The Brattle Group

Managing the Benefits and Costs of Dynamic Pricing in Australia

AEMC Power of Choice Public Forum
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Why not flat rates?

- **Providing electricity at peak times is very expensive**
- **For most utilities the annual load factor is under 60%**
- **The top 1% of the hours account for 8-18% of the annual peak load**
  - Generation and network 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 every customer pays higher rates**
- **Prices can act as a signal, telling consumers when to conserve**

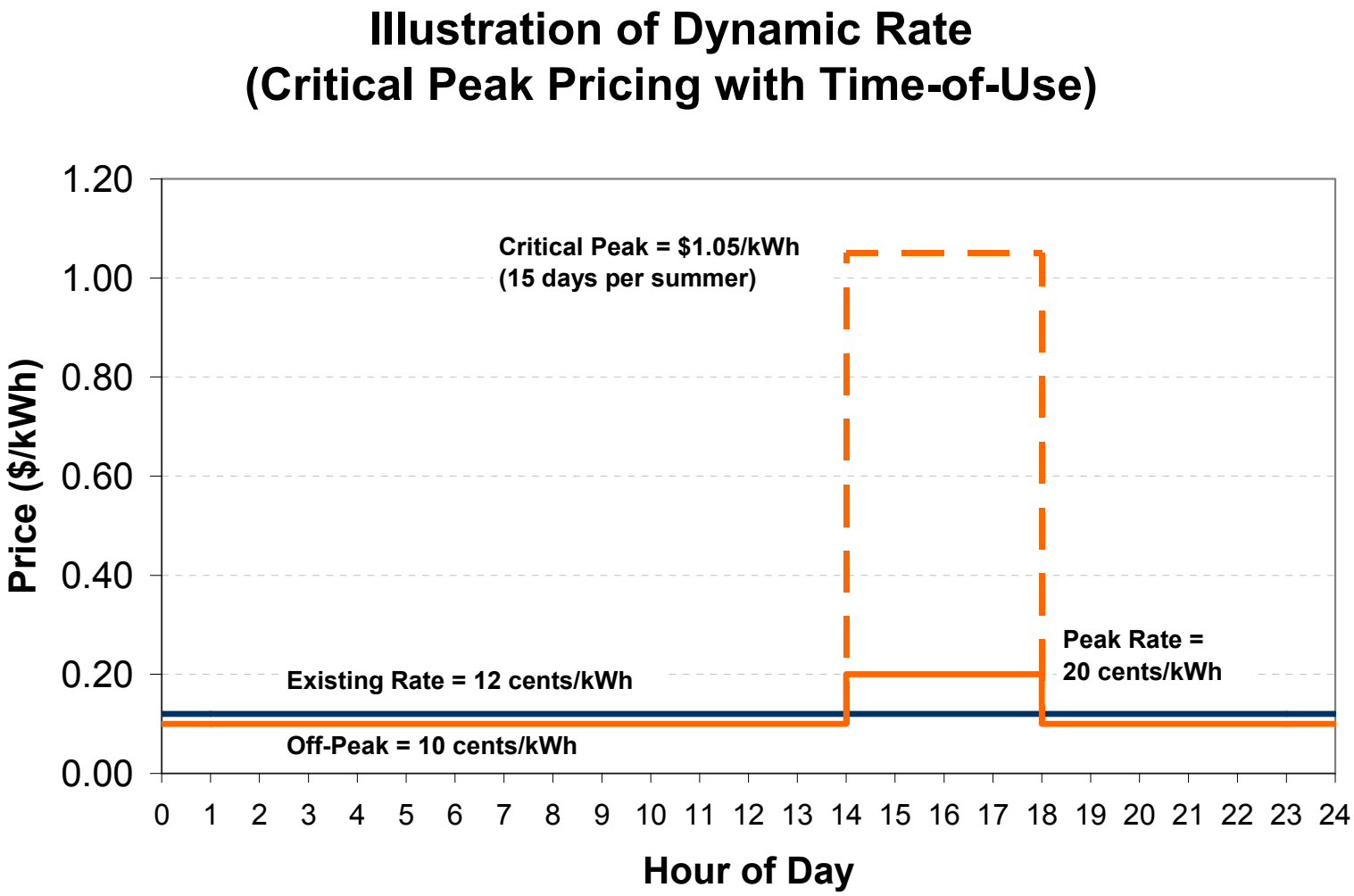
Is dynamic pricing a fiction?

- **It is widely practiced in most capital-intensive industries**
  - Airlines, hotels, car rentals, sporting events, music halls and theaters
  - More recently: fast lanes on freeways, bridge tolls, entrance to central cities, and parking in central cities
- **Why? It improves load factors, lowers average costs, manages congestion and ensures that supply is available for high valued uses**

What is dynamic pricing?

- **Simply put, it is "cost-reflective pricing"**
- **Many 'flavors' exist**
  - Time variant rates (or time-of-use rates, TOU)
  - Critical-peak pricing (CPP)
  - Peak-time rebates (PTR)
  - Variable-peak pricing (VPP)
  - Real-time pricing (RTP)
- **These can be combined to yield hybrid forms of dynamic pricing**

Dynamic pricing means lower rates for thousands of hours a year and higher prices during a few hundred



Criteria to compare different dynamic rates

1. Economic efficiency
2. Equity between customers
3. Ensure revenue stability
4. Minimize bill volatility
5. Manage risk to vulnerable customers

Economic Efficiency

- **Price acts as a signal**
- **If price is set to the incremental cost of providing a kWh**
  - Consumers who value the kWh more than the cost will use it.
  - Consumers who value it less will not.
- **Ensures resources are not wasted**
- **May not meet other social goals such as protecting vulnerable consumers**

Equity

- No consumer should unintentionally subsidize another consumer
- Different load profiles mean that "peaky" are using electricity when it is most expensive
- They are subsidized by less "peaky" consumers who overpay for cheap off-peak electricity
- In the US we estimate that under flat rate pricing, inter-customer subsidies may amount to $3 billion per year

Risks

Revenue Stability

- Risk faced by retailer in moving away from flat rate
- Theoretically, all pricing schemes can be implemented to be revenue neutral
  - More difficult to achieve with consumer price response.

Bill Risk

- Risk faced by consumer of large increases in bill
- Pricing schemes can be designed to be neutral for the average customer
- May not be neutral for all customers – winners and losers

Risk to Vulnerable Consumers

- **Bill risk faced by customers that bill support under flat pricing.**
- **In Australia, over 30 percent of the population aged 15 and over is eligible for electricity subsidies.**
  - Includes senior citizens, unemployed youth, low income families, and the chronically ill among others
  - There may still be other vulnerable consumers who do not meet the various eligibility criteria.

Flat-rate pricing is not inexpensive

Flat rates are inefficient

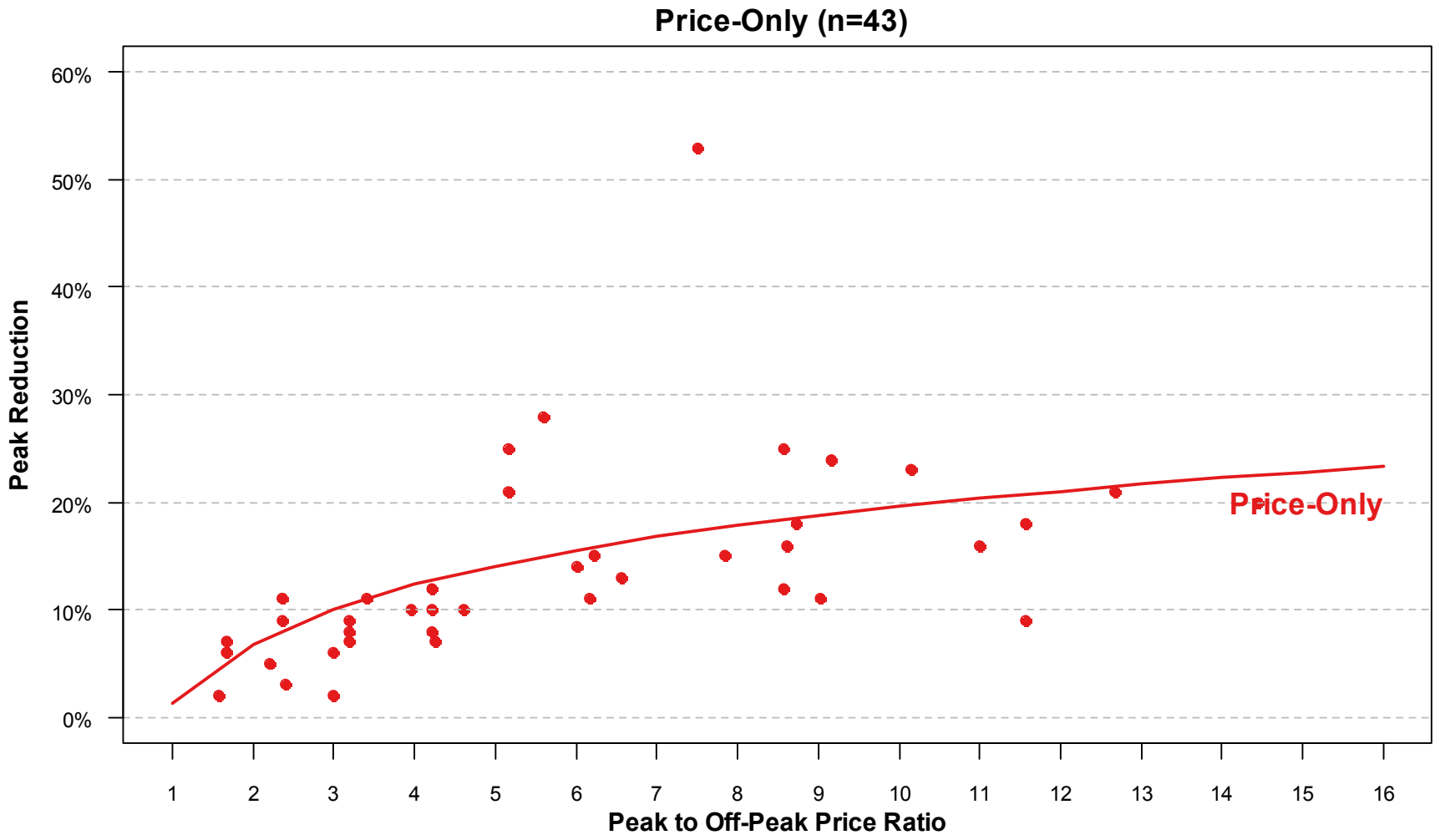
- They do not signal to consumers when electricity is expensive to consume.
- In the US customers may be overpaying for electricity by about $7 billion/year.
  - We take the FERC Staff estimate of 92 GW saved under universal dynamic pricing and value demand response at $75/kW-year

Flat rates are unfair

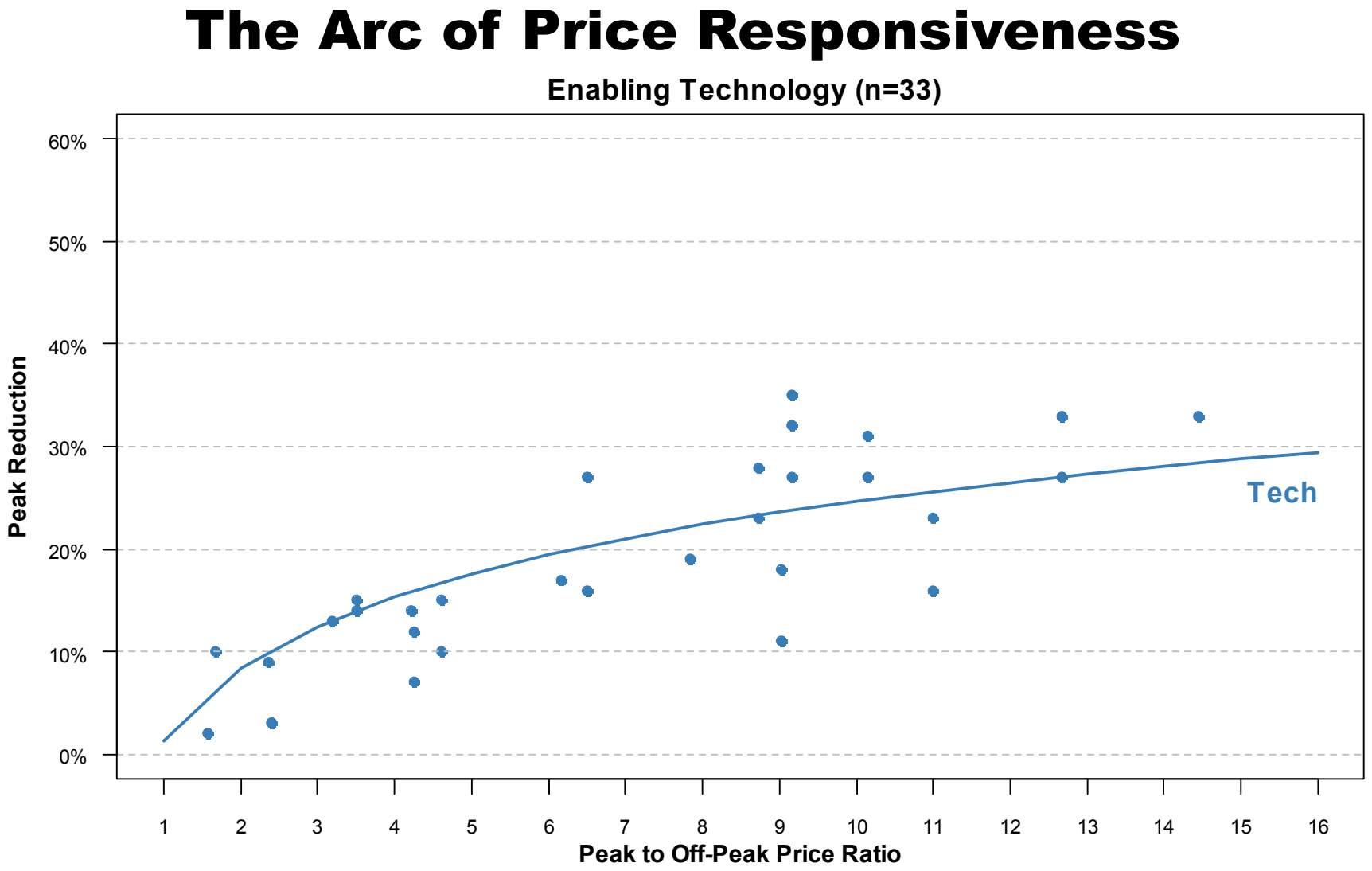
- Under flat rate pricing, inter-customer subsidies may amount to $3 billion/year in the US.
  - We scale up the results from a California rate design study that was sponsored by the Demand Response Research Center

Customers do respond to price signals

The Arc of Price Responsiveness



Enabling technology further enhances price responsiveness



Many are concerned about the risks of dynamic pricing

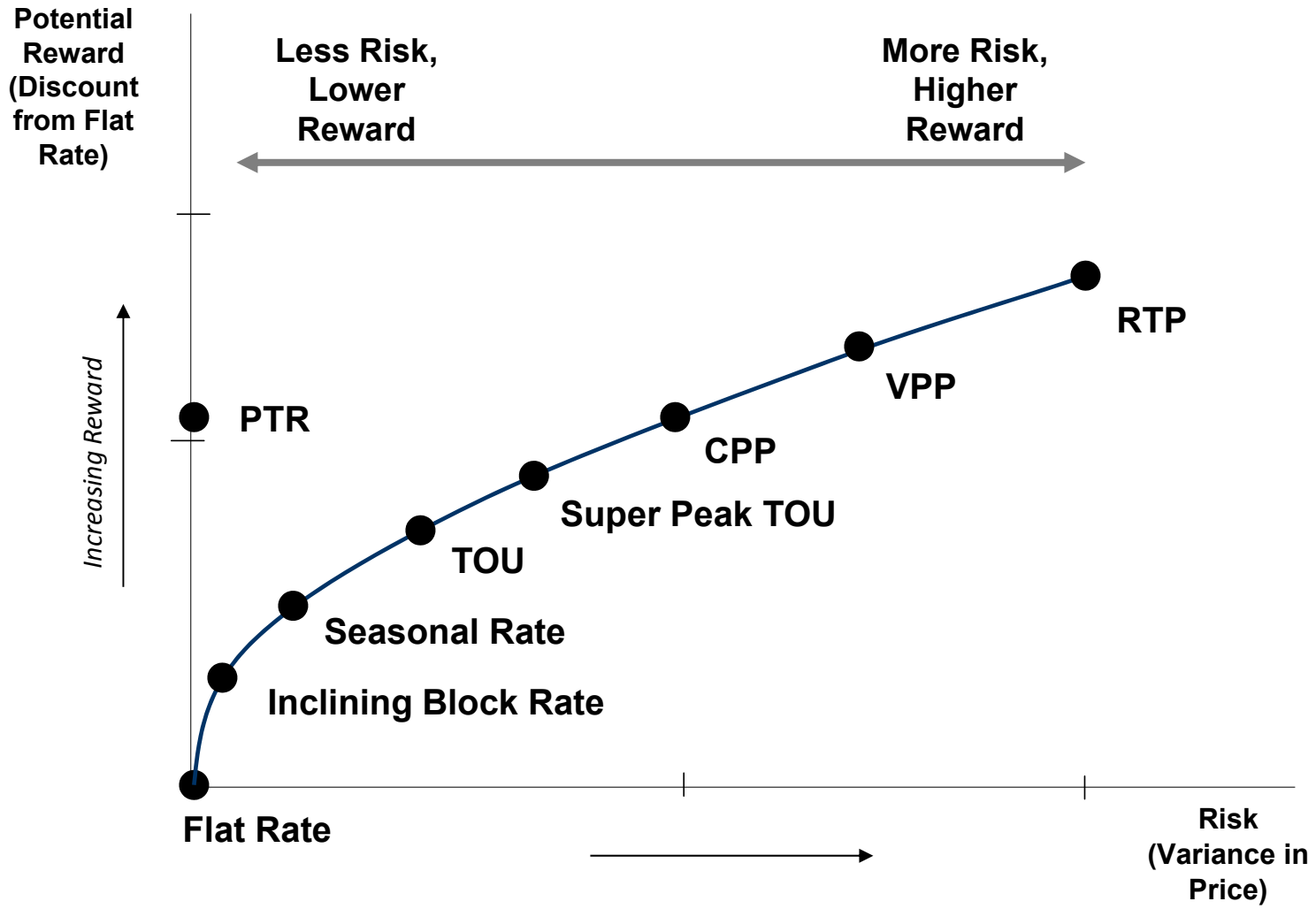
The risk of revenue loss to the retailer

- Pricing schemes can be designed to be revenue neutral

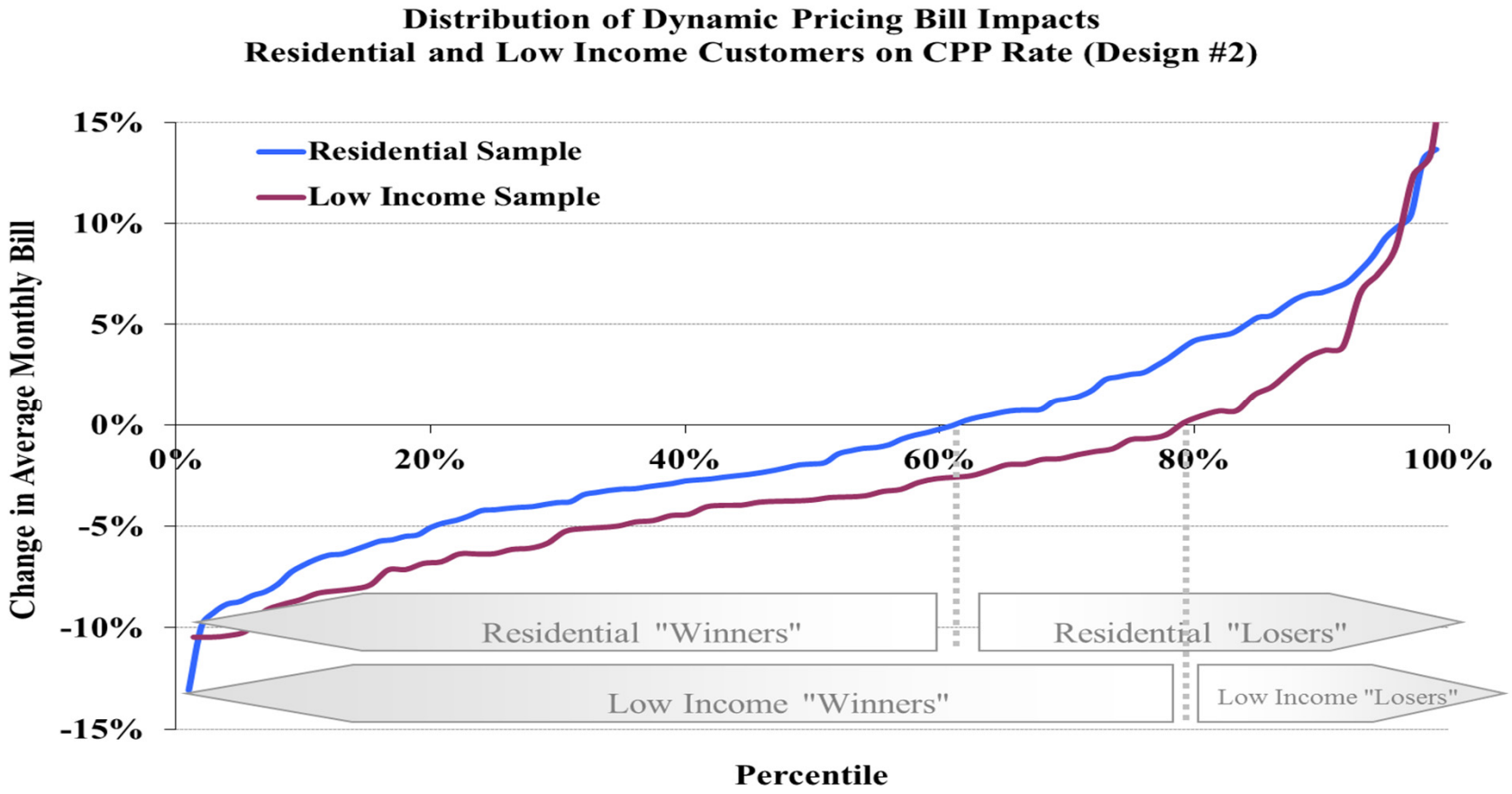
The risk of high bills to customers

- Pricing schemes can be designed to be bill neutral for the average customer
- May not be neutral for all customers – winners and losers
- Particular concern over vulnerable customers
  - In Australia over 30 percent of the population aged 15 and over is eligible for electricity bill support

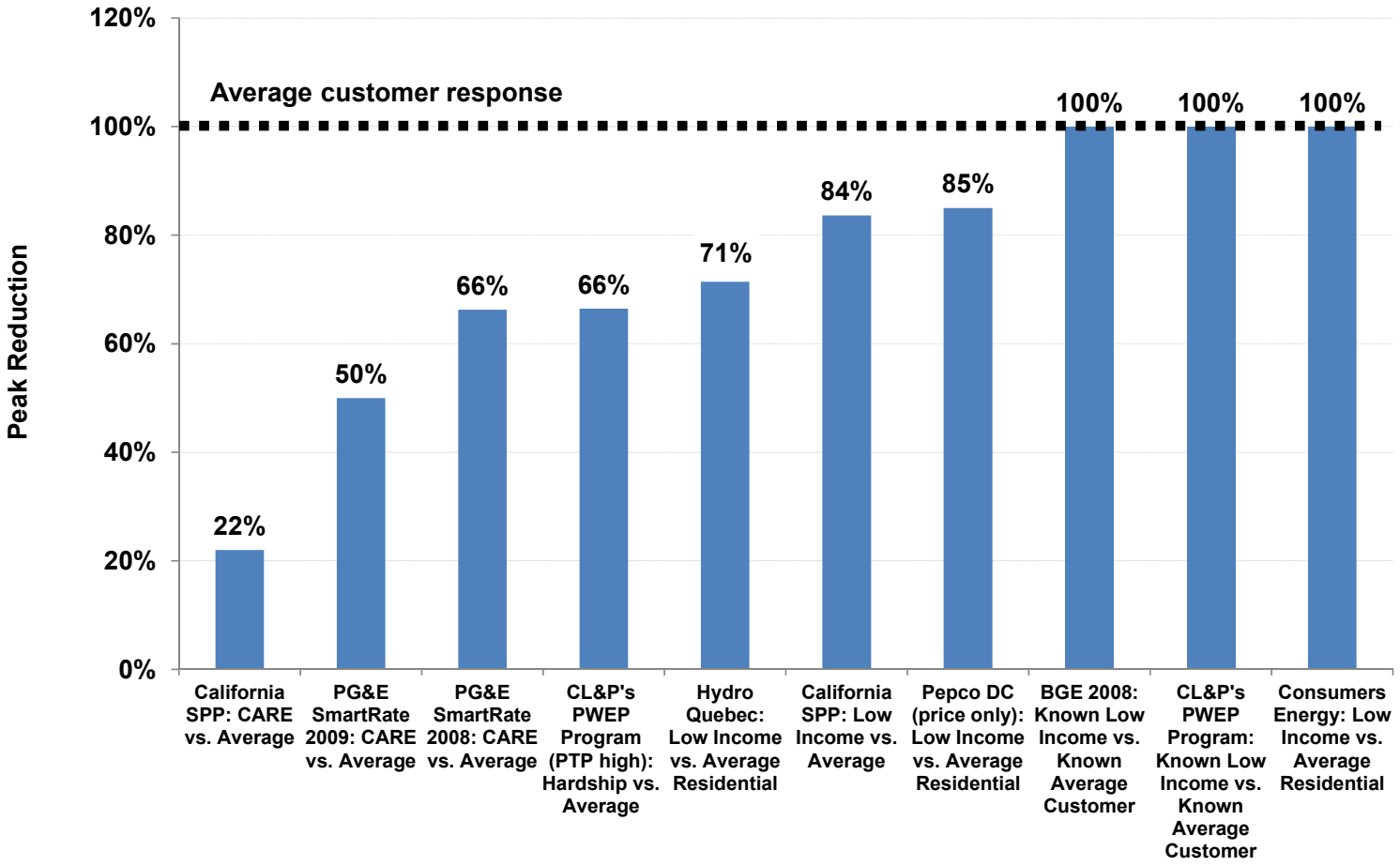
All customers face a risk-reward trade-off, including vulnerable customers



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



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



Note: For the PepcoDC pilot, the average residential response excludes low income customers that qualify for the RAD program

Pricing schemes can be designed so as to protect vulnerable consumers

Education

Enabling Devices such as in-home displays and web-portals

A smooth transition path

- ✓ Facilitates adjustment

Participation thresholds

- ✓ Limit exposure of vulnerable consumers to dynamic prices
- X However vulnerable consumers may be excluded from benefits of dynamic pricing

continued…

Pricing schemes can be designed to protect vulnerable consumers

Price floors and price ceilings

- Limits exposure to extreme short-term prices
  - ✓ Can be designed to be revenue neutral
  - X But distorts price signal

Consumer Baseline (CBL)

- Only deviations from baseline face market prices
  - ✓ No risk if usage remains unchanged
  - ✓ Correct price signal for incremental use
  - ✓ No revenue risk to retailers
  - X But preserves historic cross-subsidization
  - X May be complicated to understand

CBL has only been implemented for large commercial and industrial customers…

It can be modified to better suit residential customers

- Temperature adjustments
  - To counter events that cause “uncontrollable” deviations from the baseline
- New customers
  - CBL can be phased in so as to allow time to adapt and create a baseline
- Variable CBL
  - The CBL can be scaled up or down to limit or increase exposure to the dynamic price.
  - Customers can choose their own risk level

Comparing dynamic rates…

Policy	Economic Efficiency	Equity	Bill Stability (Risk to Vulnerable Consumers)	Revenue Stability
Flat rate	--	--	++	-
PTR	+	-	++	--
CPP	+	o	o	+
TOU	+	+	o	o
One-Part RTP	++	++	--	+
Two-Part RTP	++	++	-	++

Key:

+ + : very good
+ : good
o : average
- : poor
- - : very poor

Some recent developments that may herald the future in the United States

Arizona

- Over two decades, Arizona Public Service has enrolled 51% of its customers on a voluntary TOU rate and the Salt River Project has enrolled about 30% of its customers on a voluntary TOU rate
- In both cases, the TOU rate appeals to large consumers who avoid the upper tier of an inclining block rate by going with TOU

California

- PG&E has enrolled 60,000 customers on CPP
- SDG&E is offering PTR on an opt-out basis
- SCE is offering PTR on an opt-in basis

Illinois

- Both the investor-owned utilities, ComEd and Ameren, have enrolled about 25,000 customers on RTP in Illinois
- A new state law calls for opt-in PTR to be offered statewide

US developments (concluded)

Oklahoma

- OG&E has begun rolling out VPP and hopes to sign up 20% of its customers over the next 3 years
- By so doing, it hopes to avoid building a medium-sized power plant

The Mid-Atlantic Region

- 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, as AMI and dynamic pricing are rolled out in its footprint of 51 million customers

Some recent developments that may herald the future around the globe

Ontario, Canada

- 3.9 million (81%) residential and small business customers are on TOU rates under a regulated retail pricing plan (March 2012)
- All customers have the option of switching over to retail providers

Ireland

- The Commission for Energy Regulation is currently assessing the pros and cons of mandating TOU tariffs and intends to publish its findings by the end of this year
- Stakeholder engagement will follow in 2013

International developments (concluded)

France

- Électricité de France has offered residential customers CPP across France through the tempo tariff since 1996.
- Roughly 400,000 customers have enrolled in the rate.

China

- Beijing: 62% of the population was on TOU rates by the end of 2003.
- Hebei: 40,000 customers (about half of all sales) are on TOU rates. Additionally, Hebei has instituted a mild CPP rate.
- Jiangsu: Voluntary residential TOU since 2003.
- Shanghai: TOU rate with a 4.5-to-1 peak to off-peak price ratio.

Making the transition – Opt-in

Opt-in participation rates tend to be quite low

- The rate is 1% in the US for time-varying rates and 1% of that 1% for dynamic pricing rates

However, if the hedging premium that is embedded in flat rates is removed from the dynamic pricing rate, making it less expensive than the flat rate, higher participation rates can be expected

- The Arizona example cited earlier makes the point: time-varying rates have been selected by 51% of the customers for one utility and by 29% for another

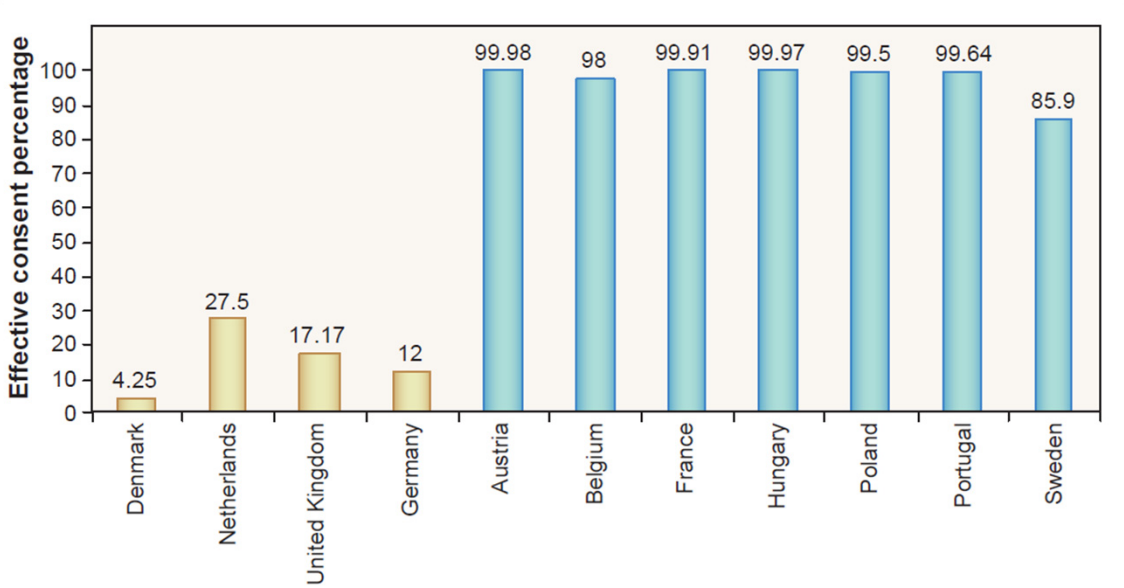
Making the transition - Opt-out

If dynamic pricing is offered on an opt-out basis, societal benefits will be maximized but some customers may see higher bills

- They could be allowed to opt-out and moved to flat rates that embody the full hedging premium
- Bill protection could be provided for the first few years
- Two-part pricing could be offered

Making the transition – Opt-in versus Opt-out

If dynamic pricing is offered on an opt-in basis, participation will be very limited



Effective consent rates, by country. Explicit consent (opt-in, gold) and presumed consent (opt-out, blue).

Organ Donor Rates by Country. Source: Johnson & Goldstein, 2003

AEMC's proposed approach is probably the best way to move forward

- **Opt-in for vulnerable consumers**
- **Mandatory for consumers above a certain size**
- **Opt-out for all other consumers**
  - And if they do opt-out, they can pick a new flat rate which reflects the full cost of hedging

Source documents
(Dynamic pricing bibliography available on request)

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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.

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