Capturing Smart Meter Enabled Benefits in System Wide Rollouts

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PRESENTED BY:

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THE Brattle GROUP

Smart meters are coming to a neighborhood near you

The new norm

- 50% of residential customers in US
- 80% of EU residential customers by 2020

Smart meters unlock potential for new DSM programs

- Measure usage across time
  - New prices possible
  - New information for customers
- Measure usage across space
  - Dynamically control resource use

How to separate hype from reality?

BALTIMORE, MD-June 3, 2016

BGE's request also included recovery of $140.7 million related to its investment over the past six years in Advanced Metering Infrastructure (AMI or 'smart meters'). The Commission received testimony on the benefits of smart meters, including the technology's ability to lower energy bills, improve customer service and relieve peak-time pressure on BGE's transmission and distribution systems. While the Commission found compelling evidence that BGE's AMI system is cost beneficial to its customers, it disallowed $47.8 million of BGE's request and authorizes BGE to recover the allowed portion of the costs over 10 years, instead of five as BGE had requested. Ultimately the Commission concluded that for every $1 invested in the AMI system, customers will receive at least $1.28 in benefits.

But what about smart measurement?

Smart meter rollouts are system-wide

How do we construct a "but-for" world without a randomly-chosen control group?

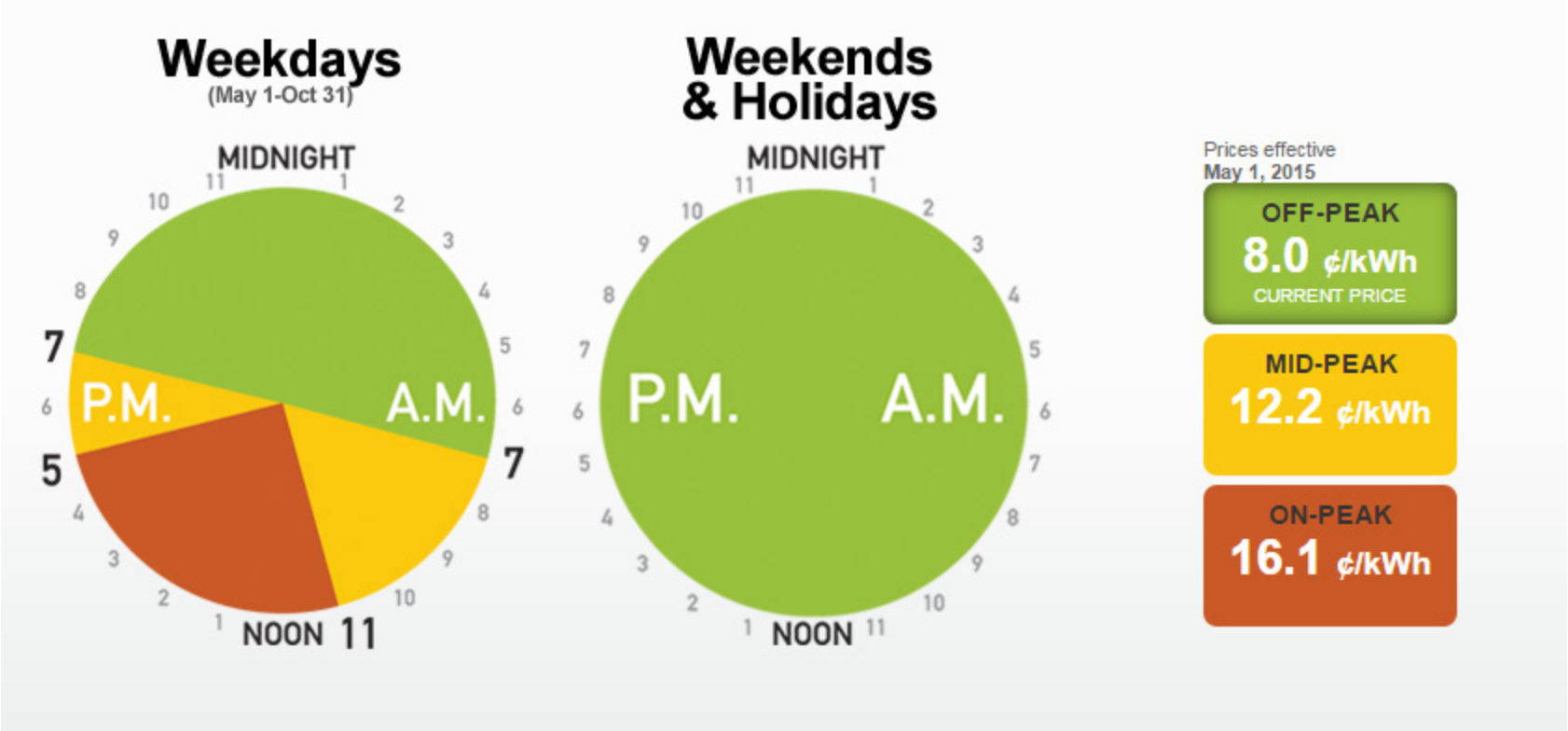
- Engineering estimates?
- Pre-post?
- Quasi-experimental design?

Three case studies

1. Time of Use in Ontario
2. Energy Management Tools
3. Conservation Voltage Reduction

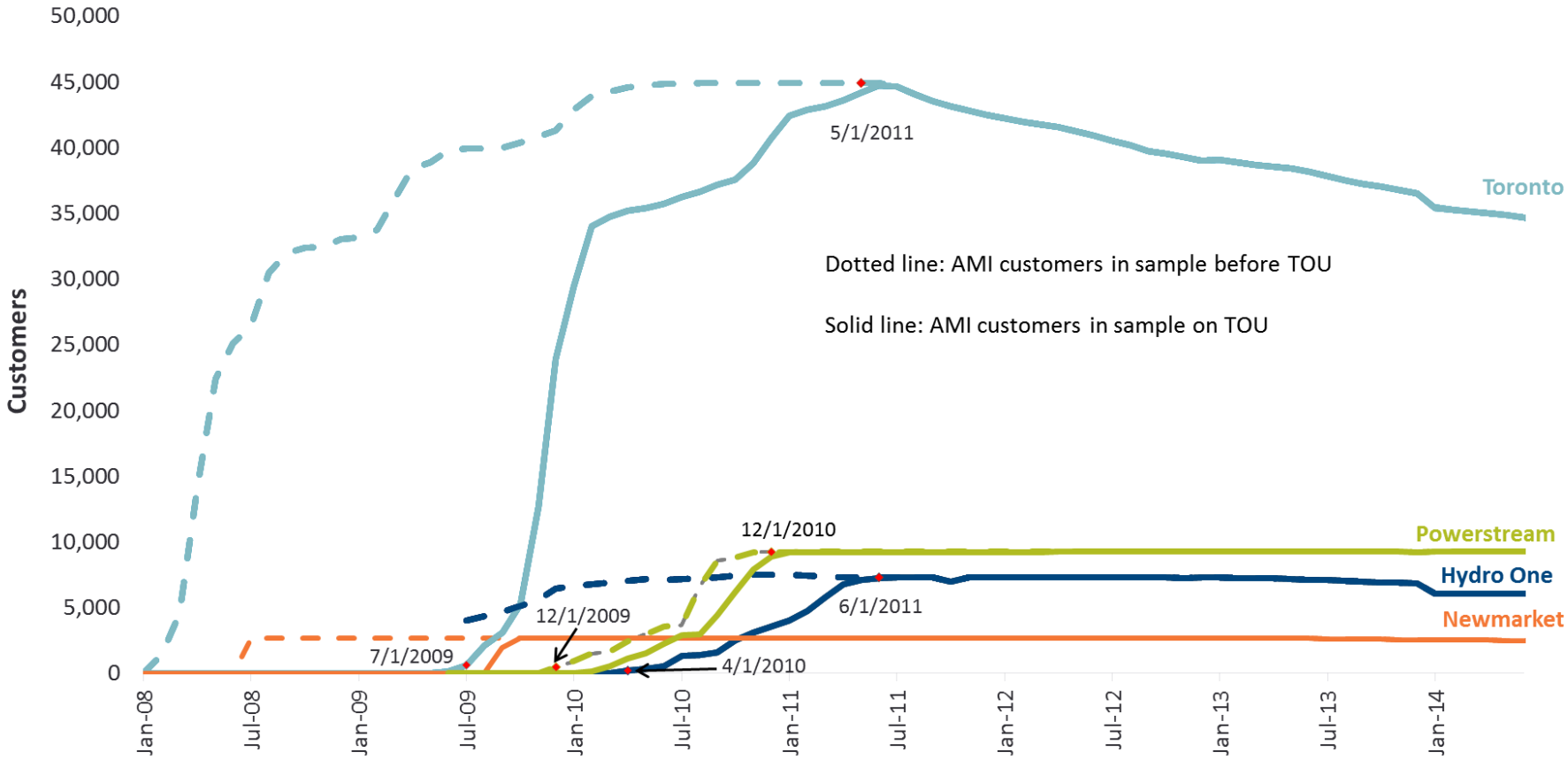
} In a mid-sized US utility

Besides Italy, Ontario is the only region in the world to deploy TOU rates to all residential customers



Note: The prices above are commodity only, this study uses the all-in prices that customers actually face

In Ontario, there are 70+ LDCs, each of which had its own smart meter and TOU deployment schedule



Control groups were created that exploited deployment timing and eligibility

1) Exploit differences in timing within an LDC

- Later installations used as control group
  - Engineering deployment – random from customer's perspective

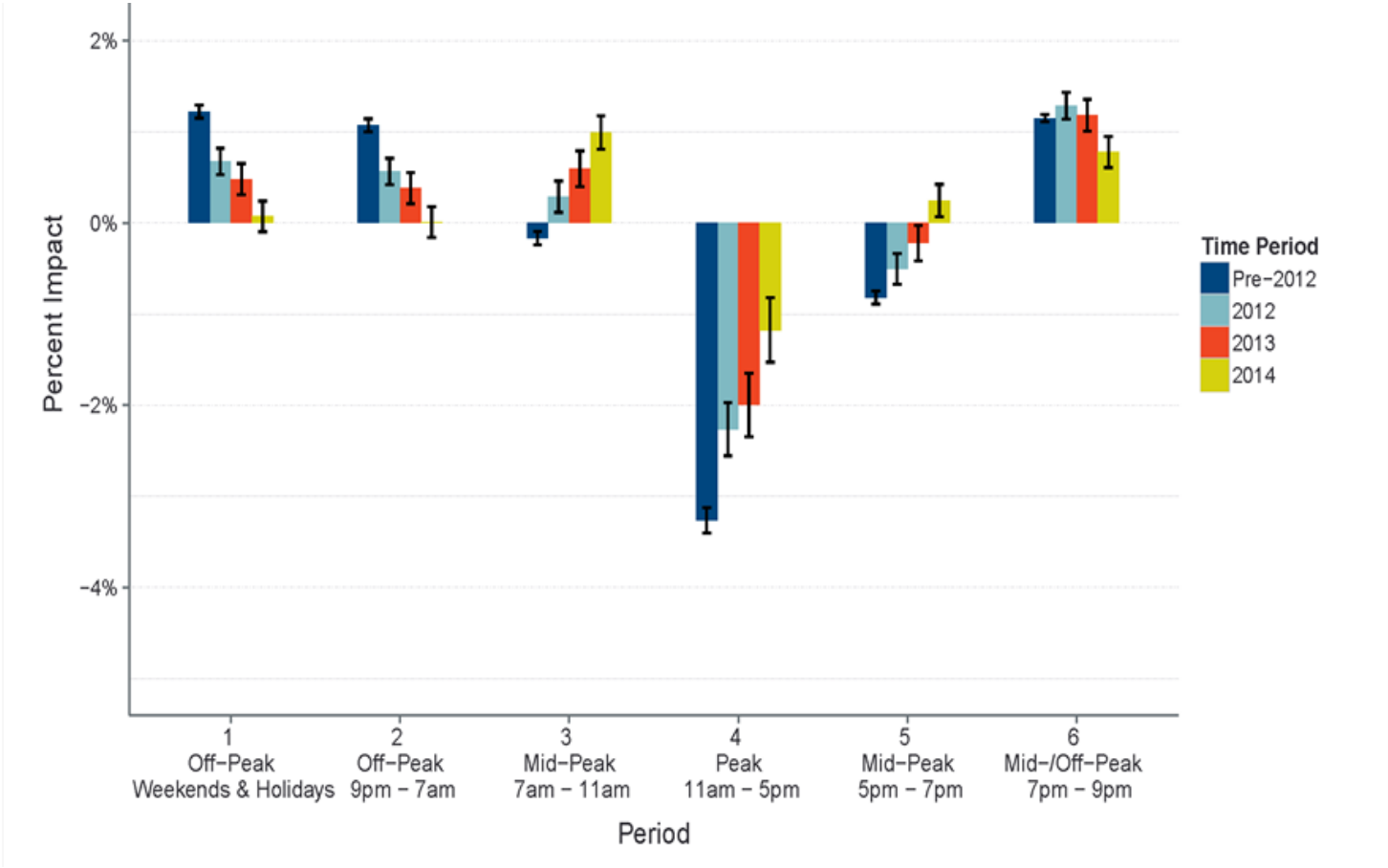
2) Included retail choice customers (excluded from TOU)

- Opted out of RPP
- Self-selection bias?

Measurement issues:

- Hard to find qualifying LDCs
  - Estimated conditional impacts
  - Reweighted to obtain provincial impacts

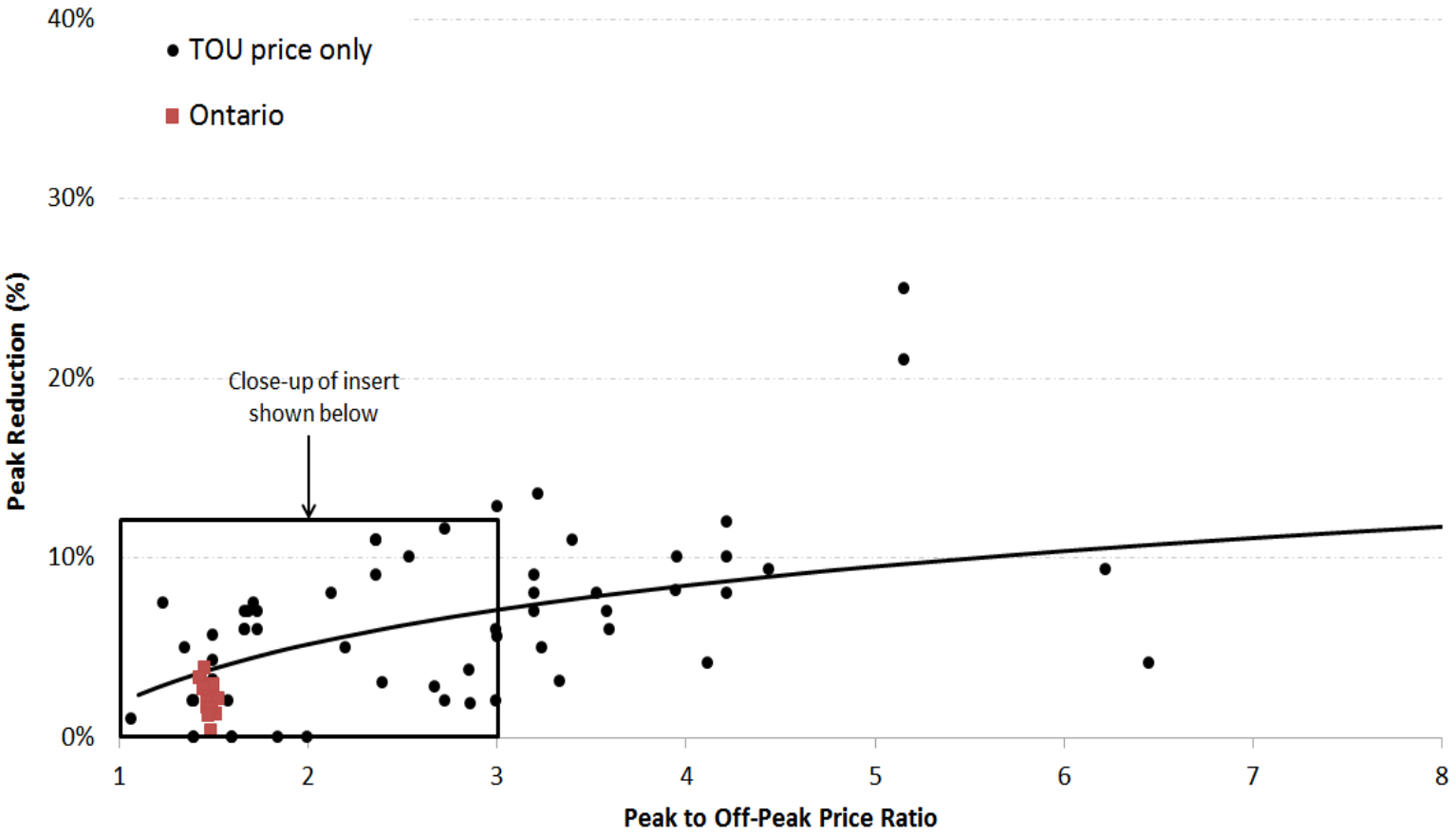
There is significant evidence of load shifting from TOU



* Period 6 was mid-peak before May 2011

Note: Black bars indicate 95% confidence intervals for the impact

Peak impacts are inline with those predicted by Brattle's Arc of Price Responsiveness



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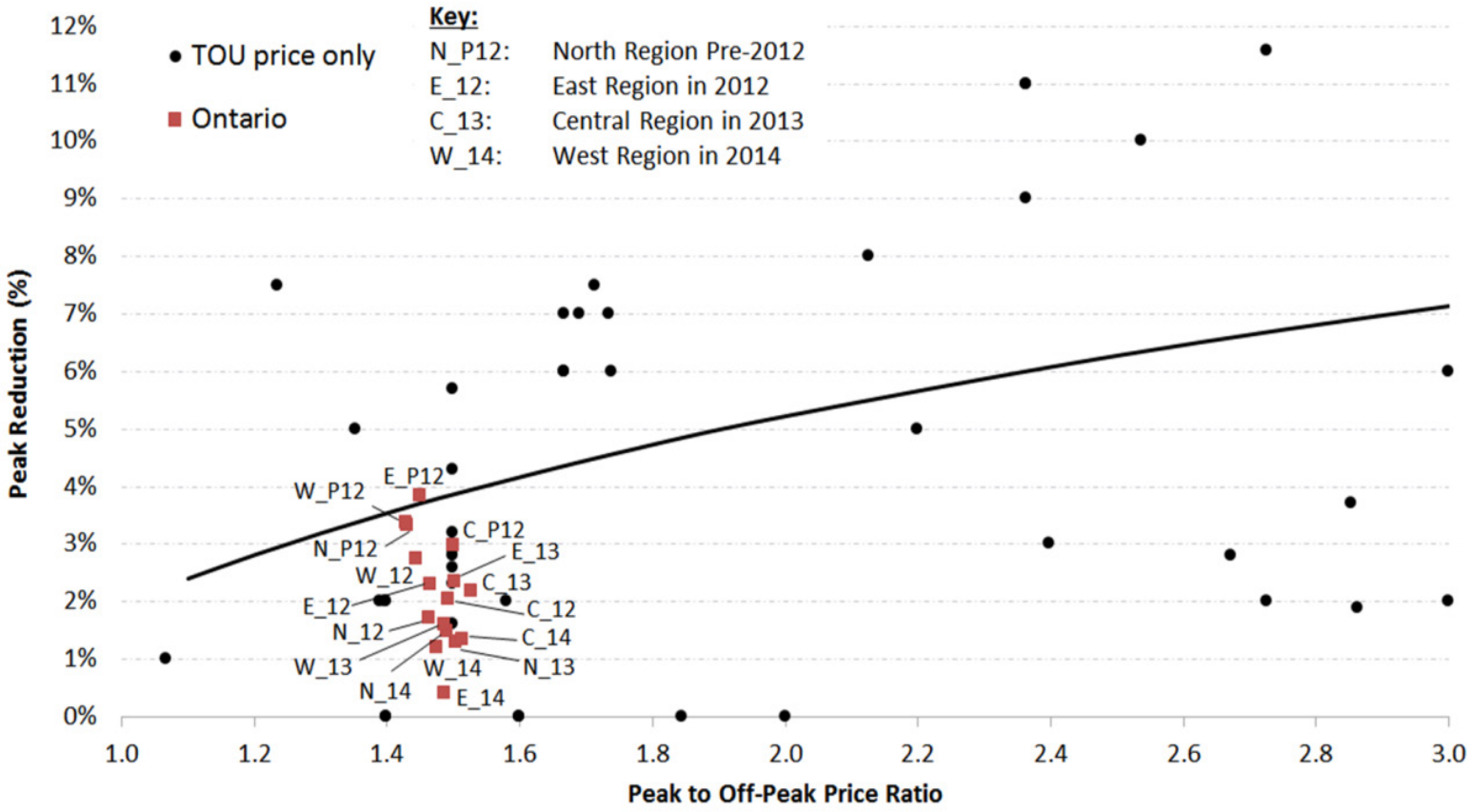


Utility M deployed smart meters to its entire customer population

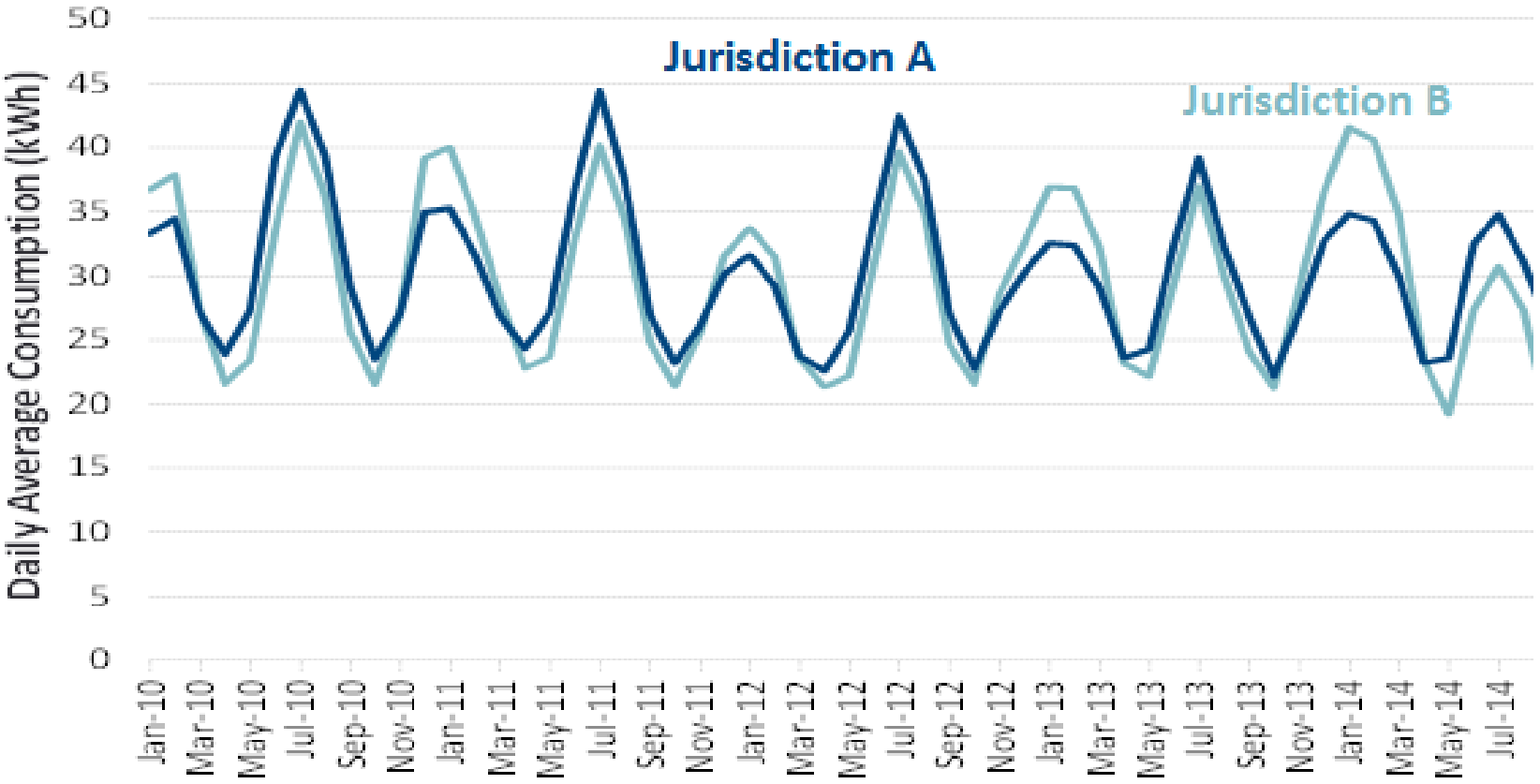
Energy Management Tools (EMT) provided enhanced information over energy usage:

- Programs rely on behavioral change
  - Web portal
  - Detailed bills
  - Educational campaigns
  - News coverage

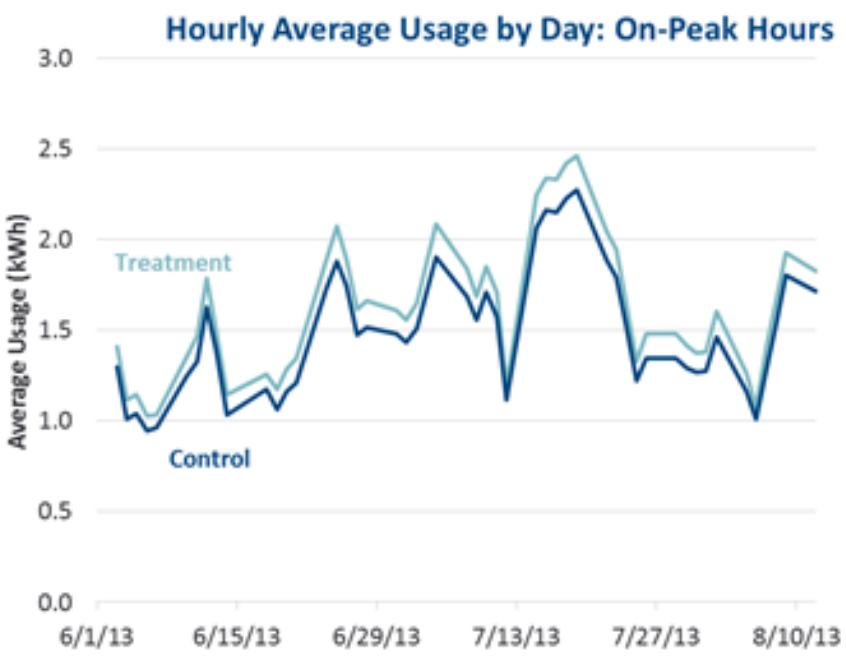
Conservation Voltage Reduction (CVR)

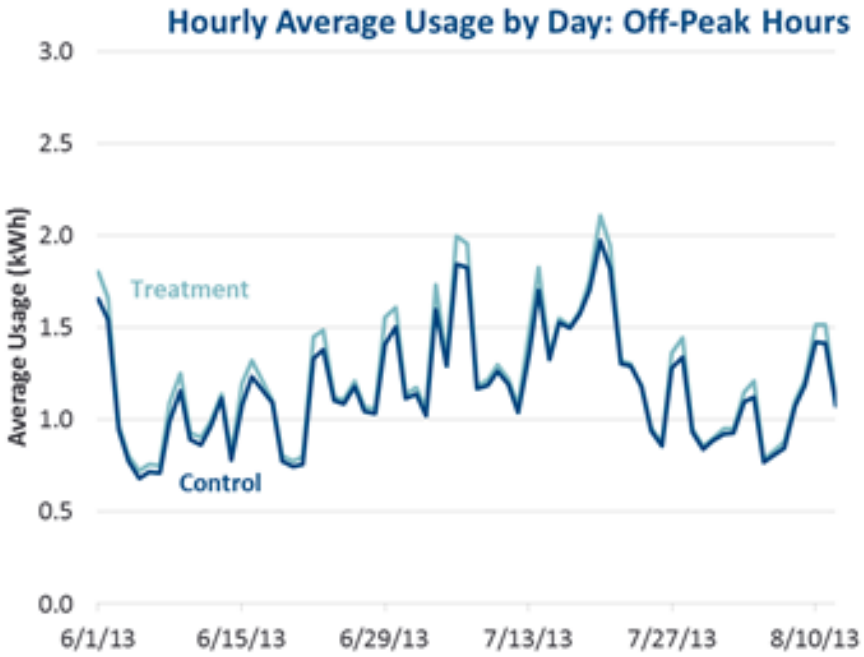
- Reduce usual voltage band (114 – 126 V) to use the lower end (114-120 V)
- Only deployed to customers on select feeders
- No behavioral changes required by customers

EMT control group was created by looking at adjacent jurisdictions



CVR Control Group was created by selecting customers on similar substations





Both EMT and CVR resulted in statistically significant energy savings

EMT program resulted in 1.7% reduction in average daily usage

CVR reduced voltage by 1.5% resulting in:

- A 1.4% reduction in average daily usage
- A 1.1% reduction in peak usage
  - (Hottest summer days: 2-7pm)

Impacts would not have been measurable without control groups

Quasi-experimental designs can be improved on if planned in conjunction with smart meter deployment

1. **$Options_{Pre\text{-}deployment} > Options_{Post\text{-}deployment}$**
   - Make your own luck

2. **Plan the Rollout**
   - Exploit engineering delays in smart meter and program rollouts to create randomized control groups
   - Ensure adequate pre-program window

3. **Exploit exogenous eligibility**
   1. Coordinate major rollouts between utilities or jurisdictions
   2. Look for control groups that are excluded from program
      - Be aware of and test for self selection

Presenter Information

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Ahmad Faruqui is an internationally recognized expert on rate design. He has testified or appeared before regulatory bodies, governmental agencies, and legislatures in the US and abroad. The venues have included Alberta, Arizona, Australia, California, the District of Columbia, Connecticut, Illinois, Indiana, Maryland, Michigan, Minnesota, New Mexico, Oklahoma, Ontario and Saudi Arabia. Ahmad's academic, consulting and research activities have spanned four decades, during which time he has advised more than 125 clients in 34 states, the District of Columbia, and eleven countries. He has made the case for cost-based rates on six continents. Within the US, he has presented at the Goldman Sachs Power and Utility Conference, the EEI Rates Committee, NARUC and the New York ISO. His work has been cited in The Economist, The New York Times and the Washington Post. He has appeared on Fox Business News and NPR. He holds a doctorate in economics from the University of California at Davis, where he was a Regents Fellow, and baccalaureate and master's degrees from the University of Karachi, Pakistan, both with the highest honors.

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Dr. Neil Lessem is a senior associate in *The Brattle Group's* San Francisco, CA office with expertise in energy, applied microeconomics, environmental economics and behavioral economics. He has consulted for utilities, policymakers and technology firms across North America, Asia, the Middle East and Australia, on rate design, energy policy, innovative pricing, experimental design, technology adoption and policy impact measurement. In his graduate studies he conducted extensive research examining consumer adoption of environmentally friendly products and conservation behaviors, utilizing both field experiments and utility data. Dr. Lessem holds a Ph.D. and M.A. in economics from the University of California – Los Angeles and a B.Bus.Sc in economics and history, from the University of Cape Town (South Africa), where he graduated with top honors.

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