Moving Demand Response back to the Demand Side

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In the beginning

After the energy crisis in California, what was for long called Load Management morphed into the term Demand Response

It was thought that Demand Response would help integrate retail and wholesale markets and prevent future crises

However, it has been very difficult to integrate the markets and Demand Response itself has been bifurcated into retail and wholesale demand response

Wholesale demand response acts as negative supply

The state of play

While demand response has grown at some 20 percent per year recently, the full potential remains unrealized

 This is borne out in several studies we have been published recently for WECC and for utilities in Colorado, Minnesota and the Pacific Northwest

The FERC's National Assessment of Demand Response Potential, filed with Congress in 2009, identified that the bulk of the potential for demand response resided in the residential and small commercial class

There was a presumption that the rollout of smart metering would enable the provision of dynamic pricing

We projected the benefits of dynamic pricing in the year 2010 for the NYISO

This was a *gedanken* (thought) experiment which presumed that smart meters had been deployed throughout the Empire State and that all customers were being served real-time pricing

Reduction in peak demand

 System peak demand would fall by 10-14 percent, depending on the zone

Reduction in costs

Total resource costs would decrease by \$143-509 million per year, or 3 percent to 6 percent

Improvement in economic well-being

- Consumer surplus would rise by \$162-572 million per year
- Social surplus in 2010 would rise by \$141-403 million per year

In other work, we have shown that flat rate pricing imposes a cost of \$10 billion each year on customers in the United States

33% of the nation's 114 million households are on smart meters

But only 2% are on time-based rates

And only 1% of these are on dynamic pricing rates

That prevents us from harnessing the benefits of universal dynamic pricing

- \$7B/year in lower energy costs
- \$3B/year in reduced cross-subsidies

Seven myths have blocked the gate to the "promised land"

Myth #1: Customers don't respond to dynamic pricing Myth #2: Customer response does not vary with the magnitude of the price signal Myth #3: Enabling technologies don't boost demand response

Dynamic pricing

Myth #7: Customers don't want dynamic pricing

> Myth #6: Customers have never encountered dynamic pricing

Myth #4: Customer response does not persist over time

Myth #5: Dynamic pricing will hurt lowincome customers

Myth #1: Customers don't respond to dynamic pricing

Because results vary widely, some conclude that we have learned nothing about customer response



Source: Faruqui, Ahmad. "Arcturus." The Brattle Group.

60% of the tests have produced peak reductions of 10% or greater



Source: Faruqui, Ahmad. "Arcturus." The Brattle Group.

Grouping results by tariff design helps explain some of the variation in impacts



Source: Faruqui, Ahmad. "Arcturus." The Brattle Group.

Myth #2: Customer response does not vary with the magnitude of the price signal

Not only do customers respond, but the magnitude of their response varies with the price incentive. The higher the incentive, the greater their demand response.

To study this relationship between price incentive and peak energy reduction, we have estimated the Arc of Price Responsiveness. The Arc is based on 210 time-varying pricing treatments from around the world.

We plot demand response against the peak to off-peak price ratio



Myth #3: Enabling technologies don't boost demand response

The data shows that enabling technologies boost price responsiveness



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Myth #4: Customer response does not persist over time

We observe that customer response has persisted in long-lived pilots

- California, Washington, D.C., Oklahoma for 2 years
- Maryland for 4 years

TOU programs have been in place for decades

- The French *tempo* tariff goes back to 1965
- Arizona's TOU rates go back to 1980

Myth #5: Dynamic pricing will hurt lowincome customers

Nearly 80% of *low income* customers are paying more under flat rates



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

Percentile

Low income customers are price responsive, so they will save more with dynamic pricing



Myth #6: Customers have never encountered dynamic pricing

Consumers experience dynamic pricing in everyday purchases

In the 1990s, Robert Cross highlighted the trend toward setting prices dynamically to maximize profit^{*}

Today, dynamic prices are used by a variety of capital-intensive industries such as airlines, hotels, rental car firms, and railroads

Since 2009, tickets for San Francisco Giants baseball games have varied according to the value of the game

*Source: Cross, Robert. Revenue Management: Hard Core Tactics for Market Domination, Broadway Books, 1997.

Myth #7: Customers don't want dynamic pricing

In Connecticut Light and Power's Plan-it Wise pilot, post-pilot surveys and focus groups were carried out to examine how customers felt about their participation in the pilot. Residential customers who participated in the survey had an overall satisfaction rating of 5.1 out of a possible 6, with 92 percent saying they would participate again

Customers showed similarly high levels of satisfaction with pilots at Consumers Energy, Baltimore Gas and Electric, Hydro One and California utilities

Customers are not inconvenienced by time-varying pricing

Related to the myth that customers do not want dynamic pricing is the idea that customers will have to resort to extreme measures to save money on dynamic rates, such as getting up at 2 AM to do the laundry

In a recent survey of customers who participated in the Hydro One TOU pilot, only 4 percent found the changes in their daily activities to be inconvenient

Most customers value the opportunity to save money by making small adjustments in their energy consumption schedules

Residential dynamic pricing is transitioning to a new phase: full-scale deployment

Several utilities are achieving significant participation through aggressive *opt-in* programs

- Time-of-use (TOU) rates at APS and SRP in Arizona
- Variable peak pricing (VPP) at OG&E in Oklahoma
- TOU pricing by AusGrid in the greater Sydney area
- Day-dependent TOU pricing in France by EDF

Others are rolling out *default* programs for the mass market

- Pepco in Delaware and Maryland
- BGE in Maryland
- Sacramento Municipal Utility District (SMUD) in California
- The Province of Ontario, Canada
- The EU, first Italy and now Spain

Ontario's Residential TOU Program

Besides Italy, Ontario is the only region in the world to deploy Time-of-Use (TOU) rates for generation charges to all customers who stay with regulated supply

TOU rates were deployed in Ontario to incentivize customers to curtail electricity usage during the peak period and possibly to reduce overall electricity usage

The Brattle Group was retained by Ontario Power Authority to undertake the impact evolution of the TOU program

Three year assignment; the 1st Year Impact Evaluation results are presented here, the 2nd year study is underway

Overview of residential class results

There is significant evidence of load shifting across all LDCs

 Reduction in usage in the peak and mid-peak periods (generally highest in the peak periods), increase in usage in the off-peak periods

Load shifting is higher in the summer rate period than the winter

- Summer peak period impacts range from -2.6% to -5.7%
- Winter peak period impacts range from -1.6% to -3.2%

Peak period substitution elasticities range from 0.12 to 0.27, somewhat higher than those observed elsewhere

There is mixed evidence on energy conservation

Should TOU rates be rolled out as the default tariff?

Residential TOU Enrollment Rates



The average TOU enrollment level is 28% under default flat rates. When TOUs are the default, the average enrollment rate rises to 85%

Should dynamic pricing be rolled out as the default tariff?

Residential Dynamic Pricing Enrollment Rates



The average dynamic pricing enrollment is 20% under default flat rates and 84% when dynamic prices are the default

What does the future hold?

The Massachusetts Department of Public Utilities has issued a straw proposal that calls for default time-of-use and critical peak pricing

 Comments are coming in and a final order is expected to be issued before year-end

The California PUC is reviewing its rate design options through a proceedings that began last year and a decision is expected next year

A workshop is being held this Wednesday and Thursday

The New York PSC has begun a proceedings to reform its energy vision and it is likely to discuss pricing options in Phase II

Conclusions

As Bushnell, Hobbs and Wolak (2009), have argued, price-based demand response is the natural form of demand response

It is time to put demand response back on the demand side of the market

To get to the "promised land," regulators need to capitalize on the roll-out of smart meters and begin making a transition to dynamic pricing

Presenter Information



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Dr. Ahmad Faruqui is a Principal with The Brattle Group. His consulting practice is focused on the full spectrum of customer strategy issues involving innovative pricing, energy efficiency, demand response, demand forecasting and cost-benefit analysis of smart grid investments. He has worked for more than 50 utilities, regulatory bodies, governments and financial institutions around the globe. He has also appeared before several state and provincial commissions and legislative bodies. His work has been cited in *The Economist, The New York Times*, the *Washington Post* and *USA Today.* He has been interviewed on Fox Business News and National Public Radio. The author, co-author, editor or co-editor of four books and more than 150 articles on energy economics, he has held teaching positions at the University of Karachi, the University of California at Davis and San Jose State University. He holds B.A. and M.A. degrees in economics from The University of Karachi, Pakistan, and M.A. and Ph. D. degrees respectively in agricultural economics and economics from the University of California at Davis.

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

Additional Resources

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