

# The movement towards deploying demand charges for residential customers

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**PRESENTED BY**

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THE **Brattle** GROUP

# What explains the new interest in demand charges for residential customers?

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**Existing two-part tariffs do not reflect the underlying cost structure**

- Fixed service charge (\$/month)
- Non-time-varying energy charge (cents/kWh)

**Costs that vary with system peak-coincident demand, a customer's maximum demand, or with time or location, are rolled into volumetric energy charges**

**This distortion between cost structure and tariff structure creates issues of equity between customers as some begin deploying smart appliances, thermostats, rooftop solar and storage while others don't**

**Advanced metering infrastructure allows demand charges to be offered without incremental metering costs**

# How would rates change with a demand charge?

## An illustration for vertically-integrated utilities

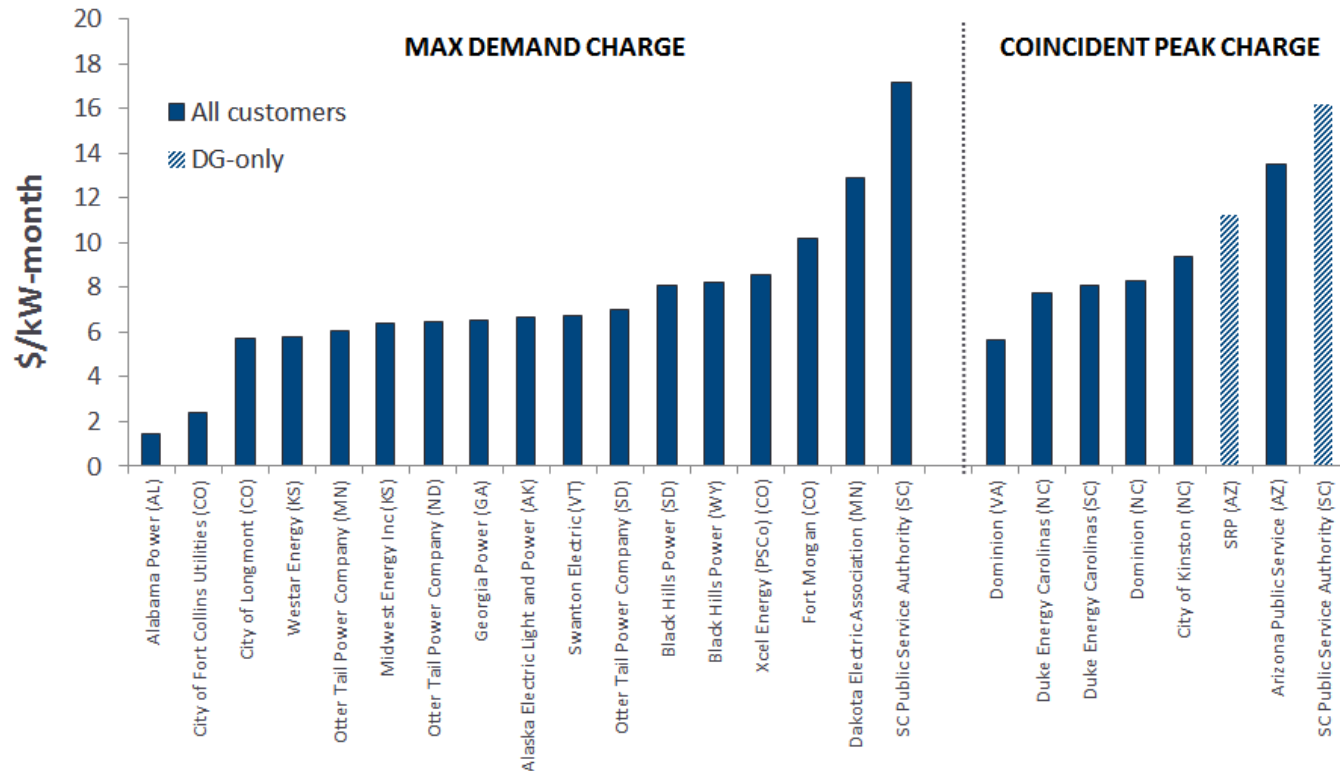
	Old Two-Part Rate		New Three-Part Rate
Fixed charge	\$10/month		\$10/month
Volumetric charge	10 cents/kWh		6 cents/kWh
Demand charge	\$0		\$10/kW-month

- The introduction of a demand charge will be coupled with a reduction in the volumetric energy charge and may also be coupled with an increase in the fixed charge
- For network-only utilities, the new rates may only include a fixed charge and a demand charge

# Some utilities already offer residential demand charges

## Summer Demand Charges in Existing Rates

## Comments



- 19 utilities offer residential demand charges, 10 of which are IOUs
- They were proposed by Westar, NV Energy, ComEd and are being considered by other utilities

### Notes:

- 1) All rates are drawn from their respective utility tariff sheets, valid as of July 2015.
- 2) The SRP rate is tiered and varies by season and amount of demand; we show the average summer demand charge for a 10 kW customer for illustrative purposes.
- 3) The SC Public Service Authority DG rate includes a peak rate of \$11.34/kW-mo and an off-peak rate of \$4.85/kW-mo. We present the sum for simplicity.

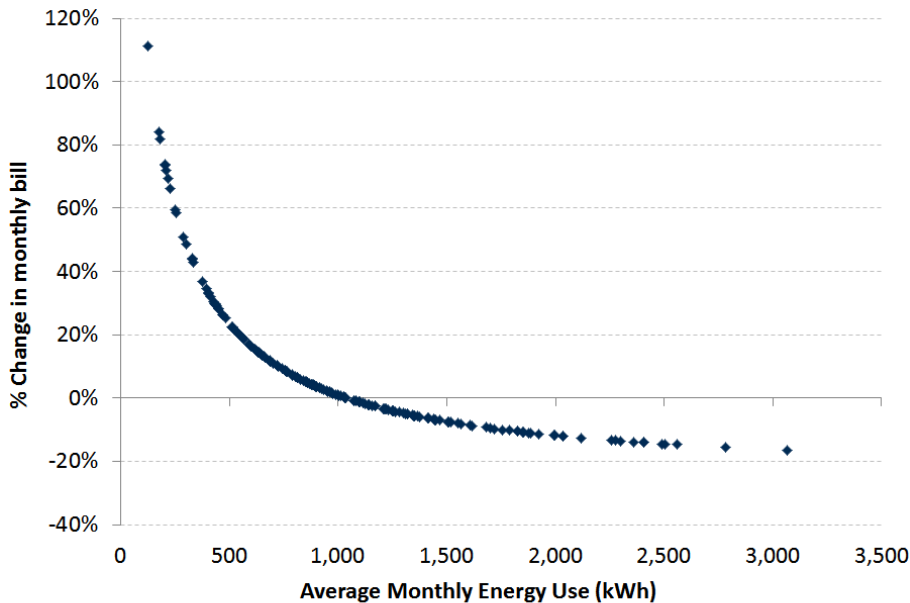
# Frequently voiced objections

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- 1. Residential customers cannot understand them, will treat them as a fixed charge, and not lower demand**
- 2. They will lower the incentive for conserving energy and installing rooftop solar panels**
- 3. They will increase monthly bill volatility**
- 4. They are an obsolete idea, time-of-use pricing is a better option**
- 5. They would require investment in metering and billing infrastructure**
- 6. They will harm low income customers**

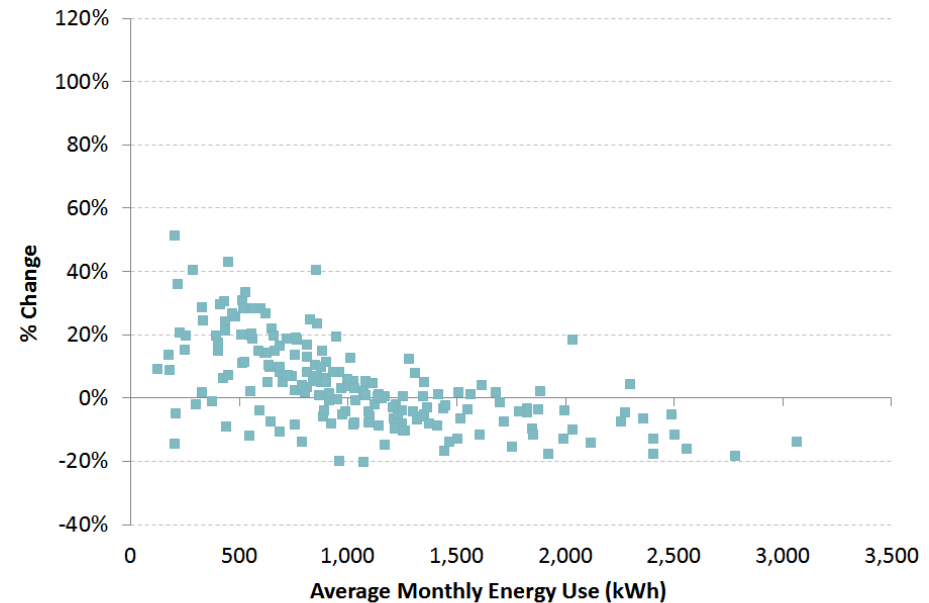
# Demand charges do not automatically increase bills for small customers

## With Increased Fixed Charge



Note: The three-part rate includes a monthly fixed charge of \$10, an energy charge of \$0.077/kWh, and a demand charge of \$6/kW. The revenue-neutral two-part rate includes a monthly fixed charge of \$40 and an energy charge of \$0.083/kWh.

## With New Demand Charge



Note: The three-part rate includes a monthly fixed charge of \$10, an energy charge of \$0.060/kWh, and a demand charge of \$9/kW. The revenue-neutral two-part rate includes a monthly fixed charge of \$40 and an energy charge of \$0.083/kWh.

- Correlation between bill impact and customer size is stronger with increased fixed charge
- Whether small customers are low income customers is another question entirely...

# Can residential customers understand demand charges?

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Anyone who has purchased a light bulb has encountered watts; ditto for anyone who has purchased a hair dryer or an electric iron

Customers often hear about kWh's after they have run into kW's; e.g., if you leave on a 100 watt bulb for 10 hours, it will use 1,000 watt-hours, or one kWh

Similarly, if you run your hair dryer at the same time that someone else is ironing their clothes and lights are on in both bathrooms, the circuit breaker may trip on you since you have exceeded its capacity, expressed in kVA's or kW's

# Are demand charges a new concept in the electricity industry?

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They have been offered to commercial and industrial customers for decades

The concept originated with an engineering professor, John Hopkinson, in Great Britain in the late nineteenth century

It acquired acceptance among economists in the decades that followed

There is a good discussion of three-part rates in Professor Bonbright's canon on public utility rates



# Stakeholder concerns can be addressed through some new initiatives - I

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**Codify and learn from the experience of utilities that have deployed demand charges, in the US and in Europe**

**Quantify bill impacts, particularly for low- and moderate income customers**

**Assess customer understanding of demand charges through market research (interviews, focus groups and surveys) and identify the best way to communicate the concept and to design the rates**

# Stakeholder concerns can be addressed through some new initiatives - II

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**Assess customer response to demand charges through a new generation of experiments whose design builds on insights gleaned from prior work on time-of-use pricing experiments**

**Study ways in which to mitigate financial impact on vulnerable customers, maybe by excluding them initially from demand charges, or by phasing in the rates, or by providing them financial assistance for installing energy efficiency measures**

# Conclusions

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**Demand charges are consistent with the well-known Bonbright principles of efficiency, equity, understandability and stability**

**Furthermore, demand charges will facilitate technological innovation in the form of battery storage, smart appliances, smart thermostats and home demand management systems**

**Of course, the transition will have to be tailored to the unique circumstances of each regulatory jurisdiction**

**And stakeholders concerns would need to be addressed by studying the lessons learned from past deployments, engaging in primary market research and scientific experimentation, and by providing financial protections for vulnerable customers**

## Further readings

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Berg, Sanford and Andreas Savvides, “The Theory of Maximum kW Demand Charges for Electricity,” *Energy Economics*, October 1983.

Bonbright, James C. *Principles of Public Utility Rates*, Columbia University Press, 1961.

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

Caves, Douglas and Laurits Christensen, “Econometric Analysis of Residential Time-of-Use Electricity Pricing Experiments,” *Journal of Econometrics*, 1980.

Caves, Douglas, Laurits Christensen, and Joseph Herriges, “Modelling Alternative Residential Peak-Load Electricity Rate Structures,” *Journal of Econometrics*, 1984.

Crew, Michael and Paul Kleindorfer, *Public Utility Economics*, St. Martin’s Press, NY, 1979.

## Further readings (continued)

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Harvard Electricity Policy Group, Residential Demand Charges, June 25, 2015.  
<http://www.ksg.harvard.edu/hepg/Papers/2015/HEPG%20June%202015%20rapporu's%20report.pdf>

Hledik, Ryan. “Rediscovering Residential Demand Charges,” *The Electricity Journal*, Volume 27, Issue 7, August–September 2014, Pages 82–96.

Schwarz, Peter, “The Estimated Effects on Industry of Time-of-Day Demand and Energy Electricity Prices,” *The Journal of Industrial Economics*, June 1984.

Snook, Leland and Meghan Gabel, “There and back again: Why a residential demand rate developed forty years ago is relevant again,” *Public Utilities Fortnightly*, November 2015, forthcoming.

Stokke, Andreas, Gerard Doorman, and Torgeir Ericson, “An Analysis of a Demand Charge Electricity Grid Tariff in the Residential Sector,” Discussion Paper 574, Statistics Norway Research Department, January 2009.

## Further readings (concluded)

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Taylor, Thomas N., “Time-of-Day Pricing with a Demand Charge: Three-Year Results for a Summer Peak,” MSU Public Utilities Papers, 1982.

Taylor, Thomas and Peter Schwartz, “A Residential Demand Charge: Evidence from the Duke Power Time-of-Day Pricing Experiment,” *The Energy Journal*, April 1986.

Yakubovich, Valery, Mark Granovetter, and Patrick McGuire, “Electric Charges: The Social Construction of Rate Systems,” *Theory and Society*, 2005.

# Appendix

# Customers don't need to be electricity experts to understand a demand charge

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Responding to a demand charge does not require that the customers know exactly when their maximum demand will occur

If customers know to avoid the simultaneous use of electricity-intensive appliances, they could easily reduce their maximum demand without ever knowing when it occurs

This simple message should be stressed in customer marketing and outreach initiatives associated with the demand rate

## Examples from utility websites

- APS: “Limit the number of appliances you use at once during on-peak hours”
- Georgia Power: “Avoid simultaneous use of major appliances. If you can avoid running appliances at the same time, then your peak demand would be lower. This translates to less demand on Georgia Power Company, and savings for you!”



# Staggering the use of a few key appliances could lead to significant demand reductions

## Avg. Demand Over 15 min

Appliance	Avg. Demand (kW)
Dryer	4.0
Oven	2.0
Stove	1.0
Hand iron	0.5
Misc. plug loads	0.2
Lighting	0.3
Refrigerator	0.5
<b>Total</b>	<b>8.5</b>

Flexible Load  
(7.5 kW)

Inflexible Load  
(1 kW)

## Comments

- Use of some of the appliances is inflexible (1 kW)
- Use of other appliances could be easily staggered to reduce demand
- Simply delaying use of the dryer until after the oven, stove, and hand iron had been turned off would reduce the customer's maximum demand by 3.5 kW
- This would bring the customer's maximum demand down to 5 kW, a **roughly 40% reduction in demand**

# Several tools are available to facilitate the rate transition

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- Gradually escalating the demand charge over time
- Temporary bill protection
- Tiered demand charges or ceiling on applicable demand
- Shadow bills
- Enhanced customer outreach and education
- Rebates for enabling technologies
- Exemption for vulnerable / low income customers

# Presenter Information

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Ahmad Faruqui leads the firm's practice in understanding and managing the changing needs of energy consumers. This work encompasses tariff design and evaluation, distributed generation, energy efficiency, demand response, demand forecasting and cost-benefit analysis of emerging technologies. He has consulted with more than 125 clients, including utilities, system operators, and regulatory commissions, in the U.S. and in Australia, Canada, Egypt, Hong Kong, Jamaica, Philippines, Saudi Arabia, and Thailand. He has filed testimony or appeared before state commissions, government agencies, or legislative bodies in Alberta (Canada), Arizona, Arkansas, California, District of Columbia, Illinois, Indiana, Kansas, Maryland, Michigan and Ontario (Canada). He has spoken at conferences in Australia, Bahrain, Brazil, Egypt, France, Germany, Ireland, Jamaica, and the United Kingdom. And his work has been cited in *Business Week*, *The Economist*, *Forbes*, *The New York Times*, *USA Today*, *The Wall Street Journal* and *Washington Post*. He has appeared on Fox News and National Public Radio and is the author, co-author, or co-editor of four books and more than 150 articles on energy economics. Dr. Faruqui holds bachelors and masters degrees from the University of Karachi in economics and masters and doctoral degrees from the University of California, Davis, in economics and in agricultural economics.

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