

A Three-Year Impact Evaluation of TOU Rates in Ontario, Canada

PRESENTED TO:

Center for Research in Regulated Industries (CRRI)
29th Annual Western Conference

PRESENTED BY:

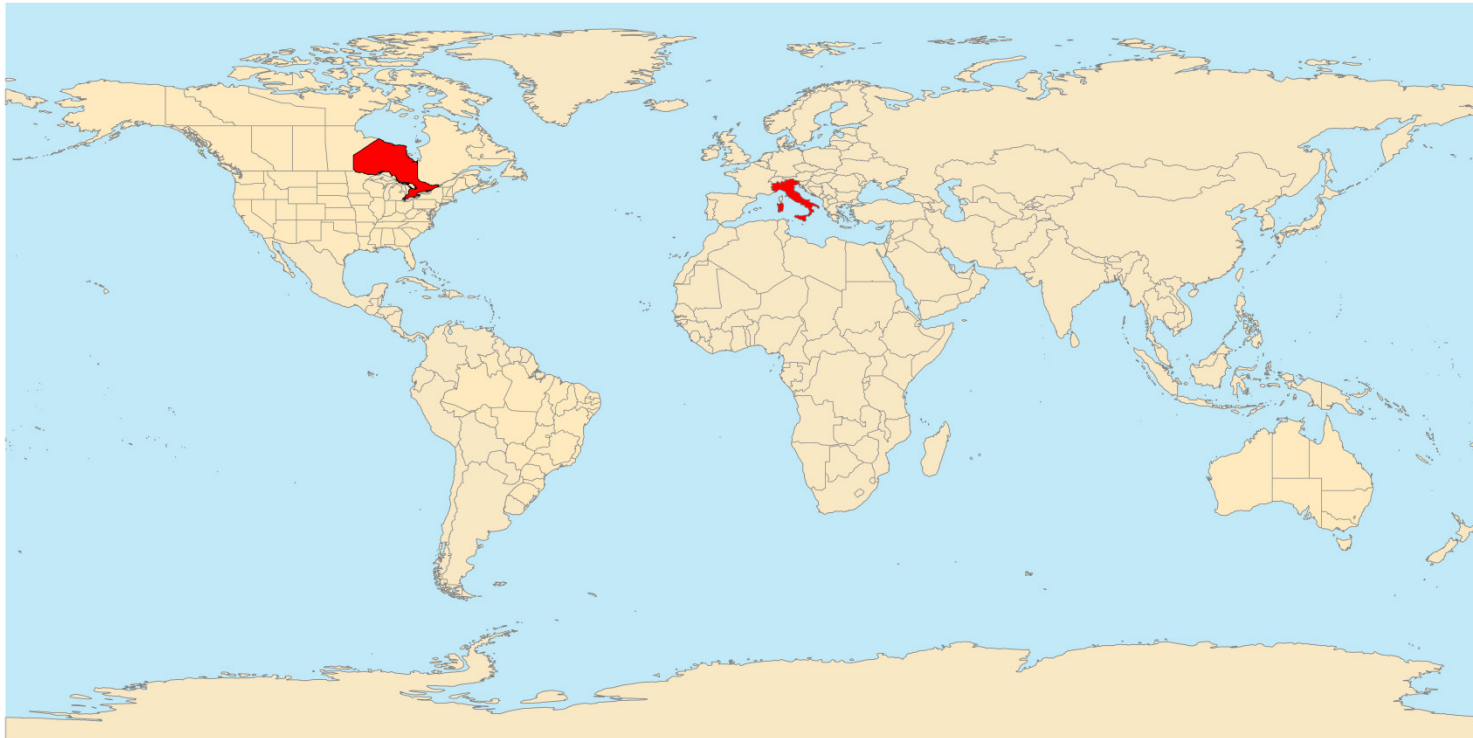
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June 23, 2016



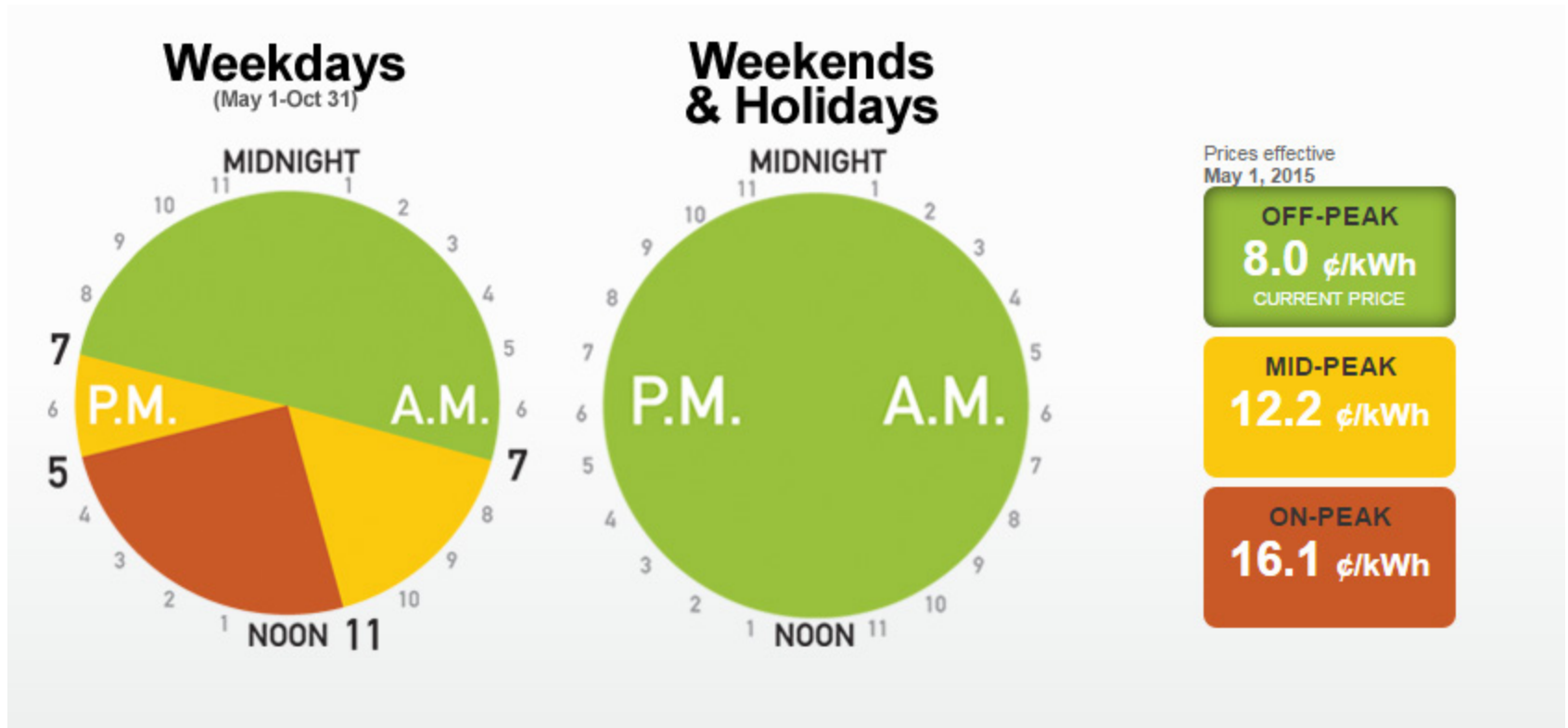
Background

Besides Italy, Ontario is the only region in the world to deploy Time-of-Use (TOU) rates as the residential default rate



This presentation evaluates the impacts of the TOU rates in Ontario through the end of 2014 by carrying out a province-wide econometric analysis

TOU Rates In Ontario



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

Institutional Background

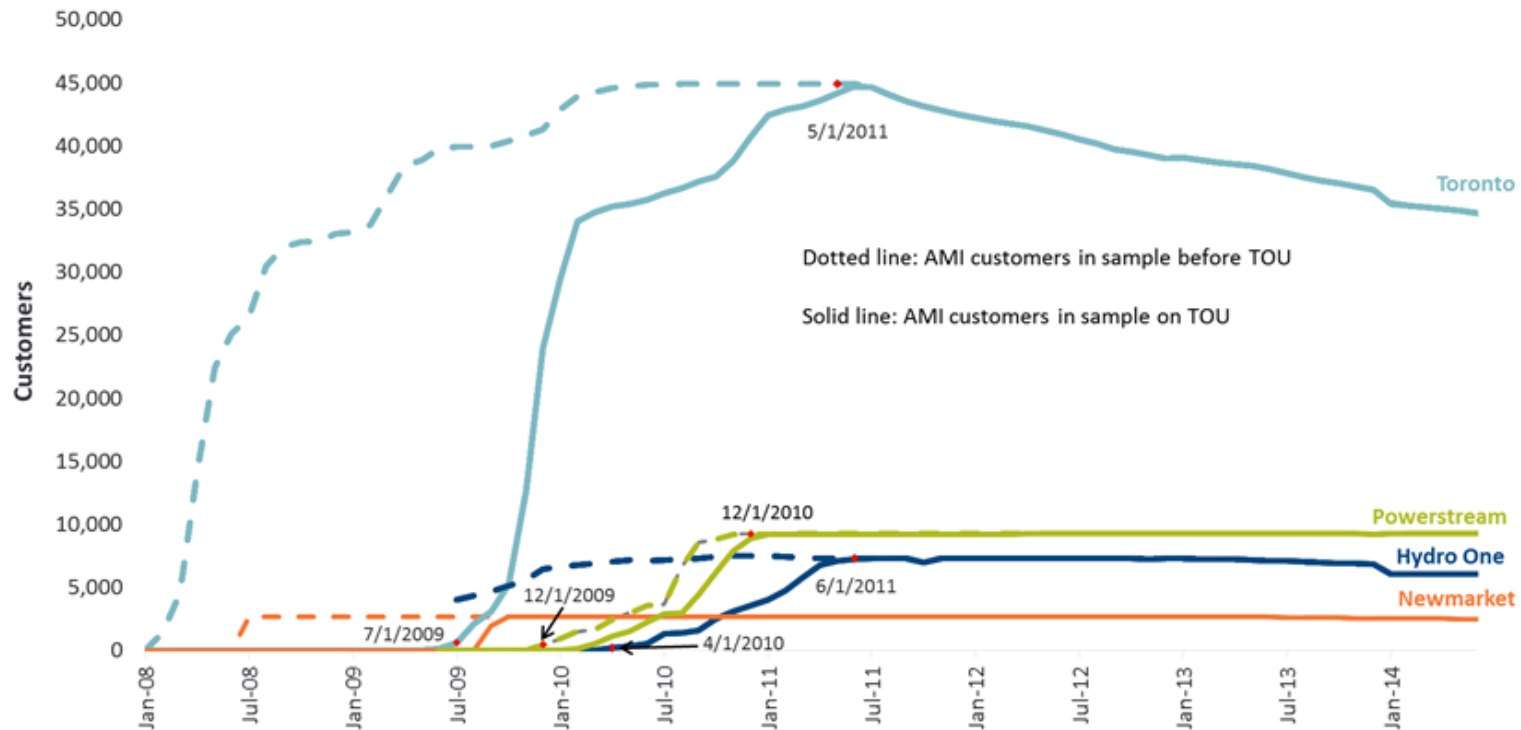
Ontario has 70+ Local Distribution Companies (LDCs)

- The Regulated Price Plan (RPP) offers TOU rates on a default basis
- Customers can opt-out of RPP by contracting with a retailer

Smart Metering Initiative announced by provincial government in 2004 required the LDCs required to

- Roll out smart meters by 2010
- Deploy TOU rates by 2012
- Migrate smart meter data to a centralized Meter Data Management and Repository (MDM/R) before TOU

Timing, Data and Challenges



For example: Central Region Rollout Schedule - Residential

total number of AMI customers in sample before TOU — — —
total number of AMI customers in sample on TOU ———

Evaluation Challenges

- 1. Recruitment of LDCs**
- 2. Disparate data sets**
- 3. Statutory Environment**
- 4. Non-experimental environment**

Lessons Learned for Future TOU Rollouts

- 1. Plan the Rollout**
- 2. Ensure Adequate Collection of and Access to New Data**
- 3. Incentivize M&V Compliance**

About the Study

Three year effort to measure load shifting and conservation impacts of TOU by calendar year

- All Impact Reports on IESO website

Examine three seasons and two customer classes

- Summer, Winter and IESO Evaluation Peak
- Residential and general service

Today's Results from Study Year 3

- Includes 8 LDCs
- Constitute more than 50% of Ontario electricity accounts.

Methodology

Use Generalized Addilog Demand System to measure impacts

- Structural Model – allows out of sample predictions
- Allows for substitution elasticities to vary between periods

Impacts calculated separately for each of four Ontario sub-regions

- Impacts allowed to vary by socio-demographic factors

Reweight regional impacts using census characteristics to obtain representative regional impacts

Province-wide impacts are calculated by weighting the regional impacts by regional customer count shares

Results

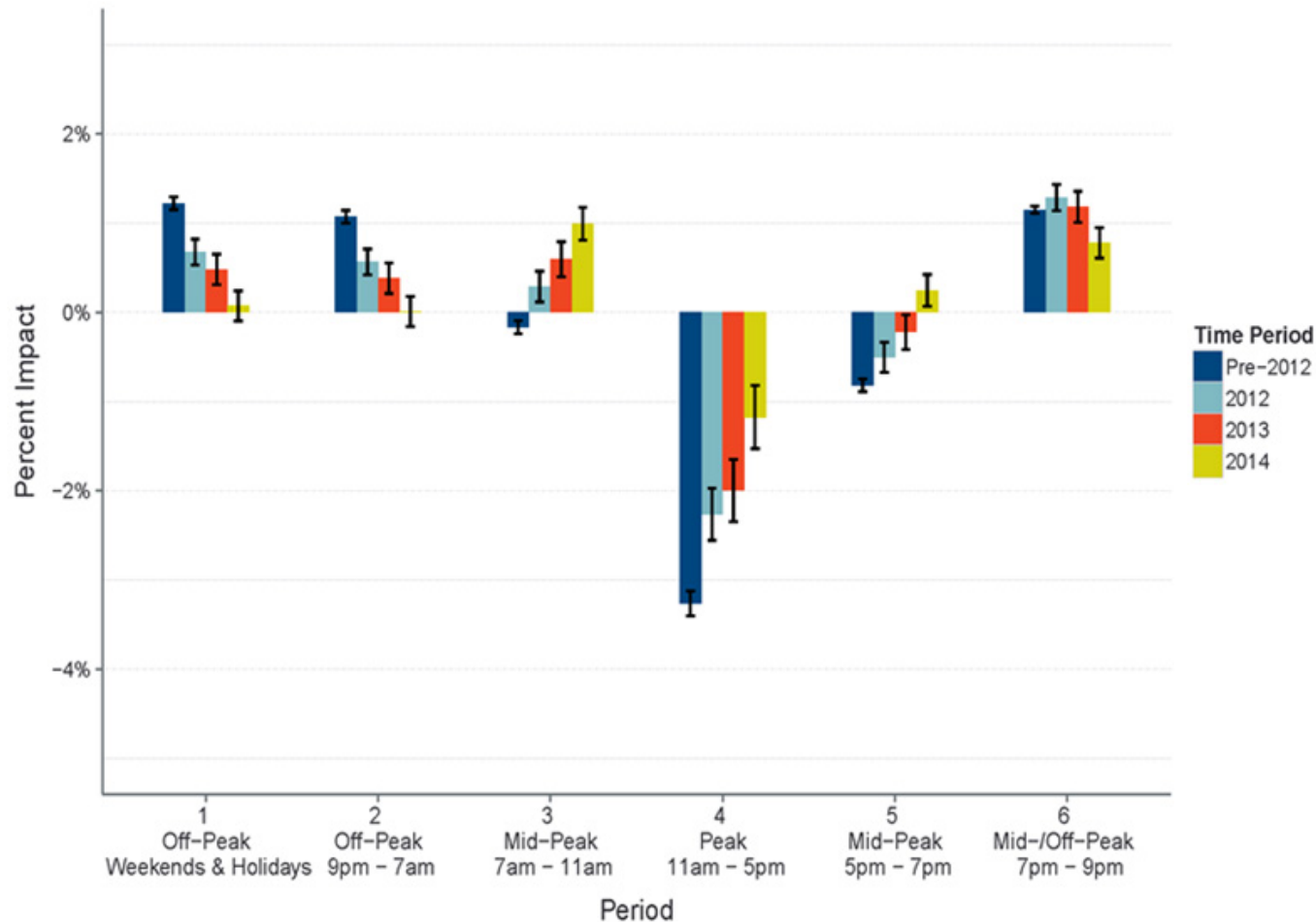
There is significant evidence of load shifting across all regions and years

- Reduction in usage in the peak period, some reduction in the mid-peak
- Increase in usage in the off-peak periods

The load shifting model parameters are generally well-behaved and have magnitudes that have been observed in other pilots

There are some unexpected, positive and significant elasticities in the conservation models, likely due to insufficient data history and little price variation

Residential Summer Load Shifting Across All Periods for Ontario

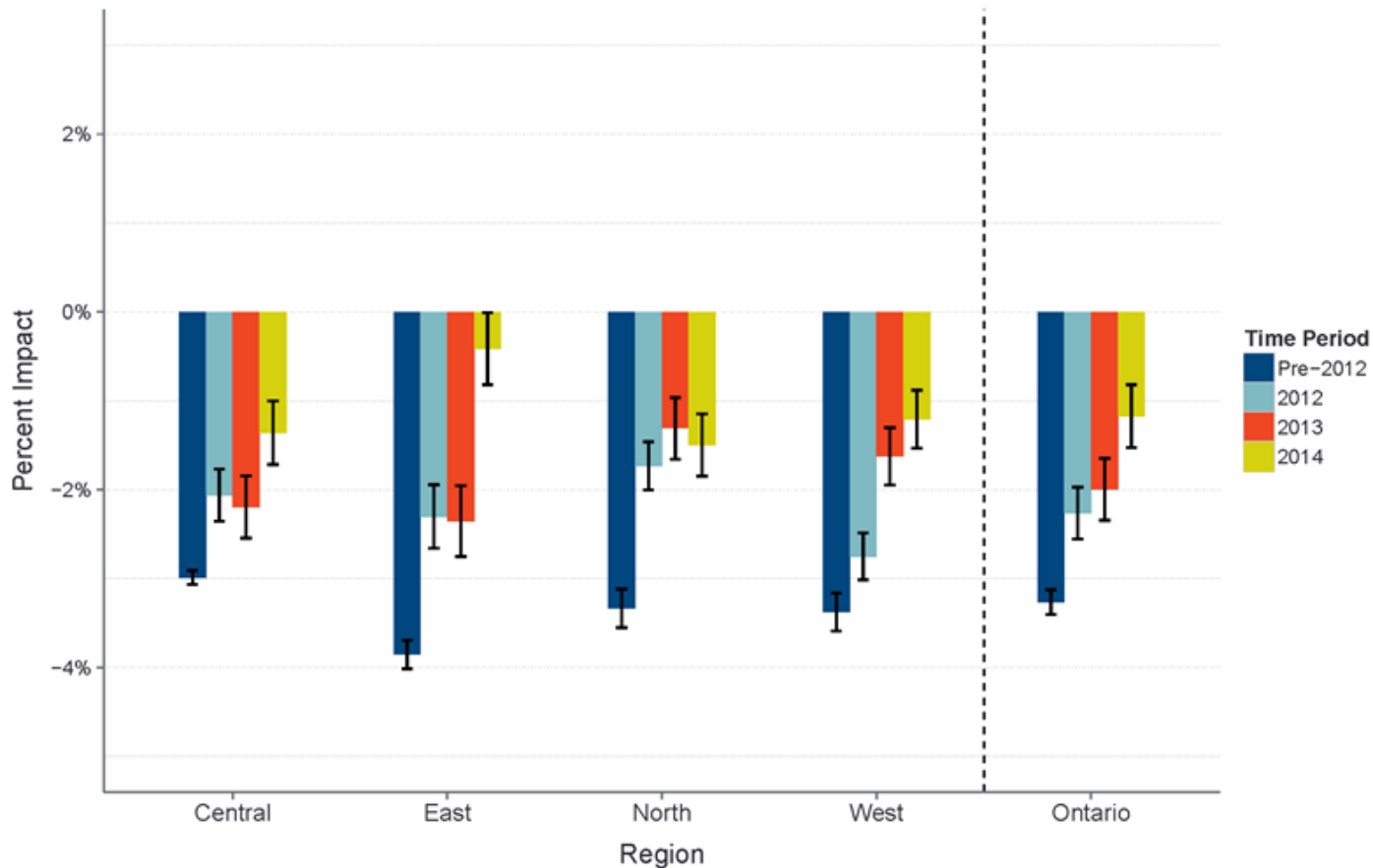


Province-Level Load Shifting Summer Residential

* Period 6 was mid-peak before May 2011

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

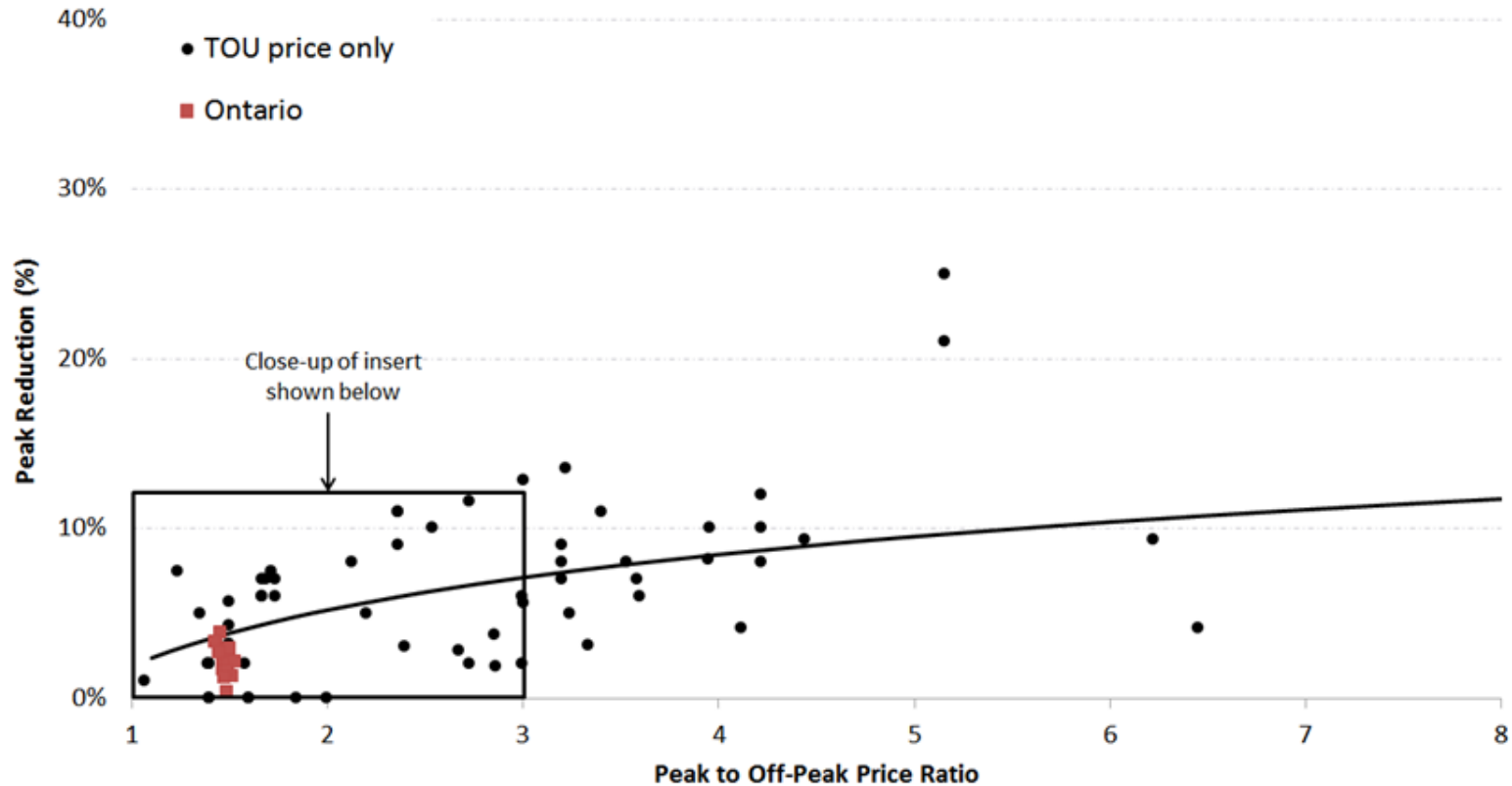
Residential TOU Peak Period Impacts across Regions



Summer TOU Peak Period (11am – 5pm) Residential Load Shifting Results

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

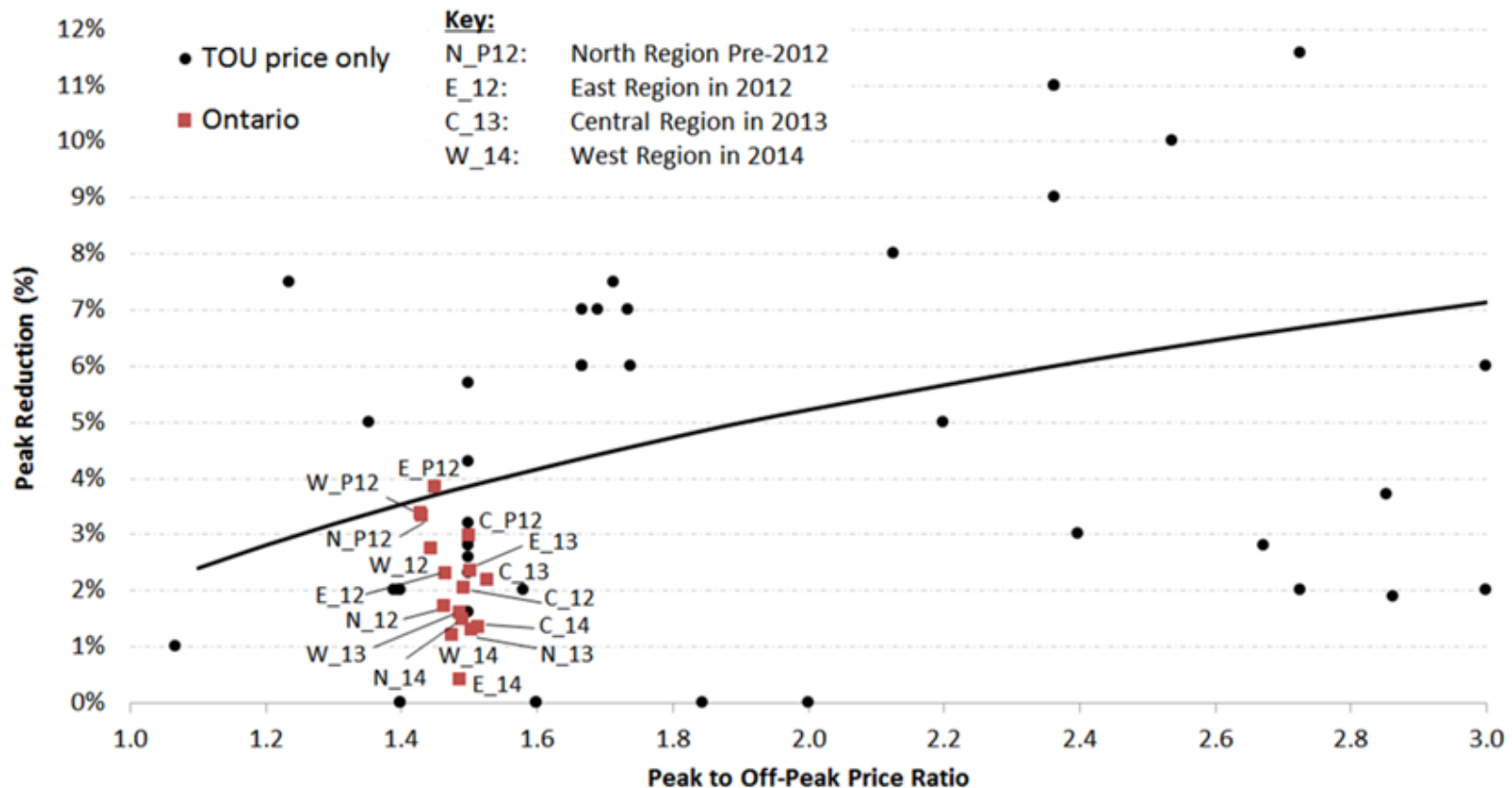
Ontario Residential TOU Impacts Compared to TOU Pilots from Around the Globe



Ontario Residential TOU Summer Impacts Compared to TOU Pilots from Around the World

All of the data points shown in blue above, are currently drawn from TOU pilot studies, not full scale rollouts like the OPA

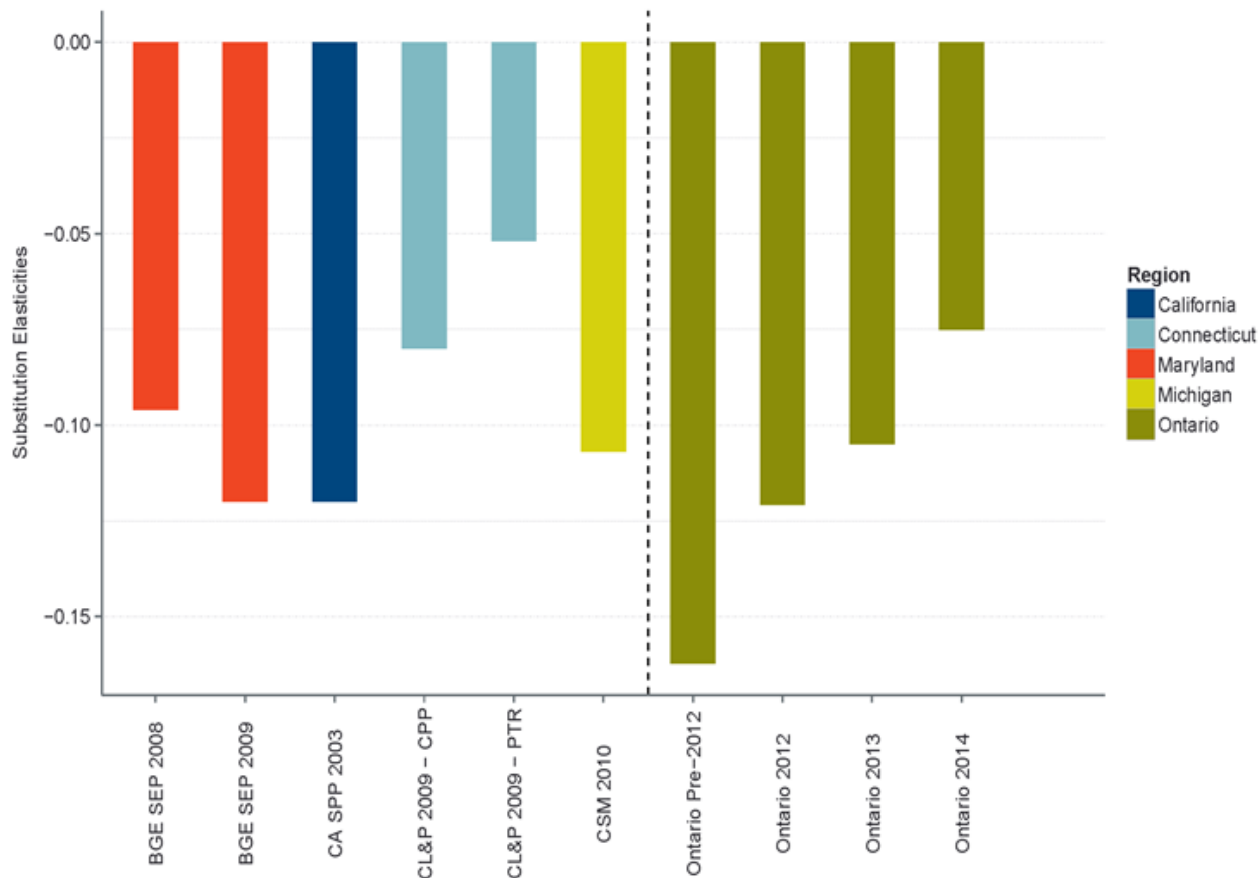
Ontario Residential TOU Impacts Compared to TOU Pilots from Around the Globe



Close-up of Ontario Residential TOU Summer Impacts Compared to TOU Pilots from Around the World

All of the data points shown in blue above, are currently drawn from TOU pilot studies, not full scale rollouts like the OPA

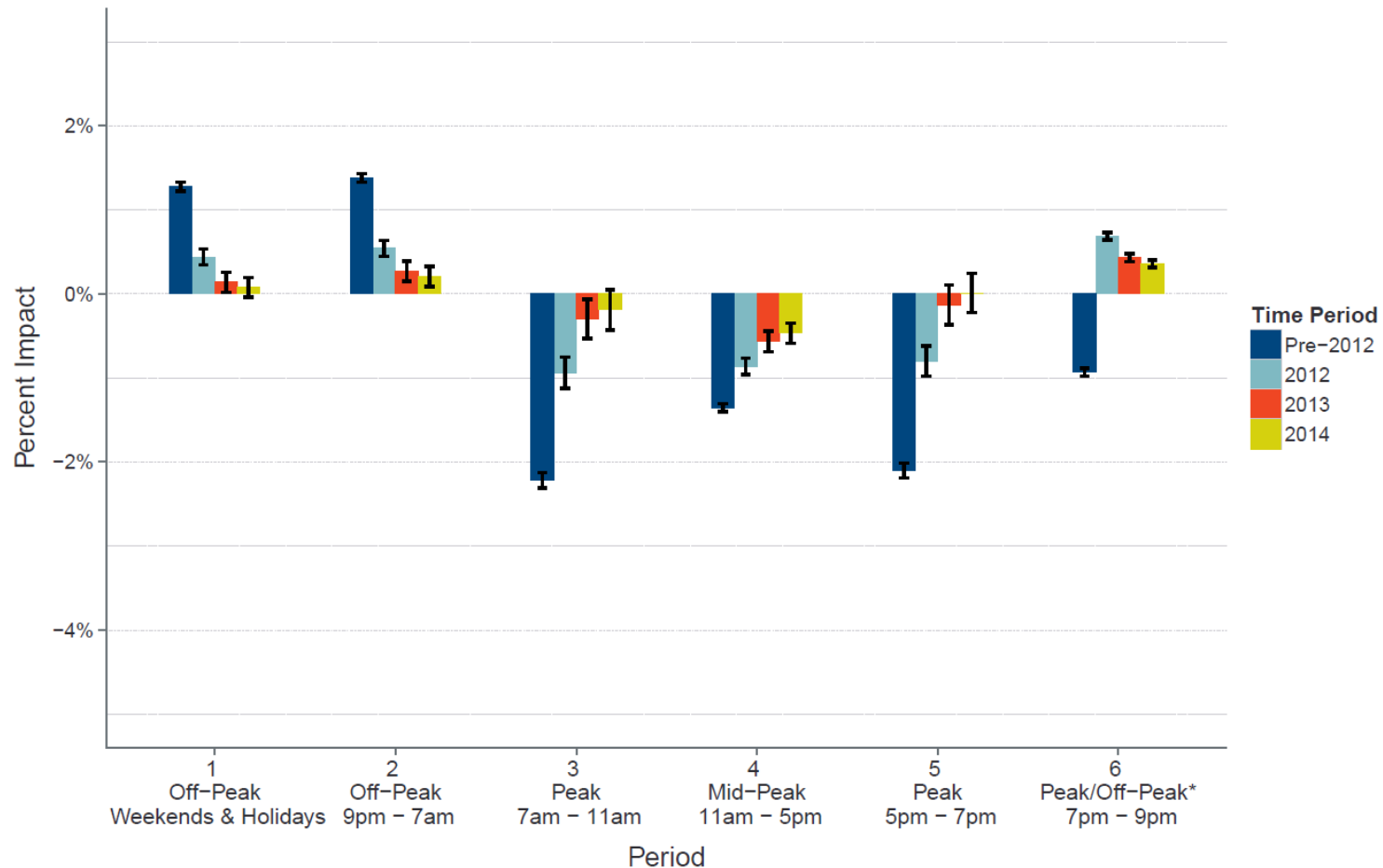
Residential Substitution Elasticities Compared to Pilot Studies Elsewhere*



Residential Substitution Elasticities Compared to Other Pilots (Summer TOU Peak Period)

* The Ontario TOU rollout was system wide, not a pilot

Residential Winter Load Shifting Across All Periods for Ontario



Provincial Winter Load Shifting for Residential

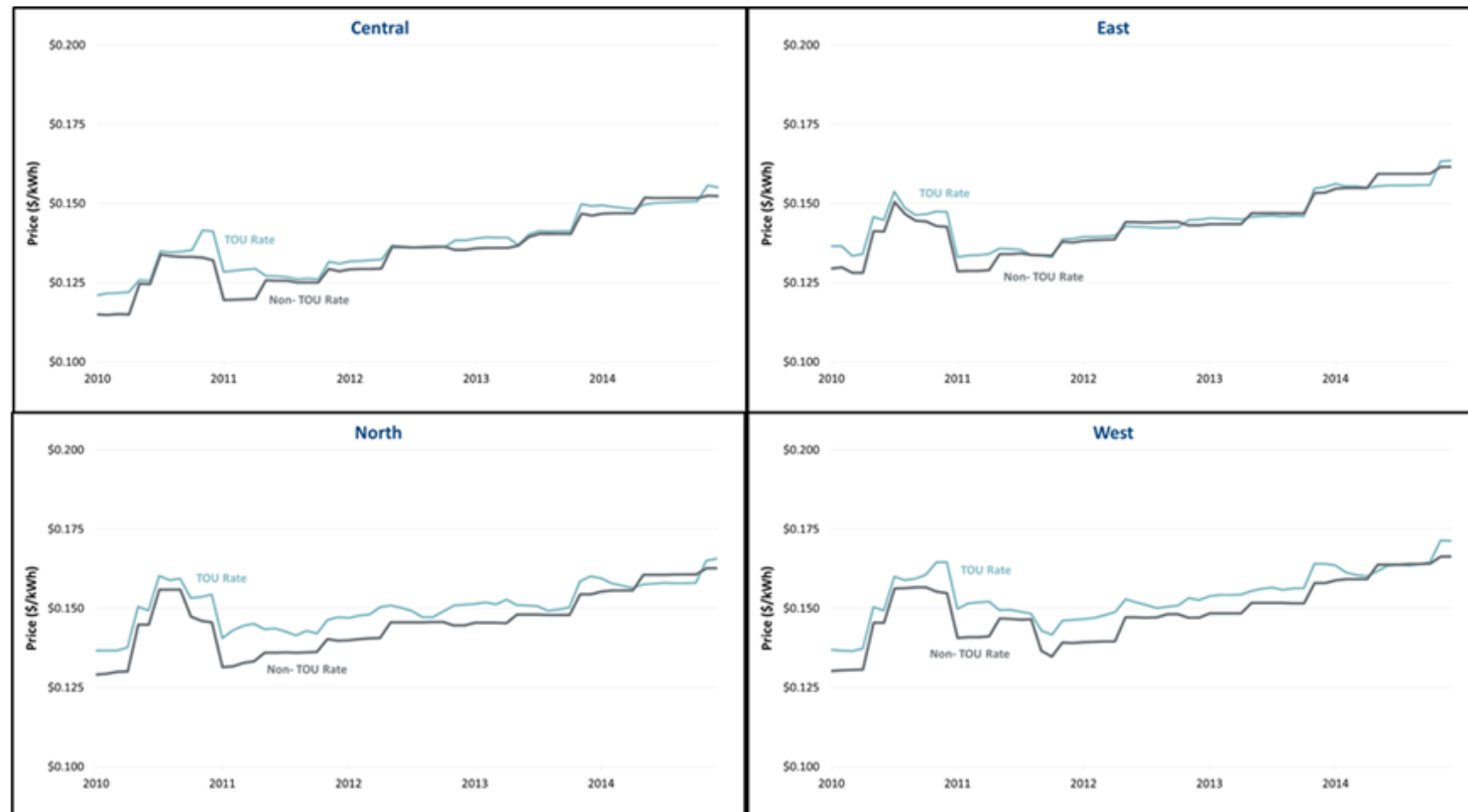
* Period 6 was peak before May 2011

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

Annual Residential Conservation Impacts by Region

We did not find any evidence of residential conservation due to the rollout of TOU rates

- There is very little variation in average prices over time



Residential TOU and Non-TOU Prices 2010-2014

Conclusions

By 2012 the province of Ontario had switched nearly 95% of residential customers to default TOU

We exploit variations in the timing of the rollout as well as the existence of non-TOU retail customers to estimate the load shifting and conservation impacts of TOU

Load shifting impacts are consistent with those found in other studies and relatively consistent across regions in Ontario and study years

We find no evidence of TOU induced conservation

Acknowledgements

Participating LDCs:

- Cambridge North Dumfries
- Hydro One
- Hydro Ottawa
- Newmarket Hydro
- PowerStream
- Thunder Bay Hydro
- Toronto Hydro

Additional Study Authors:

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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.

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

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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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Appendix A: References

References

- Faruqui, Ahmad, Neil Lessem, Sanem Sergici, Dean Mountain , Frank Denton, Byron Spencer and Chris King. “Analysis of Ontario’s Full Scale Roll-out of TOU Rates- Final Study.” (February 3, 2016).
[http://brattle.com/system/news/pdfs/000/001/061/original/Analysis_of Ontario%E2%80%99s Full Scale Roll-out of TOU Rates - Final Study.pdf?1463069898](http://brattle.com/system/news/pdfs/000/001/061/original/Analysis_of_Ontario%E2%80%99s_Full_Scale_Roll-out_of_TOU_Rates_-_Final_Study.pdf?1463069898)
- Faruqui, Ahmad, Neil Lessem, Dean Mountain and Sanem Sergici. “Impact Measurement of Tariff Changes when Experimentation is not an Option – A case study of Ontario, Canada.” *Energy Economics*, 52 (December 2015).

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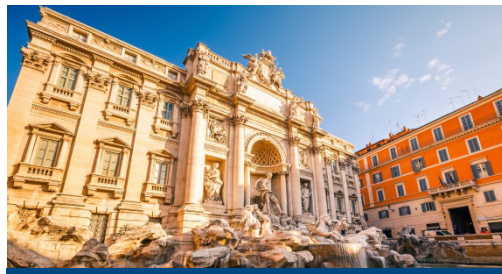
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