

*The Brattle Group*

# Shaping our Energy Future through Dynamic Pricing



**Ahmad Faruqui, Ph.D.**

**Smart Grid Educational Series**

**IBM Innovation Center**

**Foster City, CA**

**August 21, 2012**

Copyright © 2012 *The Brattle Group, Inc.*

The views expressed in this letter are strictly those of the authors and do not necessarily state or reflect the views of *The Brattle Group, Inc.*

[www.brattle.com](http://www.brattle.com)

Antitrust/Competition   Commercial Damages   Environmental Litigation and Regulation   Forensic Economics   Intellectual Property   International Arbitration  
International Trade   Product Liability   Regulatory Finance and Accounting   Risk Management   Securities   Tax   Utility Regulatory Policy and Ratemaking   Valuation  
Electric Power   Financial Institutions   Natural Gas   Petroleum   Pharmaceuticals, Medical Devices, and Biotechnology   Telecommunications and Media   Transportation

# Does *Joe Schmoe* know dynamic pricing?

- If asked, he will say he does not, like *Monsieur Jourdain* who had been speaking prose all his life and still did not know what prose was
- Joe has known dynamic pricing when he has bought an airline ticket, booked a hotel room, rented a car, gone to a Giant's game, attended a symphony performance, gone to see a play or bought out-of-season produce in the farmers' market
- Lately, Joe has also known dynamic pricing when he has driven on the Fast Track lane on I-680, crossed the Bay Bridge, driven on weekdays into London or Singapore, and parked his car in the downtown areas of any major city

## ***For Whom the Bell Tolls***

- **Dynamic pricing is a *sine qua non* for capital-intensive industries**
- **It improves load factors and raises capacity utilization**
- **By so doing, it lowers average costs**
- **It helps manage congestion**
- **It ensures that supply is available for high valued uses**

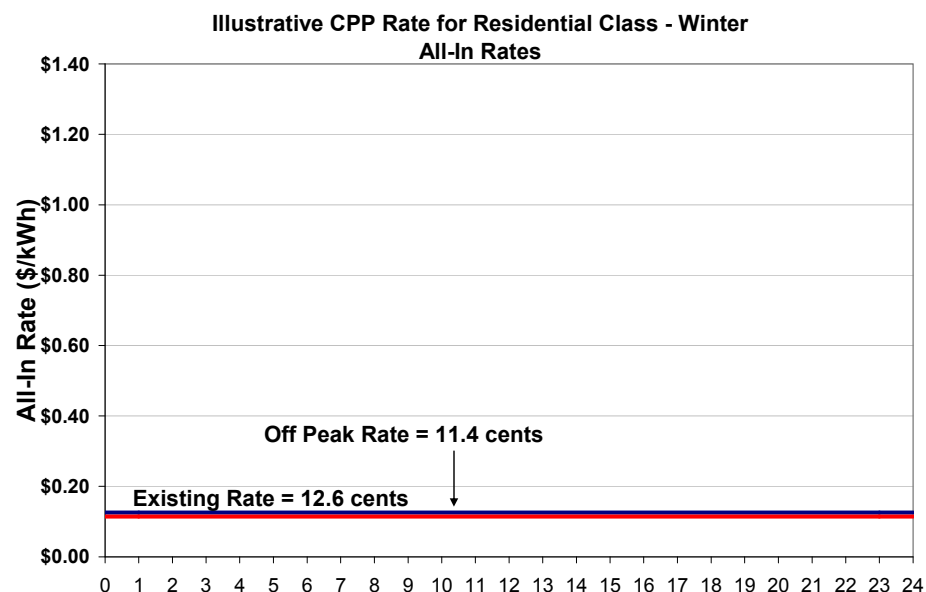
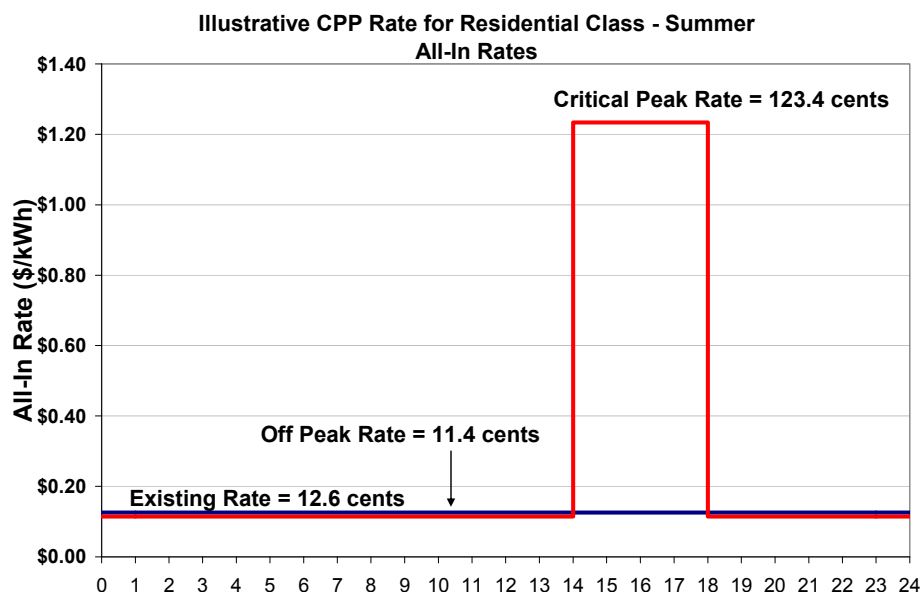
## **Dynamic pricing is pervasive in wholesale markets for electricity but not in retail power markets**

- **Consequently, the annual load factor is under 60% for most utilities**
  - **The top 1% of the hours account for 8-18% of the annual peak load**
  - **Generation capacity to meet the peak load sits idle for most of the 8,760 hours of the year**
- **This puts significant upward pressure on costs and rates**

# Is there only one type of dynamic pricing?

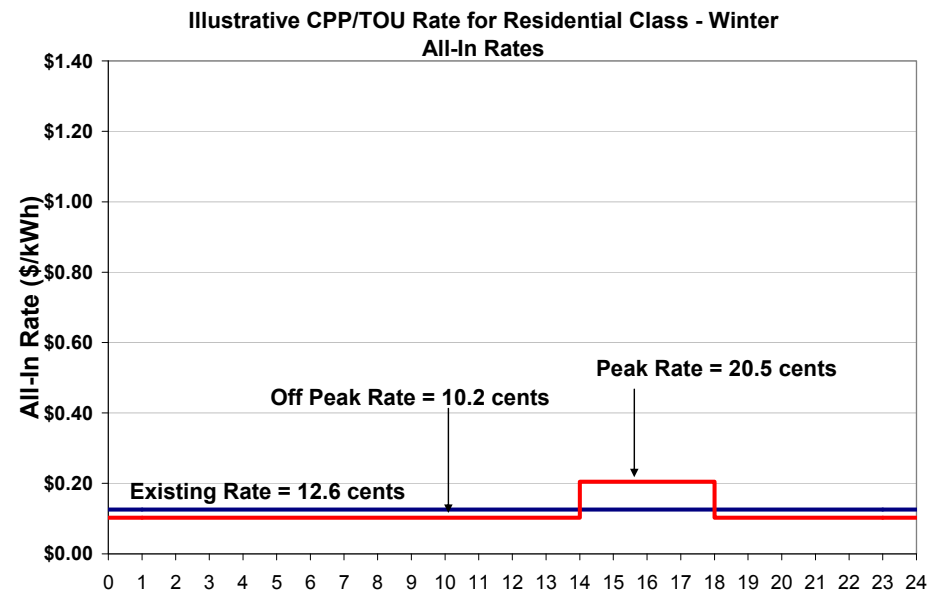
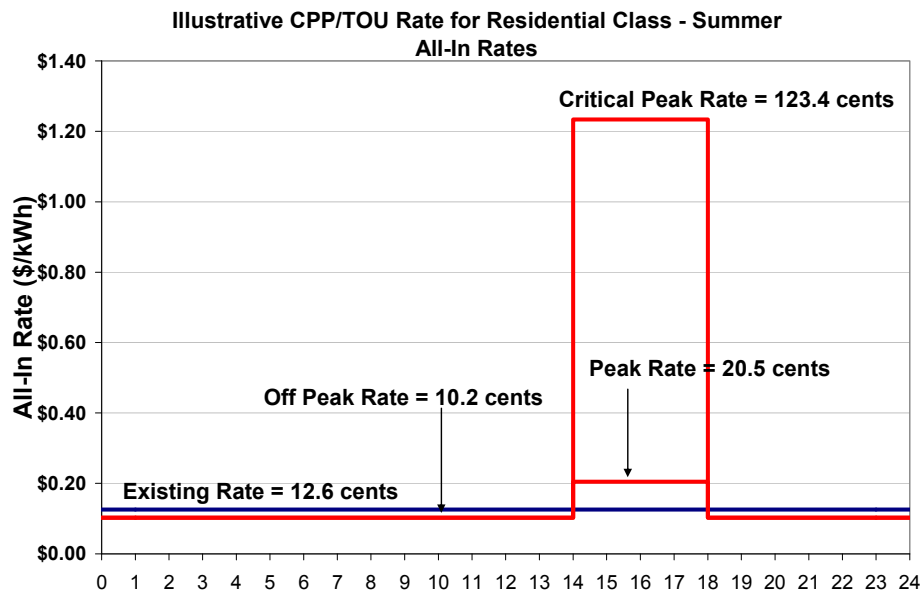
- **No, there are several**
  - **Time-of-use pricing (TOU)**
  - **Critical-peak pricing (CPP)**
  - **Peak-time rebates (PTR)**
  - **Variable-peak pricing (VPP)**
  - **Real-time pricing (RTP)**
- **Each of these types can be deployed as a one-part rate or a two-part rate**
- **The different types can be combined to yield hybrids**

# Critical-peak pricing (CPP) in its pure form



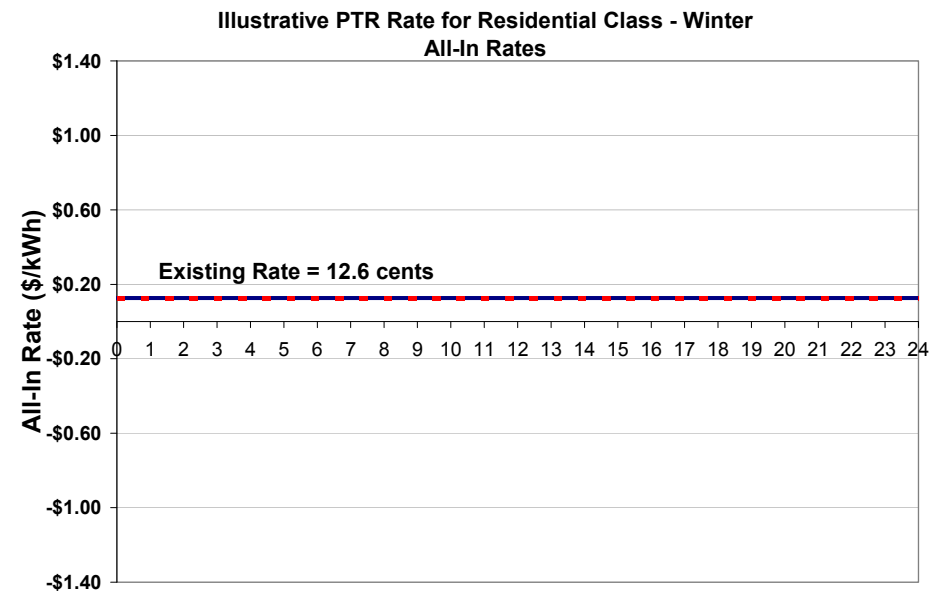
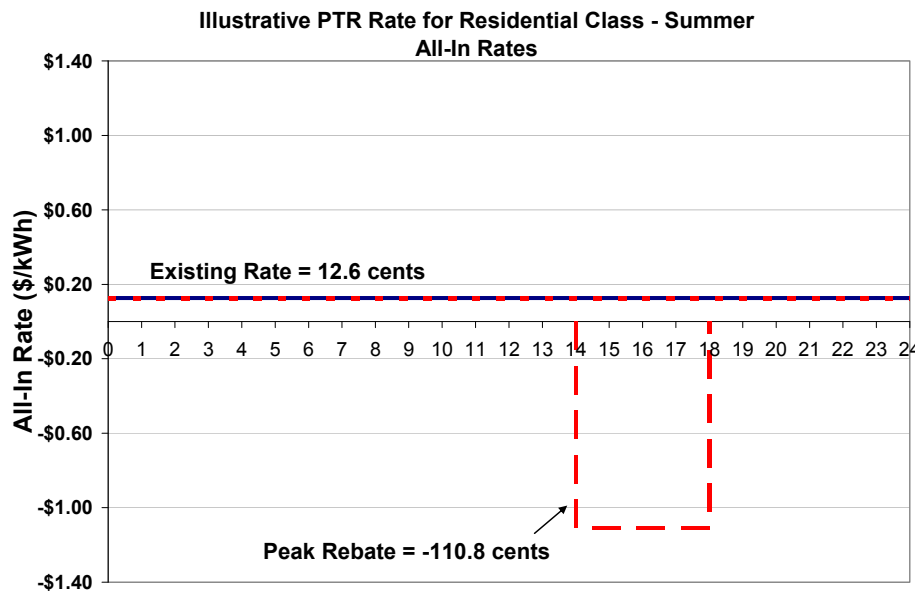
- Customers get a discount on all hours except a few critical hours of the year
- On a few critical days, customers pay a substantially higher price equal to the cost of capacity plus the average critical peak locational marginal price

# CPP combined with time-of-use (TOU) pricing



- Customers are on a mild TOU rate on all non-critical days
- On critical days, they pay a much higher price during the critical hours

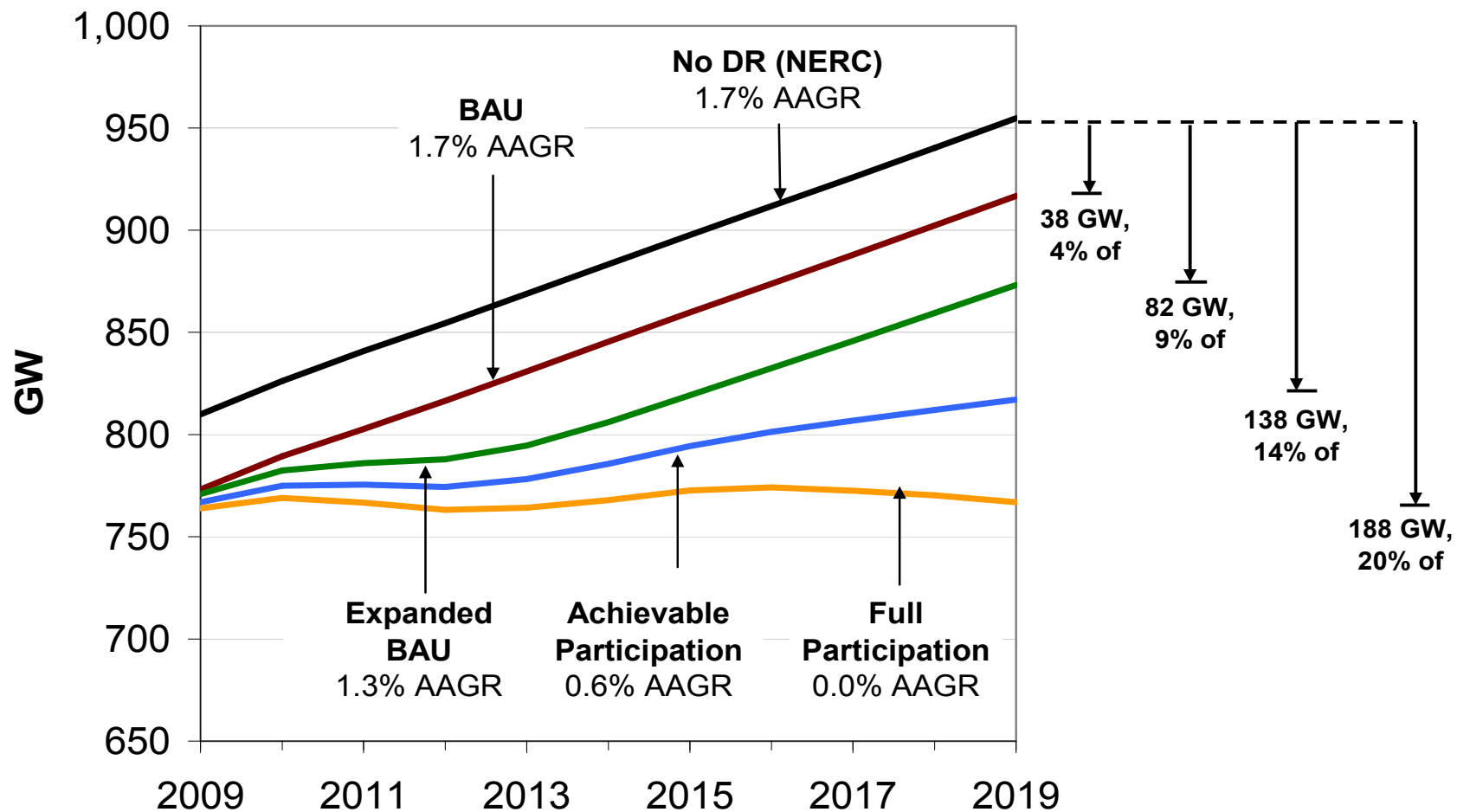
# The peak-time rebate (PTR) provides an incentive to reduce peak load but leaves the flat rate unchanged



- Customers pay the default rate for all kWh used; if they make no changes in their usage they continue to pay the default rate with no extra costs (“carrot only” approach)
- On critical days customers can earn a rebate reductions in usage below an estimate of what they otherwise would have consumed (their “baseline” calculation)

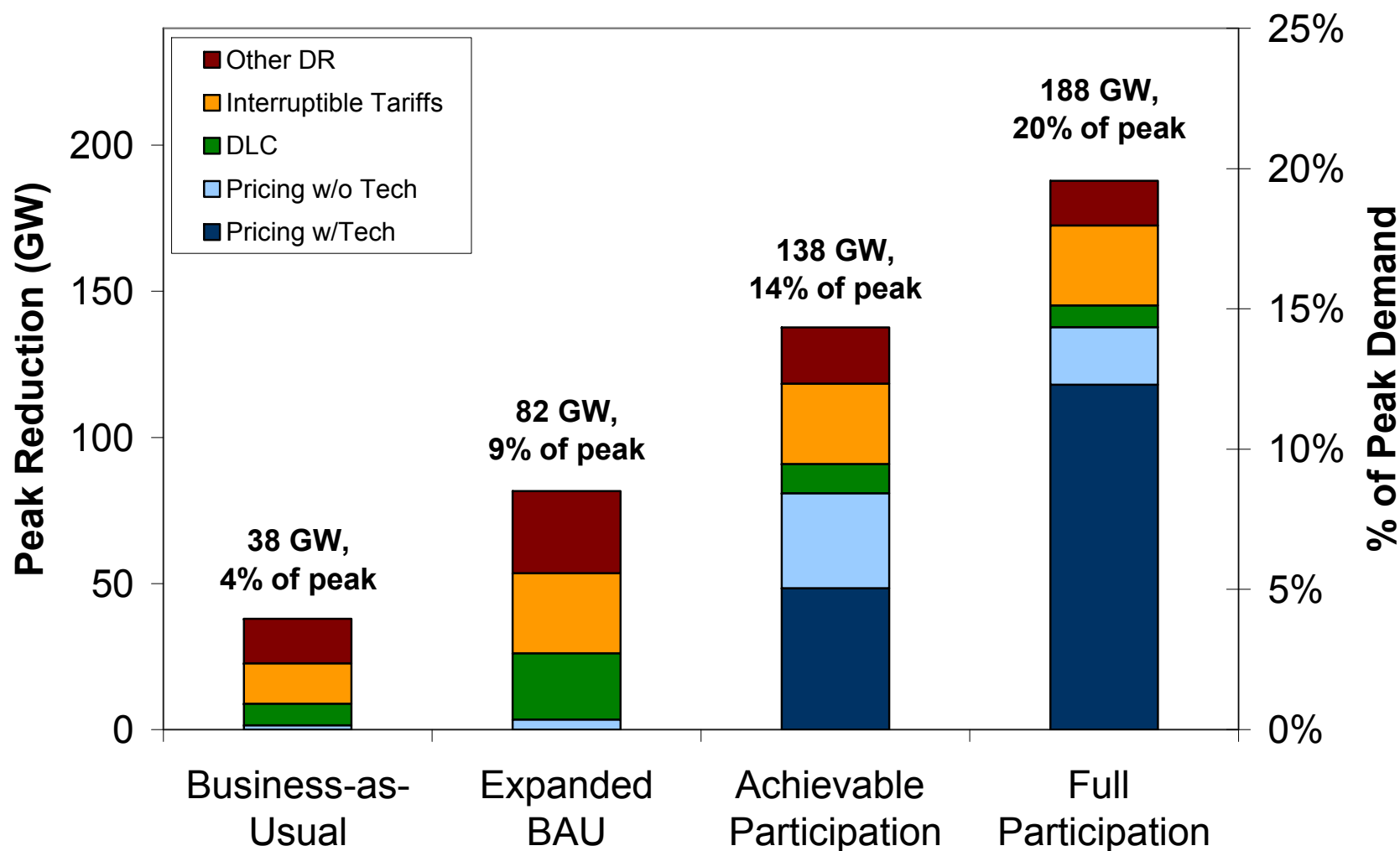


# In 2009, FERC estimated that demand response could reduce peak demand by up to 20% by 2019

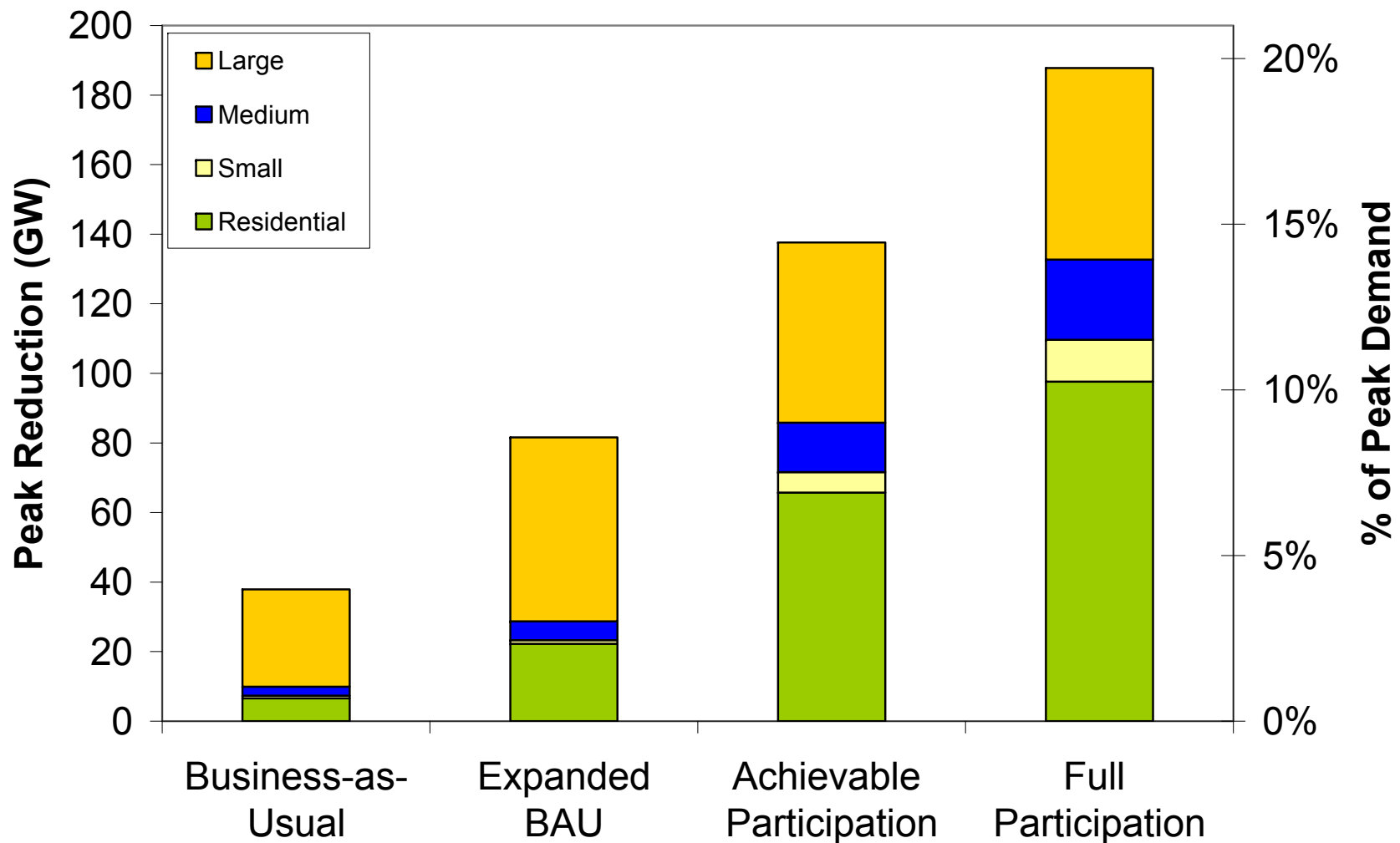


Source: FERC National Assessment of Demand Response Potential

# Aggressive pursuit of dynamic pricing could lead to substantial reductions in peak demand

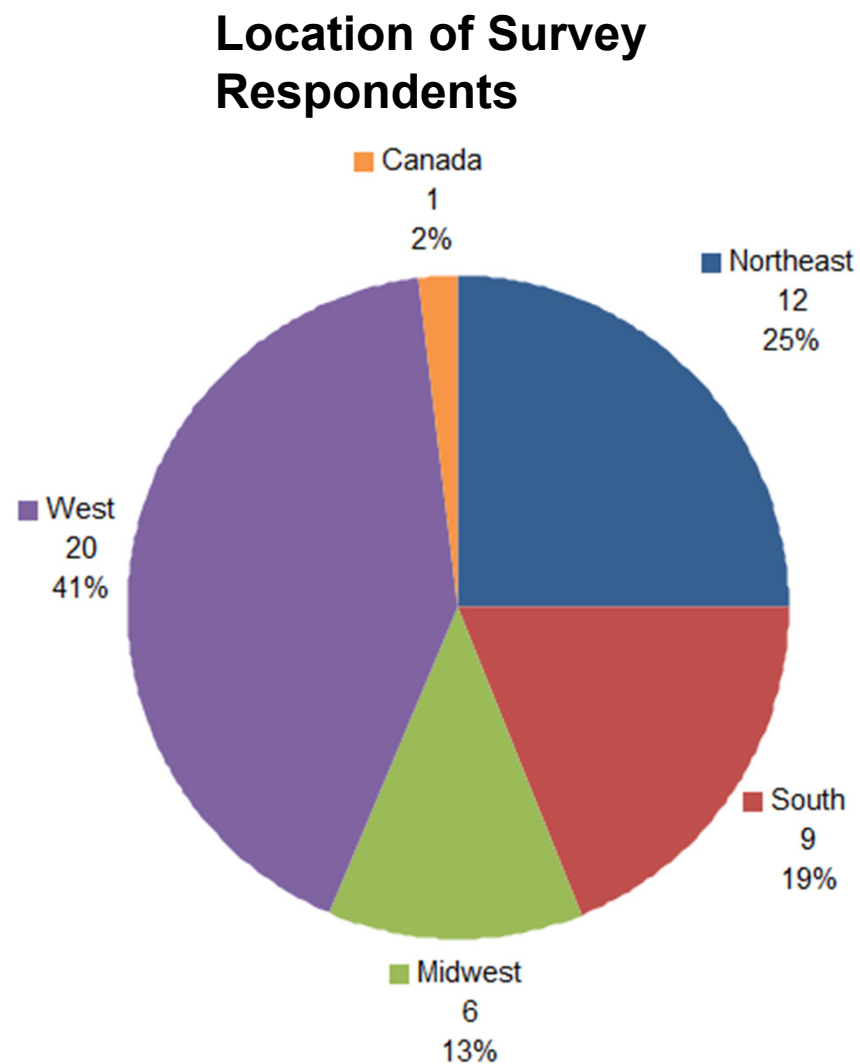


# Much of the untapped potential for dynamic pricing resides in the residential class



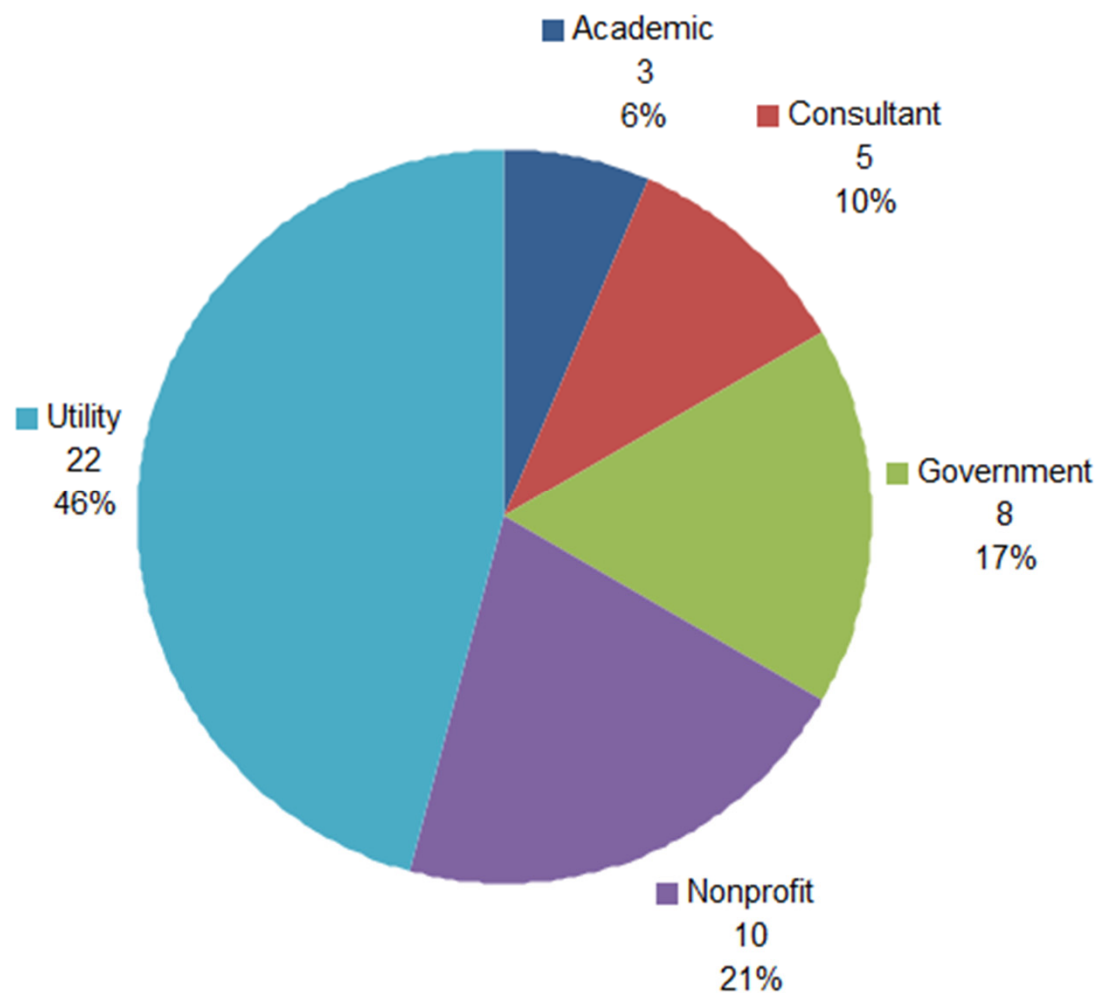
# We updated some of the results in 2010

- We polled 50 experts on the likely impact of demand response on peak demand in the year 2020

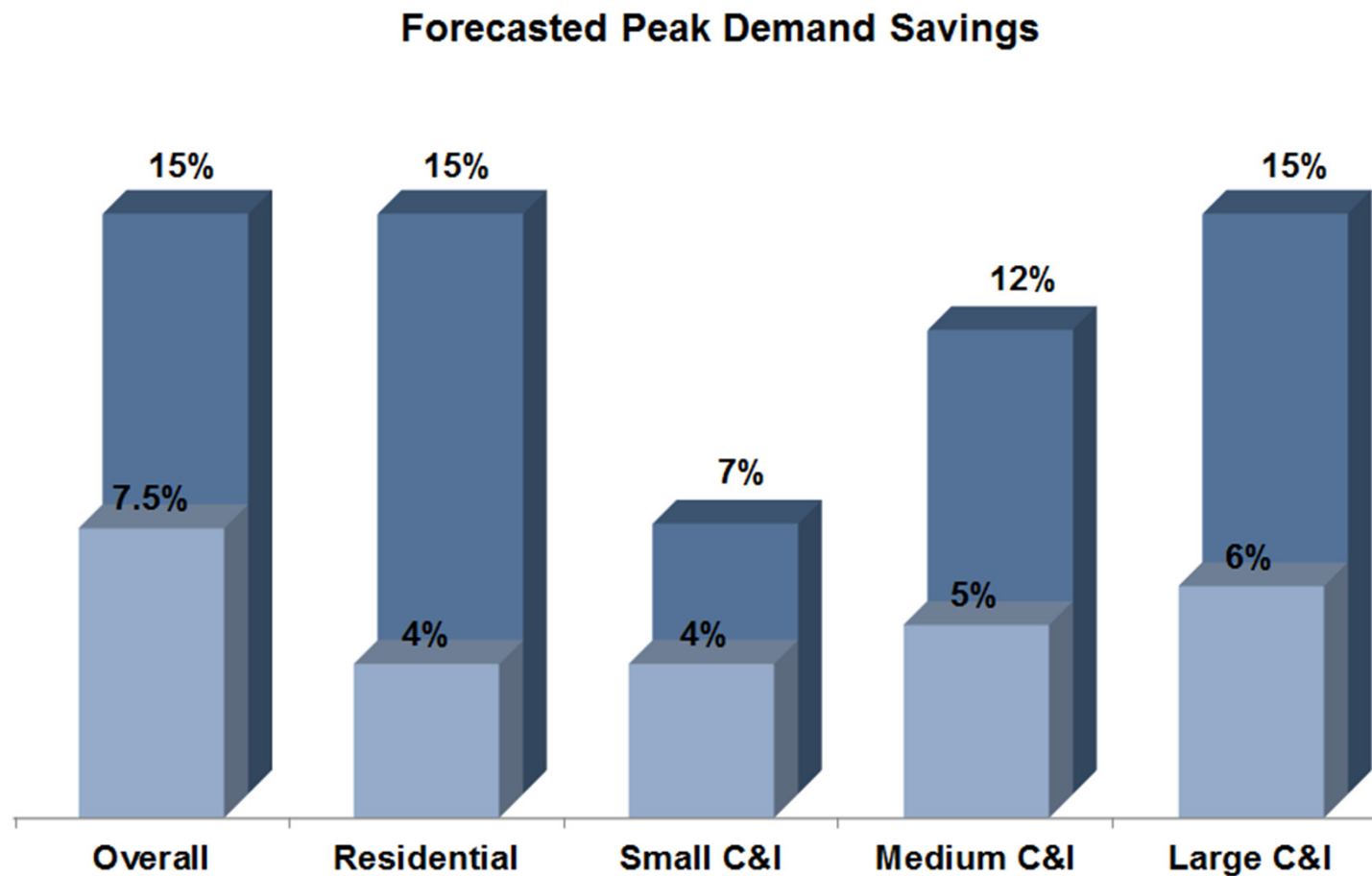


# The responders spanned a range of affiliations

Profession of Survey



# The survey said that demand response was likely to lower peak demand by 7.5% to 15% in 2020



Median Low and High Estimates  
10 Years From Now

## Where we are today?

- **About 33% of households are on smart meters and the figure is expected to hit 50% in five years**
- **Within a decade, smart meters may be universally deployed**
- **Only 1% of households are on time-based rates and only 1% of this 1% are on dynamic pricing rates**

# Flat-rate pricing is not inexpensive

- **Under flat rate pricing, inter-customer subsidies may amount to \$3 billion/year**
  - **We scale up the results from a California rate design study that was sponsored by the Demand Response Research Center**
- **Collectively, all customers may be overpaying for electricity by about \$7 billion/year**
  - **We take the FERC Staff estimate of 92 GW saved under universal dynamic pricing and value demand response at \$75/kW-year**



## **So why are we *Waiting for Godot*?**

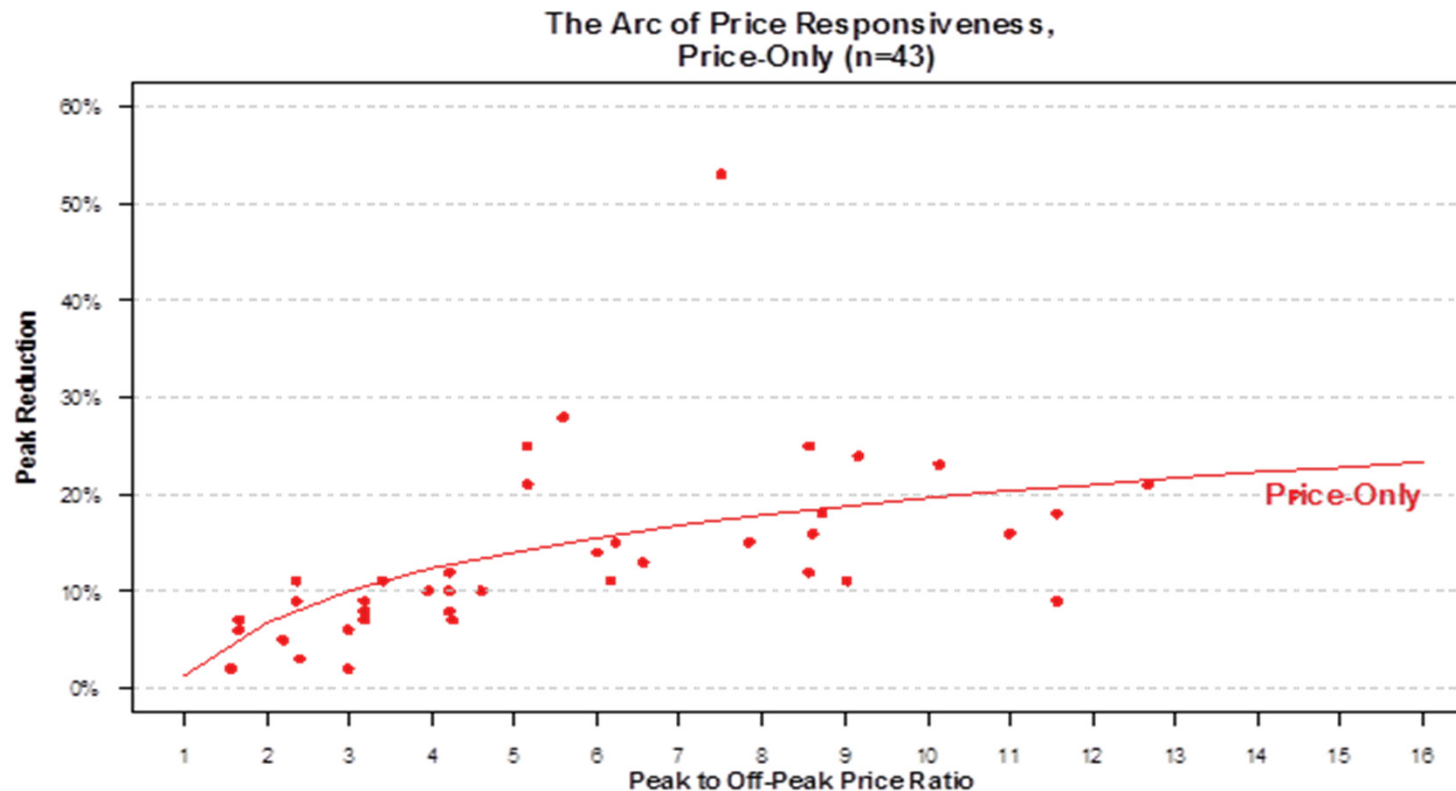
- **The train is still at the station because of three fears**
  - **One: meters are expensive, that they are harmful to health, that they violate privacy, and that they compromise cyber security**
  - **Two: customers won't respond to dynamic pricing, since electricity is a necessity**
  - **Three: customers will over-respond to dynamic pricing in order to save money and endanger their good health**

## **These fears appear to be as old as time itself**

- **I have been hearing them since I began my career**
- **Those senior to me had told me that they had been hearing them since they began their careers**
- **The good news is that we now have a mountain of empirical evidence with which to assuage the fears**

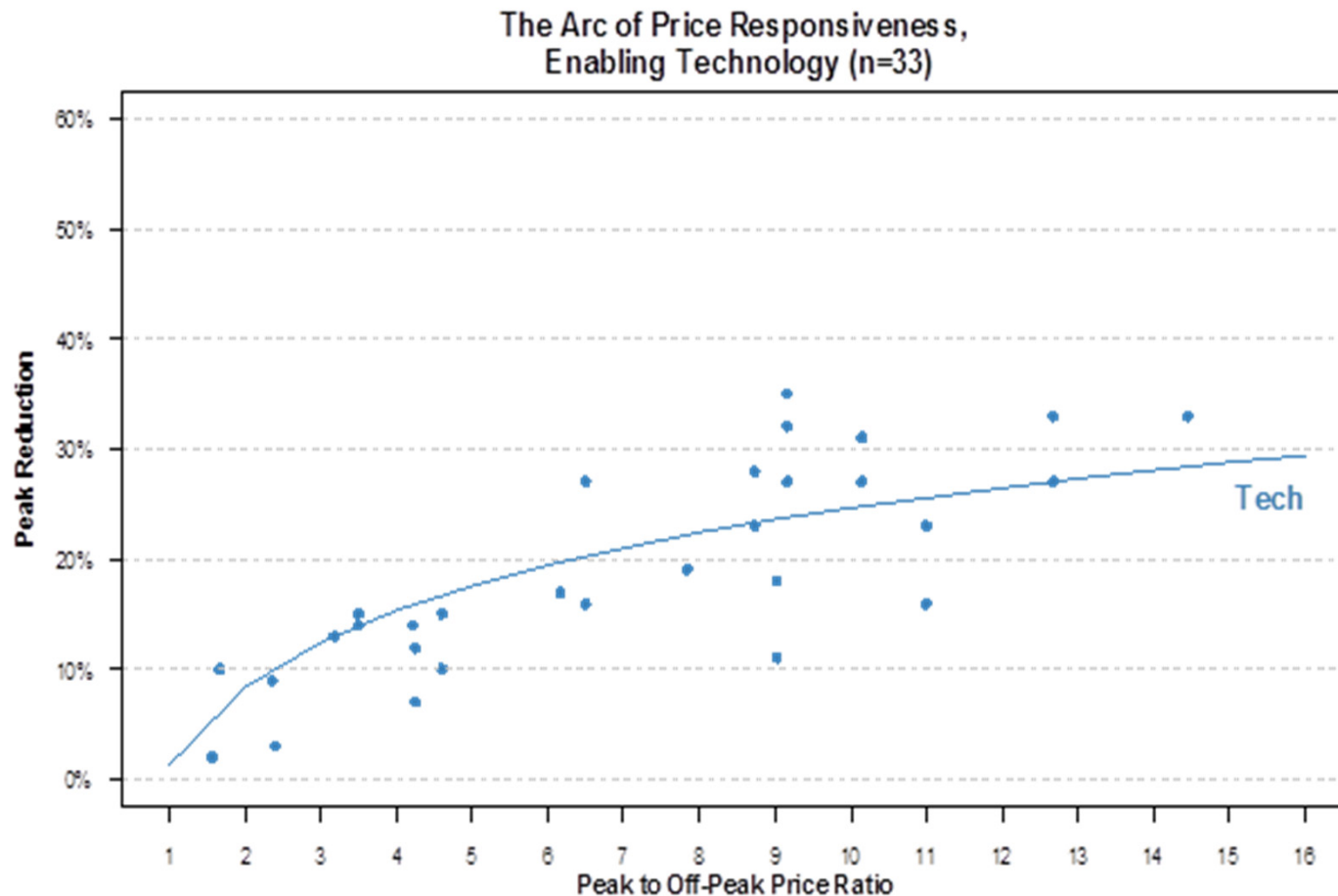
# Customers do respond to price signals, as seen in two dozen pilots around the globe

## Arc of Price Responsiveness



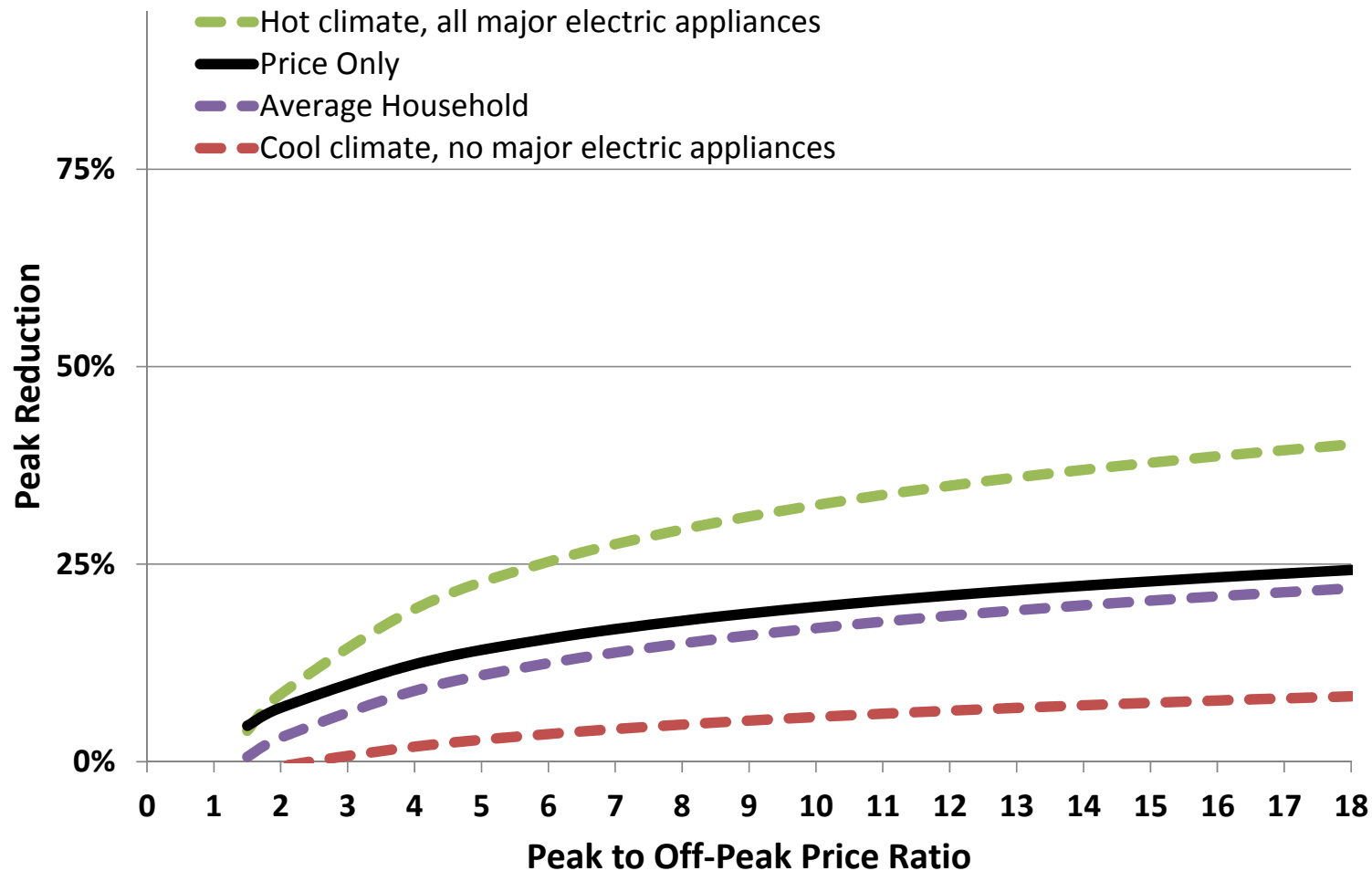
# Enabling technology further enhances price responsiveness

## Arc of Price Responsiveness



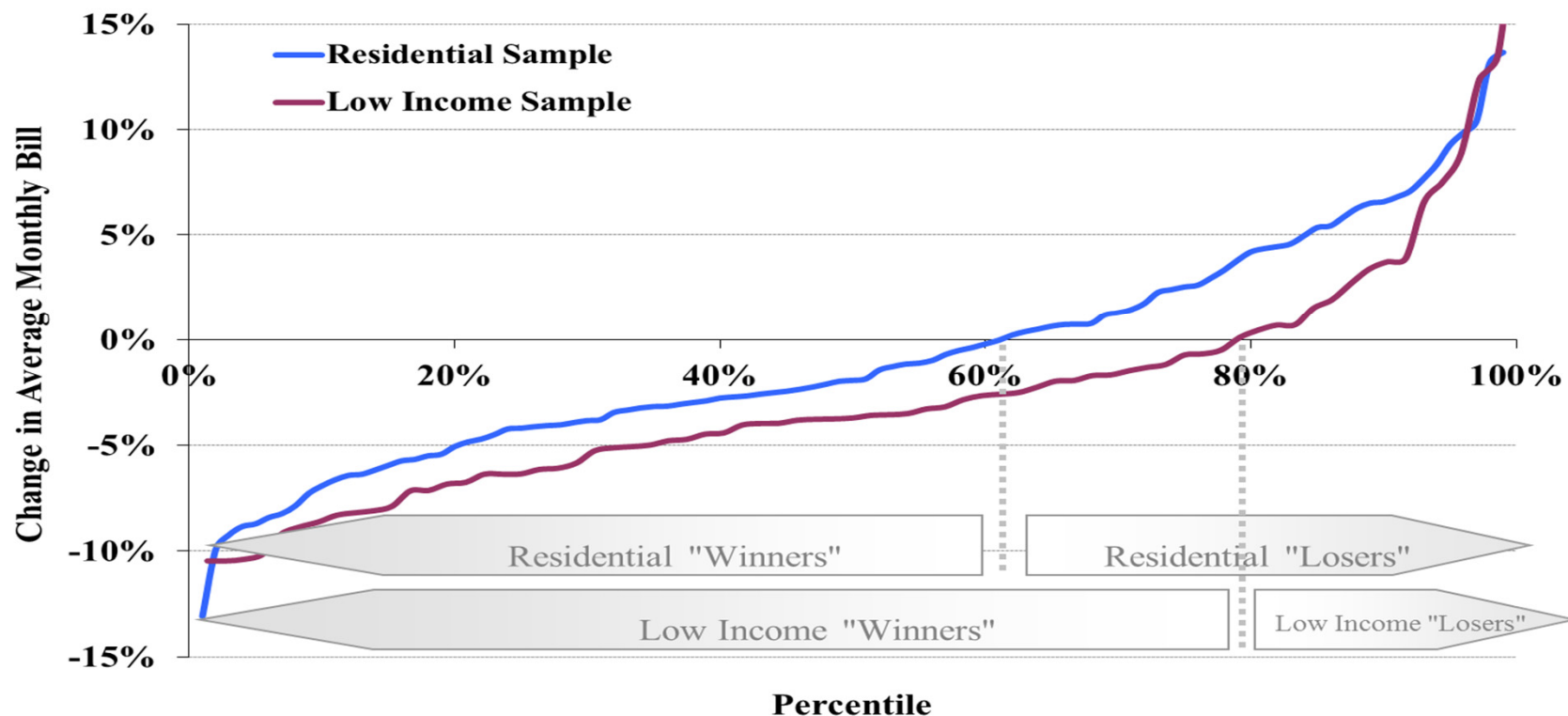
***The more things change, the more they stay the same*** (plus ça change, plus c'est la même chose)

**Arc of Price Responsiveness (1982 + current price-only)**

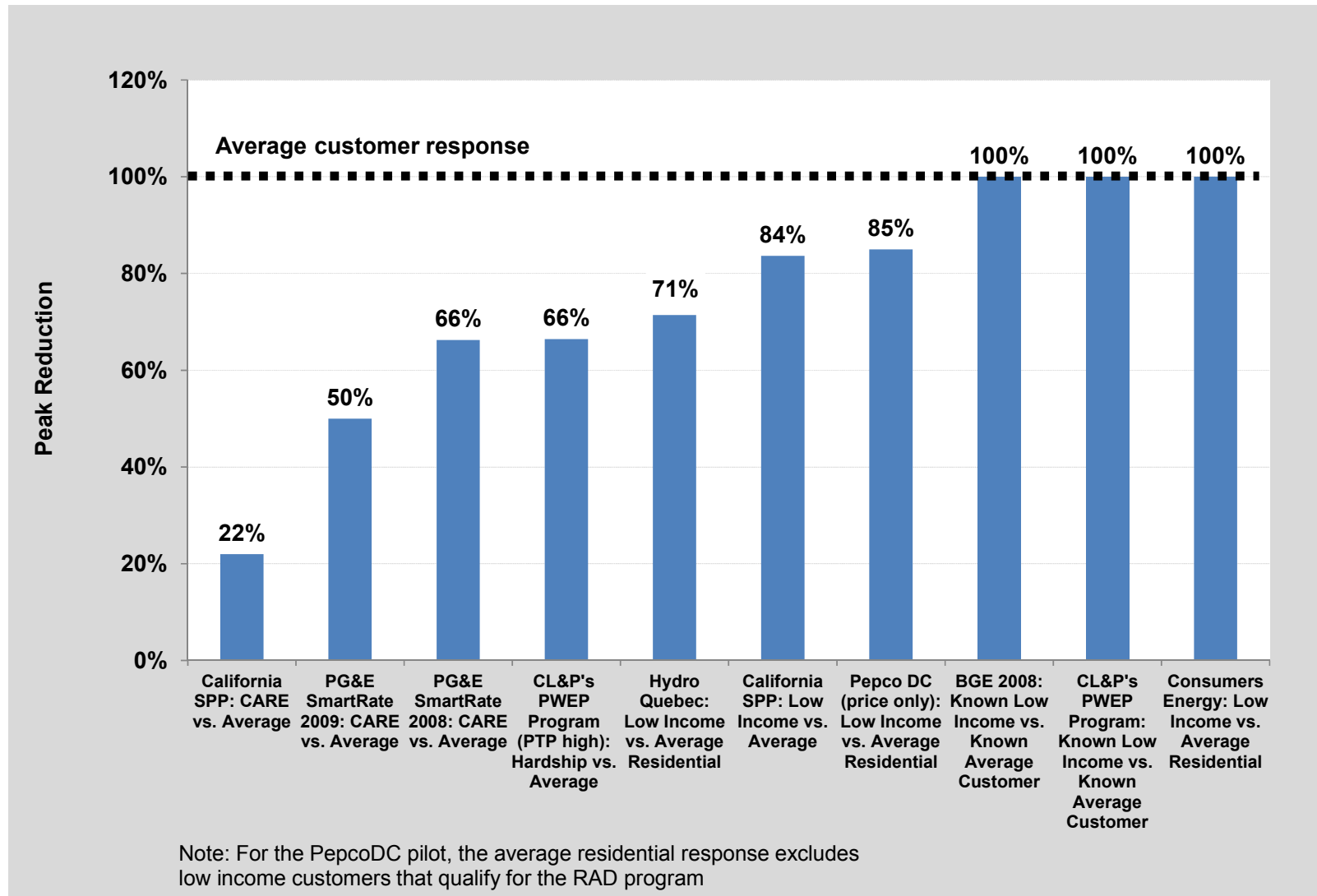


# As many as 80% of *low income* customers may be over-paying for electricity today

**Distribution of Dynamic Pricing Bill Impacts**  
**Residential and Low Income Customers on CPP Rate (Design #2)**



# Contrary to popular perception, even low income customers respond to dynamic pricing

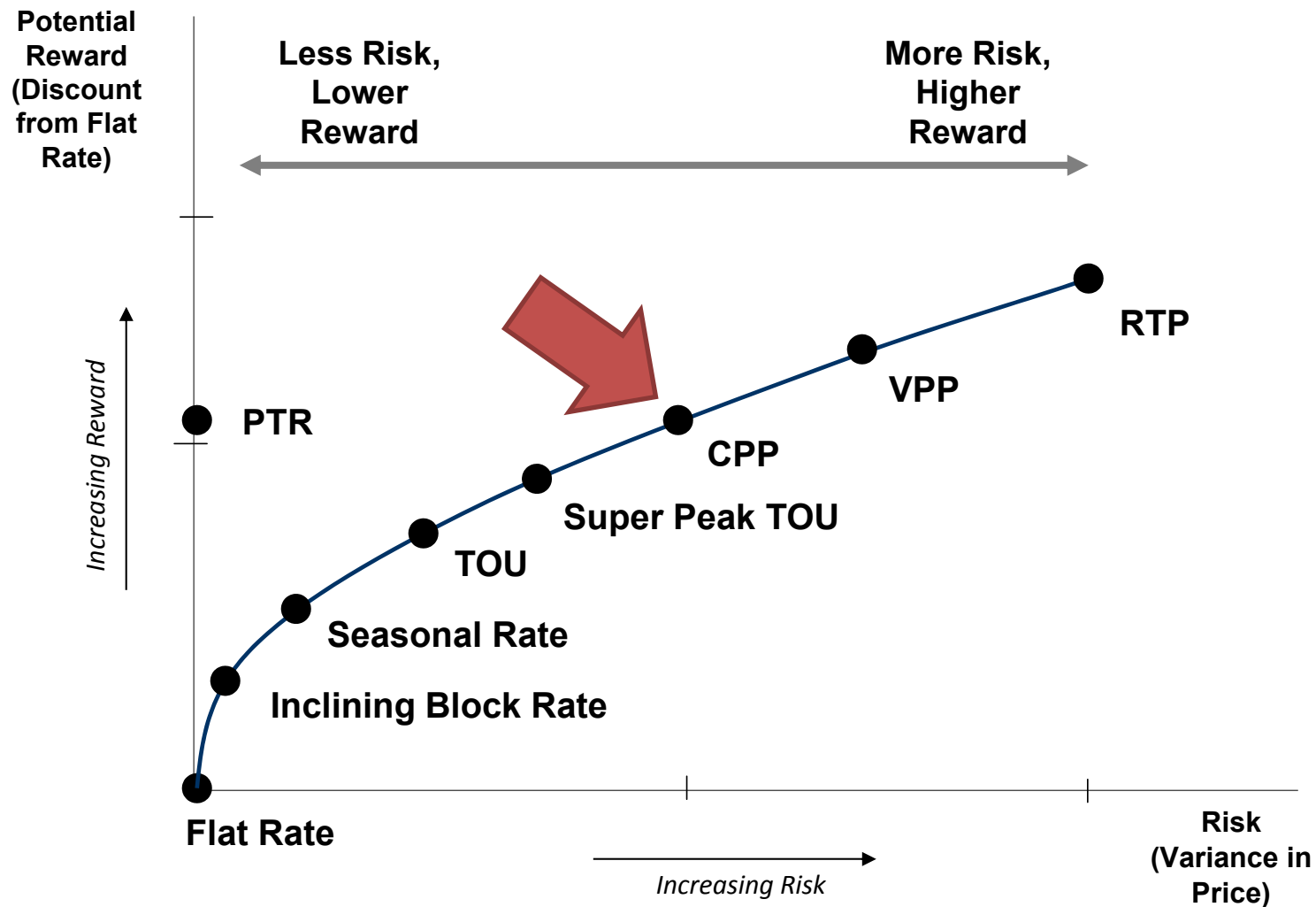


## Of course, dynamic pricing requires smart meters

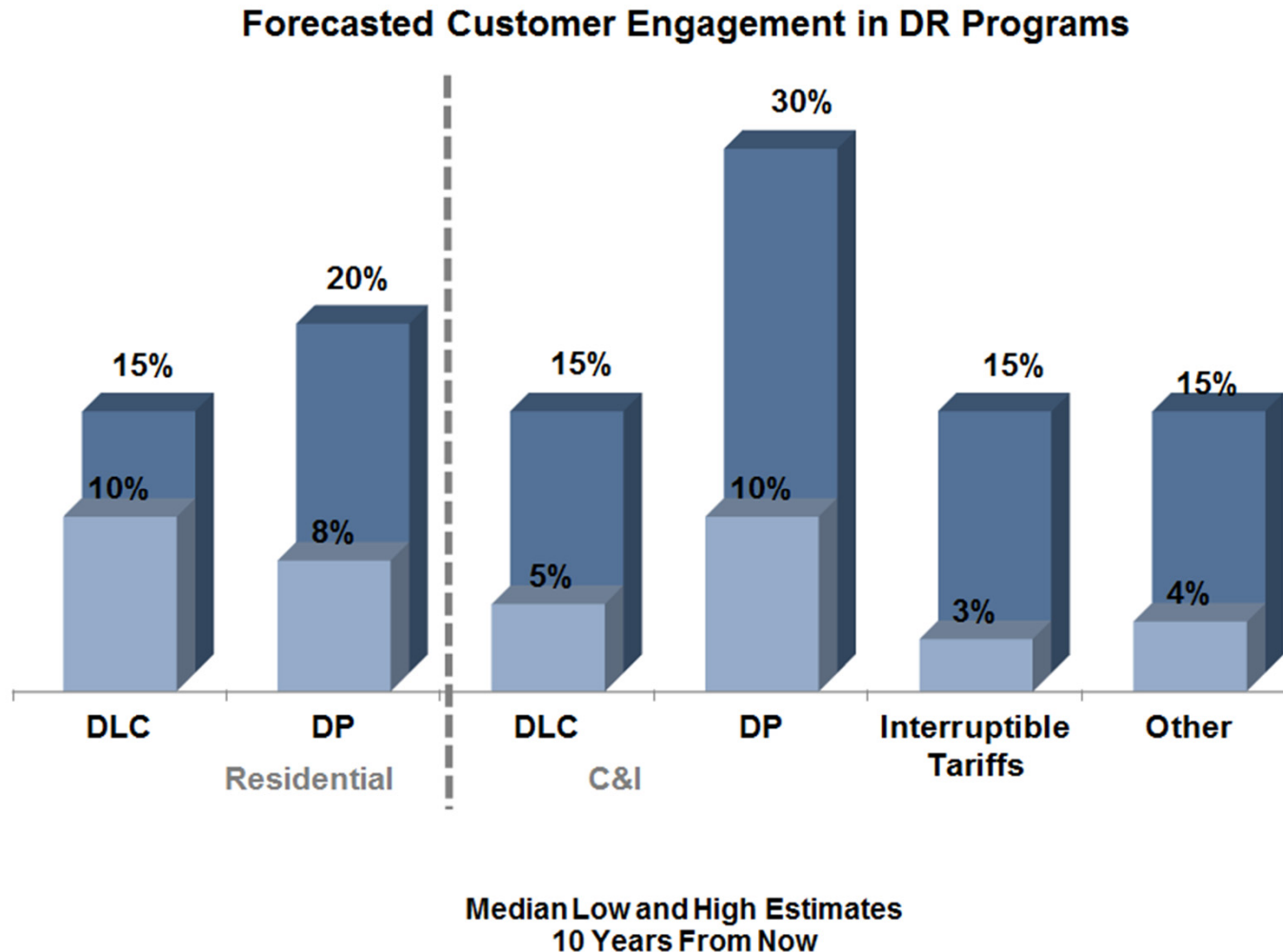
- **33% of the nation's 114 million households are already on smart meters**
- **50% are expected to be on smart meters in another five years**
- **100% may be on smart meters ten years out**
- ***Progress is inevitable; the best that some can hope to do is to delay it.***
  - **This anti-smart meter video has 1.7 million hits  
[http://www.youtube.com/watch?v=8JNFr\\_j6kdl](http://www.youtube.com/watch?v=8JNFr_j6kdl)**



# The best solution is to provide rate choices but anchor those choices on dynamic pricing



# Dynamic pricing is expected to play a significant role in the future – survey of 50 experts

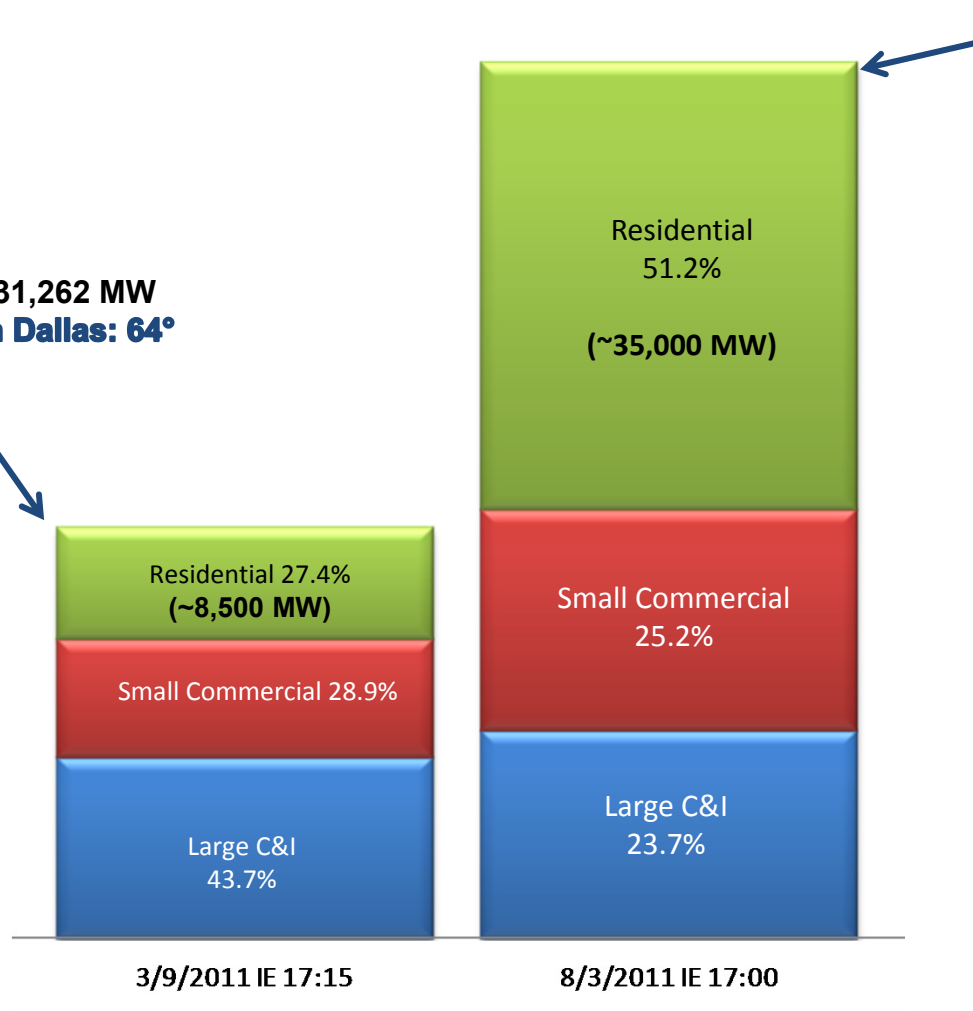


## ***The Sun also Rises***

- **ComEd and Ameren have enrolled about 25,000 customers on RTP in Illinois and a new state law calls for opt-in PTR to offered statewide**
- **PG&E has enrolled 60,000 customers on CPP**
- **This summer, SDG&E is offering PTR on an opt-out basis and SCE is offering PTR on an opt-in basis**
- **OG&E has begun rolling out VPP and hopes to sign up 20% of its customers over the next 3 years**
- **BGE and PHI will be offering PTR to two million customers over the next few years in Delaware, Maryland and the District of Columbia**
- **PJM is allowing price-responsive demand to be bid into its multi-state markets**

# The biggest opportunity may lie in Texas, where the mass market represents 50% of peak demand

Wednesday  
March 9, 2011  
5:15 PM  
ERCOT Load: 31,262 MW  
Temperature in Dallas: 64°

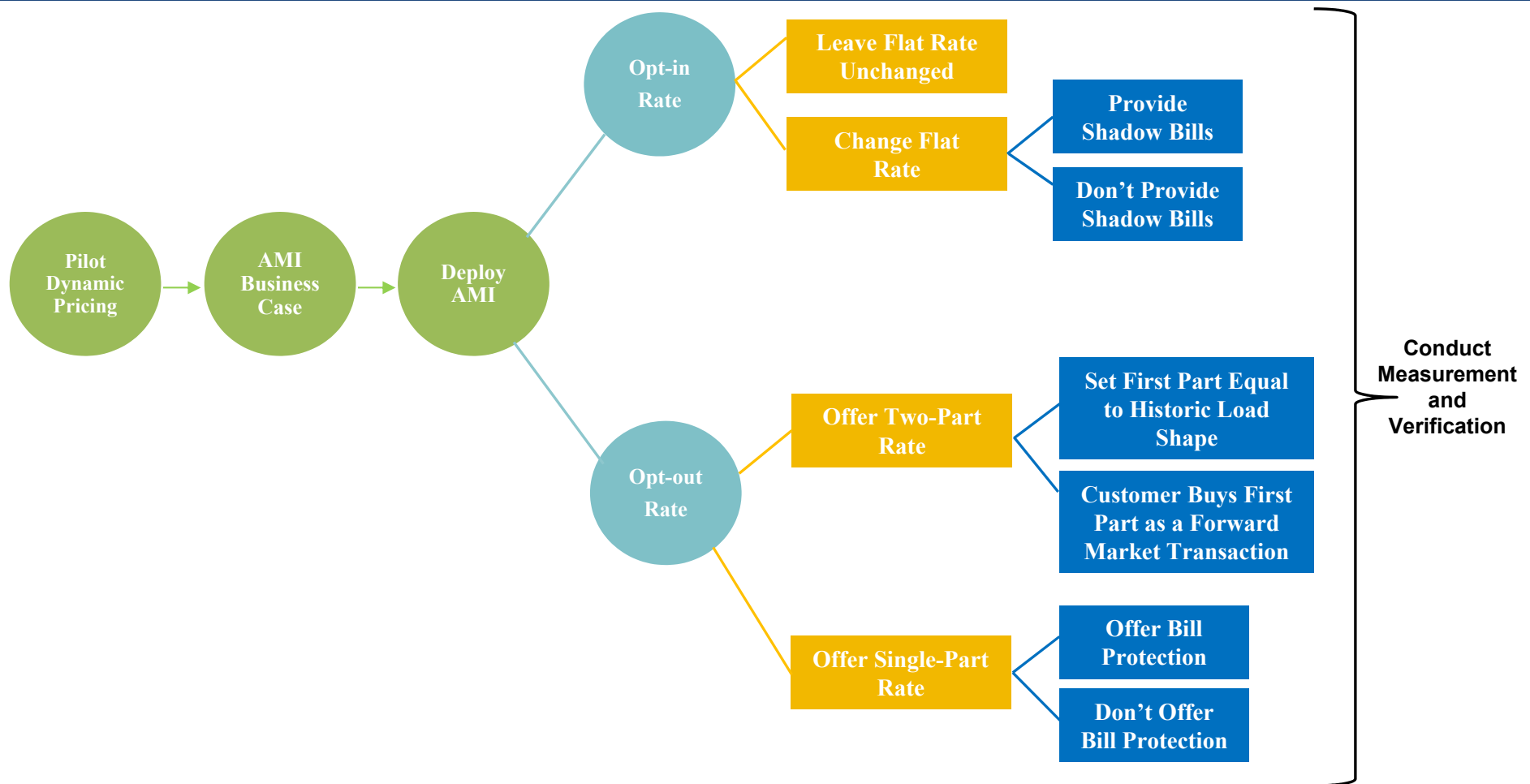


Wed., Aug. 3, 2011  
5:00 PM  
ERCOT Load: 68,416 MW  
Temperature in Dallas: 109°

- Customer class breakdown is for competitive choice areas; percentages are extrapolated for munis and co-ops to achieve region-wide estimate
- Large C&I are IDR Meter Required (>700kW)

Source: ERCOT

# *The best way to predict the future is to create it – Peter Drucker*



Understand  
Customer  
Preferences

Segment the  
Market

Create  
Segment-  
Specific  
Messages

Get the Word  
Out

Educate and  
Answer  
Questions

# Source documents

(Dynamic pricing bibliography available on request)

- Federal Energy Regulatory Commission staff. *A National Assessment of Demand Response Potential*. June 2009. <http://www.ferc.gov/legal/staff-reports/06-09-demand-response.pdf>
- Faruqui, Ahmad, Ryan Hledik and Jennifer Palmer, *Time-Varying and Dynamic Rate Design*, Regulatory Assistance Project, July 2012. <http://www.raonline.org/topic/global-power-best-practice-series>.
- Faruqui, Ahmad and Doug Mitarotonda, "Energy Efficiency and Demand Response in 2020: A Survey of Expert Opinion," *The Brattle Group*, November 2011. <http://www.brattle.com/documents/UploadLibrary/Upload990.pdf>
- Faruqui, Ahmad and Jenny Palmer, "The Discovery of Price Responsiveness – A Survey of Experiments Involving Dynamic Pricing of Electricity," *EDI Quarterly*, April 2012, [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2020587](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2020587)
- Faruqui, Ahmad and Jenny Palmer, "Dynamic Pricing and its Discontents," *Regulation*, Fall 2011. <http://www.cato.org/pubs/regulation/regv34n3/regv34n3-5.pdf>
- Faruqui, Ahmad and J. Robert Malko, "The Residential Demand for Electricity by Time-of-Use: A survey of twelve experiments with peak load pricing," *Energy: The International Journal*, Volume 8, Issue 10, October 1983, pp. 781-795.
- Schwartz, Judith, "The Clash of the Dynamic Pricing Titans," University Club, San Francisco, February 17, 2011, <http://vimeo.com/20206833>
- Wood, Lisa and Ahmad Faruqui, "Dynamic Pricing and Low-Income Customers: Correcting misconceptions about load-management programs," *Public Utilities Fortnightly*, November 2010, pp. 60-64. [http://www.fortnightly.com/archive/puf\\_archive\\_1110.cfm](http://www.fortnightly.com/archive/puf_archive_1110.cfm)

# Biography – Ahmad Faruqui



**Ahmad Faruqui, Ph. D.**  
Principal  
*The Brattle Group*  
San Francisco, California  
Ahmad.Faruqui@brattle.com  
925-408-0149

Ahmad Faruqui is a principal with *The Brattle Group* who specializes in the analysis, design and evaluation of smart grid strategies involving the consumer. He has **consulted with more than 50** utilities and transmission system operators around the globe and testified or appeared before a dozen state and provincial commissions and legislative bodies in the United States and Canada. He has also advised the Alberta Utilities Commission, the Edison Electric Institute, the Electric Power Research Institute, the Federal Energy Regulatory Commission, the Institute for Electric Efficiency, the Ontario Energy Board, the Saudi Electricity and Co-Generation Regulatory Authority, and the World Bank. His work has been cited in publications such as *The Economist*, *The New York Times*, and *USA Today* and he has appeared on Fox News and National Public Radio. The author, co-author or editor of four books and more than 150 articles, papers and reports on efficient energy use, he holds a Ph.D. in economics and an M.A. in agricultural economics from The University of California at Davis, where he was a Regents Fellow, and B.A. and M.A. degrees in economics from The University of Karachi with the highest honors.

The views expressed in this presentation are strictly those of the presenter(s) and do not necessarily state or reflect the views of *The Brattle Group, Inc.*

# Our contacts

[www.brattle.com](http://www.brattle.com)

## North America



**Cambridge, MA**  
+1.617.864.7900



**Washington, DC**  
+1.202.955.5050



**San Francisco, CA**  
+1.415.217.1000

## Europe



**London, England**  
+44.20.7406.7900



**Madrid, Spain**  
+34.91.418.69.70



**Rome, Italy**  
+39.06.48.888.10