

# Moving forward with tariff reform

**PRESENTED TO:**

EEI Webinar on Rate Design

**PRESENTED BY:**

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THE **Brattle** GROUP

# **This presentation answers the following five questions**

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- ❖ **How has tariff reform evolved with time?**
- ❖ **What is holding back tariff reform?**
- ❖ **How should we move ahead with tariff reform?**
- ❖ **Is it necessary to run new pilots?**
- ❖ **If so, how should the new pilots be designed?**

# The 1<sup>st</sup> wave of tariff reforms

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- ❖ Energy-only time-of-use tariffs (E-TOU) were tested in the late 1970s in twelve pilots funded by the Federal Energy Administration (later part of the US Department of Energy)
- ❖ Their experimental designs were of uneven quality
- ❖ The results were encouraging but not consistent
- ❖ <http://www.sciencedirect.com/science/article/pii/036054428390052X>

## The 2<sup>nd</sup> wave

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- ❖ In the mid 1980s, EPRI took the results from the top five pilots and found consistent evidence of consumer behavior
- ❖ Unfortunately, not much happened in the late 1980's and most of the 1990's because of the lack of smart metering and the onset of restructuring
- ❖ However, a few utilities did move ahead with mandatory E-TOU rates for large residential customers
- ❖ Virtually all utilities moved ahead with opt-in E-TOU rates but only a handful of customers were actually on those rates

❖ <http://www.sciencedirect.com/science/article/pii/0304407684900174>

## The 3<sup>rd</sup> wave

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- ❖ The California energy crisis in 2000/01 gave impetus to the next wave of pilots featuring dynamic pricing, some with smart thermostats
- ❖ More than 40 pilots featuring more than 200 energy-only pricing treatments were carried out around the globe
- ❖ Today, 50 million households have smart meters but only a few million customers are on smart rates due to fears of bill volatility
- ❖ <http://www.sciencedirect.com/science/article/pii/S1040619013001656>

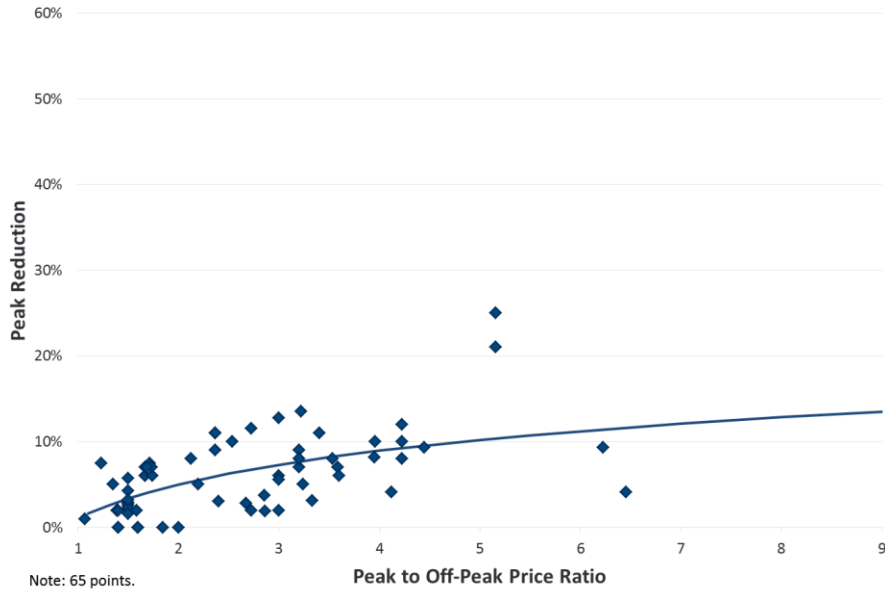
# There is a lot that we know today about energy-based time-varying (E-TV)R

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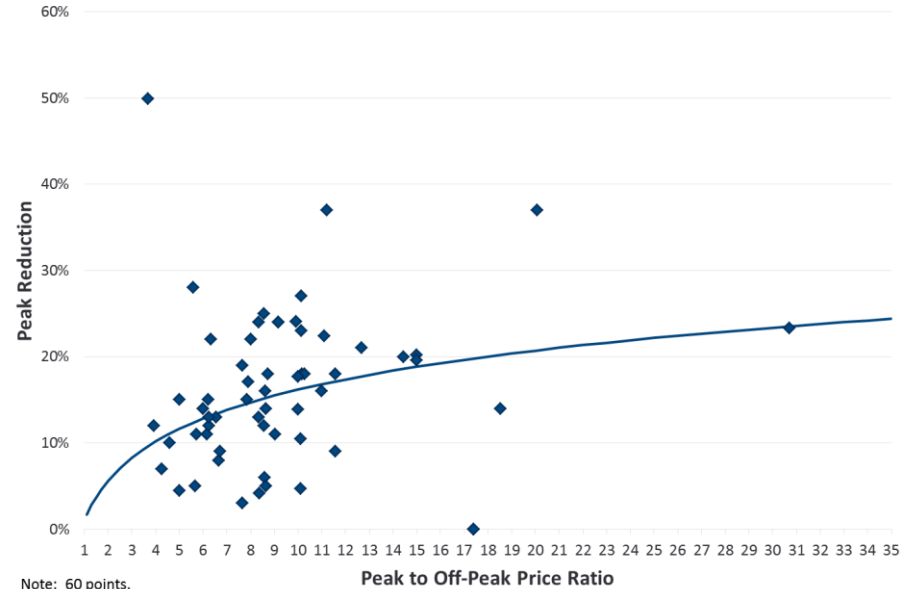
- ❖ More than 200 tests have been carried out with energy-based time-varying rates (E-TV)R around the globe
  - ❖ France deployed the *tempo* tariff back in the mid 1960's in which rates varied by time periods and also across three-day types
  - ❖ Arizona deployed E-TV)R rates in the 1980's and 50% of all customers are on such tariffs today
  - ❖ In Oklahoma, dynamic E-TV)R rates have attracted 20% of residential customers just during the past three years
  - ❖ Some 90% of residential customers in Ontario, Canada, or 4 million households, have been on E-TV)R rates for the past five years

# The magnitude of demand response rises with the peak to off-peak price ratio

## TOU Impacts (price only)

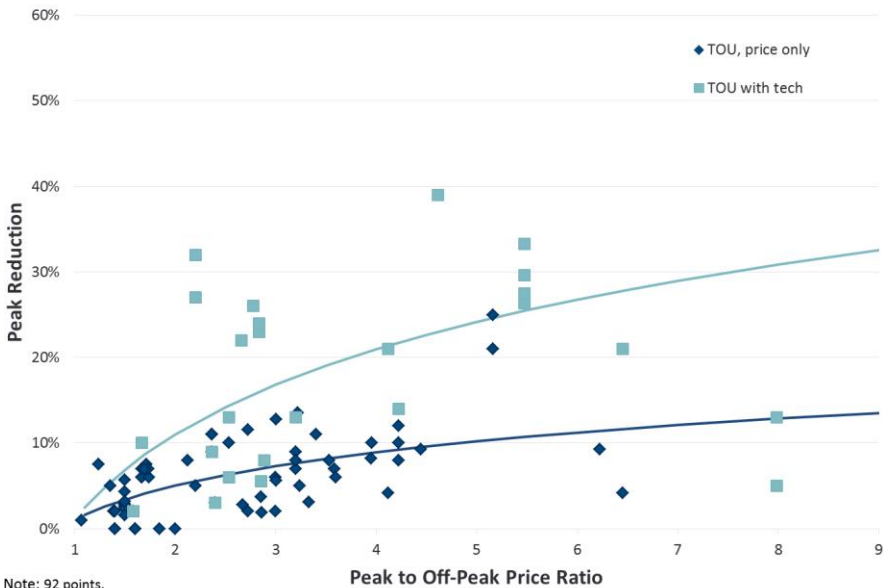


## Dynamic Pricing Impacts (price only)



# Enabling technologies boost demand response

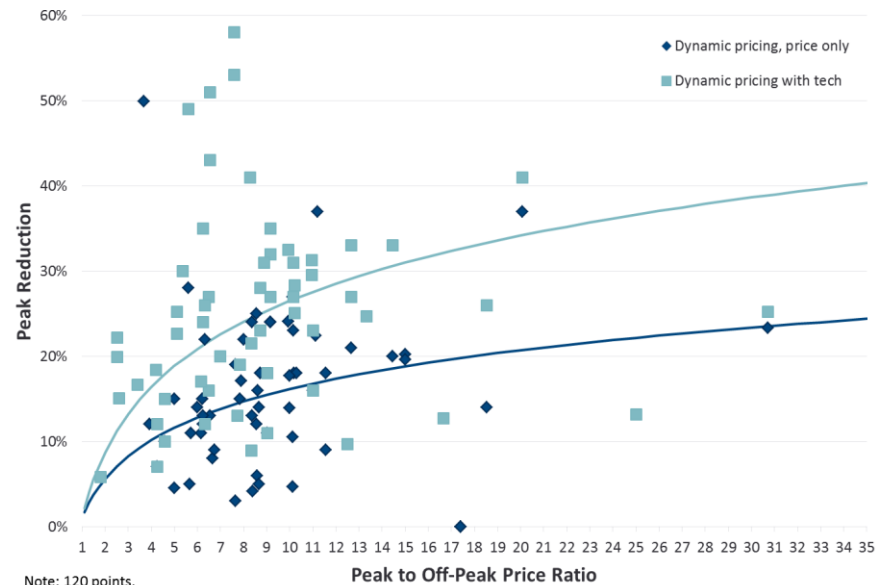
## TOU Impacts



Note: 92 points.

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

## Dynamic Pricing Impacts



Note: 120 points.

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



# The 4<sup>th</sup> wave

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- ❖ More than 30 utilities today are offering demand charges, sometimes with energy-based dynamic pricing rates, to mitigate cross-subsidies caused by prosumers and by the slowdown in sales growth
- ❖ However, the only empirical evidence on customer response to demand charges comes from three older pilots, one of which was carried out in Norway
- ❖ <http://www.sciencedirect.com/science/article/pii/S104061901400150X>

# We know a little bit about customer response to demand charges, part of the 4<sup>th</sup> Wave

Study	Location	Utility	Year(s)	# of participants	Monthly demand charge (\$/kW)	Energy charge (cents/kWh)	Fixed charge (\$/month)	Timing of demand measurement	Interval of demand measurement	Peak period	Estimated avg reduction in peak period consumption
1	Norway	Istad Nett AS	2006	443	10.28	3.4	12.10	Peak coincident	60 mins	7 am to 4 pm	5%
2	North Carolina	Duke Power	1978 - 1983	178	10.80	6.4	35.49	Peak coincident	30 mins	1 pm to 7 pm	17%
3	Wisconsin	Wisconsin Public Service	1977-1978	40	10.13	5.8	0.00	Peak coincident	15 mins	8 am to 5 pm	29%

Notes:

All prices shown have been inflated to 2014 dollars

In the Norwegian pilot, demand is determined in winter months (the utility is winter peaking) and then applied on a monthly basis throughout the year. The Norwegian demand rate has been offered since 2000 and roughly 5 percent of customers have chosen to enroll in the rate.

In the Duke pilot, roughly 10% of those invited to participate in the pilot agreed to enroll in the demand rate.

The Duke rate was not revenue neutral - it included an additional cost for demand metering.

The Wisconsin demand charge is seasonal; the summer charge is presented here because the utility is summer peaking.

- The average peak period demand reduction is around **14%**
- <http://www.sciencedirect.com/science/article/pii/S104061901400150X>

# The 5<sup>th</sup> wave

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- ❖ **Customers subscribe to a “baseline” load shape, and sometimes to a given level of kW demand or monthly kWh energy consumption.**
  - ❖ This directly addresses the bill volatility issue
  
- ❖ **Customers buy or sell deviations from the baseline on the wholesale market.**
  - ❖ Original called demand subscription, this idea has morphed into “Transactive Energy (TE)”
  
- ❖ **The idea has gained traction as Wi-Fi thermostats, digital appliances and home energy management systems have become ubiquitous**
  - ❖ The millennials are really into “organic” conservation
  
- ❖ **Ed Cazalet and Steve Barrager, *Transactive Energy: A Sustainable Business and Regulatory Model for Electricity*, Public Utilities Report, 2016.**

# There are several barriers to tariff reform – Part I

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## ❖ **Fear of the unknown**

- ❖ This is equally pervasive among customers, utilities and regulators

## ❖ **Bills will rise for some customers and they will complain**

- ❖ Even though bills will fall for other customers, they will remain silent

## ❖ **The new rates would not be understood by customers and sow confusion and distrust of the utilities**

## ❖ **Low income customers and small users will be harmed by the new rates**

## ❖ **Customers with disabilities will be harmed by the new rates**

# There are several barriers to tariff reforms – Part II

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- ❖ **Customers will not respond to the new rates**
- ❖ **The rates will fail to promote economic efficiency or equity**
- ❖ **The rates will require new meters and billing systems**
- ❖ **The rates will impose an extra load on customer service staff**
- ❖ **Revenue volatility will rise**

# Making the transition to the new tariffs – Part I

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## ❖ Understand how customer bills will change if the new rates are implemented immediately

- ❖ Identify how much bills will rise for small users
- ❖ Find ways to mitigate these bill impacts

## ❖ Simulate the impact of the rates to study the likely customer response

- ❖ Models are available for carrying out such simulations

## ❖ Engage in a customer outreach program to explain why tariffs are being changed

- ❖ Make sure the new rates use clear and understandable language
- ❖ Enlist neutral parties to endorse the change
- ❖ Use social media to spread the word

## **Making the transition to new tariffs – Part II**

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- ❖ **Change the rates gradually over a three-to-five year period or provide bill protection that is gradually phased out**
- ❖ **For the first five years, make the rates optional for low income, small users and disabled customers**
  - ❖ Or provide financial assistance to them for a limited period of time
- ❖ **Consider a subscription concept in which customers “buy” their historical usage and the historical price and buy or sell deviations from that usage at the new tariffs**
- ❖ **Conduct pilots to test customer acceptance and load response to the new rates**

# The pilots should follow some basic precepts

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- ❖ They should be carried out as scientific experiments, expected to yield valid inferences about energy conservation and demand response
- ❖ They should be designed to yield price elasticity estimates which would allow the results to be extrapolated to other prices than the ones being tested in the pilot
- ❖ The samples should be of sufficient size to yield valid inferences about the population
- ❖ Ideally, they should yield glean granular information by customer segment
- ❖ Also, they should test different marketing, education and communication technologies



# It is best to use the “gold standard” in pilot design

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- ❖ This involves signing up customers in *both* treatment and control groups and not just in the treatment group
- ❖ It also involves taking measurements on customer usage *before and after* the treatments have been initiated
- ❖ Samples sizes should be sufficient to ensure drawing valid inferences about cause-and-effect within the pilot and extrapolating them to the applicable population of interest
- ❖ Sample selection should be random, as discussed in the next two slides

# Ensure that the pilot has internal and external validity – Part I

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- ❖ **If the new rates will eventually be rolled out on a default basis, it is preferable to follow a randomized control trial (*RCT*) approach which involves a random assignment of the customer sample into the treatment and control groups.**
  - ❖ RCT can be implemented in the form of a recruit and deny or recruit and delay.
  
- ❖ **However, if mandatory assignment of customers to the treatment group is not feasible or appropriate, which is often the case, a random encouragement design (*RED*) approach can be used to construct a valid control group**

# Ensure that the pilot has internal and external validity – Part II

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- ❖ The RED approach still involves random assignment of customers to treatment and control groups, but in this case the treated group is *encouraged* to apply for the intervention rather than being automatically placed on it
- ❖ The encouragement may be as simple as extending an offer to opt-in to the program or a default assignment to a rate (from which customers can opt out)
- ❖ [http://www.ontarioenergyboard.ca/oeb/ Documents/EB-2016-0201/RPP\\_Roadmap\\_Pilot\\_Plan\\_Technical\\_Manual.pdf](http://www.ontarioenergyboard.ca/oeb/ Documents/EB-2016-0201/RPP_Roadmap_Pilot_Plan_Technical_Manual.pdf)

# Conclusions

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- ❖ **Tariff reform has evolved through five waves**
- ❖ **While many 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 will affect customers**
- ❖ **There are several ways in which the transition to new tariffs can be carried out**
- ❖ **There is a need to test the newer tariffs of the 4<sup>th</sup> and 5<sup>th</sup> waves**
- ❖ **The tests should be carried out through scientific experiments**

# Presenter Information

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Dr. Faruqui's 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. Ahmad has worked for more than 125 clients on five continents. These include electric and gas utilities, state and federal commissions, independent system operators, government agencies, trade associations, research institutes, and manufacturing companies. He 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 the governments of Australia, Egypt, Ireland, Philippines, Thailand and the United Kingdom and given energy seminars on all six continents. His research has been cited in Business Week, The Economist, Forbes, National Geographic, The New York Times, the San Francisco Chronicle, San Jose Mercury News, Wall Street Journal, Washington Post and USA Today. He has appeared on Fox Business News, National Public Radio and Voice of America. He has contributed more than 150 articles, papers and reports to the literature and published in peer-reviewed journals such as Energy Economics, Energy Journal, Energy Efficiency, and the Journal of Regulatory Economics and trade journals such as The Electricity Journal and the Public Utilities Fortnightly. He holds bachelors and masters degrees from the University of Karachi and a doctorate in economics from The University of California at Davis.

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