

GRID MODERNIZATION INITIATIVE PEER REVIEW

1.4.29 – Future Electric Utility Regulation

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Sheraton Pentagon City Hotel – Arlington, VA

Future Electric Utility Regulation

High-Level Project Summary

Project Description

Provide technical assistance and analysis for public utility commissions (PUCs) and a series of reports with multiple perspectives on evolving utility regulation and ratemaking, utility business models and electricity markets:

- Adapting to new technologies and services
- Assessing potential financial impacts on utility shareholders and customers
- Engaging consumers
- Addressing utility incentives to achieve grid modernization goals

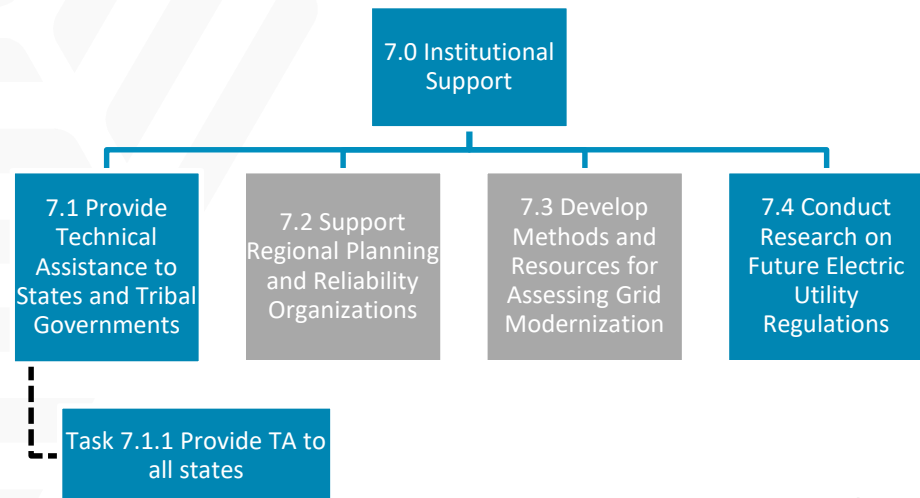
Value Proposition

- ✓ Modernizing grids requires utilities to make large investments in the face of rapid change and increasing risk and uncertainty.
- ✓ This project helps PUCs and utilities explore regulatory changes to deploy needed capital.

Project Objectives

- ✓ Improve capability of states to consider alternative regulatory and ratemaking approaches that enable grid modernization investments.
- ✓ Better tie utility earnings to consumer value, economic efficiency, and other policy goals.
- ✓ More efficiently deploy capital to achieve grid modernization goals.

Relationship to Grid Modernization MYPP



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Project Team

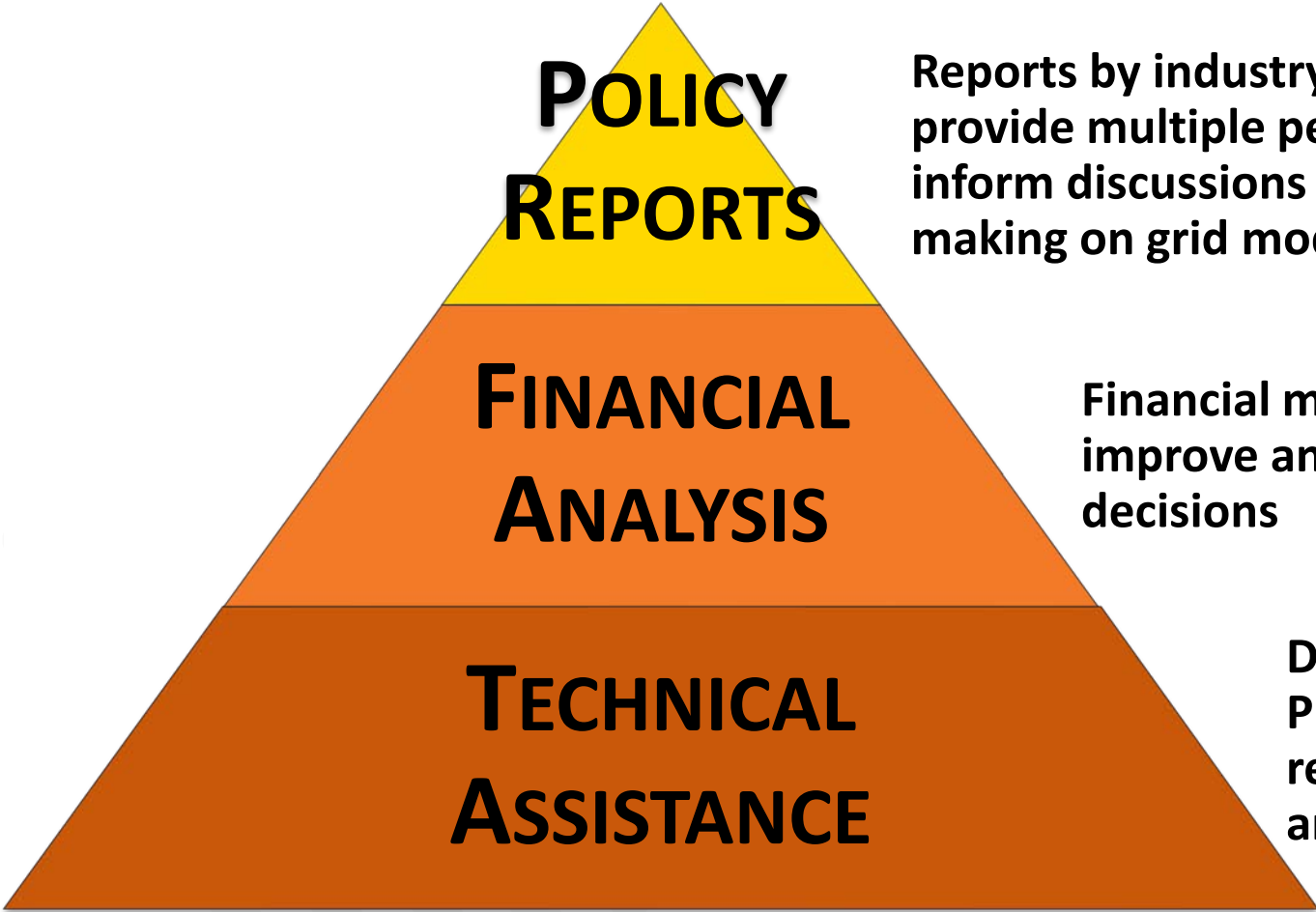


Project Participants and Roles

- LBNL – Project manager; modeling and state technical assistance (TA); Future Electric Utility Regulation report series; performance-based regulation technical report
- NREL – Plus one; modeling and state TA
- NETL – Modeling and state TA
- SNL – State TA
- PNNL – State TA
- National Association of Regulatory Utility Commissioners – Outreach

PROJECT FUNDING			
Lab	FY16 \$	FY17 \$	FY18 \$
LBNL	\$810	\$803	\$803
NREL	\$71	\$125	\$125
NETL	\$75	\$0	\$0
SNL	\$34	\$41	\$42
PNNL	\$10	\$30	\$30
TOTAL	\$1M	\$1M	\$1M

Future Electric Utility Regulation Approach



Reports by industry thought-leaders provide multiple perspectives to inform discussions and decision-making on grid modernization

Financial modeling tools to improve analyses and decisions

Direct TA to state PUCs to provide requested expertise and resources

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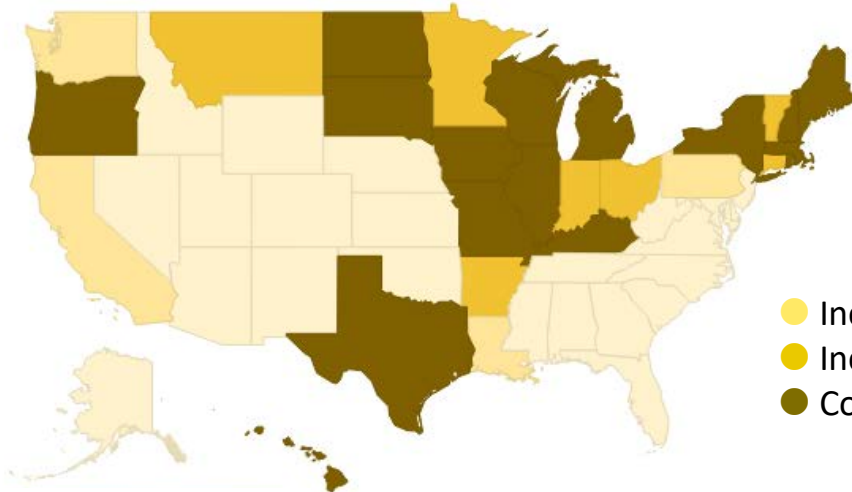
Accomplishments to Date

► Two types of TA

- **Incremental changes:** Initiatives that consider modest (i.e., narrow) changes to specific elements of cost of service (COS) regulation
- **Comprehensive changes:** Initiatives that examine fundamental, alternative approaches to COS

► Topics covered to date include

- Cost recovery approaches for grid modernization investments
- Customers economics of DER
- Distribution system planning
- Metrics and performance incentive mechanisms
- Utility financial impacts of DER
- Revenue recovery mechanisms
- Performance-based regulation
- Utility investor valuation framework and shareholder incentives



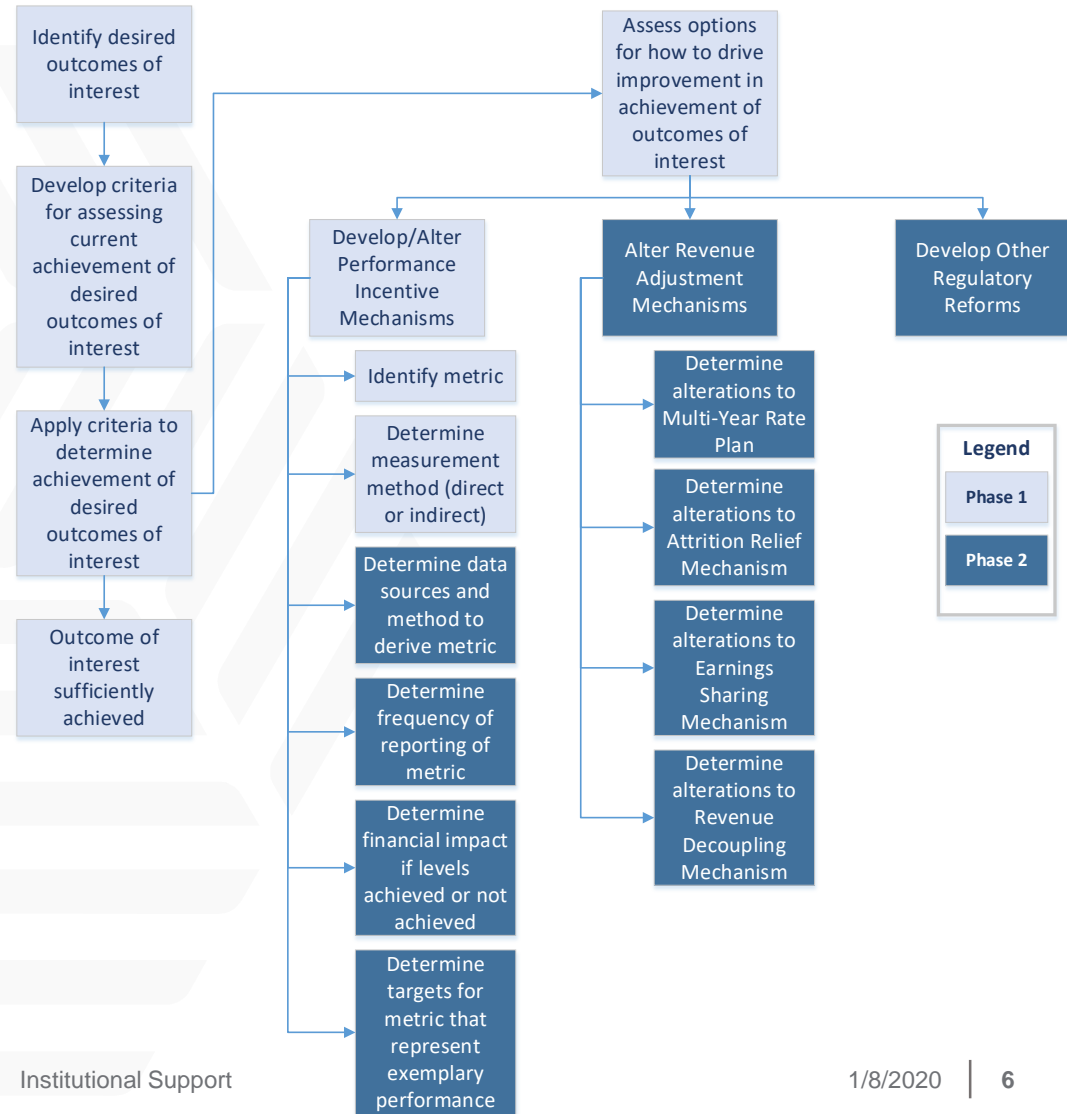
- Incremental TA
- Incremental & Comprehensive TA
- Comprehensive TA

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Accomplishments to Date



- ▶ Regulatory proceeding in Hawaii to investigate economic and policy issues associated with transition to PBR
- ▶ LBNL supporting Commission and staff since December 2017
 - Reviewed and commented on Opening Order, Convening Order, and Staff Report on *“Goals and Outcomes for PBR in Hawaii”*
 - Developed a process for segmenting issues of interest into two phases that Commission adopted (see graphic)
 - Supported stakeholder workshops
- ▶ Full Commission sent letter of appreciation to DOE for the value of TA delivered so far

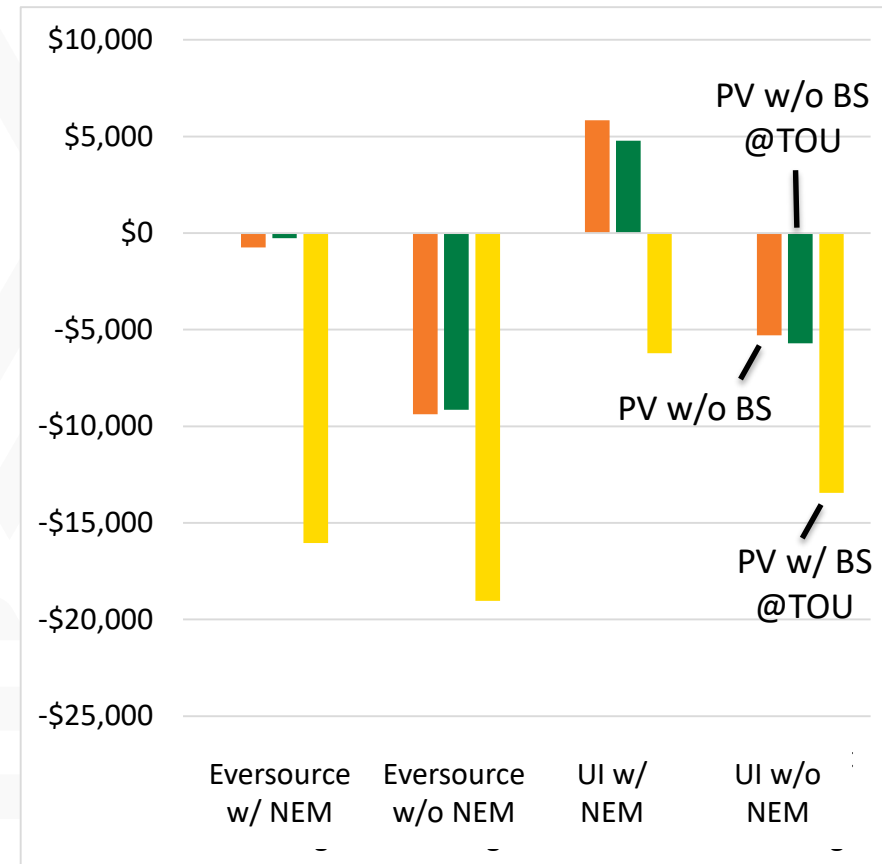


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Accomplishments to Date

- ▶ NREL conducted modeling of the economics of solar PV plus battery storage (BS) systems in Connecticut (December 2017)
 - Used existing NREL REopt model
 - Informed design of PV & BS incentive program
 - Assessed opportunities for customer use of storage as back-up power
- ▶ NREL improved Integrated Energy Systems Model for assessing DER impacts and load response under various rates (August 2018)
 - Added capability to assess export rates
 - Improved treatment of storage and appliance response to export rates
 - States can use model to examine how rates can drive consumer behavior to minimize grid impacts and investments, and evaluate customer economics

Net Present Value of PV and Storage Investment



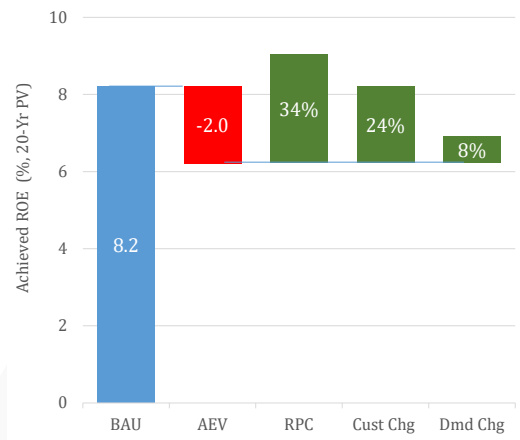
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Accomplishments to Date

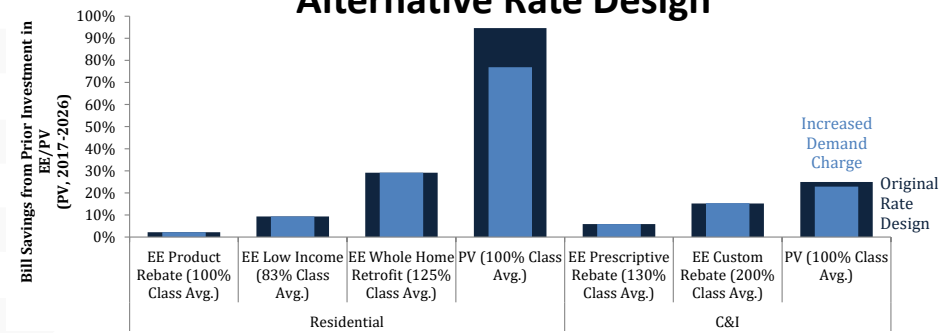


- ▶ LBNL analyzed utility and customer (participant and non-participant) financial impacts from combined effects of aggressive 10-yr ramp-up of energy efficiency and distributed solar PV for a northeast utility (April 2017)
 - Hourly impacts → shifts in timing of system peak
 - Impacts on utility costs, revenues, earnings, return on equity and customer rates
 - Impact of mitigation approaches — e.g., alternative revenue collection mechanisms such as demand charges and increased fixed customer charges
 - Presented to a number of national/regional regulatory and policymaking organizations
 - Published in a peer-reviewed journal
- ▶ Framework and results used to support subsequent technical assistance activities in Michigan and Minnesota

Utility ROE Impacts under Alternative Revenue Collection Mechanisms



Participant Bill Impacts (Savings) under Alternative Rate Design



Future Electric Utility Regulation

Accomplishments to Date



- ▶ Innovative series of reports taps industry thought leaders to grapple with complex electricity issues
- ▶ Unique multiple-perspective approach highlights different views on the future of utility regulation and business models and achieving a reliable, affordable, and flexible power system to inform ongoing discussion and debate
- ▶ 4 of 6 reports completed so far
- ▶ Commissioners and their Staff, Utilities, and other stakeholders have all indicated the importance these reports have played in their development of positions on these topics

<p>THE FUTURE OF CENTRALLY-ORGANIZED WHOLESALE ELECTRICITY MARKETS</p> <p>Craig Glazer, PJM Jay Morrison and Paul Breakman, National Rural Electric Cooperative Association Allison Clements, Natural Resources Defense Council National Association of State Utility Consumer Advocates</p> <p>Project Manager and Technical Editor: Lisa Schwartz, Lawrence Berkeley National Laboratory</p>	<p>REGULATORY INCENTIVES AND DISINCENTIVES FOR UTILITY INVESTMENTS IN GRID MODERNIZATION</p> <p>Steve Kihm, Seventhwave Janice Beecher, Institute of Public Utilities, Michigan State University Ronald Lehr</p> <p>Project Manager and Technical Editor: Lisa Schwartz, Lawrence Berkeley National Laboratory</p>
<p>Report No. 7 March 2017</p>	<p>Report No. 8 May 2017</p>
<p>VALUE-ADDED ELECTRICITY SERVICES: NEW ROLES FOR UTILITIES AND THIRD-PARTY PROVIDERS</p> <p>Jonathan Blansfield and Lisa Wood, Institute for Electric Innovation Ryan Katofsky, Benjamin Stafford and Danny Waggoner, Advanced Energy Economy National Association of State Utility Consumer Advocates</p> <p>Project Manager and Technical Editor: Lisa Schwartz, Lawrence Berkeley National Laboratory</p>	<p>THE FUTURE OF TRANSPORTATION ELECTRIFICATION: UTILITY, INDUSTRY AND CONSUMER PERSPECTIVES</p> <p>Philip B. Jones, Alliance for Transportation Electrification Jonathan Levy, EVgo/Vision Ridge Jennifer Bosco, John Howat and John W. Van Ahst, National Consumer Law Center</p> <p>Project Manager and Technical Editor: Lisa Schwartz, Lawrence Berkeley National Laboratory</p>
<p>Report No. 9 October 2017</p>	<p>Report No. 10 August 2018</p>

Future of Electric Utility Regulation

Next Steps and Future Plans

► Next Steps

- Complete **state TA** to support decision making in HI, LA, NY, VT, and WA
- Conclude **modeling** activities
- Finalize the last two installments of the **Future Electric Utility Regulation report series**

► Future Plans

- Continue providing state TA through DOE-funded efforts
- Apply expanded analytical models in new DOE-funded research projects
- Possibly continue with the FEUR report series

BACKUP SLIDES

Project Team: Roles and Responsibilities to Date



- LBNL
 - Project manager
 - Financial analysis
 - State technical assistance (AK, CT, HI, IN, MN, MT, NY, OH, PA, VT, WA)
 - Regional training (Northeast, Midwest)
 - Future Electric Utility Regulation report series
 - Performance-based regulation technical report
- NREL
 - Plus one
 - Financial analysis
 - State TA (CT, Puerto Rico, WA)
- NETL
 - Financial analysis
 - State TA (Pittsburg)
- SNL
 - State TA (New Orleans, VT)
- PNNL
 - State TA (HI, OR)

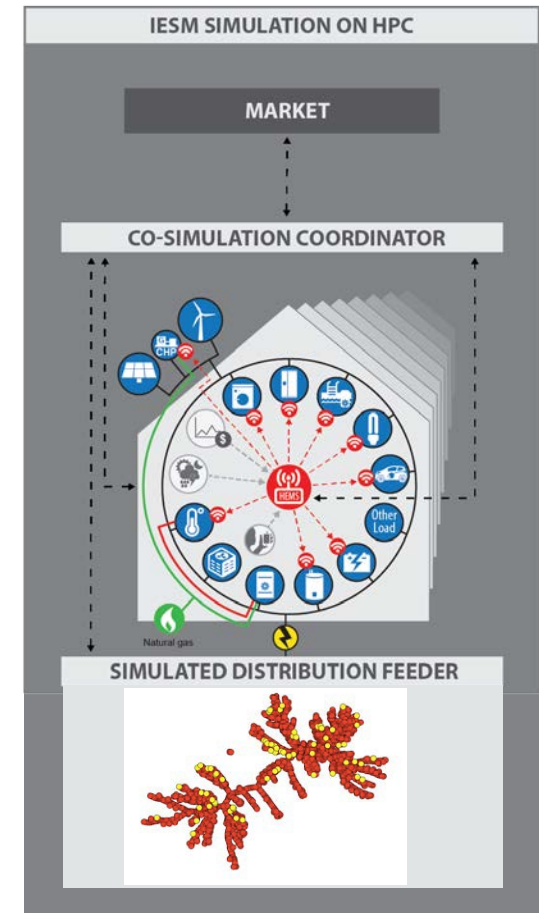
Technical Assistance Opportunities to Date



- ▶ Cost recovery mechanisms for demand response (MN)
- ▶ Cost recovery approaches for grid resiliency and security investments (PA)
- ▶ Customer economics of DER (CT, Puerto Rico, WA)
- ▶ Distribution system services and market design (HI)
- ▶ Distribution system planning (IN, NE states: CT, MA, ME, NH, RI, NH; OMS states: AK, IL, IN, IA, KY, MI, MN, MO, MT, ND, OH, SD, TX, WI)
- ▶ DR potential and cost effectiveness (OR)
- ▶ Metrics and performance incentive mechanism design and implementation experience (HI, LA, NY, VT)
- ▶ Microgrid development (Pittsburg)
- ▶ Revenue recovery mechanism design and implementation experience (OH, MT)
- ▶ Utility financial impacts of DER aggregations (AK)
- ▶ Utility investor valuation framework and shareholder incentives (CA)
- ▶ Regulatory approaches for improving resilience (New Orleans)

Integrated Energy System Model (IESM) Overview

- ▶ IESM simulates performance of *technologies* within multiple *buildings* under various retail *market* structures
- ▶ Co-simulation coordinator integrates feeder & building simulations, home energy management systems (HEMS) & markets
 - Python-based (plan to adopt HELICS)
- ▶ HEMS schedules operation of appliances in response to consumer preferences, price, weather, and distributed generation forecasts
 - Multi-objective, stochastic optimization based on model predictive control (MPC)
 - HEMS controls thermostat, EVSE and water heater
 - Runs on HPC to parallelize hundreds of HEMS



Participant/Non-Participant Impacts from EE & PV for Northeast Utility

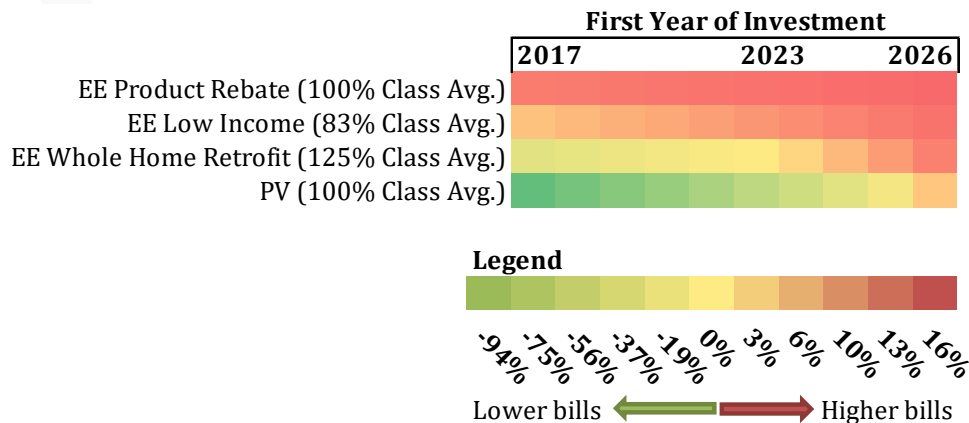


- ▶ For participants, PV systems are so large no matter when they are installed, they provide net bill savings but not so for EE – size of energy savings can not keep pace with rising retail rates
- ▶ For non-participants, because rates are designed for the class-average customer and all customer sub-populations are scaled up or down from class-average, the impact of greater reliance on demand charges have very minor effects on size of non-participating customer bill impacts

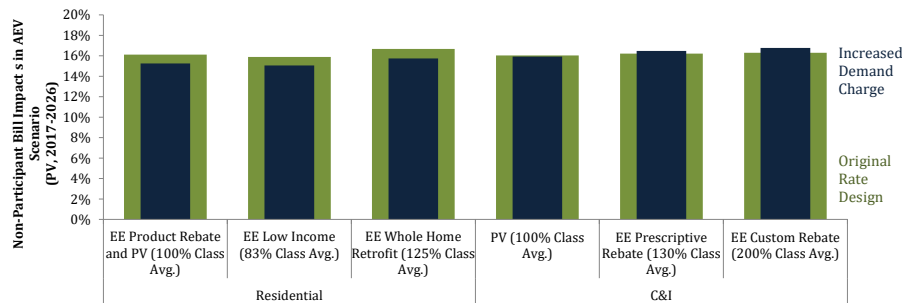
Satchwell, Andrew, Peter Cappers, and Charles A Goldman. **Financial Impacts of a Combined Energy Efficiency and Net-Metered PV Portfolio on a Prototypical Northeast Utility**. 2017.

<https://emp.lbl.gov/publications/financial-impacts-combined-energy>

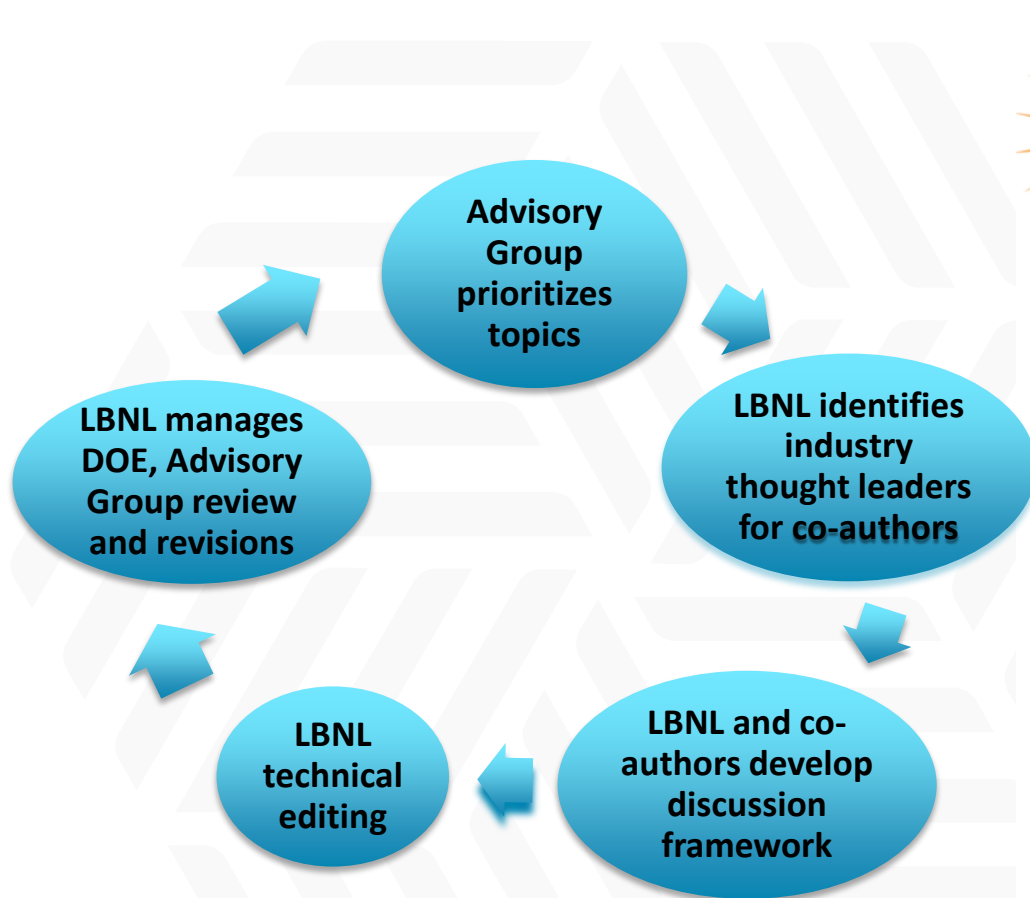
Magnitude and Timing of Participant Bill Impacts



Non-Participant Bill Impacts under Alternative Rate Design



FEUR Report Series: Process and Advisory Group Members



FUTURE ELECTRIC Utility Regulation

The Future Electric Utility Regulation Advisory Group is composed of recognized experts including state regulators, utilities, stakeholders, and academia. The Advisory Group provides input to the topics and key issues the series covers and their prioritization, and reviews draft reports.

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- **Janice Beecher**, Institute of Public Utilities, Michigan State University
- **Ashley Brown**, Harvard Electricity Policy Group
- **Steven Caldwell**, National Grid
- **Paula Carmody**, Maryland Office of People's Counsel
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- **Commissioner Jennifer Potter**, Hawaii PUC
- **Karl Rábago**, Pace Energy & Climate Center, Pace University School of Law
- **Rich Sedano**, Regulatory Assistance Project

FEUR Report Series: Publications to Date



- ▶ Jones, Philip B, Jonathan Levy, Jenifer Bosco, John Howat, and John W Van Alst. ***The Future of Transportation Electrification: Utility, Industry and Consumer Perspectives***. Ed. Schwartz, Lisa C. Vol. FEUR Report No. 10. 2018. <https://emp.lbl.gov/publications/future-transportation-electrification>
- ▶ Blansfield, Jonathan, Lisa Wood, Ryan Katofsky, Benjamin Stafford, Danny Waggoner, and National Association of State Utility Consumer Advocate. ***Value-Added Electricity Services: New Roles for Utilities and Third-Party Providers***. Ed. Schwartz, Lisa C. Vol. FEUR Report No. 9. 2017. <https://emp.lbl.gov/publications/value-added-electricity-services-new>
- ▶ Kihm, Steve, Janice Beecher, and Ronald Lehr. ***Regulatory Incentives and Disincentives for Utility Investments in Grid Modernization***. Ed. Schwartz, Lisa C. Vol. FEUR Report No. 8. 2017. <https://emp.lbl.gov/publications/regulatory-incentives-and>
- ▶ Glazer, Craig, Jay Morrison, Paul Breakman, Allison Clements, and National Association of State Utility Consumer Advocate. ***The Future of Centrally-Organized Wholesale Electricity Markets***. Ed. Schwartz, Lisa C. Vol. FEUR Report No. 7. 2017. <https://emp.lbl.gov/publications/future-centrally-organized-wholesale>