Title

Considering the time and locational value of efficiency in electricity planning

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Considering the time and locational value of efficiency in planning

Natalie Mims Frick

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Presentation agenda

- Background
- Using the time and locational value of efficiency in planning
- Examples of policies that promote the use of time and locational value of efficiency
- Resources

DERs must be in the right place and operate at the right time to meet system needs

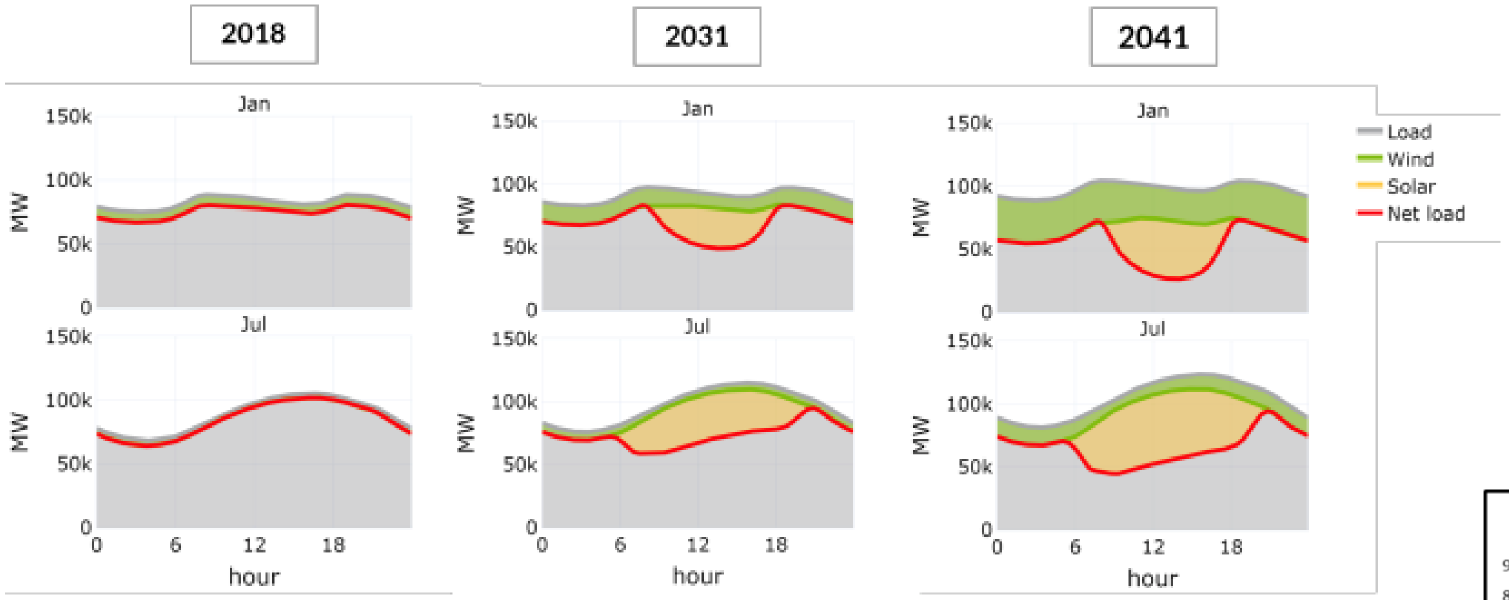
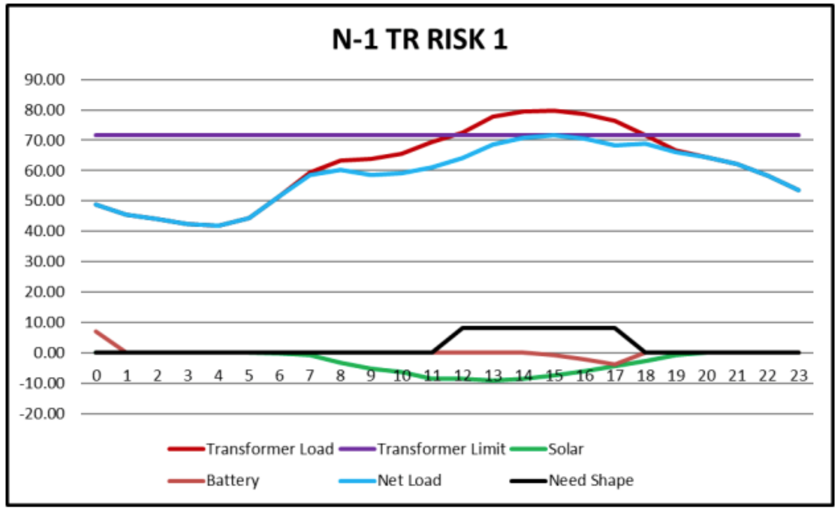


Figure 19: Monthly averages of diurnal net load components for January and July

DERs must operate at the ***right time*** to ensure they will relieve the identified constraint and provide generation or load reduction during the *peak day.*



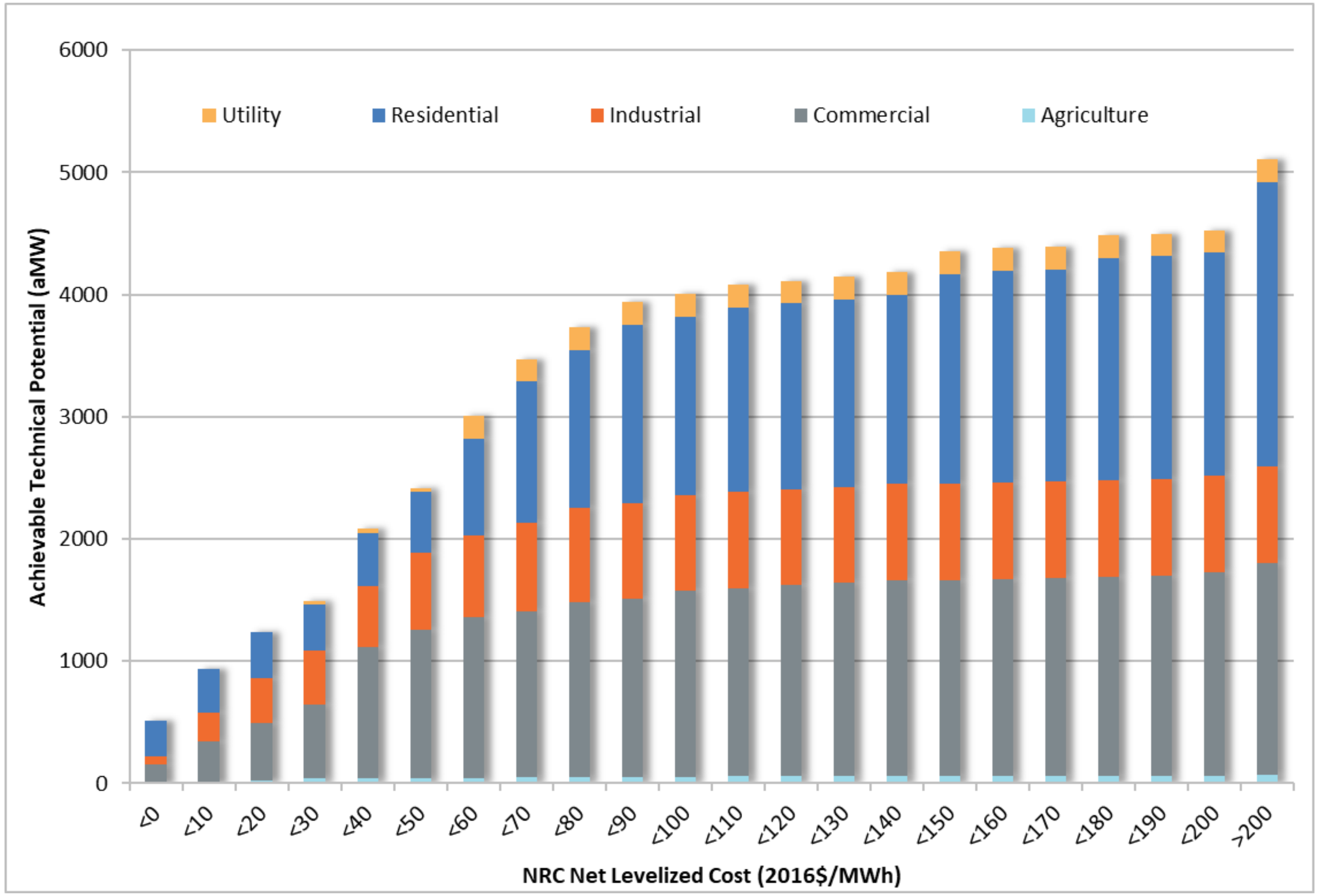
Value of DERs for the distribution system ***depends on location***.

- Value may be associated with a distribution substation, individual feeder, section of feeder, or a combination of these components.
- Avoided distribution costs vary by area. DERs must be targeted to capture the highest value.

Sources: MISO Regional Resource Assessment 2022, Xcel MN 2022 IDP

Several states and utilities are treating or considering efficiency as a selectable resource in long-term electricity planning

- EE potential is comprised of hundreds of measures.
- IRP models cannot simulate individual efficiency measures, so they are grouped together.
- Supply curves for EE (and other DERs) are usually represented as the amount of resource potential that is technically achievable in discrete "bundles" or "bins."



Source: NWPC 2021 Plan

Methods to Incorporate Energy Efficiency in Electricity System Planning and Markets

Energy efficiency as a selectable resource in long term electricity planning in Hawaii

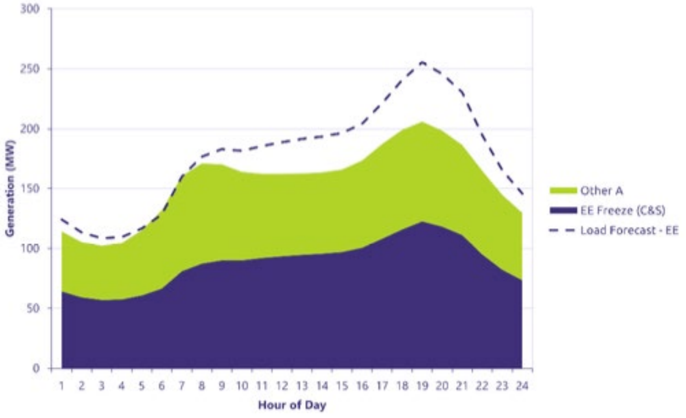


Figure 11-13. O'ahu: EE Base forecast layer vs. EE RESOLVE selected resources, 2030

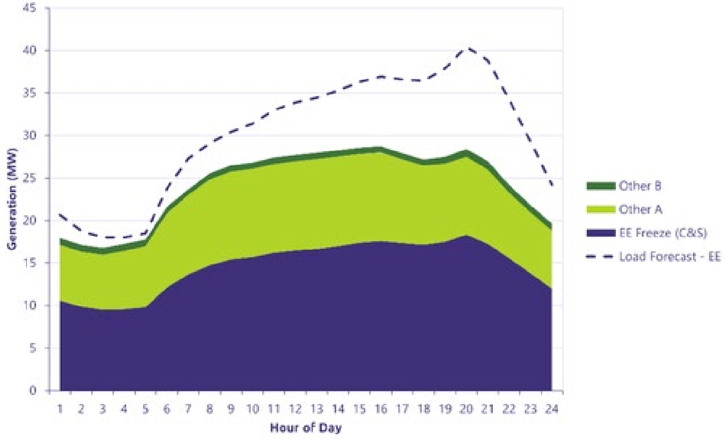


Figure 11-14. Hawai'i Island: EE Base forecast layer vs. EE RESOLVE selected resources, 2030

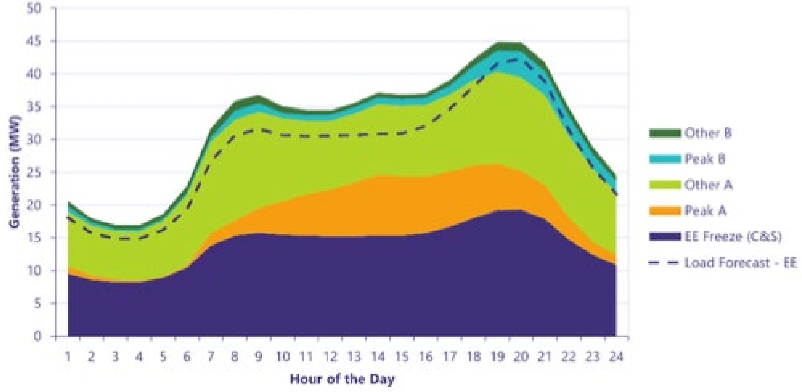


Figure 11-15. Maui: EE Base forecast layer vs. EE RESOLVE selected resources, 2030

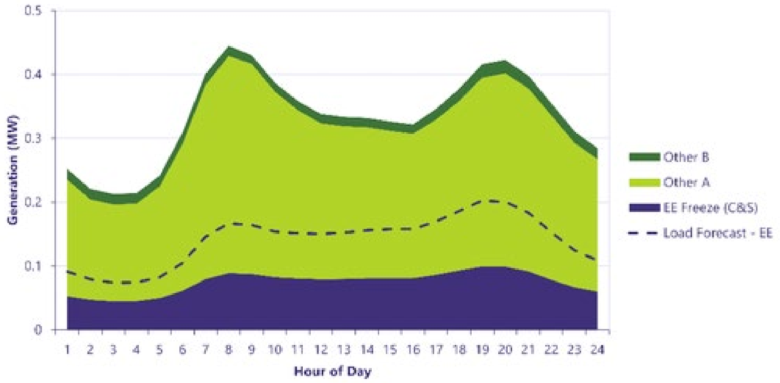


Figure 11-17. Lāna'i: EE Base forecast layer vs. EE RESOLVE selected resources, 2030

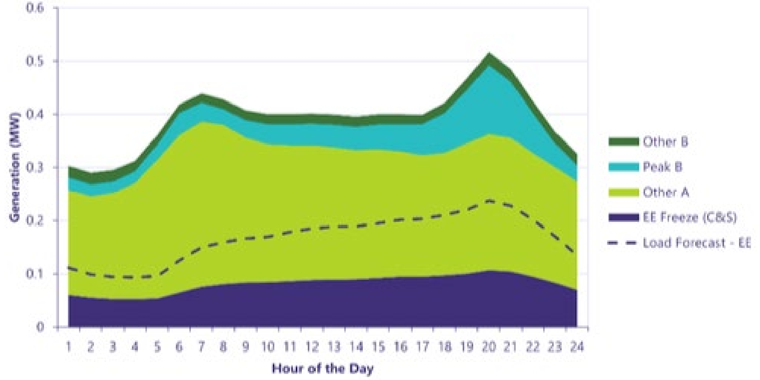


Figure 11-16. Moloka'i: EE Base forecast layer vs. EE RESOLVE selected resources, 2030

Source: HECO IGP

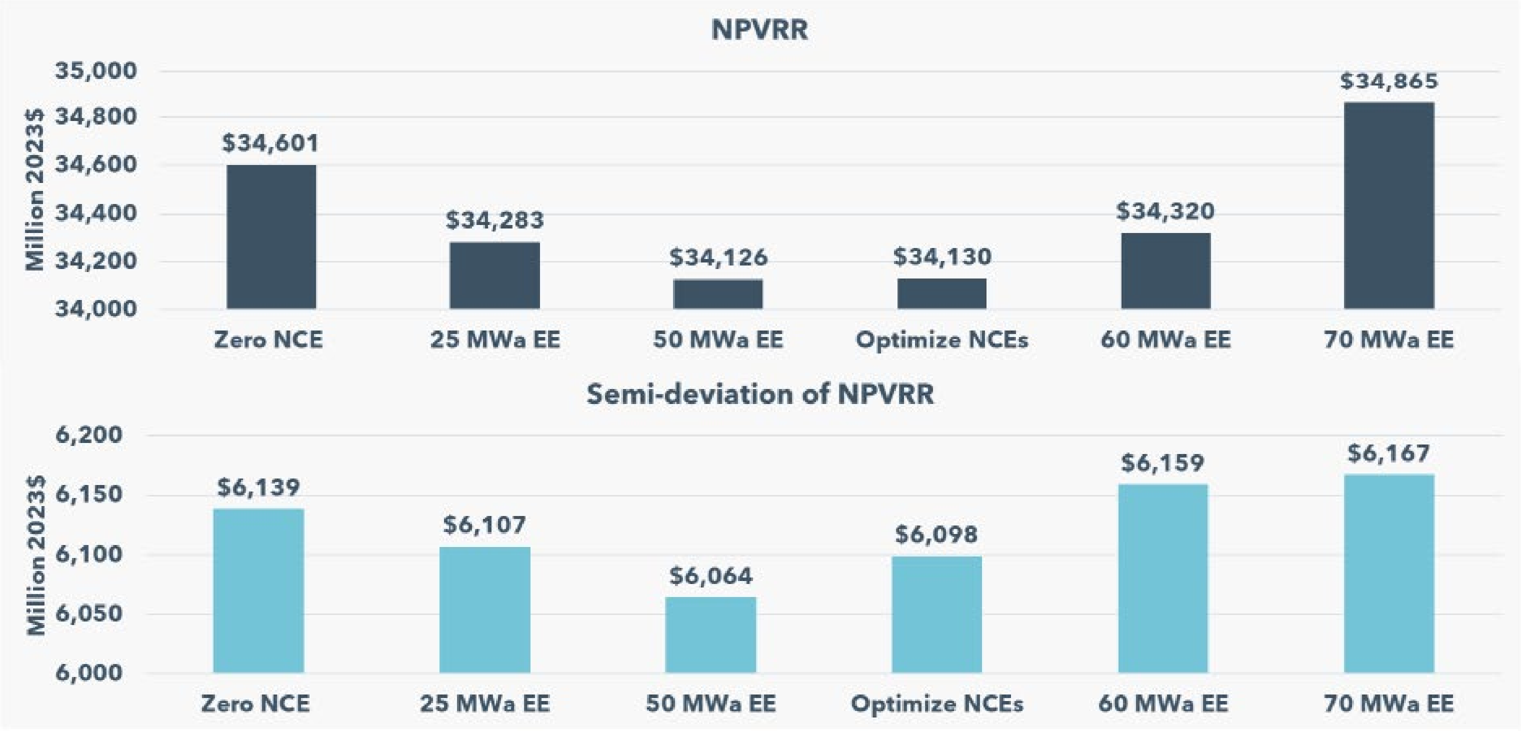
Energy efficiency as a selectable resource in long term electricity planning in Oregon

- Net present value of revenue requirement (NPVRR) is the **cost metric** used in PGE's portfolio scoring.
- Semi-deviation of NPVRR is the **variability metric** used in PGE's portfolio scoring.
  - Captures the potential variation in cost outcomes across futures, considering futures only in which NPVRR exceeds the Reference Case.
  - Low variability provides more cost certainty and lessen customer impacts of higher than expected conditions.

Table 60. List of EE and DR portfolios

Portfolios	Portfolio condition through 2030
Optimized Non-Cost-Effective (NCE) DERs	Allow model to select from total potential of additional EE and DR
Zero NCE	No additional EE and DR available (ETO and PGE cannot increase savings beyond current commitments)
25 MWa NCE EE	25 MWa of additional EE (5 MWa annually)
50 MWa NCE EE	50 MWa of additional EE (10 MWa annually)
60 MWa NCE EE	60 MWa of additional EE (12 MWa annually)
70 MWa NCE EE	70 MWa of additional EE (14 MWa annually)

Figure 92. Cost and risk metrics of EE&DR portfolios



Source: PGE

Distribution system planning and non-wires alternatives

- Assesses needed physical and operational changes for the local grid
  - Annual planning for distribution system spending for next year or two
  - Longer-term utility capital plan over 5–10 year planning horizon
    - Solutions and cost estimates updated every 1 to 3 years

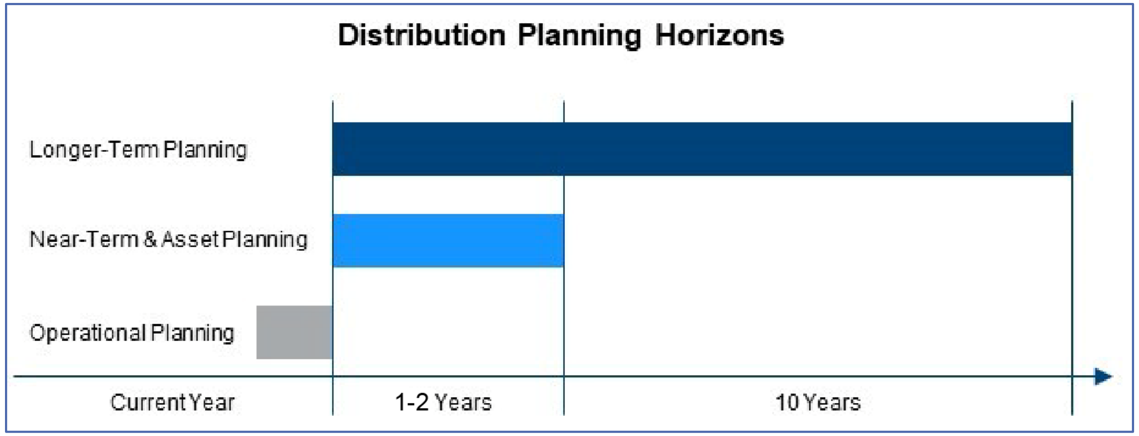


Figure: DOE 2020

- Non wires solutions (or non-wires alternatives) are options for meeting distribution system needs related to load growth, reliability and resilience.
  - Single large DER (e.g., battery) or portfolio of DERs that can meet the specified need
  - Objectives: Provide load relief, address voltage issues, reduce interruptions, enhance resilience, or meet local generation needs
- Potential to reduce utility costs
  - Defer or avoid infrastructure upgrades
  - Implement solutions *incrementally,* offering a flexible approach to uncertainty in load growth and potentially avoiding large upfront costs for load that may not show up.

Source: Schwartz 2023, Schwartz and Frick 2022

Example: Non-wires alternative (1)

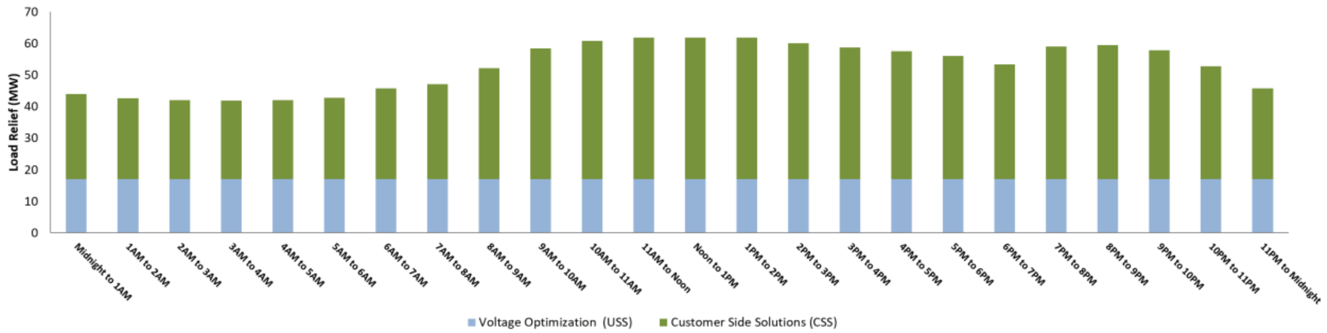


Figure 1: Hourly Load Profile of Operational BQDM Customer-Side Solutions and Non-Traditional Utility-Side Solutions. *Note: A 1.5 MW 4-hour utility-side battery energy storage system is not depicted in the load profile as its dispatch varies.*

Source: Consolidated Edison

- Brooklyn Queens Demand Management project is a well-known, long-running NWA project in New York.

- The Pomona NWA solution is a utility-owned (Orange & Rockland) battery system combined with efficiency and demand response measures to provide a 4.1 MW peak demand reduction and support reliability. The incentives are primarily to small businesses in the area.
  - Small Business Direct Install
  - Bring Your Own Thermostat
  - Commercial System Relief Program and Distribution Load Relief Program (commercial demand response)
- Project was completed in 2021.

Example: Non-wires alternative (2)

- The West Warwick NWA solution is three individual third-party owned battery systems combined with energy efficiency to meet load relief and emergency contingency needs (i.e., defer capital infrastructure investment), and improve reliability.
- The project is ongoing. As of Q1 2023, there was 400 kW of customer energy efficiency planned and 120 kW installed.
- Leveraging existing several existing programs:
  - Door to door direct install with free audits and additional incentives for customers with coincident load relief
  - Commercial and residential customers on constrained circuits qualify for higher incentives based on coincident load relief
  - Residential direct load control demand response program will also be part of solution.

Photo by American Public Power Association on Unsplash

More examples and information in Guillermo Pereira's EER presentation on 10/18, our Locational Value of DER report and our Integrated Distribution System Planning website.

Policies that promote using time and locational value of efficiency in electricity planning – Integrated resource planning

- Consider supply and demand side resources equally in IRP
  - Indiana - "The IRP must include the following… (4) An analysis showing that supply-side resources and demand-side resources have been evaluated on a consistent and comparable basis, including consideration of: (A) safety; (B) reliability; (C) risk and uncertainty; (D) cost effectiveness; and (E) customer rate impacts."

- Include efficiency supply curves in IRP analysis
  - Hawaii – The Hawaii PUC directed HECO to evaluate energy efficiency on a consistent and comparable basis with supply-side resources by developing efficiency supply curves and modeling them as portfolio options that compete with supply side options (among other requirements).
  - Georgia – The Georgia PSC directed Georgia Power and PUC Staff to collaboratively investigate methodologies to model demand-side management (DSM) as an additional scenario in its supply side system planning, and model DSM alongside traditional supply-side options.

Policies that promote using time and locational value of efficiency in electricity planning – Distribution system planning

- Develop distribution system planning requirements - Examples of state practices for developing distribution system planning requirements include:
  - Prepare a whilte paper to articulate PUC vision for DSP process
  - Determine if current filings can be integrated or consolidated
  - Host working groups to develop and refine requirements
  - Consider pilots for new processes or technologies

- Consider energy efficiency or non-wires alternatives in distribution system planning
  - Maine – Integrated Grid Planning requirements were established through legislation in 2022. Utilities are required to file plans that include relevant elements of the third-party energy efficiency administrator's (Efficiency Maine) triennial plan, including their analysis of cost-effective energy efficiency and non-wires alternatives (among other requirements).
  - Michigan – The Commission's 2020 order on distribution system plans directed utilities to work with PUC staff develop non-wires alternatives pilots that go beyond the utilities existing demand response and energy efficiency programs.
  - Minnesota – The Commission's 2022 order required Xcel Energy to hold a series of stakeholder meetings to generate new ideas around a shared vision of the distribution grid of the future. The meetings must include a discussion on how energy efficiency and other DERs might impact the utilities planning process.

Contacts

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For more information

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Acknowledgements

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The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof, or The Regents of the University of California.

Resources

Several states and utilities are treating or considering efficiency as a selectable resource in long-term electricity planning*

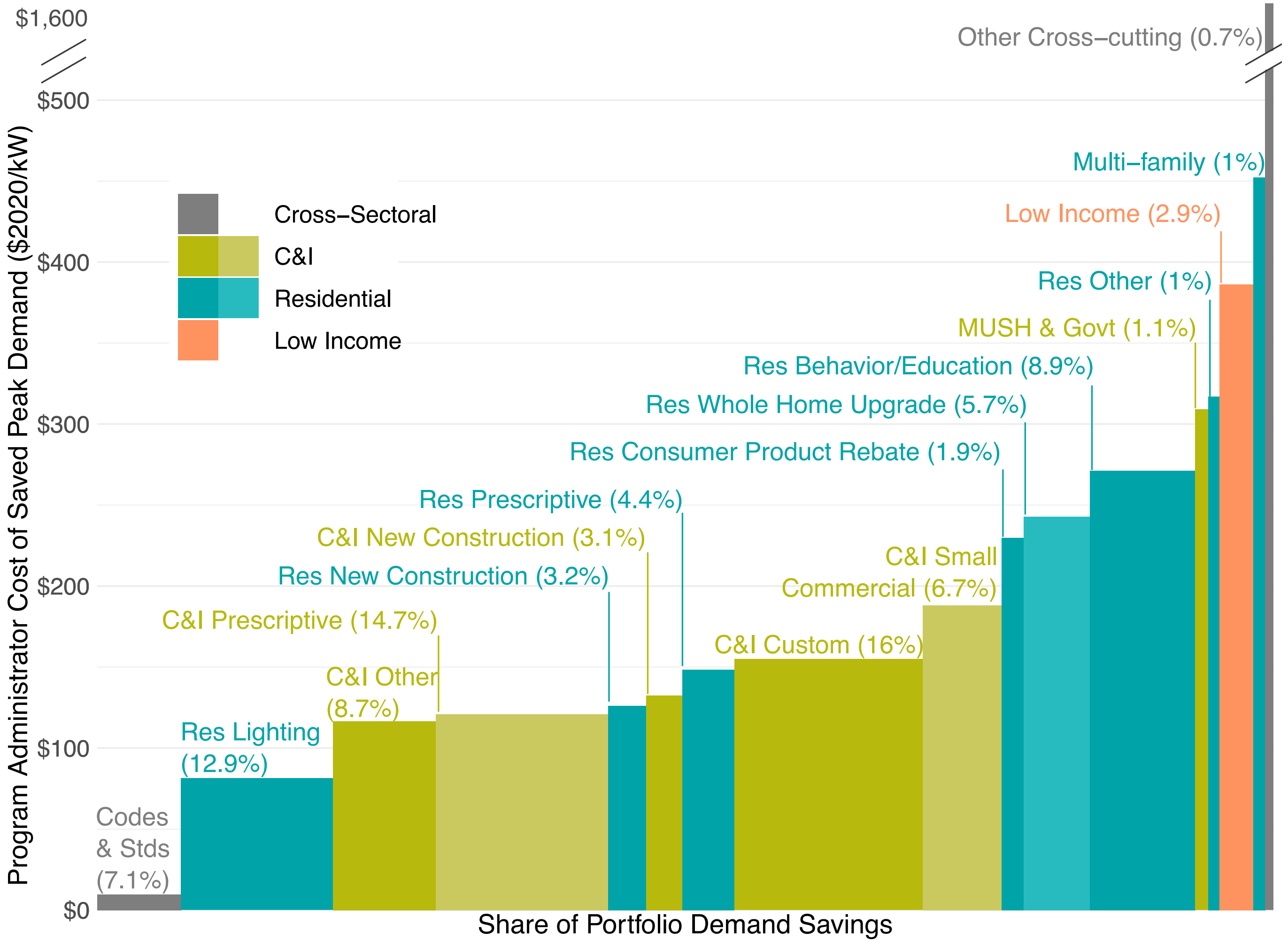
- California
  - 2023 Energy Efficiency Potential and Goals Study
  - Staff Proposal for Incorporating Energy Efficiency into the SB 350 Integrated Resource Planning Process
- Georgia
  - Georgia Power - Supply-Side Representation of Energy Efficiency Resources in the Georgia Power IRP Model (2022)
- Hawaii
  - Hawaiian Electric Company Integrated Grid Plan (2023)
- Idaho
  - Idaho Power 2023 IRP
- Indiana
  - Duke Energy 2021 IRP
  - Centerpoint 2023 IRP
  - IPL/AES 2022 IRP
  - NIPSCO 2021 IRP
- Louisiana
  - Entergy New Orleans 2021 IRP
- Missouri
  - Ameren 2020 IRP
- Minnesota
  - Xcel Energy /Northern States Power 2020 IRP
- Northwest Power and Conservation Council
  - 2021 Power Plan
- Oregon
  - Portland General Electric 2023 Clean Energy Plan and IRP
- PacifiCorp (CA, OR, WA, WY, UT)
  - 2023 IRP
- Tennessee
  - Tennessee Valley Authority 2019 IRP
- Washington
  - Puget Sound Energy 2023 IRP Update
  - Avista 2023 IRP

*These are the states/utilities that I am aware of - please let me know if you see an omission.

Efficiency can reduce peak demand

- Research from Berkeley Lab shows that energy efficiency programs reduce peak demand at relatively low costs.

Source: Frick, Murphy, Miller and Pigman, 2021



Examples of recent Berkeley Lab research on time and locational value of DERs in planning

GRID MODERNIZATION LABORATORY CONSORTIUM

Forecasting Efficiency and Demand Flexibility

Natalie Mims Frick
Berkeley Lab

This presentation was funded by the U.S. Department of Energy's Office of Electricity and Building Technologies Office.

March 24, 2023 | 59

Developing Forecasts: Basics & Best Practices

TECHNICAL ASSISTANCE TO STATE PUBLIC UTILITY COMMISSIONS — GRID MODERNIZATION INITIATIVE, U.S. Department of Energy

Duke Energy's Integrated System and Operations Planning: A comparative analysis of integrated planning practices

Prepared for the South Carolina Office of Regulatory Staff

Jeremy Keen and Erik Pohl, National Renewable Energy Laboratory
Natalie Mims Frick, JP Carvallo and Lisa Schwartz, Berkeley Lab

June 2023

Duke Energy's Integrated Systems and Operations Planning: A comparative analysis of integrated grid planning practices

Electricity Markets & Policy
Energy Analysis & Environmental Impacts Division
Lawrence Berkeley National Laboratory

Time-sensitive value calculator for energy efficiency and other distributed energy resources

Natalie Mims Frick, JP Carvallo and Margaret Pigman

February 2022

Time-sensitive value calculator for energy efficiency and other DERs

BERKELEY LAB — ELECTRICITY MARKETS & POLICY

Training on Integrated Resource Planning for South Carolina Office of Regulatory Staff

Treating Energy Efficiency and Demand Response As a Resource in Electric Utility Integrated Resource Plans

Natalie Mims Frick
March 1, 2021

Treating Energy Efficiency and Demand Response as Resouces in Electric Utility Integrated Resource Plans

Electricity Markets & Policy
Energy Analysis & Environmental Impacts Division
Lawrence Berkeley National Laboratory

Locational Value of Distributed Energy Resources

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[1]Energy and Environmental Economics, Inc.

February 2021

Locational Value of Distributed Energy Resources

Electricity Markets & Policy
Energy Analysis & Environmental Impacts Division
Lawrence Berkeley National Laboratory

Methods to Incorporate Energy Efficiency in Electricity System Planning and Markets

Natalie Mims Frick, Tom Eckman,[1] Greg Leventis, and Alan Sanstad

[1]Consultant

January 2021

Methods to Incorporate Energy Efficiency into Electricity System Planning and Markets

BERKELEY LAB — ELECTRICITY MARKETS & POLICY

Still the One: Efficiency Remains a Cost-Effective Electricity Resource

Natalie Mims Frick, Sean Murphy, Chandler Miller and Margaret Pigman
Berkeley Lab

August 10, 2021

Still The One: Efficiency Remains a Cost-Effective Electricity Resource

End-Use Load Profile and Savings Shape Reports

[Market Needs, Use Cases and Data Gaps](#)

[Methodology and Results of Model Calibration, Validation and Uncertainty Quantification](#)

[Practical Guidance on Accessing and Using the Data](#)

[End-Use Savings Shapes: Residential Round 1](#)

[End-Use Savings Shapes: Commercial Round 1](#)

Access all datasets on the project website https://www.nrel.gov/buildings/end-use-load-profiles.html

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