

# A global survey of customer-centric tariff reforms

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## PRESENTED BY

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# **A variety of disruptive technologies have begun to appear in customers' premises**

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**Smart thermostats**

**Digital appliances around the house**

**Electric vehicles in the driveway**

**Battery storage in the garage**

**PV panels on roofs**

# Customers are beginning to meet their own needs

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This has caught the industry off guard; some people are wondering if “distributed generation” may spell doom and gloom for the industry

Of course, self production (*i.e.*, distributed generation) has been around for a long time in other industries

- Back in 1980, the futurist, Alvin Toffler, coined the term *prosumers* in his book, *The Third Wave*

In the electric industry, co-generation, or combined heat and power (CHP), has been around for almost a century among large customers

# Industry guru, Leonard Hyman, has summed up the industry's conundrum

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**“Technology will change the business, but we don’t know for sure how”**

**“And if decentralization and self-generation become the norm, it will become exceedingly difficult to force consumers to pay for the stranded assets at the utility”**

**“Nobody could make former trolley car passengers pay for a service they did not use anymore, either”**

# The industry needs to become customer-centric

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**The industry has always been dominated by an engineering mindset, focusing on generation, transmission, and distribution**

- The customer has been at various times called a load, a meter, and a ratepayer
- Would any retail business survive if they had such a mindset toward their primary revenue producing asset?

**Thus, customer research has been underfunded, often carried out in a desultory manner and relegated to a secondary role**

**Activities inside the customer's premises have been unglamorously dubbed "behind-the-meter"**

- Imagine Nordstrom saying what the customer does with their fashionable merchandise is "beyond-the-cash register"

# The time has come to move forward with tariff reform

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**But it is unclear whether customers (or regulators) will accept the new tariffs**

- Tariff changes create winners and losers
- Retailers may or may not pass through the tariff changes

**The industry has often imposed products and services on customers without assessing customer needs**

- *E.g.*, energy efficiency, demand response, time-varying rates ...
- Customers often can't grasp the language of tariffs

**The industry needs to understand the services that customers want**

# Tariff reforms in the industry have a long history going back to the 1970s

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1st Wave  
Initial  
E-TOU Pilot  
Programs

2nd Wave  
Limited  
Adoption of  
E-TOU  
Rate Design

3rd Wave  
More  
Sophisticated  
Pilots &  
Initial  
Smart Grid  
Deployment

4th Wave  
Addition of  
Res. Demand  
Charges &  
Broader  
Smart Grid  
Deployment

5th Wave  
Smart Homes &  
Transactive Energy

# **Across the globe, utilities are experimenting with multiple pricing options**

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**Guaranteed bill (regardless of usage and load shape)**

**Simple energy-only (volumetric) tariffs with a modest customer charge**

**Time-of-use energy-only tariffs**

**Demand charges with and without time-of-use energy tariffs**

**Peak time rebates**

**Critical peak pricing**

**Variable peak pricing**

**Real-time pricing**

**Transactive energy**



# TOU tariffs in Ontario, Canada

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**For the past five years, some 90% of Ontario's 4 million residential customers have been buying their energy through a regulated supply option, which features a three-period TOU rate**

- They have reduced their peak demand by ~3%, based on a three-year analysis that we carried out for the IESO

**Knowing the limitations of TOU rates, the Ontario Energy Board (OEB) has authorized dynamic pricing pilots that would allow those rates to be offered as supplements to the TOU rates**

**The OEB has ruled that distribution charges will be collected through a fixed charge**

- The Texas PUC is watching the developments with interest

# Variable Peak Pricing in Oklahoma

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**OGE rolled out a dynamic pricing rate coupled with a smart thermostat to its residential customers a few years ago**

- “Smart Hours” features variable peak pricing, or five levels of peak pricing depending on what day type it happens to be

**Some 130,000 customers are on that rate today; they control their thermostat setting, not OGE**

- Average peak load has dropped by ~40%
- Average bill savings amount to ~20% of the customer’s bill

# Peak time rebates in Maryland

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**Both BGE and PHI offer dynamic pricing rebates of \$1.25/kWh to their customers in Maryland (~ 2 million households), and bid in the load reductions into the PJM market**

**At BGE, about 80% of its customers have taken advantage of the rebates and saved \$40 million in utility bills since the program began in 2013**

**In 2015, BGE's PTR customers showed an average demand reduction of 16.2%, up from 14.5% in 2014, and 13.7% in 2013**

# Peak time rebates in Australia

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**A distribution network in Victoria is offering significant rebates for dynamic demand curtailment during peak times (~ \$5/kWh curtailed)**

- Avoiding costly upgrade on low load factor feeder
- Electricity rules say networks must consult alternative resources before building

# Peak time rebates and time-varying rates in the UK

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**UK Power Networks (London) is piloting a peak time rebate targeted specifically at low income customers**

**A couple of pilots have tested time-varying rates**

- One rate featured a “wind twinning” tariff, which was intended to encourage consumption increases/decreases at times of unexpectedly high/low output from wind generation
- Some of the rates tested were dynamic in nature

**Ofgem, the regulator, is looking at new ways to increase the role of price responsive demand, including the possible introduction of firms like Amazon and Google into the marketplace**

# TOU rates in the UK

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**13% of customers are on a TOU rate (Economy 7) designed for customers with thermal energy storage**

- The rate that has been offered for many years, is based on old technology, and the number of participants is in decline

**A start-up retailer has introduced a TOU tariff with a strong price signal**

**British Gas offers a FreeTime tariff, which allows customers to pick one weekend day during which their electricity is free**

**A pilot tested the “Sunshine Tariff,” which charged a lower price during mid-day hours in an attempt to alleviate local distribution system constraints due to net excess solar generation**

# Peak time rebates in Hong Kong

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**Pilot with ~2,000 customers on PTR was carried out a few years ago**

- It showed a peak reduction in the 15-20% range attributable to the dynamic rebate

**The rollout of PTR is being expanded to some 27,000 customers**

# Regulatory perspectives on tariff reforms

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**Globally, while supportive of cost-based tariffs, regulators are universally concerned about adverse bill impacts on any customers**

**There is a special concern about the impact on low income customers and customers with disabilities**

**Bill protection has often been offered to such customers**

**It has also been suggested as a mechanism to protect all customers in the near term**



# Regulators have supported testing cost-based tariffs in pilots

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More than 300 variations of time-varying tariffs have been tested around the globe

Based on the results of the pilots, some regulators have supported rolling out cost-based tariffs on an optional basis

Energy-based TOU tariffs are offered by virtually all utilities as an option

# Demand charges

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**Capacity charges based on the size of the connection are mandatory in France, Italy, and Spain**

**Demand charges are being offered by more than 30 utilities in the U.S. as an optional tariff**

**Utilities such as Arizona Public Service, NV Energy, and Westar Energy filed applications to make them a mandatory tariff for customers with PVs on their roof**

- Salt River Project in Arizona, a municipally owned system, has instituted a mandatory tariff for DG customers
- A couple of rural cooperatives in Kansas and in the Carolinas offer them as a mandatory tariff for all customers

# **In some jurisdictions, cost-based tariffs are the default tariff**

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**Spain offers real-time pricing as the default regulated supply option and about half of all customers have elected to stay on it**

**Ontario has made TOU tariffs the default supply option**

- The rates vary seasonally and feature three periods in each season
- Some 90% of customers are on that tariff

**California is planning to roll out TOU tariffs to all residential customers by 2019**

- A pilot to test default deployment will be implemented next year

# **Peak time rebates have emerged as a very popular option in several jurisdictions**

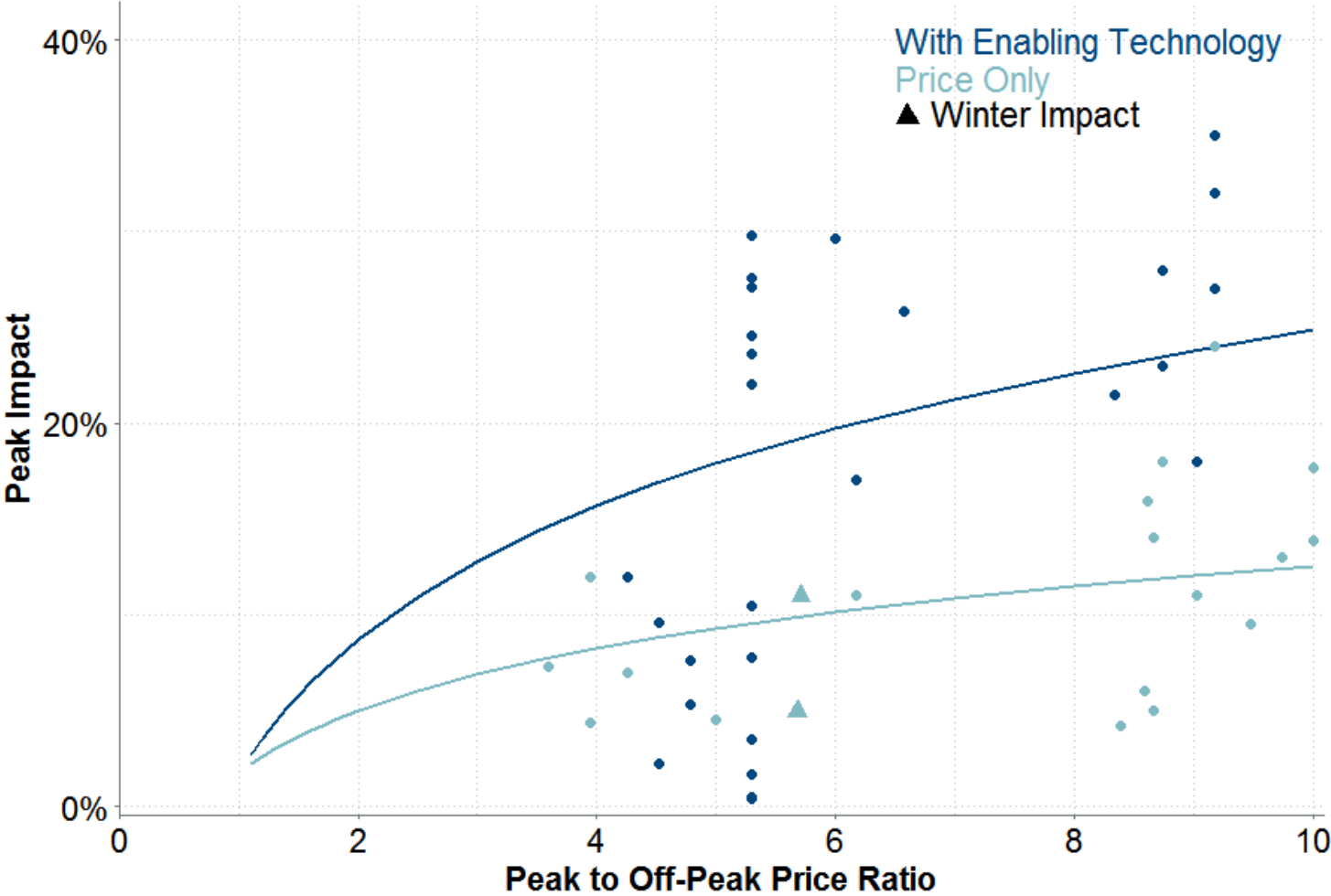
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**They are seen as having no downside for any customer**

**They also have a significant upside for those who chose to lower their demand during dynamically-called peak periods**

**They have been shown to reduce peak loads dynamically consistently**

# The impact of peak time rebates on peak demand can be quite significant



# Conclusions

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**Tariff reform has evolved through five waves since the late 1970s**

**While 300+ pilots have shown that customers respond to time-varying rates, there is a reluctance among policy makers, regulators, and utilities to move ahead with new tariffs because of strongly-held misperceptions about how they may raise customer bills**

**Peak time rebates can represent a step forward in helping customers lower their bills at a time when capacity is very expensive**

**It would be helpful to test likely customer response to peak time rebates in New Zealand, and to also test other designs that are part of the fourth and fifth waves**

# Selected papers

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## Primary

Faruqui, Ahmad and Mariko Geronimo, "Moving Forward with Tariff Reform," *Regulation*, forthcoming, September 2017.

Faruqui, Ahmad and Henna Trewn, "Enhancing Customer-Centricity," *Public Utilities Fortnightly*, August 2017.

<https://www.fortnightly.com/fortnightly/2017/08/enhancing-customer-centricity>

Faruqui, Ahmad and Henna Trewn, "Rethinking Customer Research in the Utility Industry," *Public Utilities Fortnightly*, July 2017.

<https://www.fortnightly.com/fortnightly/2017/07/rethinking-customer-research>

## Secondary

"The Impact of Time-of-Use Rates in Ontario," with Neil Lessem, Sanem Sergici, and Dean Mountain, *Public Utilities Fortnightly*, February 2017.

<https://www.fortnightly.com/fortnightly/2017/02/impact-time-use-rates-ontario>

"Dynamic pricing works in a hot, humid climate: evidence from Florida," with Neil Lessem and Sanem Sergici, *Public Utilities Fortnightly*, May 2017.

<https://www.fortnightly.com/fortnightly/2017/05/dynamic-pricing-works-hot-humid-climate>

"Curating the Future of Rate Design for Residential Customers." With Wade Davis, Josephine Duh, and Cody Warner, *Electricity Daily*, 2016.

# Selected papers II

---

Faruqui, Ahmad, Toby Brown and Lea Grausz, “Efficient Tariff Structures for Distribution Network Services,” *Economic Analysis and Policy*, 2015.

Faruqui, Ahmad, Ryan Hledik and Neil Lessem, “Smart By Default,” *Public Utilities Fortnightly*, August 2014.

<http://www.fortnightly.com/fortnightly/2014/08/smart-default?page=0%2C0&authkey=e5b59c3e26805e2c6b9e469cb9c1855a9b0f18c67bbe7d8d4ca08a8abd39c54d>

Faruqui, Ahmad, Sanem Sergici and Lamine Akaba, “Dynamic Pricing in a Moderate Climate: The Evidence from Connecticut,” *Energy Journal*, 35:1, pp. 137-160, January 2014.

Faruqui, Ahmad and Sanem Sergici, “Arcturus: International Evidence on Dynamic Pricing,” *The Electricity Journal*, 26:7, August/September 2013, pp. 55-65.

<http://www.sciencedirect.com/science/article/pii/S1040619013001656>

Faruqui, Ahmad, Sanem Sergici, and Lamine Akaba, “Dynamic Pricing of Electricity for Residential Customers: The Evidence from Michigan,” *Energy Efficiency*, 6:3, August 2013, pp. 571–584.

Faruqui, Ahmad, Ryan Hledik, and Jennifer Palmer, *Time-Varying and Dynamic Rate Design*. Global Power Best Practice Series, The Regulatory Assistance Project (RAP), 2012.



# Selected papers III

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Faruqui, Ahmad and Jennifer Palmer, “Dynamic Pricing of Electricity and its Discontents,” *Regulation*, Volume 34, Number 3, Fall 2011, pp. 16-22.

<http://www.cato.org/pubs/regulation/regv34n3/regv34n3-5.pdf>

Faruqui, Ahmad and Sanem Sergici, “Dynamic pricing of electricity in the mid-Atlantic region: econometric results from the Baltimore gas and electric company experiment,” *Journal of Regulatory Economics*, 40:1, August 2011, pp. 82-109.

Faruqui, Ahmad and Jackalyne Pfannenstiel, “California: Mandating Demand Response,” *Public Utilities Fortnightly*, January 2008, pp. 48-53.

[http://www.fortnightly.com/display\\_pdf.cfm?id=01012008\\_MandatingDemandResponse.pdf](http://www.fortnightly.com/display_pdf.cfm?id=01012008_MandatingDemandResponse.pdf)

Faruqui, Ahmad and Stephen S. George, “Quantifying Customer Response to Dynamic Pricing,” *Electricity Journal*, May 2005.

Faruqui, Ahmad, William D. Bandt, Tom Campbell, Carl Danner, Harold Demsetz, Paul R. Kleindorfer, Robert Z. Lawrence, David Levine, Phil McLeod, Robert Michaels, Shmuel S. Oren, Jim Ratliff, John G. Riley, Richard Rumelt, Vernon L. Smith, Pablo Spiller, James Sweeney, David Teece, Philip Verleger, Mitch Wilk, and Oliver Williamson, “2003 Manifesto on the California Electricity Crisis,” May 2003.

<http://www.aei-brookings.org/publications/abstract.php?pid=341>

# Selected papers IV

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Faruqui, Ahmad, Hung-po Chao, Vic Niemeyer, Jeremy Platt, and Karl Stahlkopf, “Analyzing California's Power Crisis,” *The Energy Journal* 22, no. 4 (2001): 29–52.

Faruqui, Ahmad and J. Robert Malko, “Residential Demand for Electricity by Time-of-Use: A Survey of Twelve Experiments with Peak Load Pricing,” *Energy* 8, no. 10 (1983): 781–795.

# Appendix A: Electric tariffs defined by analogy to the car industry

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- Flat tariff = charge on distance travelled
- TOU tariff = higher charge on distance travelled during peak times, lower charge on distance travelled during off peak times
- Demand tariff = charge on maximum speed car reaches
- Installed capacity = charge on maximum possible speed of the car
- Nominated capacity = charge on agreed maximum speed limit with a higher charge for going over that speed limit

# Presenter Information

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Ahmad Faruqui's consulting practice is focused on the efficient use of energy. His areas of expertise include rate design, demand response, energy efficiency, distributed energy resources, advanced metering infrastructure, plug-in electric vehicles, energy storage, inter-fuel substitution, combined heat and power, microgrids, and demand forecasting. He has worked for nearly 150 clients on 5 continents. These include electric and gas utilities, state and federal commissions, independent system operators, government agencies, trade associations, research institutes, and manufacturing companies. Ahmad has testified or appeared before commissions in Alberta (Canada), Arizona, Arkansas, California, Colorado, Connecticut, Delaware, the District of Columbia, FERC, Illinois, Indiana, Kansas, Maryland, Minnesota, Nevada, Ohio, Oklahoma, Ontario (Canada), Pennsylvania, ECRA (Saudi Arabia), and Texas. He has presented to governments in Australia, Egypt, Ireland, the Philippines, Thailand and the United Kingdom and given seminars on all 6 continents. His research been cited in Business Week, The Economist, Forbes, National Geographic, The New York Times, San Francisco Chronicle, San Jose Mercury News, Wall Street Journal and USA Today. He has appeared on Fox Business News, National Public Radio and Voice of America. He is the author, co-author or editor of 4 books and more than 150 articles, papers and reports on energy matters. He has published in peer-reviewed journals such as Energy Economics, Energy Journal, Energy Efficiency, Energy Policy, Journal of Regulatory Economics and Utilities Policy and trade journals such as The Electricity Journal and the Public Utilities Fortnightly. He holds BA and MA degrees from the University of Karachi, an MA in agricultural economics and Ph. D. in economics from The University of California at Davis.

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Neil Lessem is an expert on consumer behavior and energy markets. He has assisted clients around the world on issues such as wholesale market design, regulated tariffs and cost allocation, innovative customer and pricing programs, and policy impact measurement.

He has worked with more than 50 clients across North America, Asia-Pacific and the Middle-East. His clients include regulators, policy makers, utilities, system operators, consumer representatives, tech startups and infrastructure owners. He has published in peer-reviewed journals such as the *Journal of Economics and Environmental Management* and *Business and Society*; and trade journals such as *The Electricity Journal* and *the Public Utilities Fortnightly*. He has presented on pressing energy topics to audiences in Brazil, Hong Kong, the United States, Canada, Malaysia and Hong Kong. In his graduate studies, Neil Lessem conducted extensive research examining consumer adoption of environmentally-friendly products and conservation behaviors, utilizing both field experiments and utility data.

He holds a Ph.D. and M.A. in Economics from the University of California, Los Angeles and an honours degree in Business, Economics and History from the University of Cape Town.

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