

# Residential Demand Charges, Distributional Effects and Energy Storage

## **PRESENTED TO**

EEl Grid Talk Webinar

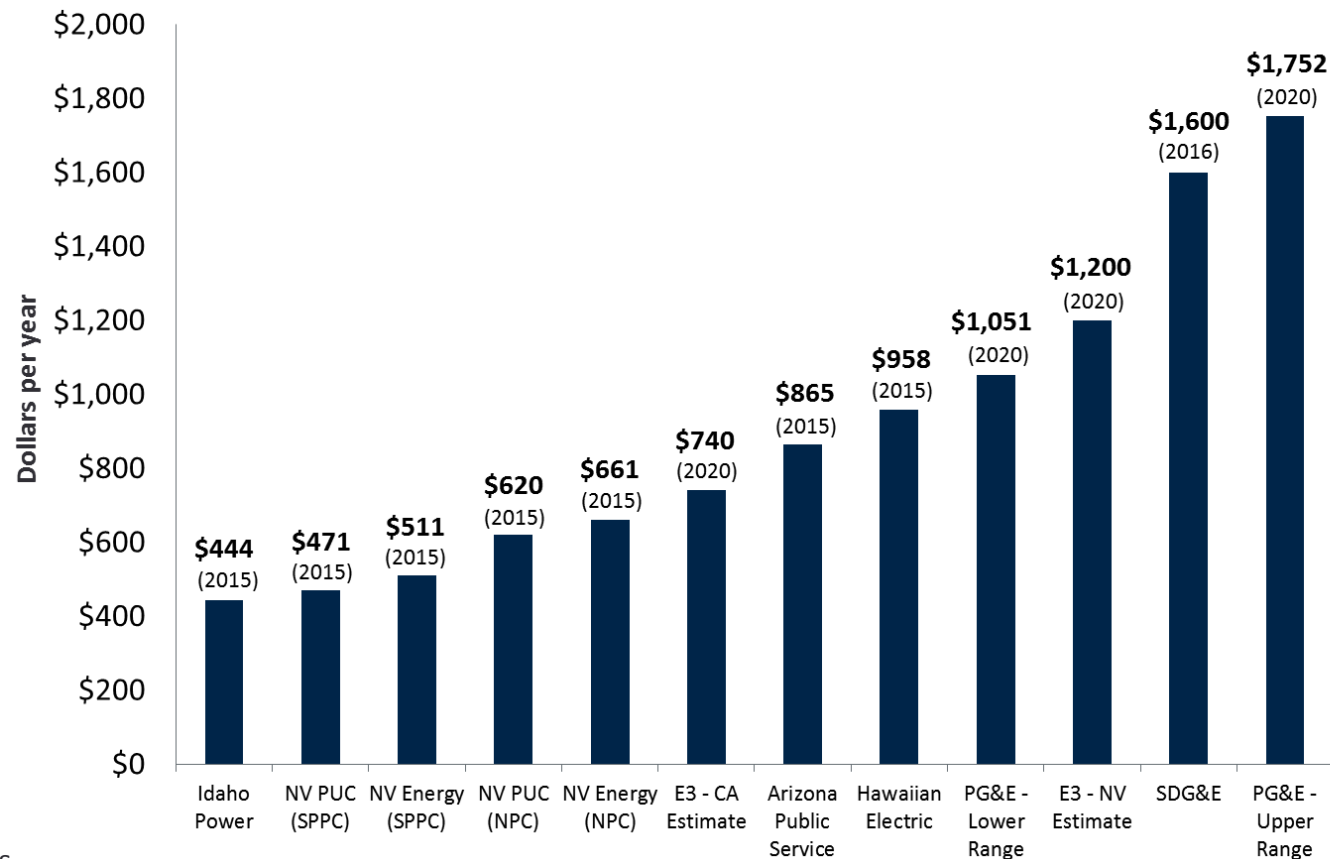
## **PRESENTED BY**

Ahmad Faruqui  
(with contributions from Ryan Hledik)

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# Solar customers are being subsidized by non-solar customers through two-part rates



Source:

Barbara Alexander, Ashley Brown, and Ahmad Faruqi, "Rethinking Rationale for Net Metering," *Public Utilities Fortnightly*, October 2016.

Notes:

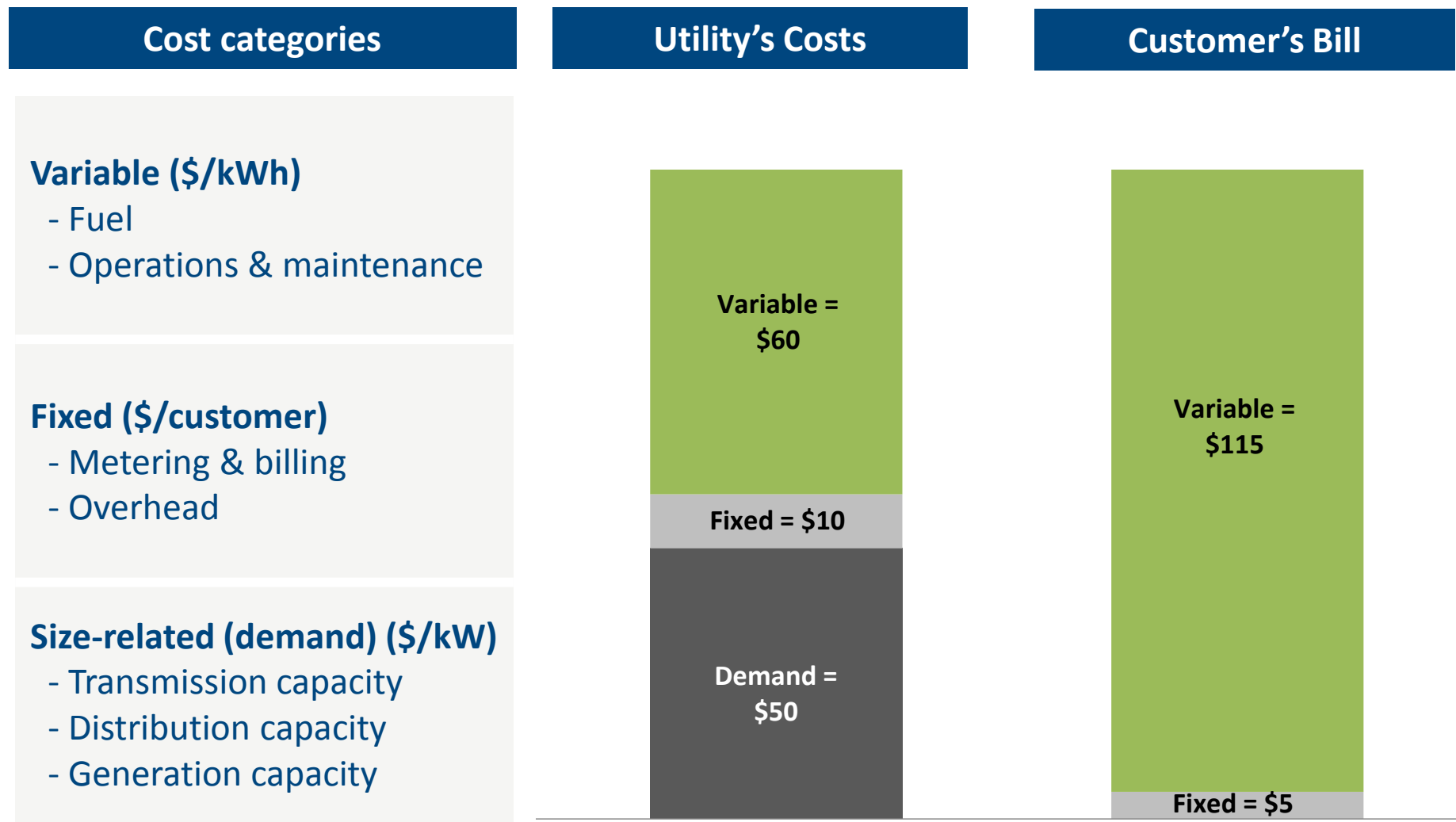
Year indicates date of cost-shift estimate, which is sometimes a forecast.

In some cases, reported estimates were converted to annual dollars per NEM customer for comparison purposes.

The PG&E ranges are calculated using assumptions from the California Public Utilities Commission's Public Modeling Tool.

SPPC and NPC refer to Sierra Pacific Power Company and Nevada Power Company service territories respectively.

# Two-part rates do not reflect the utility's cost structure



# All grid costs and some generation capacity costs should be recovered through demand charges

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**Utilities have begun moving to a three-part rate for residential customers, consisting of a monthly service charge, a demand charge and a time-varying energy charge**

## **Simple time-of-use rates will not solve the cost shift problem**

- Georgia Power has 2,200 C&I customers on real time pricing but these customers still face a demand charge for their use of the grid  
[https://www.georgiapower.com/docs/rates-schedules/marginally-priced/6.20 RTP-DA.pdf](https://www.georgiapower.com/docs/rates-schedules/marginally-priced/6.20_RTP-DA.pdf)
- Facility-based demand charges persist in California even when dynamic pricing rates have been rolled out to commercial and industrial customers

**Ryan Hledik and Gus Greenstein of Brattle have published a paper that explores two questions**

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**How will demand charges impact the bills of low-income residential customers?**

**To what extent will residential demand charges create opportunities for distributed energy storage?**

# Methodology and data

## Data for 2,000 residential customers in Vermont

- 15-minute load data for a full year
- Customer-specific estimates of household income
- Low-income threshold assumed 150% of federal poverty line

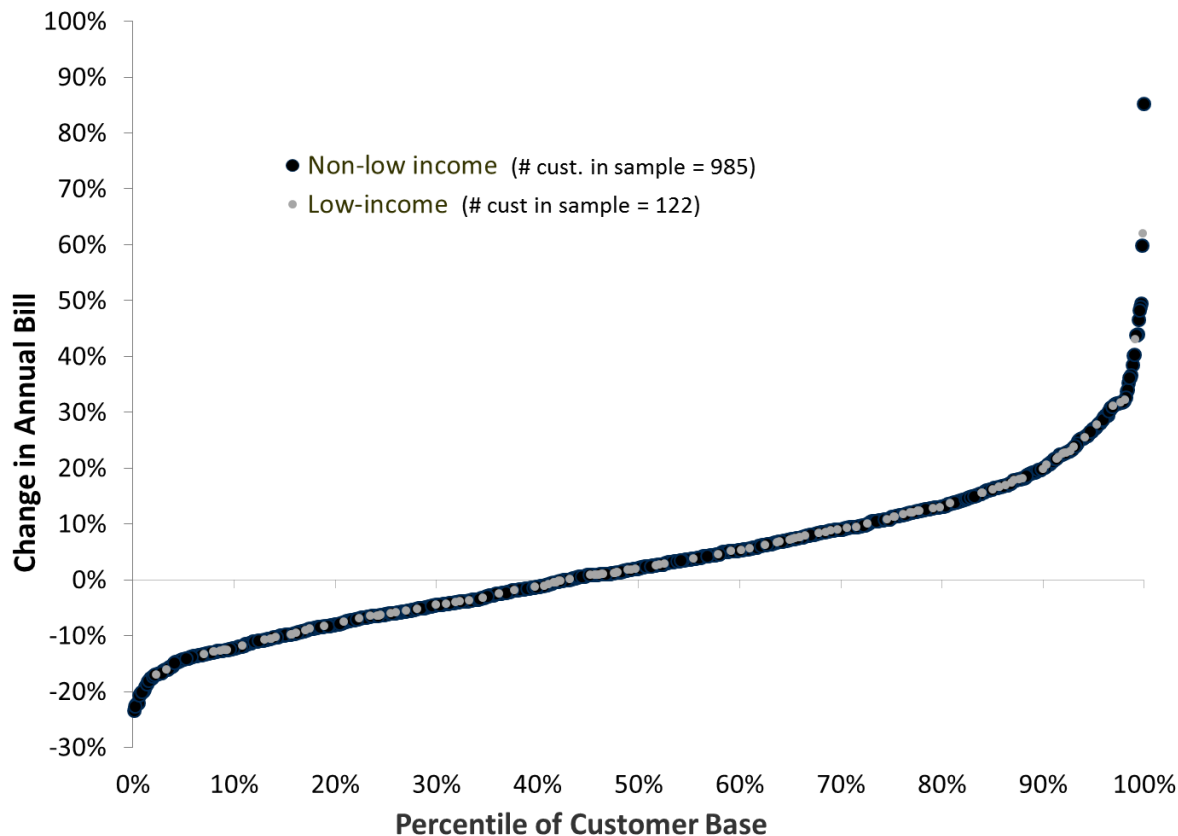
## Illustrative rate designs

- Revenue neutral for the sample of customers
- Demand measurement constrained to peak hours (2 pm to 6 pm)
- Note: this is just one of many ways to design a demand charge

	Two-part rate	Three-part rate
Demand charge (\$/kW-month)	None	\$7.00
Volumetric charge (\$/kWh)	\$0.110	\$0.068
Fixed charge (\$/month)	\$10.00	\$10.00

# On average, low-income customer are impacted the same as other customers

## Distribution of Bill Impacts Across Customers

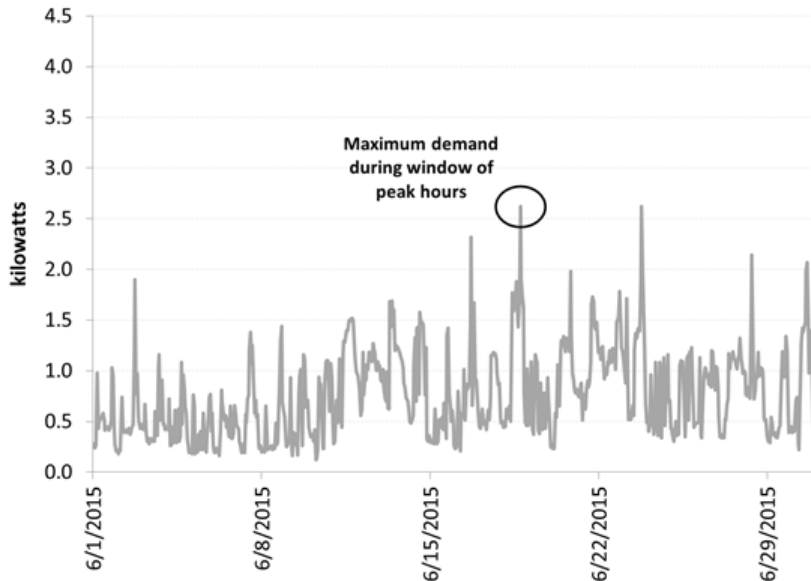


## Comments

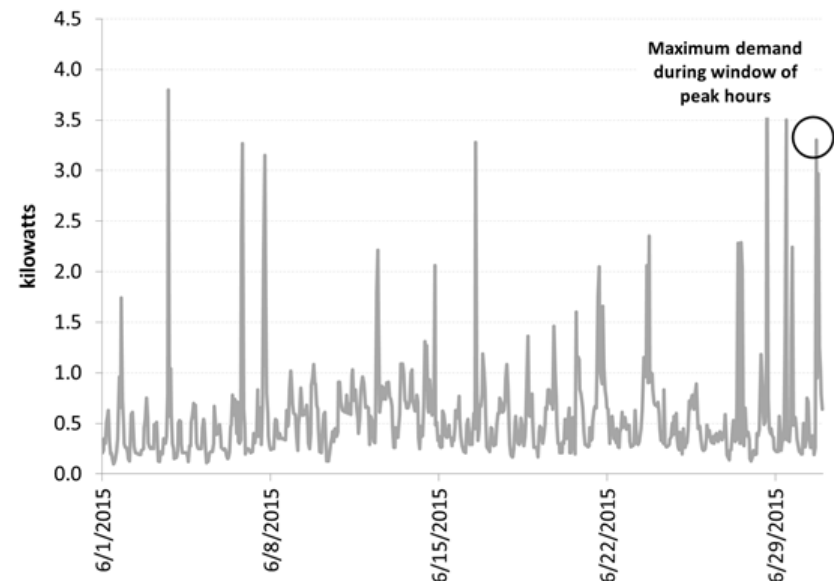
- There is no statistically significant difference in the bill change for the average low income and non-low income customer
- A majority of customers (61%) would experience a *decrease* in monthly bill volatility with the demand charge
- At the extreme end of the distribution, some customers experience a significant bill change

# Load profiles of two prototypical customers (June)

**Customer with Bill Savings**



**Customer with Bill Increase**



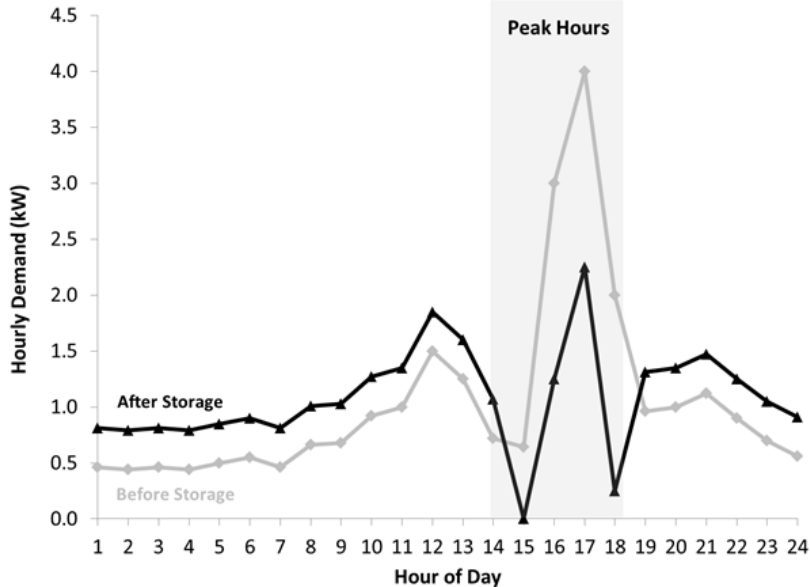
## Drivers of “peaky” usage could include

- Sporadic occupancy, low average load with occasional use of large appliances, or electric heating/cooling (depending on climate)
- Further research is needed to identify the customer segments likely to be impacted most significantly

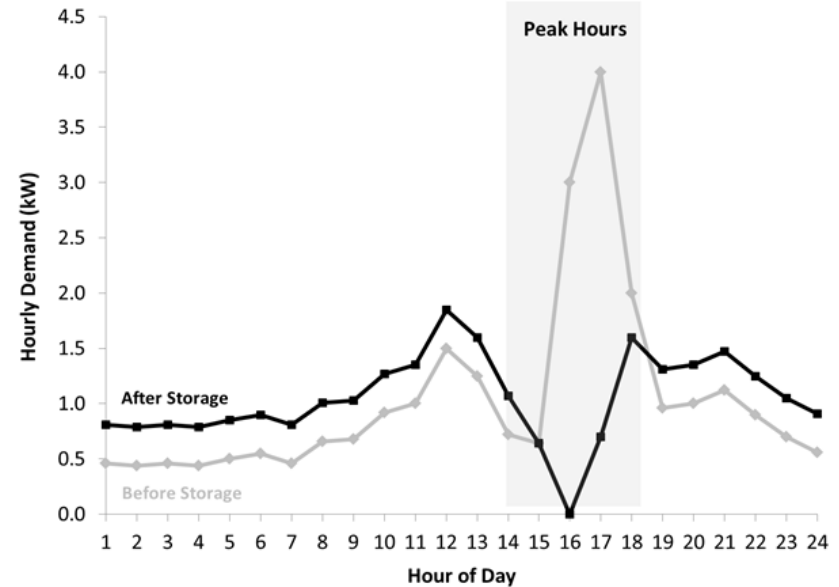


# Distributed energy storage can be operated to reduce demand

## Simple Charging Strategy



## Predictive Charging Strategy

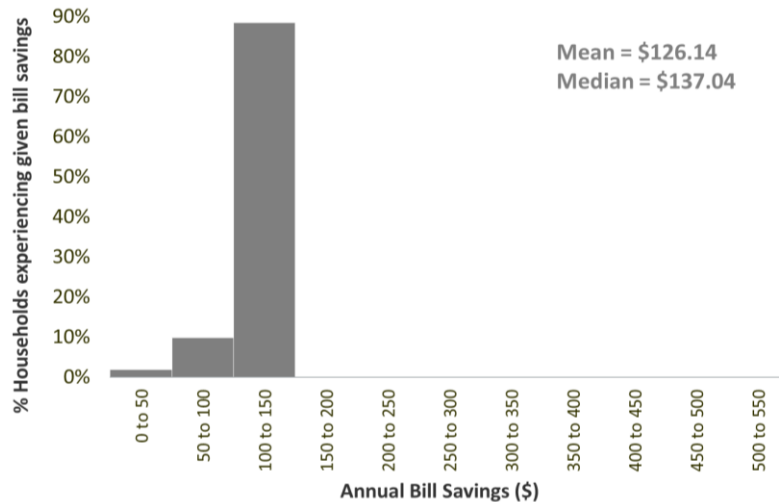


## Assumptions

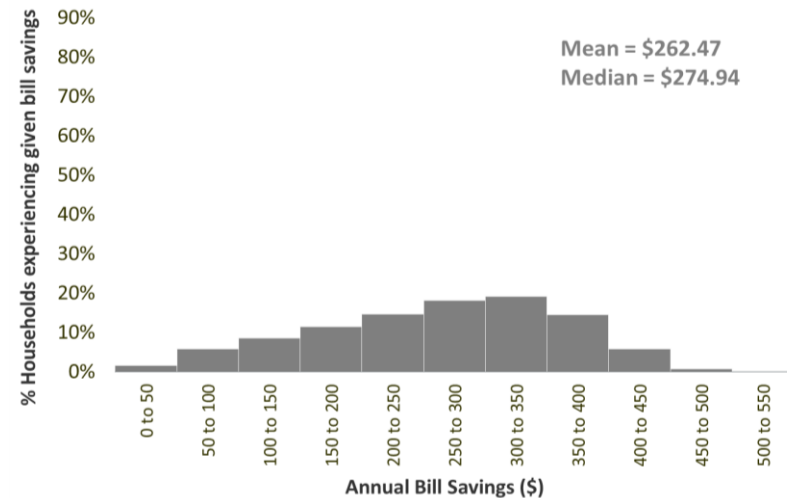
- 7 kWh of energy storage, max discharge rate of 3.3 kWh/hr, 92% efficiency
- “Simple charging” reduces all peak hours equally, while “predictive charging” targets highest demand hours during peak period

# Bill savings can be significant with energy storage

## Simple Charging

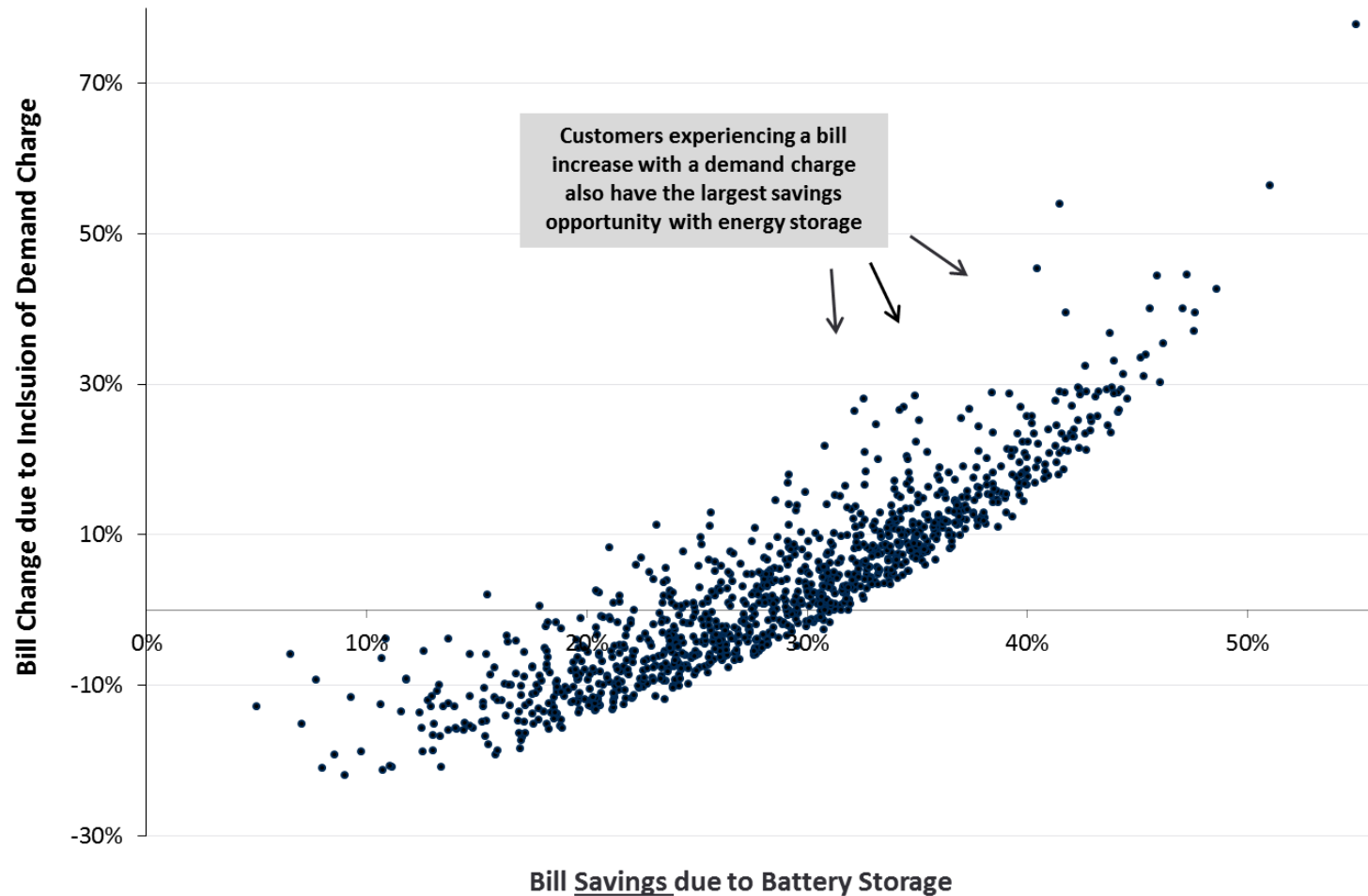


## Predictive Charging



- Simple charging reduces bills by 13%, or \$126 per year on average
- Predictive charging increases average savings to 28%, or \$263/year
- Savings do not account for the cost of the technology
- Different rate design and dispatch strategy could increase savings further

# Energy storage could significantly mitigate bill increases for customers with peaky usage



# Preliminary recommendations

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- **Develop a rate transition strategy**
- **Promote demand management technologies**
- **Pilot demand charges with and without storage**
- **Analyze the extent to which bill savings translate to cost savings**
- **Develop predictive algorithms for battery operation**
- **Extend research to other regions / climate conditions**

# References

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**Faruqui, Ahmad, Wade Davis, Josephine Duh and Cody Warner.**  
**“Curating the Future of Rate Design for Residential Customers.”**  
***Electricity Policy*, July 2016.**

**Hledik, Ryan and Gus Greenstein, “The Distributional Impacts of Residential Demand Charges,” *The Electricity Journal*, July 2016.**

# Presenter Information

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Ahmad Faruqui is an economist whose 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 more than a hundred 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. 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 the governments of Australia, Egypt, Ireland, Philippines, Thailand and the United Kingdom and given energy seminars on all six continents. His research on the energy behavior of consumers has been cited in Business Week, The Economist, Forbes, National Geographic, The New York Times, the San Francisco Chronicle, the San Jose Mercury News, the 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 four books and more than 150 articles, papers and reports on energy matters. His work has appeared 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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