from shifting)
- **PTR is like giving free chips away at the casino**
  - Extremely expensive
  - Low response, especially for default (***opt-out***) customers
  - Bad economics (CBLs rarely represent individual customer loads)

Counter Argument

- **CPP does not "work" in every situation**
  - It works to collect the utility's total revenue requirement, but only if all events are called
  - It does not work for all customers because it creates windfall winners and losers
  - All customers do not benefit in the sense of having lower bills than on the standard rate
- **PTR can work, if properly implemented**
  - Offer on an opt-in rather than opt-out basis
  - All rate structures are based on average customer characteristics, not just PTR
  - There are fixes to mitigate some of the problems noted (set thresholds for load reductions; set minimum levels for payouts, etc.)

*Josh Shellenberg, "Key Insights from California's Large-scale Implementations of Residential Dynamic Pricing," Western Load Research Association, Spring 2014 Meeting and Conference, April 9-11, 2014, San Francisco, CA.

Proponents of PTR

Argument

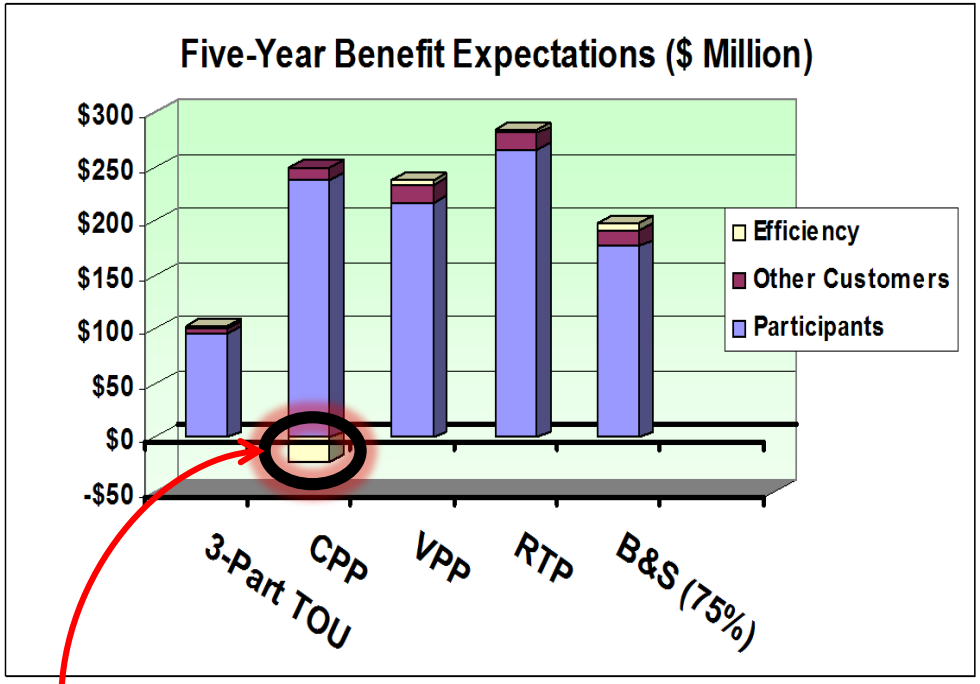
- **PTR is customer-friendly**
  - Customer can choose whether to participate
  - There are no windfall losers relative to the status quo because credits are paid as a rebate
  - Individual (participant) customer bills can only go down
  - It's available as needed, but there's no obligation to use it

Counter-Argument

- **PTR is not a free lunch**
  - There can be some cost-shifting because the cost of rebates must be collected through revenue requirements. However, the effects are not likely to be noticeable to customers
  - It can be difficult for participants to benefit if they don't know their CBLs and their energy consumption during events
  - Benefit to purposeful responders may be too small to be noticed or bother with

How do CPP and PTR Affect Overall System Performance (Efficiency)?

- Simulations of impacts of alternative retail rates on ISO-NE market performance
- Conducted in 2005
- Results used to support VPP as the default rate in Connecticut for C&I customers



- CPP produced negative economic efficiency impacts because in many hours, the CPP price was lower or higher than the market price (LMP)
- VPP produces greater positive net benefits because event prices are set to reflect prevailing market prices

CPP vs. PTR: A Distinction without a Difference at the system level? At the customer level?

- During events, CPP and PTR appear to offer customers the exact same proposition when they have the same event price/inducement (e.g. $0.50/kWh)
  - CPP – every kWh reduced results in a bill reduction of $0.50
  - PTR – every kWh reduced relative to a CBL earns a payment (and hence a bill reduction) equal to $0.50
- Back to the psychology of gains and losses
  - CPP – prospect of losing the benefit earned through the lower non-event price vs. prospect of a loss due to kWh consumed during events
  - PTR – prospect of not realizing a gain vs. prospect of paying slightly more per kWh
- What constitutes the status quo bias in this case, and how does it affect customer response?

Summary – Subtle but Important Differences

- **They have different benefit distribution impacts**
  - Opt-out PTR may result in excessive payments for no load reduction
  - Opt-in CPP may attract mostly structural winners that also erode performance
- **Both are call options, but structured differently**
  - PTR is a free call option in the sense that the utility doesn't need to use it to collect its revenue requirements. (It does, however, need a way to collect the cost of the rebates if PTR events are called.)
  - CPP – utility pays the call option value up front (through lower base rates) and the utility takes the risk of benefitting or not
- **Different risks**
  - CPP with limited calls may result in missing the peak and payments for avoided costs are for naught
  - PTR response may be more dependent on exigent conditions since no penalty is assessed for non-response.

VII. How to assess which rate is right for your company?

How to Decide Between CPP and PTR (1)

- **Start with your company goals:** Whether CPP or PTR is best for your utility's circumstances will depend on your goals.
  - Among the resource goals listed on slide 5, is reducing peak load or load shifting a major objective? If not, then neither option may fit your needs.
- **Issues that apply to both CPP and PTR:**
  - How to recruit customers – opt-in v. opt-out (default)
  - Resources required for implementation (PTR requires back-office for estimating the CBL for billing; CPP does not)
  - How will you measure the ongoing load response of the program (for assessing program effectiveness)?
- **Issues that are different for CPP and PTR:**
  - Potential customer bill impacts
  - Potential financial impacts on the company – what happens if you don't bill all the CPP events due to mild weather? How will you collect the cost of the rebates for PTR?

How to Decide Between CPP and PTR (2)

- **Listen to key interest groups:** Customers, regulators, consumer advocates and all parts of the company. Look for areas of agreement, as well as areas of disagreement. Both will contribute to making good decisions about program implementation

- **Let the customers speak (and listen) –** How customers will respond to the approach is key – is a dip in overall satisfaction worth the gains?

Can CPP and PTR Coexist in a Electricity Service Plan Portfolio? (1)

- **Both products can be used in the same portfolio, even if the goal of both is to achieve the same objective:**
  - If the objective is to avoid the need to build or buy additional capacity, both can still be in the same portfolio because they can appeal to different customers
  - There are some customers who are willing to reduce load if they are paid to do so, but who would not be willing sign up for a product like CPP because of its potential for negative bill impacts

Can CPP and PTR Coexist in a Electricity Service Plan Portfolio? (2)

- The two products can also be used to achieve different goals:
  - PTR-like products in wholesale markets are used as a reserve resource that is only called upon when, absent load reductions, compromised system reliability might require forced outages
  - CPP could be used as a capacity product to reduce peak usage to avoid capital expenditures (generation, distribution, or both)
  - The event prices would not be the same. They would need to be priced to reflect how they will be used
    - PTR prices should reflect customer outage costs
    - CPP prices should reflect the cost of new capacity
- Both require a revenue adjustment mechanism to keep the utility whole

Responses and Comments

- Donna Pratt, New York ISO
- Heather Anderson, BG&E
- Bryan Scott, OG&E

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