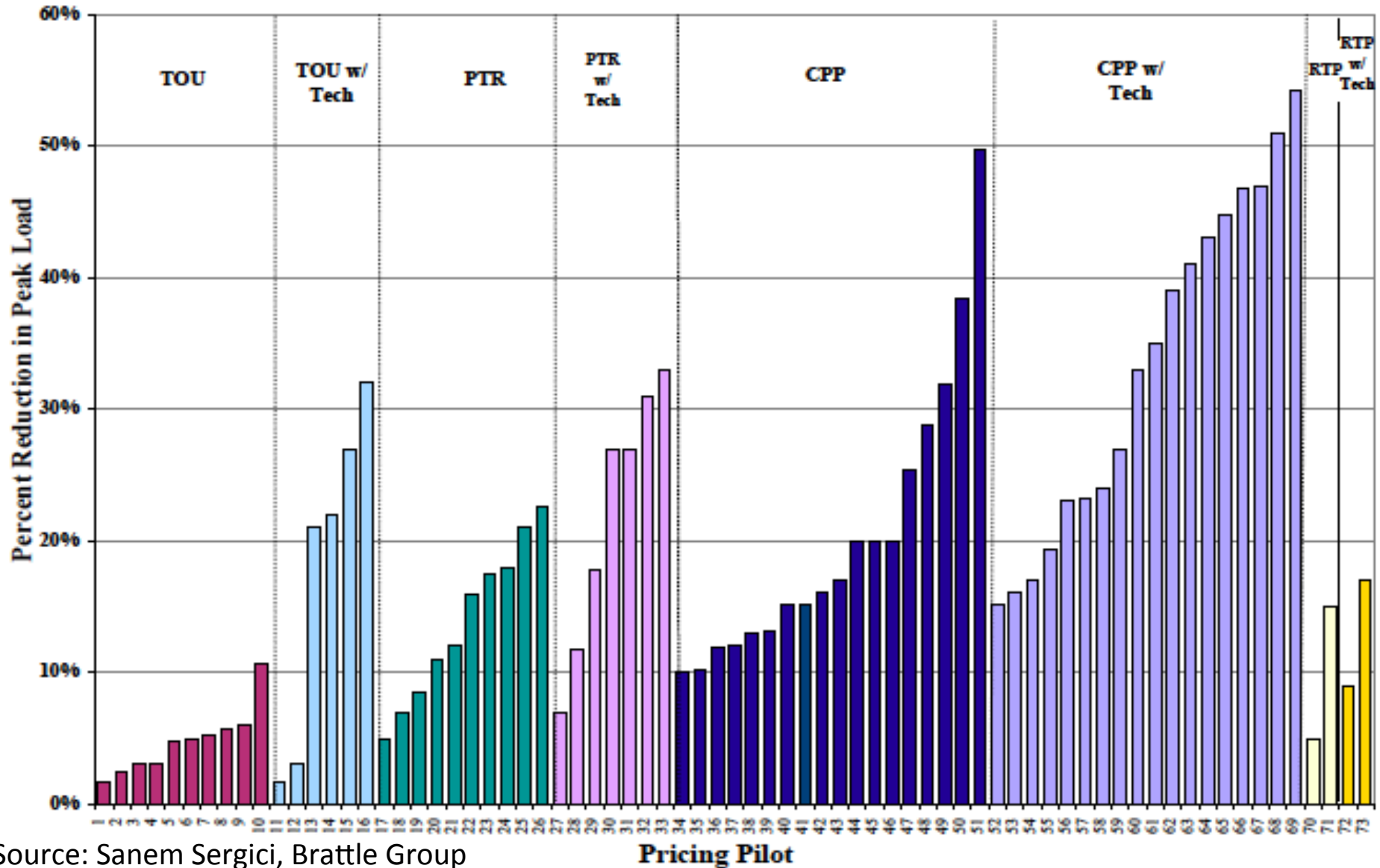




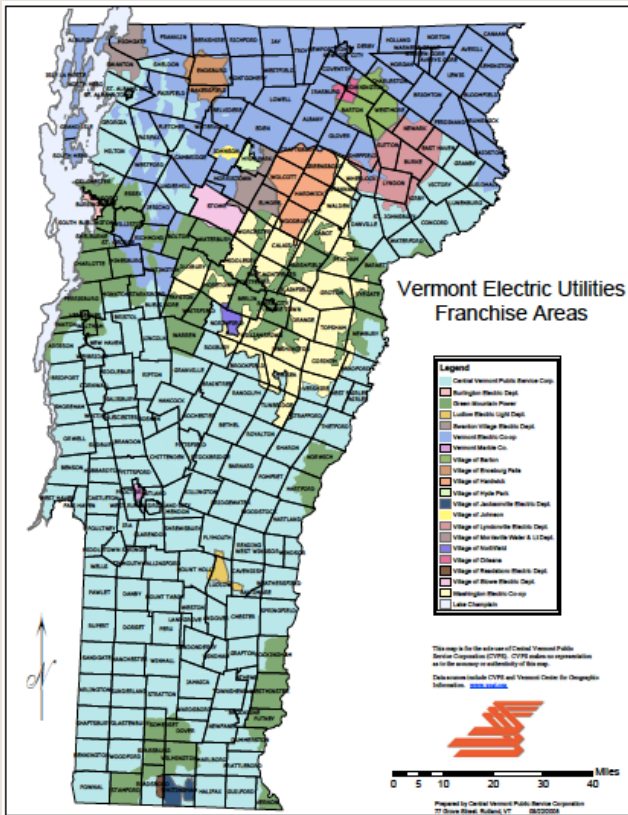
# Carrots and Sticks



Source: Sanem Sergici, Brattle Group

# eEnergy Vermont Experiment

Fall 2011



Dec. 2013

- Fall 2011: Smart meter installation begins.
- February – April 2012: Customer recruitment.
- April 2012: Smart meter installations completed. Meter data collection begins.
- August 2012: CPP and CPR customers placed on new rate; IHDs mailed to customers.
- September 14, 21, 25; Oct. 5, 2012: Year 1 events called.
- December 2012: Interim survey completed.
- July 5, 15, 16, 17, 18, 19, 2013: Year 2 events called.
- August 13, 21, 22, 28, 2013: Year 2 events called.
- Sept. 30, 2013: Meter data collection ends.
- December 2013: Post-treatment survey completed.

# eEnergy Vermont Experiment

- RCT involving 3,735 GMP residential customers in Rutland;
- Opt-in to enroll; opt-out at any time;
- Event-based study with 24-hour notification of “peak days,” rate treatments: peak pricing, peak rebates and a transition group who started on a rebate and were moved to peak pricing;
- Tech and no-tech groups;
- Notification mode choices (phone, e-mail, text message);
- Detailed pre/mid/post study surveys.

# eEnergy Vermont Experiment

Group No	Group Name	Survey	Year 1	Year 2	IHD	Notification	Required sample size
1	CPR	X	CPR	CPR		X	390
2	CPR+IHD	X	CPR	CPR	X	X	195
3	CPP	X	CPP	CPP		X	390
4	CPP+IHD	X	CPP	CPP	X	X	195
5	CPR-CPP	X	CPR	CPP		X	390
6	CPR-CPP+IHD	X	CPR	CPP	X	X	195
7	Flat+Notification	X	Flat	Flat		X	390
C1	Flat w/o Notification (Control)	X	Flat	Flat			390
C2	Control, No Survey		Flat	Flat			1200
<b>Totals</b>							<b>3735</b>

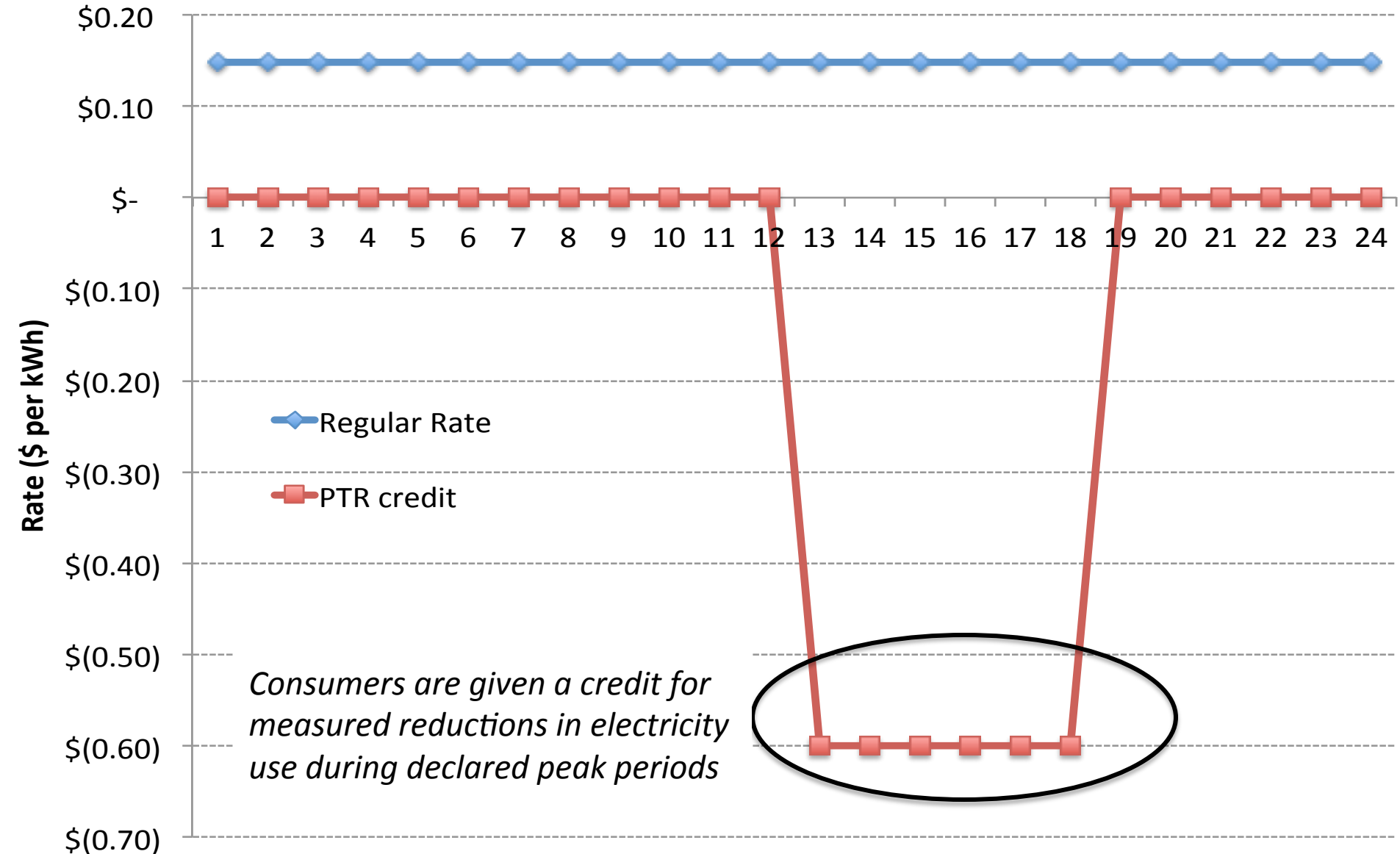
# eEnergy Vermont Experiment

Rate/Information Treatment	Technology Treatment
Critical Peak Price (CPP)	IHD
	No IHD
Critical Peak Rebate (CPR)	IHD
	No IHD
CPR in Year 1, CPP in Year 2	IHD
	No IHD
Flat Rate w/Notification	No IHD
Flat Rate w/o Notification	No IHD

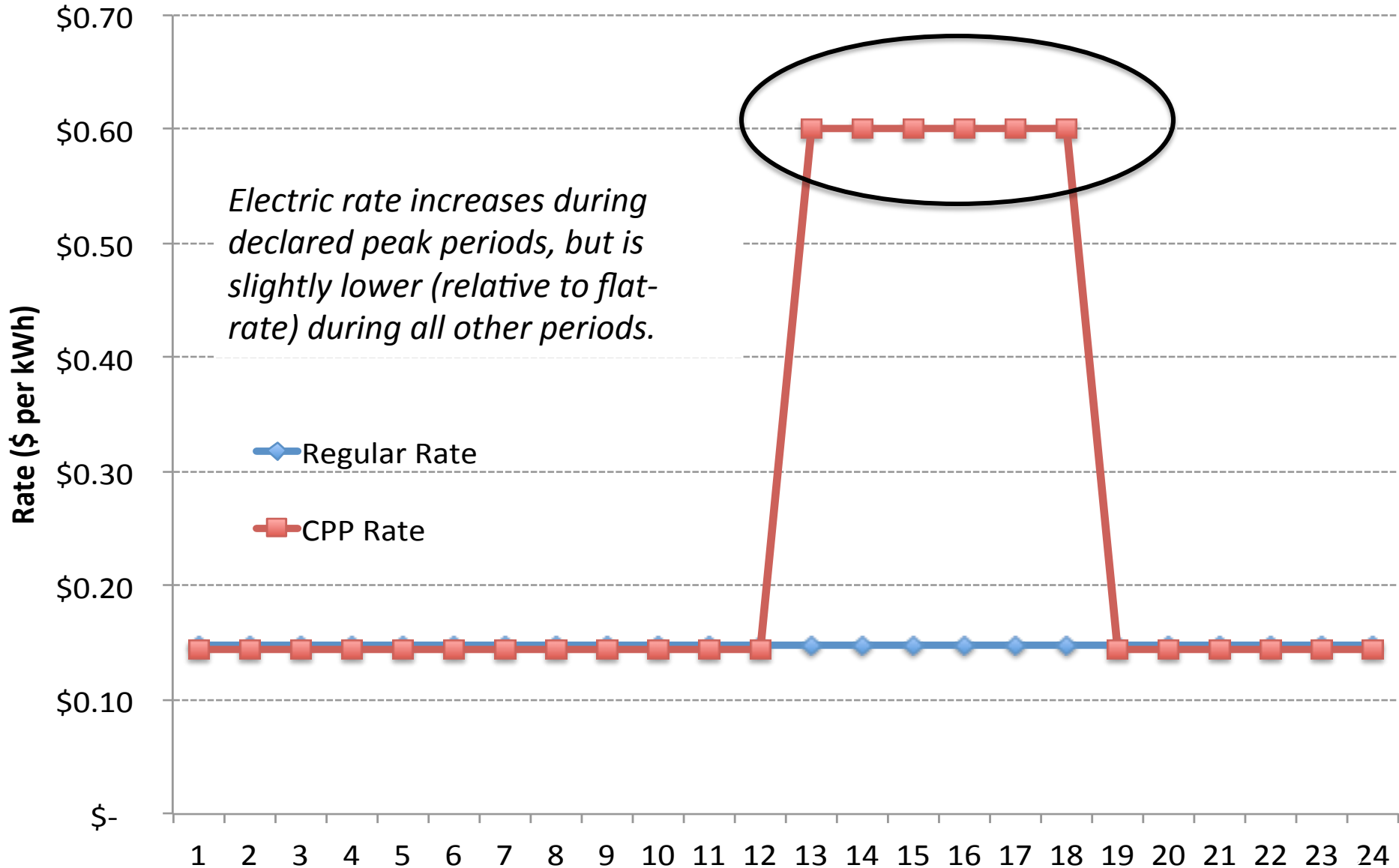
~ 4,000 customers involved in the pilot.

A “Hawthorne” group was created but no Hawthorne effect detected.

# The Carrot: Critical Peak Rebates (CPR)



# The Stick: Critical Peak Pricing (CPP)





# In Home Device (Circa the Stone Age)

TE<sub>N</sub>DRIL™



**Insight**  
In-Home Display

## Overview

- Displays current household energy use in both kilowatts and dollars-per-hour
- Displays current day accumulated energy usage and compares cost with previous day's cost

# CPR, CPP and GMP

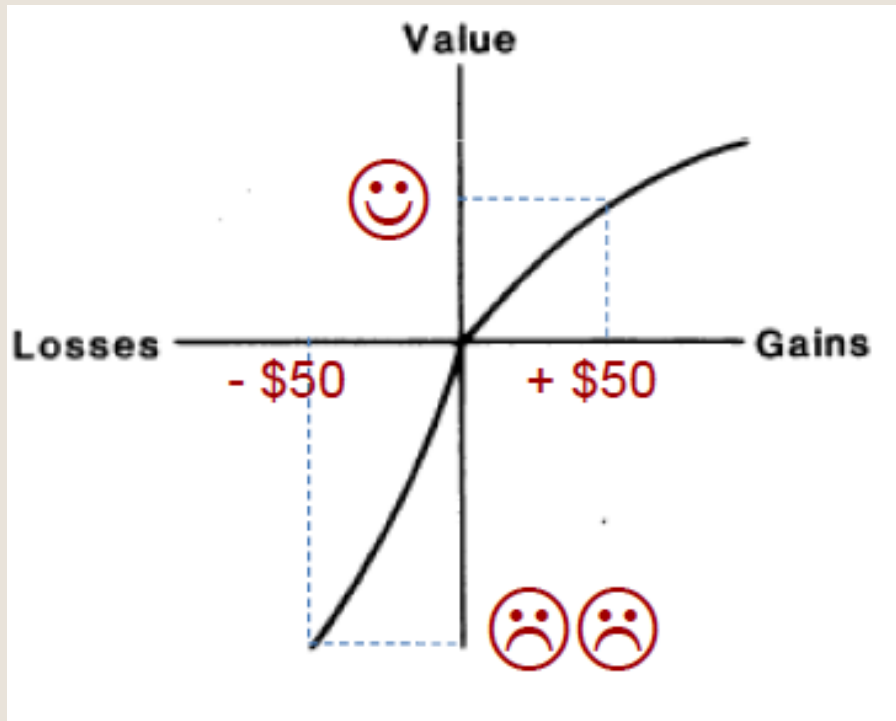


Image source: NPR

- Some utilities have run pilot programs that use peak-time rebates. Others have used critical-peak pricing.
- GMP was convinced to do both. This made their state regulator confused, and a little irritated. Aren't peak prices and peak rebates basically the same thing? Why punish the poor people of Vermont?

# Framing Gains and Losses

“The aggravation that one experiences in losing a sum of money appears to be greater than the pleasure associated with gaining the same amount.” - Kahneman and Tversky, 1979



Graphic: Annika Todd, LBNL

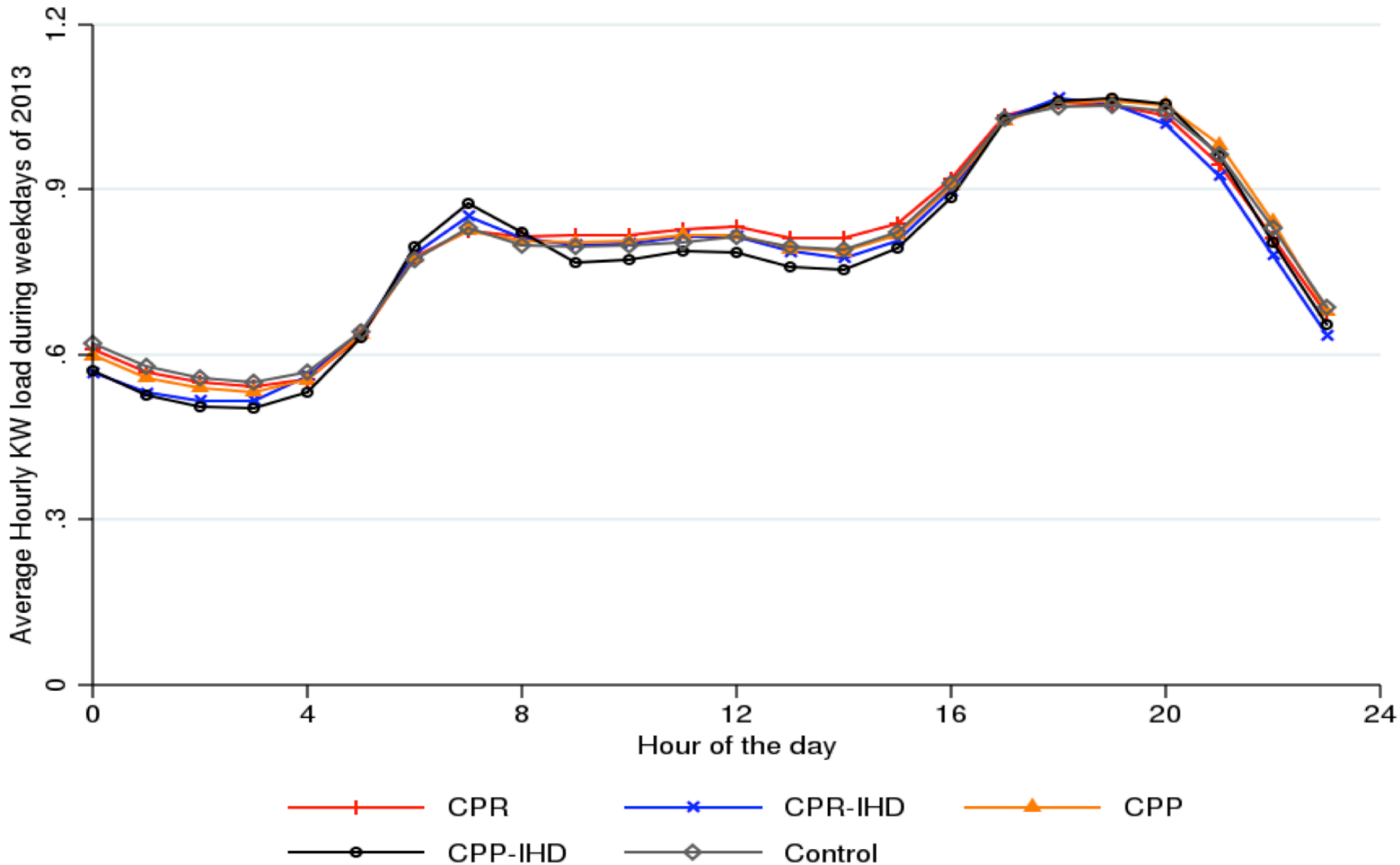
- Avoiding a loss is somehow preferred to achieving a gain that is identical in magnitude.
- Suggests that we should expect larger savings from CPP than CPR
- Can ratepayers be trained to like the stick?

# Data and Estimation

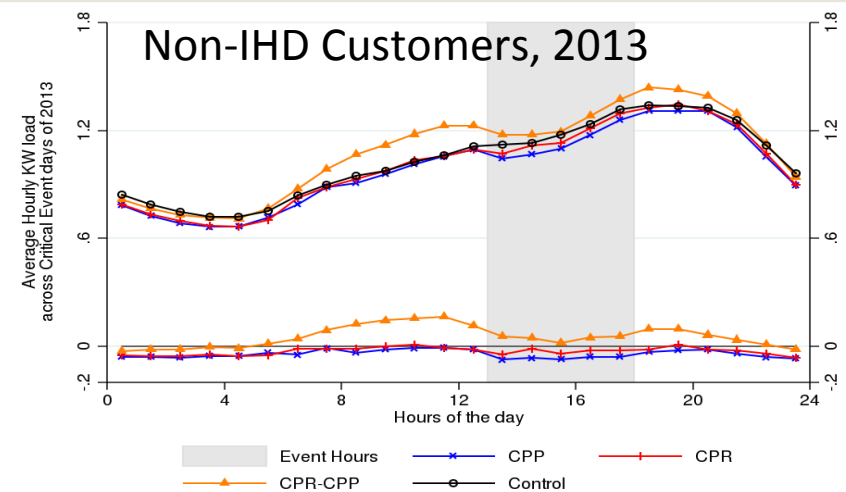
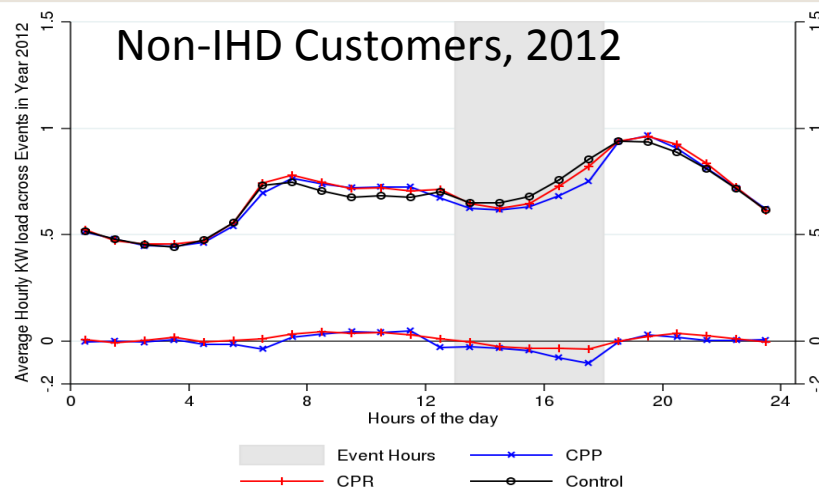
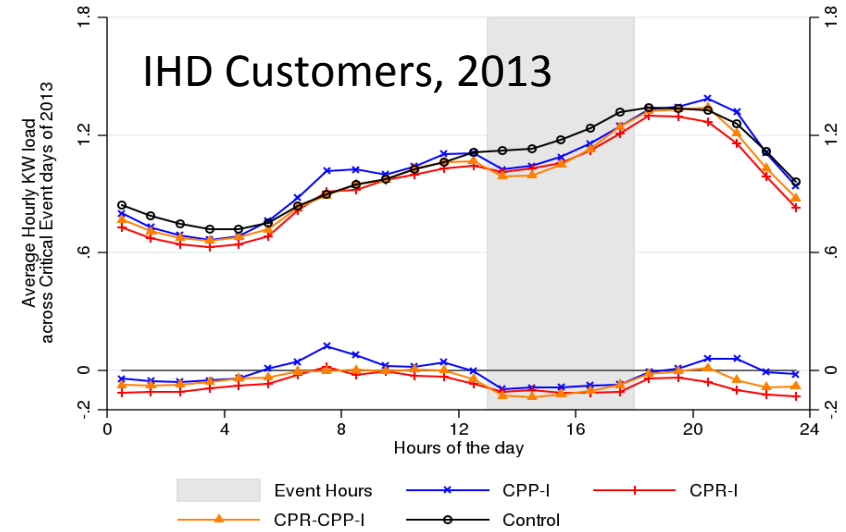
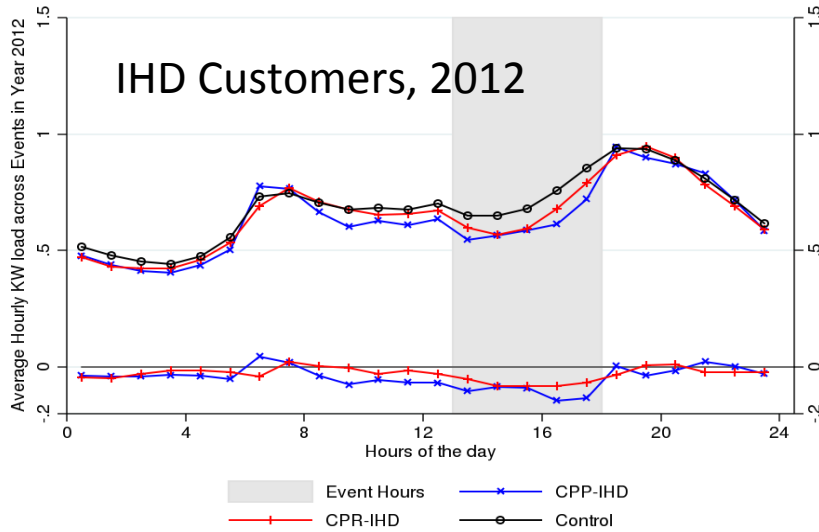
$$\begin{aligned} y_{it} = & \beta + \sum_j \beta_j T_{ij} + \sum_k \beta_k^{DB} DB_{ik} + \sum_k \beta_k^{DE} DE_{ik} + \sum_k \beta_k^{DA} DA_{ik} \\ & + \sum_j \sum_k \beta_{jk}^{DE(k)} T_{ij} DB_{kt} + \sum_j \sum_k \beta_{jk}^{DB(k)} T_{ij} DE_{kt} + \sum_j \sum_k \beta_{jk}^{DB(k)} T_{ij} DA_{kt} \\ & + \beta_t^{CD} CD_t + \beta_t^{HI} HI_t + \varepsilon_{it} \end{aligned}$$

- 15-minute interval meter data for several thousand GMP residential customers in Rutland
- Plus some socio-economic data (house size, appliance stock, income, education, household size, etc)

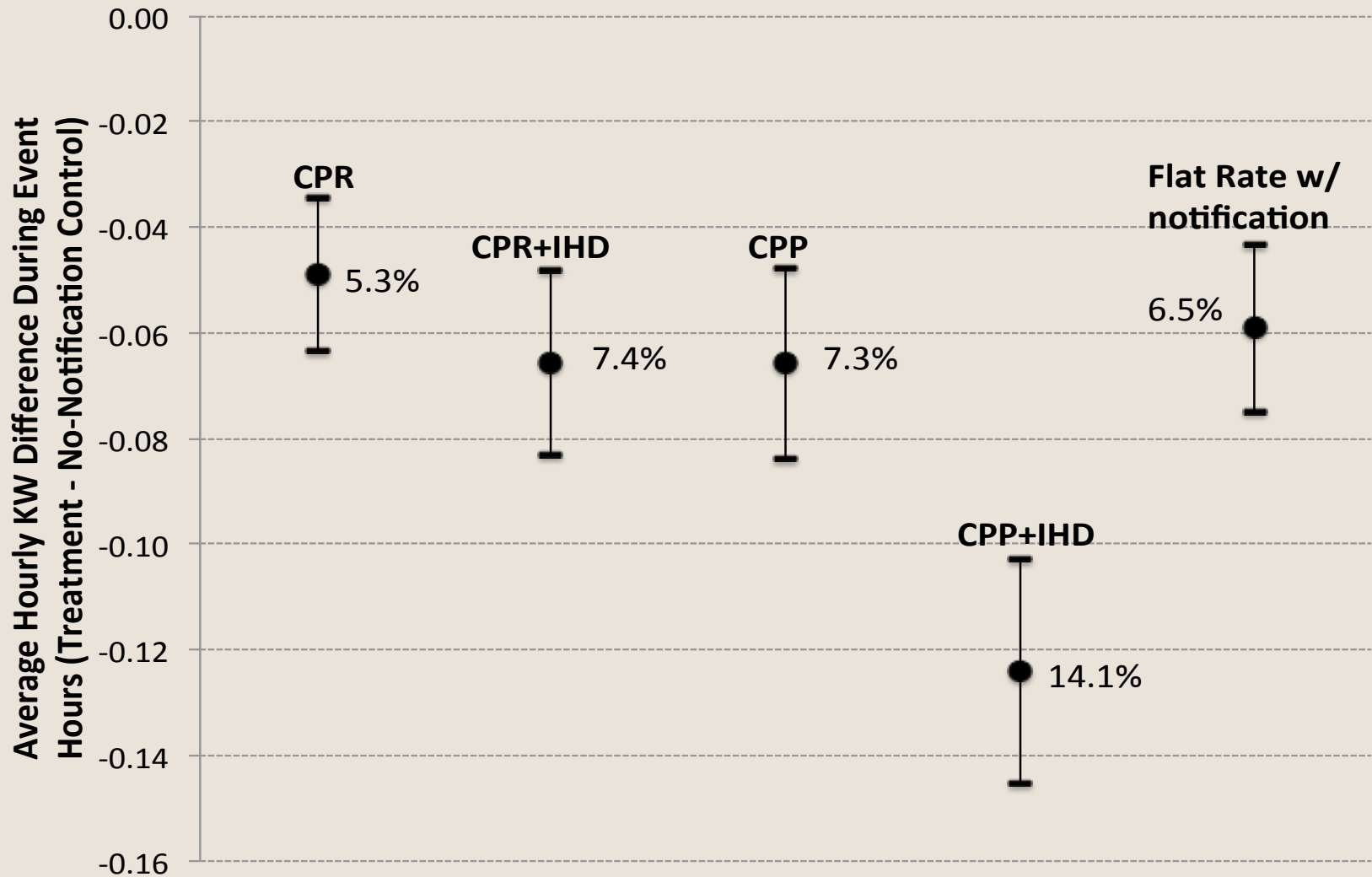
# Weekday Load Shapes



# Event-Day Behavior, 2012 and 2013



# Average Peak Time Load Reductions



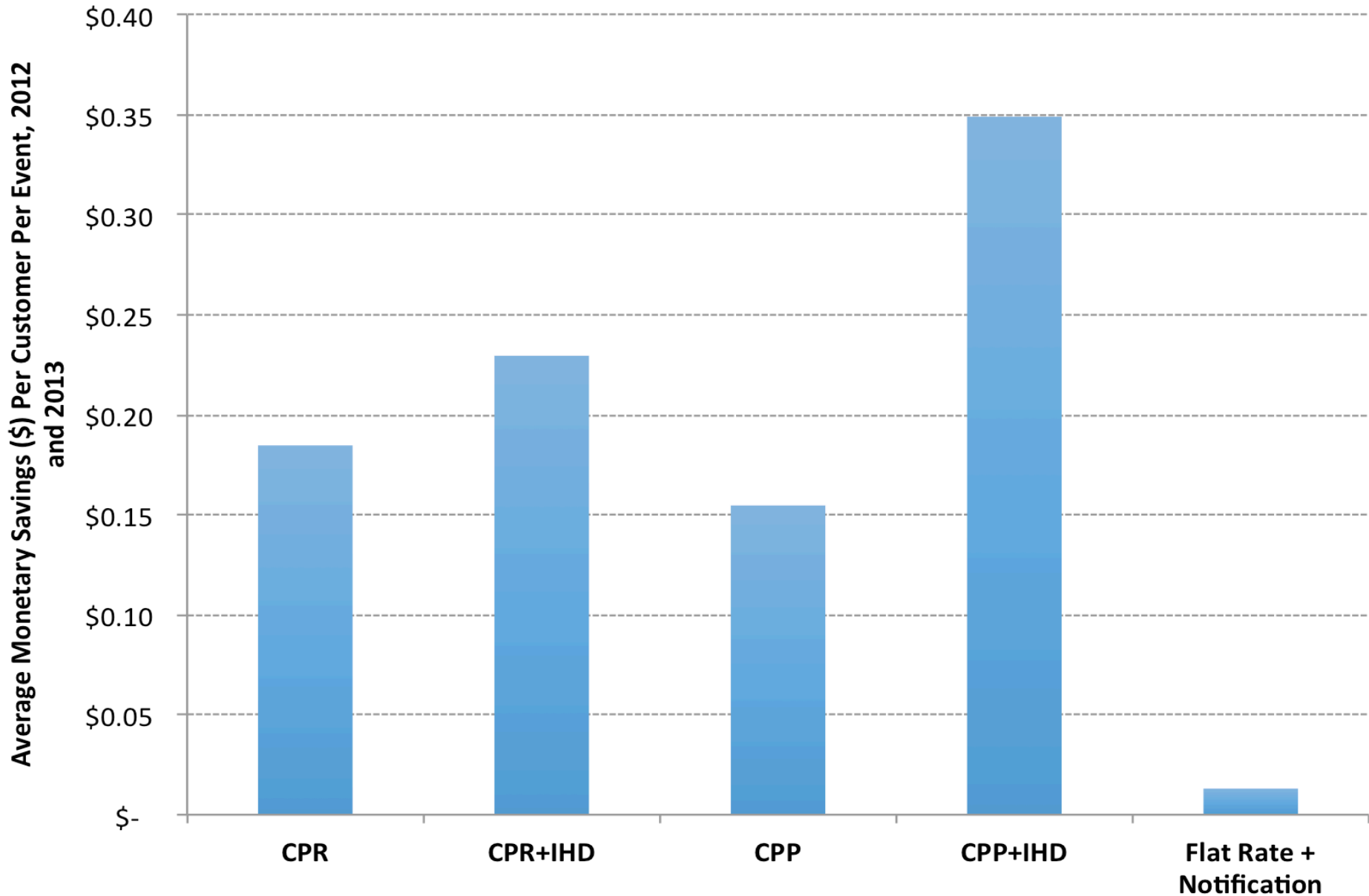
# Before/During/After Event

**Table E-1: Summary of load impacts (percentage reductions relative to the no-notification control group), 2012 and 2013**

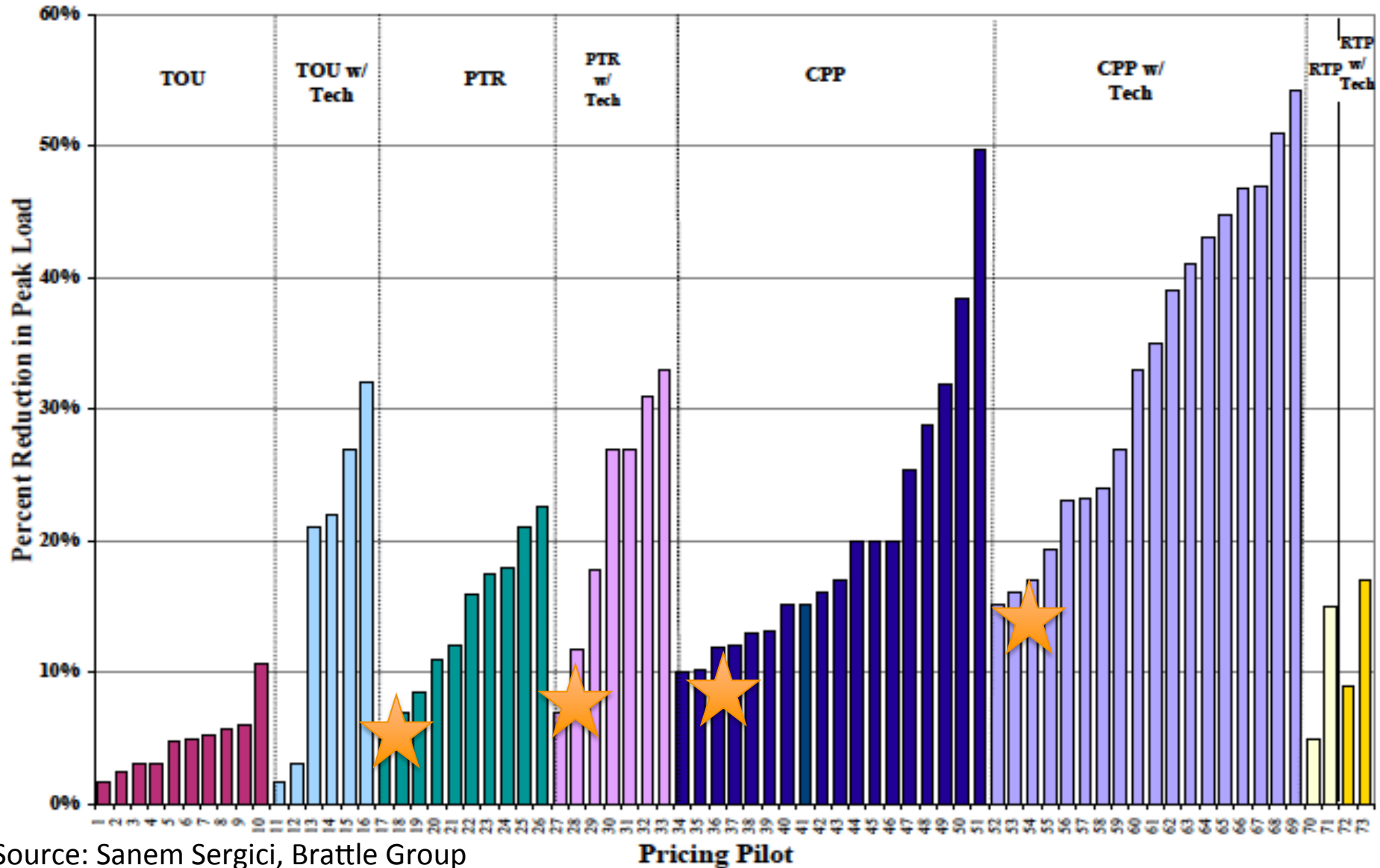
Treatment	2012			2013		
	Before	During	After	Before	During	After
Flat Rate w/ Notification	-6.45%	-3.38%	0.15%	-3.81%	-8.18%	-5.81%
CPR-CPR	-4.72%	-5.29%	-0.57%	1.06%	-2.17%	-1.52%
CPR-CPR w/IHD	-2.65%	-7.64%	3.41%	2.41%	-9.55%	-5.77%
CPP-CPP	-1.51%	-7.42%	1.77%	-0.56%	-7.46%	-3.79%
CPP-CPP w/ IHD	-8.67%	<b>-11.80%</b>	2.68%	3.56%	<b>-14.48%</b>	-0.67%
CPR-CPP	-4.29%	-8.57%	-1.27%	<b>16.86%</b>	1.40%	1.90%
CPR-CPP w/ IHD	-5.29%	-6.24%	-4.40%	1.82%	-16.40%	-3.43%



# Monetary Savings

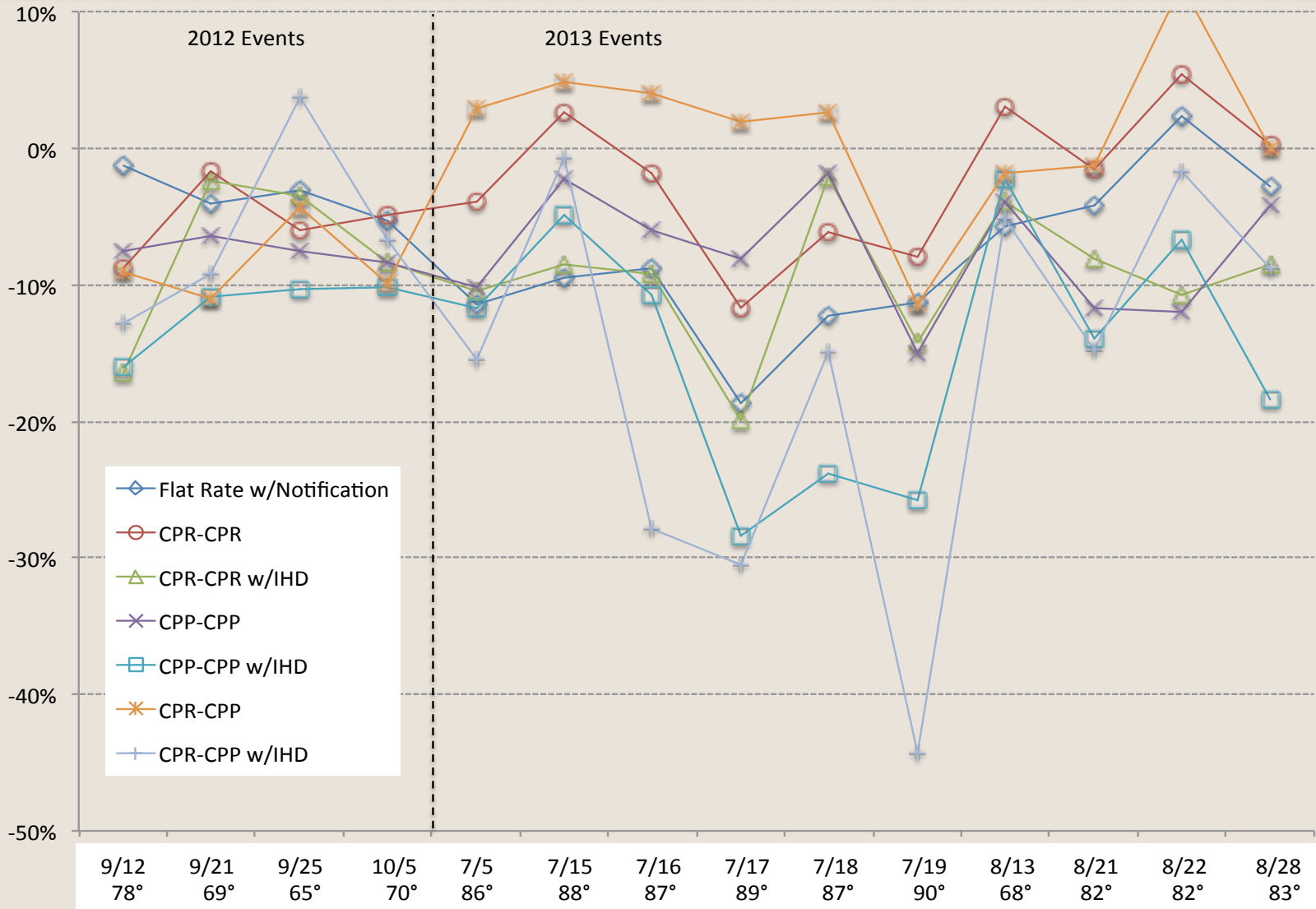


# So, What Did We Learn?

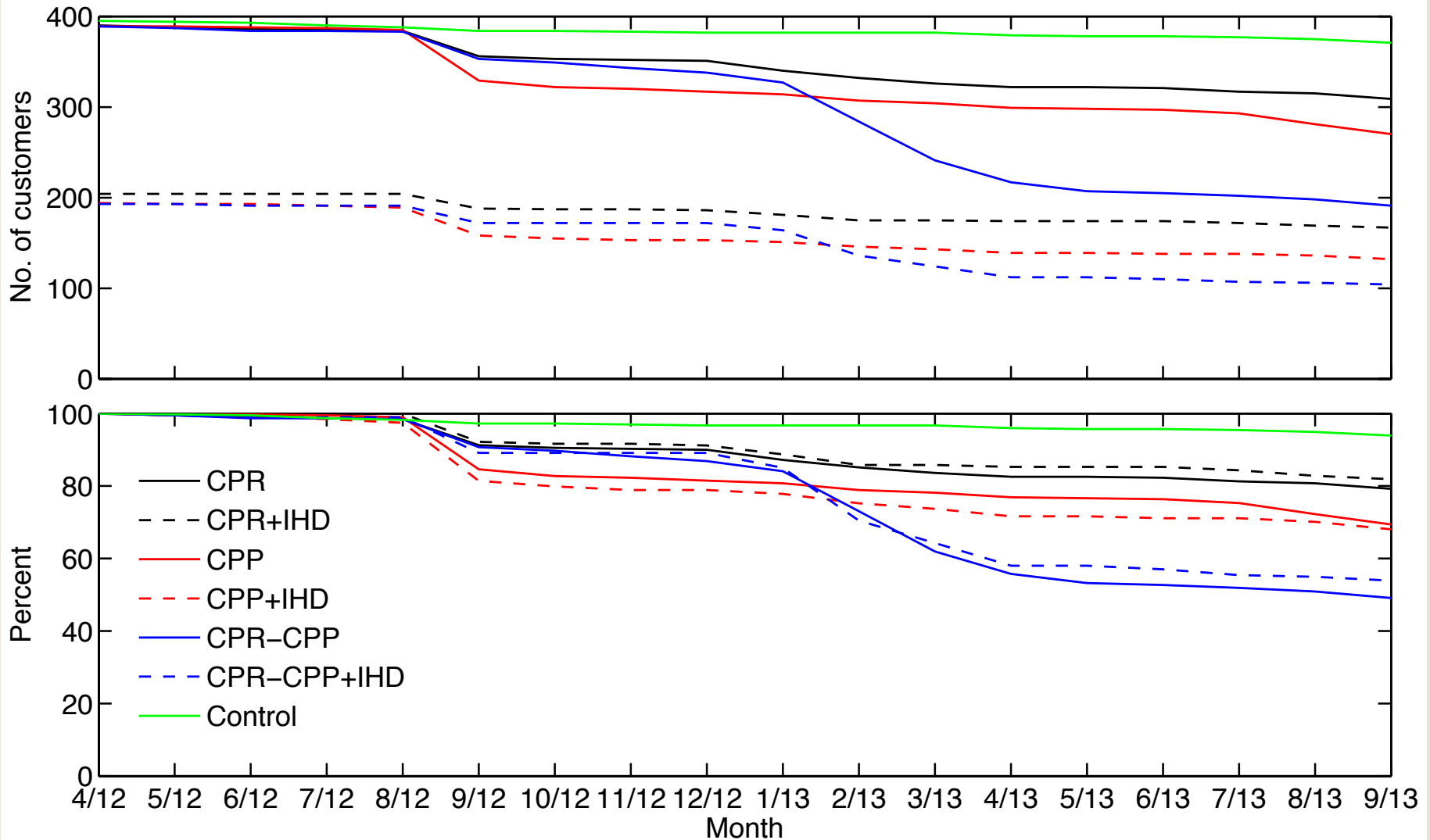


Source: Sanem Sergici, Brattle Group

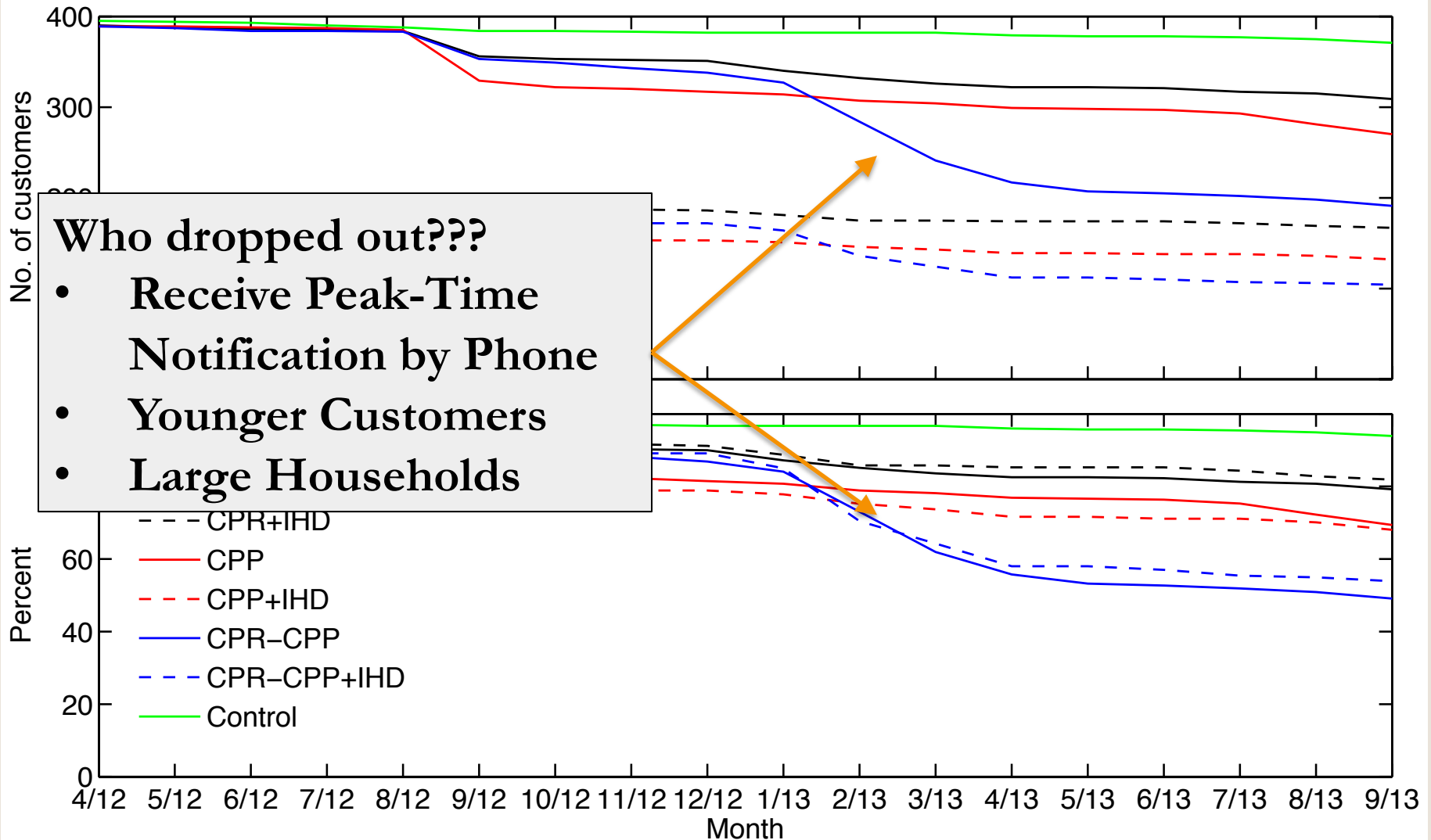
# Capacity Value of Retail DR



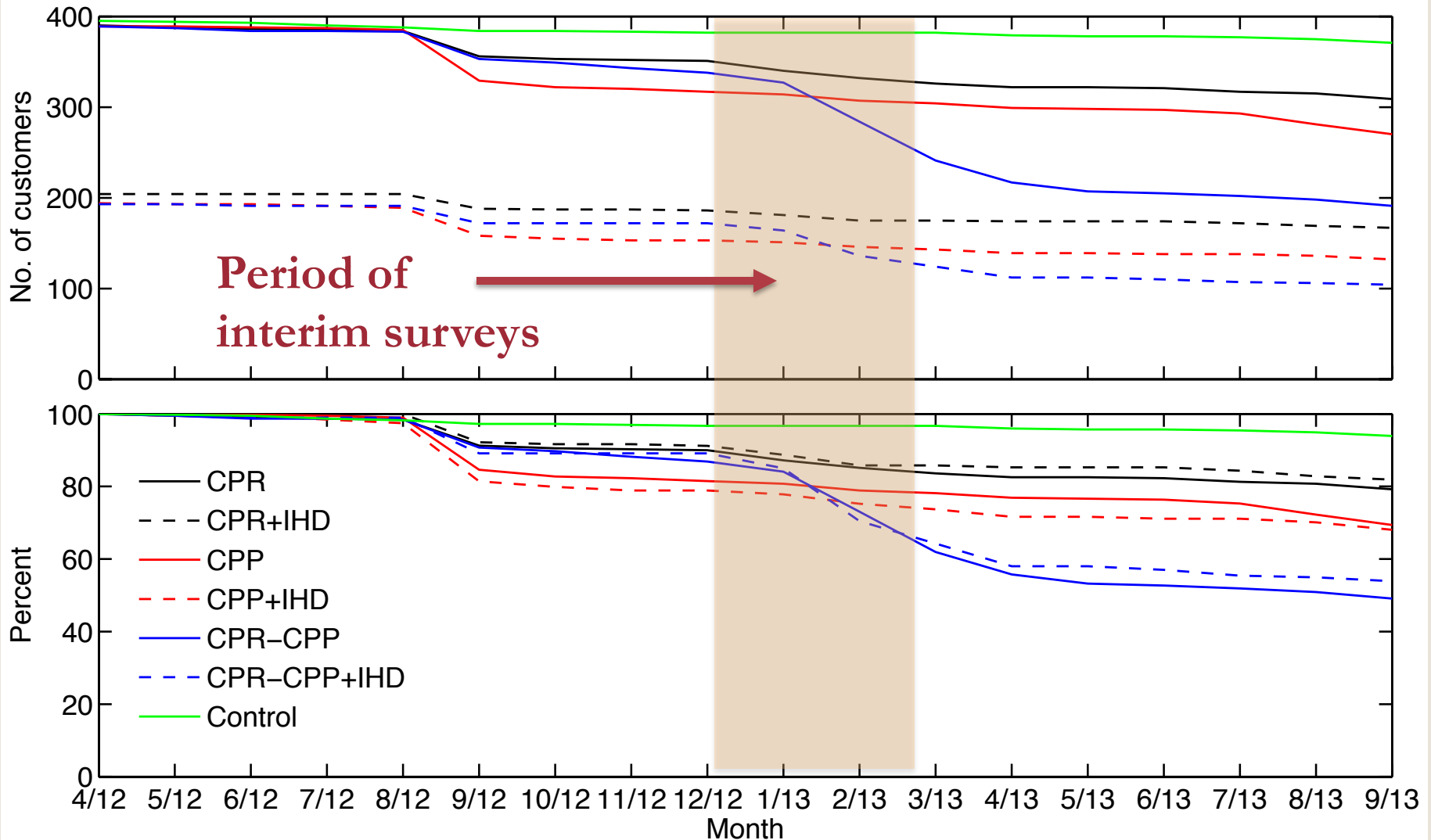
# How Not to be Popular!



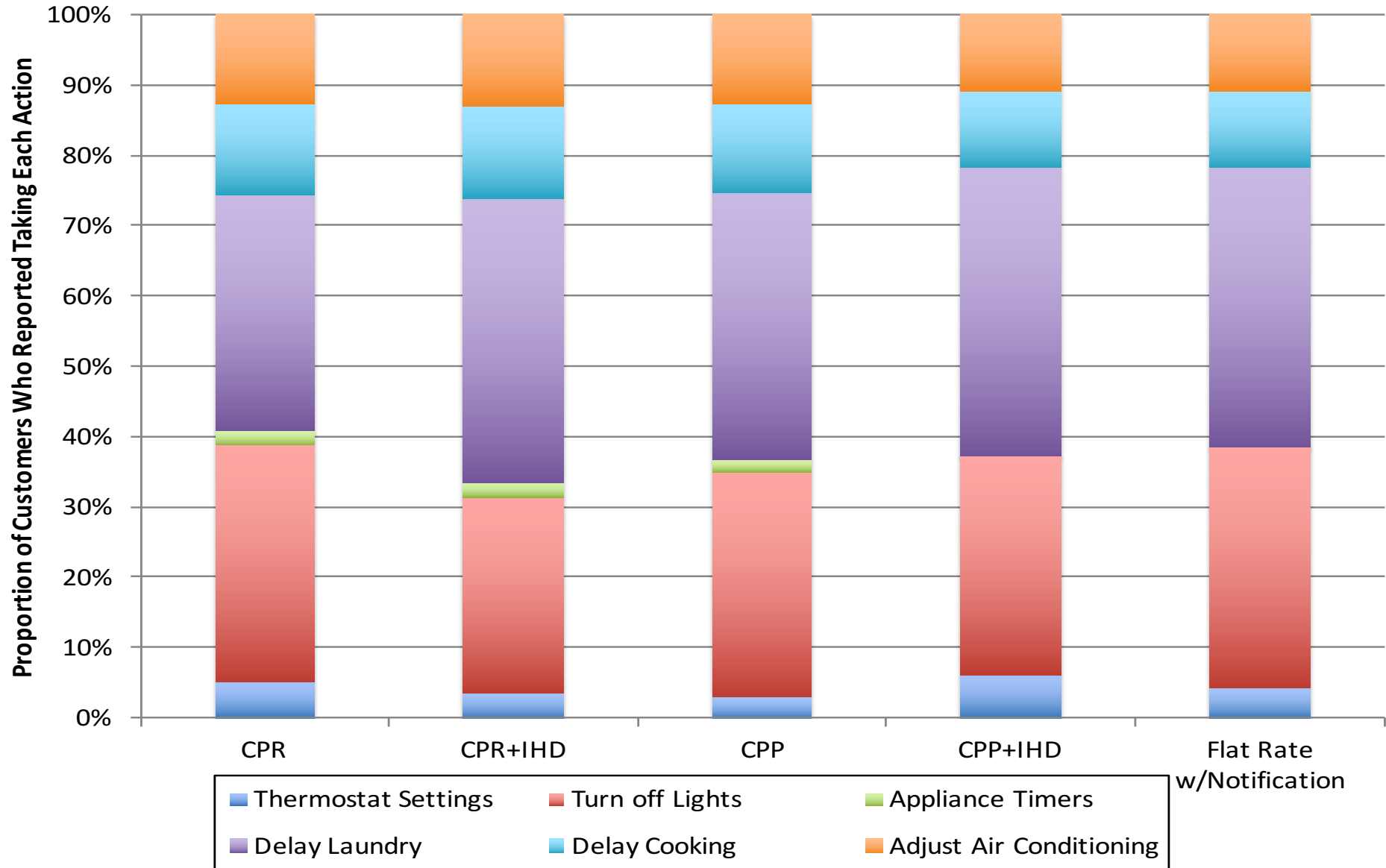
# How Not to be Popular!



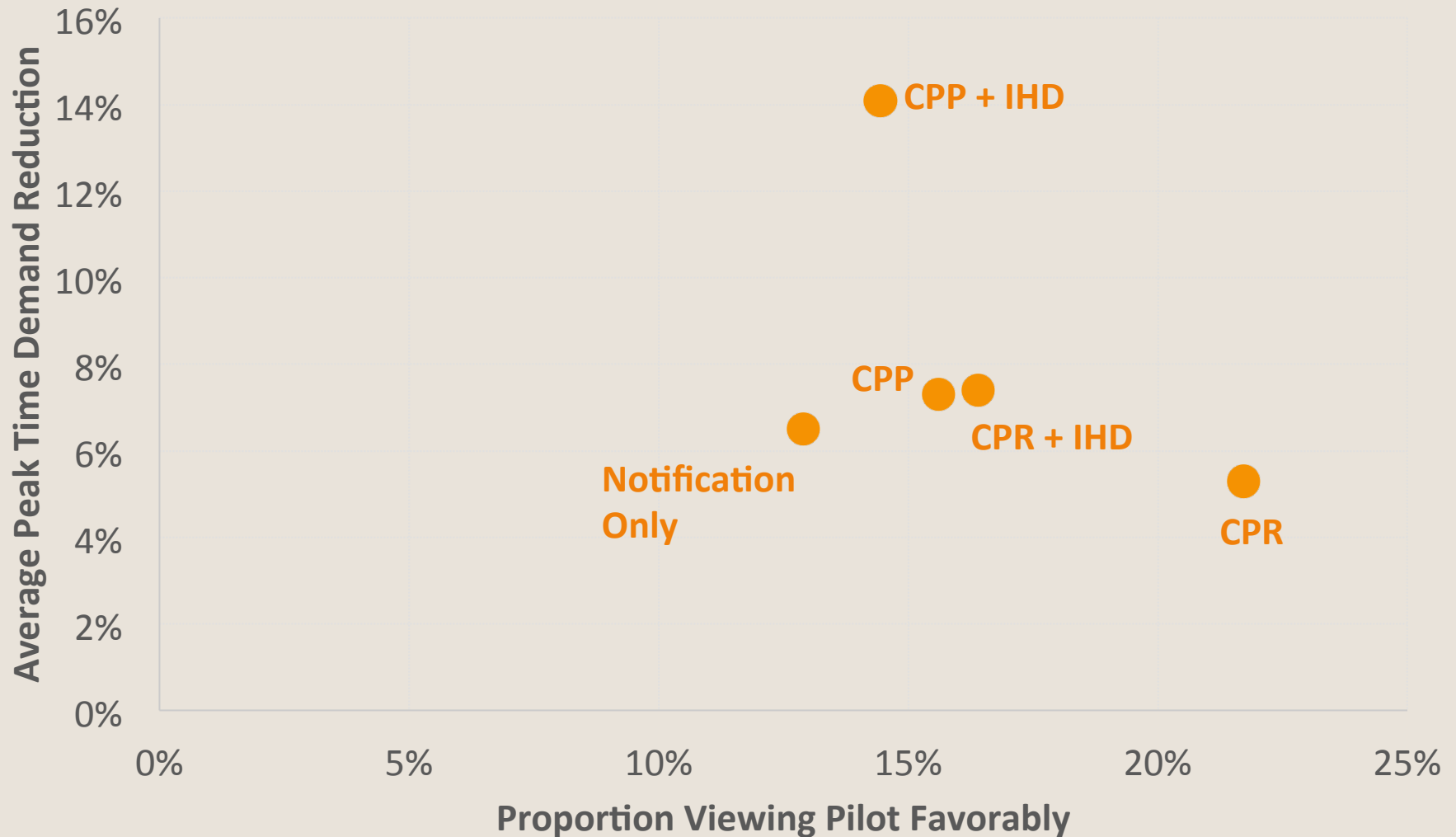
# How Not to be Popular!



# Actions Reported

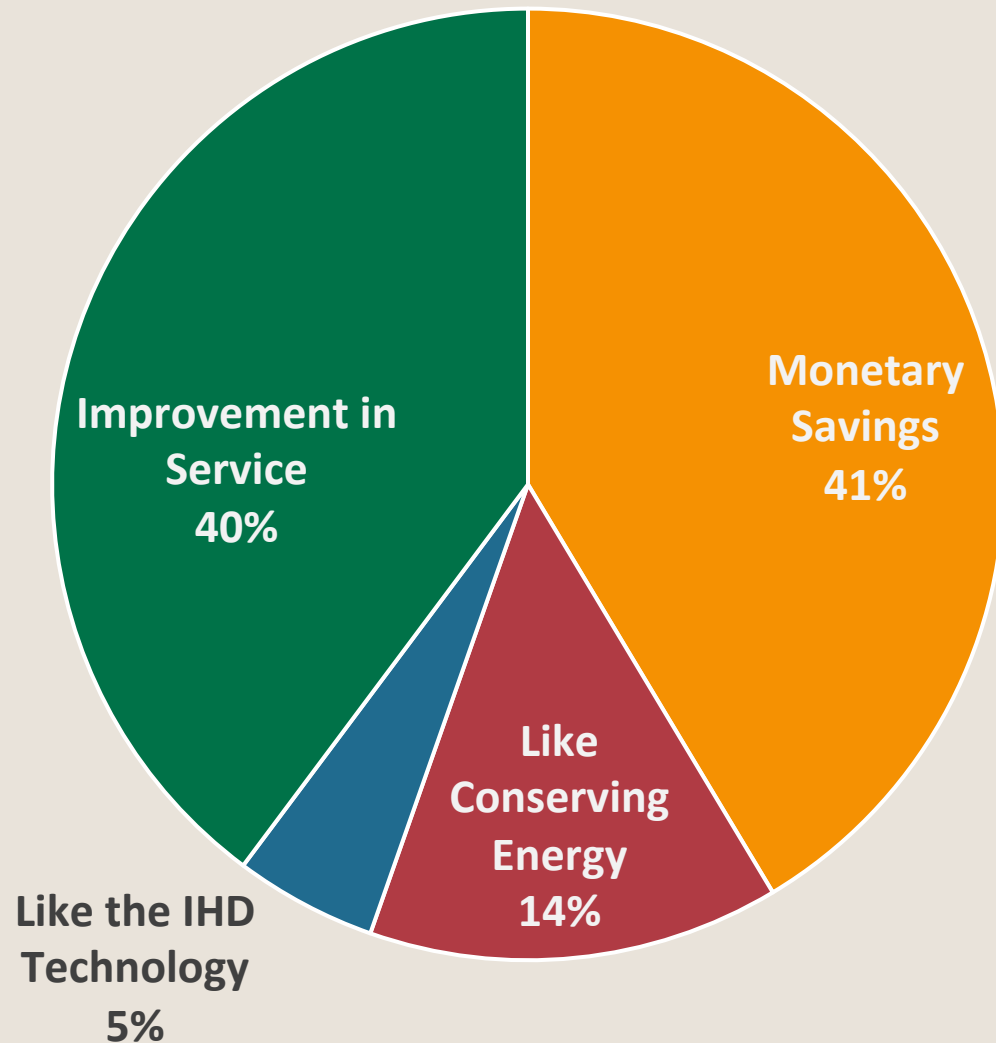


# Efficacy-Popularity Frontier





# How Do Consumers Value Smart Grids?



“They knew where we were when we had power outages”

--GMP customer  
(without IHD)



# Utility Lessons

**Sticks work better than carrots...**

*...but sticks are unpopular, especially after dangling carrots before customers/regulators.*

**Customers DO respond to incentives...**

*...but not persistently enough to have much (retail) capacity value.*

**Information CAN be useful...**

*...but the supporting systems need to become as EASY as making coffee.*

# A Final Musing



- Why do *households* care about the carrot or the stick?
- GMP customers each saved *tens of cents* during every peak event!
- What motivates customers? Does the penny make the conservation choice more or less complicated?

# Thank You!

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