



NARUC

National Association of Regulatory Utility Commissioners

NARUC Center for Partnerships & Innovation

February 27, 2023

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www.naruc.org/cpi

THE NARUC CENTER FOR PARTNERSHIPS & INNOVATION

- NARUC staff team dedicated to providing technical assistance to members.
- CPI identifies emerging challenges and connects state commissions with expertise and strategies to inform their decision making.
- CPI builds relationships, develops resources, and delivers trainings.
- All CPI support is federally funded via cooperative agreements with DOE and NIST.



Newly updated CPI fact sheet with recent publications, upcoming events, new member working groups

- under Quick Links at: www.naruc.org/cpi

Recent Publications

- [Demand Flexibility within a Performance-Based Regulatory Framework](#) (Feb 2023)
- State Energy Justice Roundtable Series: [Customer Affordability and Arrearages; Participation in Decision Making; Energy Justice Metrics](#) (Feb 2023)
- [Mini Guide on PUCs and the Investment Community](#) (Feb 2023)
- [Energy Resilience Reference Guide: Chapters 1 & 2](#) (Jan & Feb 2023)
- [Potential State Regulatory Pathways to Facilitate Low-Carbon Fuels](#) (Dec 2022)
- [Digitalization in Electric Power Systems and Regulation: A Primer](#) (Dec 2022)
- [Interoperability for Electric Vehicle Charging: A Case Study](#) (Dec 2022)
- [Electric Vehicle Interoperability: Considerations for Utility Regulators](#) (Nov 2022)
- [Models for Incorporating Equity in Transportation Electrification](#) (Nov 2022)
- [Mini Guide on Transportation Electrification](#) (Nov 2022)
- [Grid Data Sharing: Brief Summary of Current State Practices](#) (Nov 2022)
- Regulator's Financial Toolbox Briefs: [Community Solar for LMI Customers; Electrification; ADMS/DERMS](#) (Oct 2022)
- [Defense Energy Resilience Resources: Guide & FAQ for Commissioners](#) (Oct 2022)
- [Workforce Development Toolbox: Recruitment Templates and Social Media Engagement Materials](#) (Sept 2022)

Forthcoming Publications

- Black Sky Playbook
- Energy Resilience Reference Guide Chapter 3: Climate Resilience
- State Microgrid Policy, Programmatic, and Regulatory Framework
- Renewable Energy Microgrids
- Considerations of Advanced Nuclear in Resource Planning

Upcoming Virtual Learning Opportunities

- Modern DER Capabilities and Deployment. March 8: Next in the virtual interconnection workshop series, NREL will address PUC questions on DER technical capabilities, deployment concerns, and benefits. [Contact Jeff](#)
- Resilience for Regulators Webinar Series. March 9: Climate Informed Mitigation Strategies. Find [past presentations](#) on critical infrastructure resilience, climate resilience, defense energy resilience, and more. [Contact William](#)
- Monthly Innovation Webinars. March 16: Advances in Resource Adequacy. [Register | past recordings](#). [Contact Jessica](#)
- On-Demand, Video-Based Learning Modules. Dozens of training videos in English and Spanish on [electricity system planning, distribution systems and planning, smart grid and EV interoperability](#). [Contact Danielle](#)

Upcoming In Person Events *Travel stipends available*

- Cybersecurity Training, Indianapolis, IN. March 22-24: Experts will provide content on cybersecurity topics through the lens of utility regulators with presentations, engaging activities, and more. (Commissioners and staff) [Contact Lynn](#)
- Nuclear Energy Partnership Pacific Northwest National Lab Site Visit. April 25-28: Tour PNNL and NW nuclear sites. Advanced Nuclear State Collaborative kickoff workshop will also take place. (Commissioners and staff) [Contact Kiara](#)
- Natural Gas Partnership Site Visit, Savannah, GA. May 2023: Tour the Elba Island liquefied natural gas export facility, Port of Savannah compressed natural gas fueling station, and more. (Commissioners only) [Contact Kiara](#)
- More Info Available Soon: Energy Justice Midwest Regional Workshop (early May); Grid Data Sharing Collaborative Demonstration Workshop (mid-May in Washington, DC); Resilience Planning Regional Workshops [Contact Danielle](#)

Join a Member Working Group! *For Commissioners and Commission Staff*

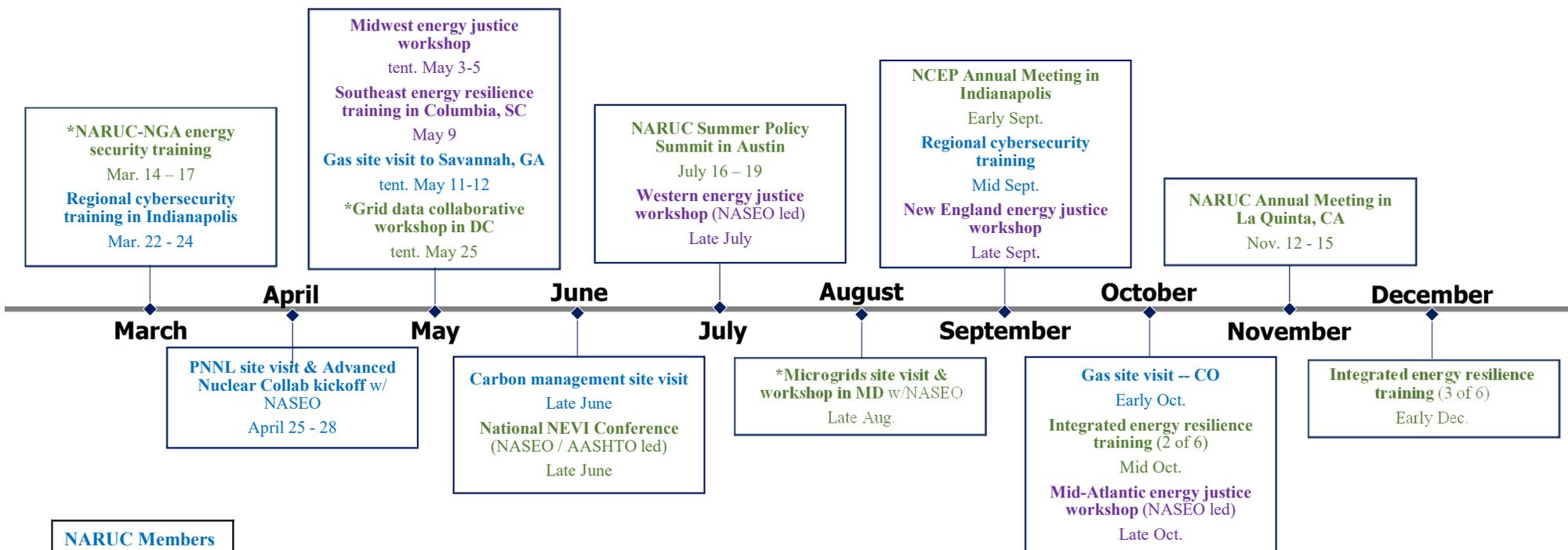
- [Integrated Distribution System Planning](#). Register for presentations by subject matter experts and commissions followed by questions and facilitated discussions among members. Six sessions: Feb 27 – Jun 12. [Contact Jeff](#)
- [NARUC-NASEO Advanced Nuclear State Collaborative](#). Exchange questions, needs, and challenges relating to the planning and deployment of new advanced nuclear generation. [Contact Kiara](#)
- [NARUC-NASEO Microgrids State Working Group](#). Explore capabilities, costs, benefits, and deployment strategies for microgrids with PUCs and State Energy Offices. [Contact Kiara](#)
- [Electric Vehicles State Working Group](#). Learn and discuss regulatory questions around transportation electrification, including charging infrastructure buildout, rate design, equity considerations, V2G, and more. [Contact Danielle](#)
- [Performance-Based Regulation State Working Group](#). Examine approaches to performance-based regulation and alternative ratemaking across states in a collaborative peer group setting. [Contact Elliott](#)
- [i2X Working Groups](#). DOE/National Lab effort for commissions and stakeholders to identify grid interconnection challenges and discuss solutions. [Contact Jeff](#)
- [Workforce Development Peer Advisory Group](#). Supporting recruitment & retention for commissions. [Contact Hyleah](#)

In partnership with DOE, NIST, and members NARUC CPI work spans five key topical areas

Energy Generation	Energy Transmission	Energy Distribution	Energy Customers
<ul style="list-style-type: none"> • Coal & Carbon Management* • Nuclear Energy* • Natural Gas* • Hydrogen • Offshore Wind 	<ul style="list-style-type: none"> • Transmission Infrastructure • Transmission-Distribution Coordination* • Storage • Comprehensive Electricity Planning 	<ul style="list-style-type: none"> • Integrated Distribution Planning* • Smart Grid / Grid Modernization • Microgrids* • Performance-Based Regulation* 	<ul style="list-style-type: none"> • DER Integration & Compensation* • Demand Flexibility* • Electric Vehicles* • Stakeholder Engagement • Energy Justice
<i>Contact Kiera Zitelman</i>		<i>Contact Jeffrey Loiter</i>	
Critical Infrastructure Preparedness, Response, and Resilience			
<ul style="list-style-type: none"> • Cybersecurity for Utility Regulators* • Energy Emergency Preparedness 		<ul style="list-style-type: none"> • Integrated System Resilience* • Defense Community Partnerships 	
<i>Contact Lynn Costantini</i>			

*NARUC CPI facilitates a working group or partnership for regular member learning and peer exchange opportunities.

NARUC CPI 2023 Events



NARUC Members
Open Invite
Regional

* Limited space available

IDSP PEER-SHARING WEBINARS

- February 27 – Evaluating Cost-Effectiveness of Grid Mod Investments
- March 20 – Forecasting Loads and Distributed Energy Resources
- April 10 – Reviewing Utility Distribution Plans
- May 1 – Advancing Equity Considerations in Distribution System Planning
- May 22 – Non-Wires Alternatives
- June 12 – Developing Requirements for Utility Distribution Plans



Evaluating the Cost-Effectiveness of Grid Modernization Investments

Fredrich (Fritz) Kahrl, 3rdRail, Inc.
Paul De Martini, Newport Consulting
Consultants to Berkeley Lab

PUC peer-sharing webinars on integrated distribution system planning
Hosted by NARUC, Berkeley Lab and Pacific Northwest National Laboratory
February 27, 2023

Disclaimer

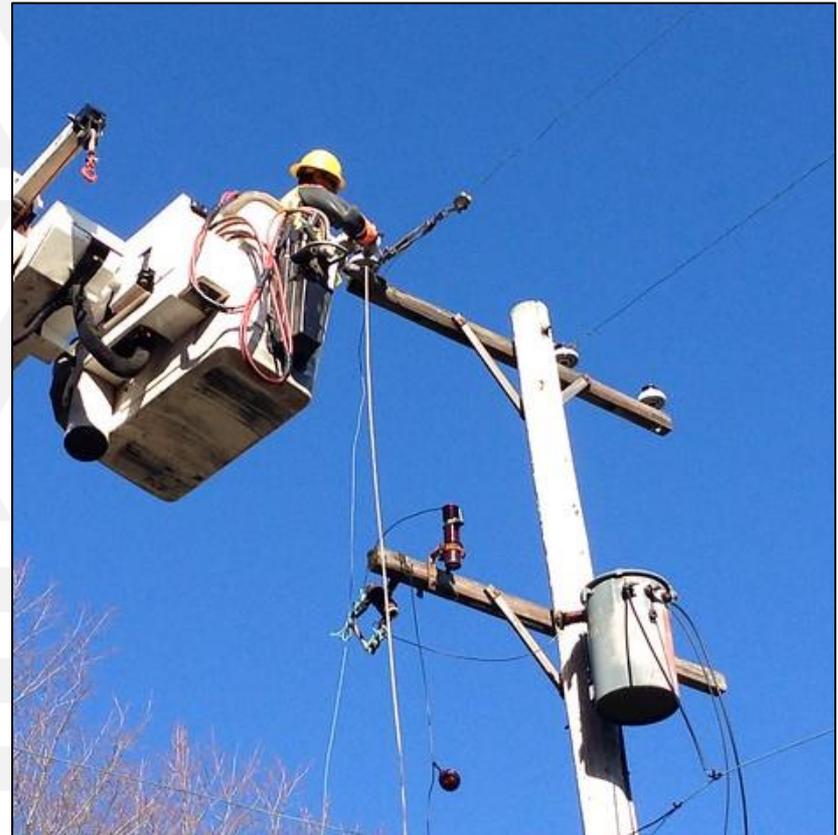
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Grid modernization investment cost-effectiveness

- ▶ The electricity industry has a generational opportunity to modernize distribution grids.
- ▶ Key drivers of grid modernization are resilience and reliability, electrification, distributed energy resources (DERs), and new information and communication technologies.
- ▶ Public utility commissions (PUCs) across the U.S. are struggling with how to evaluate the cost-effectiveness and allocate the costs of investments that expand and modernize distribution grids.

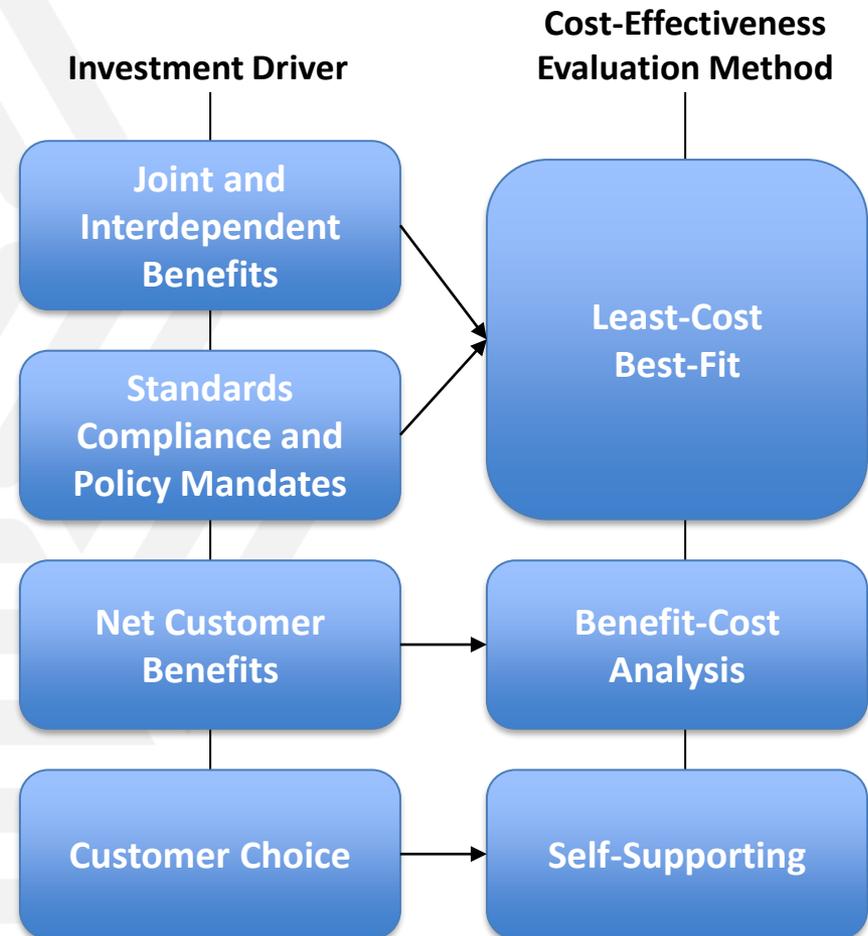


Investment categorization

- ▶ Distribution investments are frequently lumped together in grid modernization proceedings, but for cost-effectiveness evaluation and cost allocation it's important to categorize investments according to type and drivers.
- ▶ In terms of type, a high-level taxonomy of investments might include:
 - Existing infrastructure replacements and upgrades (e.g., 4 kV to 12 kV upgrades)
 - Line extension and service upgrades (e.g., new service requests, amperage upgrades)
 - Distribution capacity expansion (e.g., substation upgrades)
 - Hardening (e.g., undergrounding, steel/concrete poles, raising equipment)
 - Grid management (e.g., grid monitoring hardware and software)
 - Administrative (e.g., meters and backend software, billing software)

Investment drivers and cost-effectiveness evaluation methods

- ▶ Investments can be grouped under four key drivers:
 - **Joint and interdependent benefits** — core platform investments that are needed to enable new capabilities and functions in the distribution grid (e.g., distribution management systems)
 - **Standards compliance and policy mandates** — utility investments that are needed to comply with safety and reliability standards or to meet policy mandates for proactive investments to integrate DER (e.g., replacements and upgrades)
 - **Net customer benefits** — utility investments from which some or all customers receive net benefits in the form of bill savings (e.g., advanced metering infrastructure)
 - **Customer choice** — utility investments triggered by customer interconnection, opt-in utility programs, and customer-driven reliability improvements, paid for by individual customers (e.g., line extensions, hardening)
- ▶ The investment driver points toward an appropriate cost-effectiveness evaluation method (right side of figure).



Applying economic evaluation methods

- ▶ Least-cost best-fit (LCFB) and benefit-cost analysis (BCA) are often conflated, but they are used in different situations and answer different questions.
- ▶ LCBF – used for most distribution infrastructure investments and platform software investments
 - *Given that we want some functionality/capability on the distribution system or that we want to meet some safety, reliability, or regulatory goal, what is the lowest cost way to do so?*
- ▶ BCA – used for investments in advanced meters (often but not always), non-wires alternatives, utility resource procurement and programs
 - *Will an investment enhance welfare (benefits > costs) for all or a subset of customers?*
- ▶ There may be overlap between BCA and self-supporting investments, which historically have been addressed through cost-sharing mechanisms (e.g., free footage allowances in line extension).

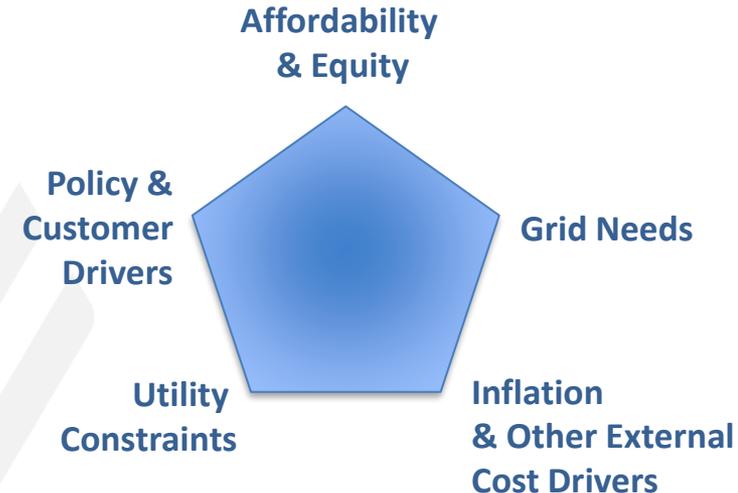
Example: applying cost-effectiveness methods

- ▶ A state legislature develops a new statute requiring distribution utilities to meet minimum performance standards (e.g., outage frequency and duration, service restoration times) during extreme weather events.
- ▶ The PUC orders regulated utilities to review performance standards, approaches, and propose spending to meet these standards. The order also requires utilities to integrate microgrids that several communities have proposed.
- ▶ Evaluation and cost allocation
 - **LCBF:** The law deems major hardening investments (e.g., raising substations in flood zones) to be in the public interest and that taxpayers will pay for them, up to a specified dollar cap.
 - **LCBF:** Investments that exceed the cap and more minor investments that are needed to meet the standard are financed by the utility, included in the utility's rate base, and paid by the utility's customers, if the Commission determines the costs are prudently incurred.
 - **BCA:** Net of wholesale benefits, the utility finds that microgrids are not a least-cost approach to meeting the performance standard.
 - **Self-supporting:** The utilities file a tariff for microgrid exports based on avoided costs. The PUC approves the tariff. Microgrid customers pay for net microgrid costs (incremental costs minus tariff revenues) and the higher reliability that it provides.

Distribution expenditure evaluation challenge

Evaluate utility distribution expenditure plans within a holistic frame

- ▶ Transformation of energy use from fossil fuel to clean electricity will place considerable demands on the electric grid.
- ▶ Distribution systems will require expenditures, both capital investments and operational expenses (e.g., software as a service and non-wires alternatives), to enable policies and meet customer needs.
- ▶ Nearly all grid expenditures result in incremental costs* and related rate impacts, as most are not offset by utility operational savings.
- ▶ External factors such as inflationary effects on equipment and labor costs create an additional challenge.
- ▶ This requires navigating several interrelated factors (see figure) that will ultimately shape a financially reasonable trajectory to address desired outcomes.



* While non-wires alternatives may avoid capital costs, they typically require utility payments to DER aggregators or directly to participating customers. These payments are usually treated as operating expenses. Both traditional and non-wires solutions are incremental costs that impact retail rates, although capital investments impact rates differently than operating expenses.

Project vs. portfolio cost-effectiveness

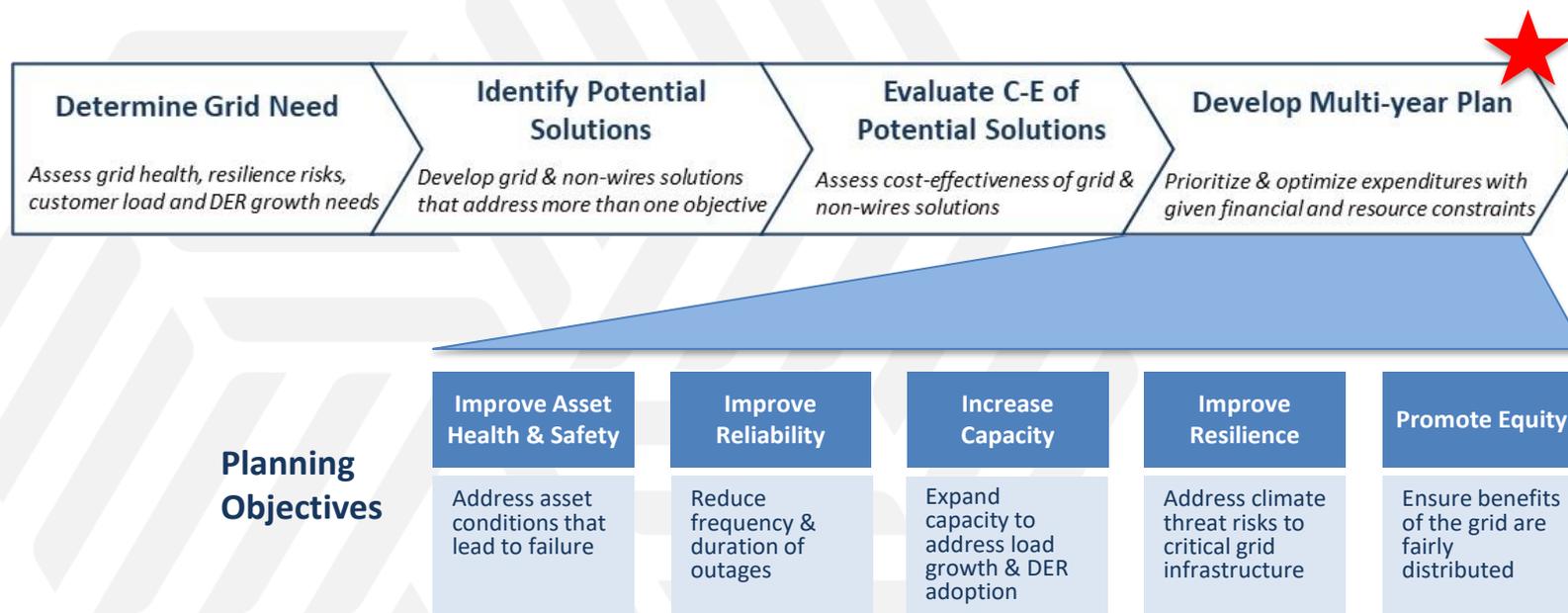
Project cost-effectiveness is the first step to evaluate an overall distribution plan.

- ▶ But evaluation of individual grid modernization projects is not sufficient to determine whether an overall distribution expenditure plan is reasonable.
- ▶ It also is necessary to consider if the proposed portfolio of expenditures:
 - Clearly addresses more than one identified statutory and/or regulatory objective
 - Represents an integrated set of projects that are complementary
 - Represents a set of projects that are part of a series of expenditures to address identified statutory and/or regulatory objectives
 - Represents a prioritized set of expenditures given the urgency of grid needs that address identified statutory and/or regulatory objectives and utility financial and resource constraints
 - Represents an optimized set of expenditures respecting customer affordability and equity considerations
- ▶ Distribution expenditure plans require a multi-objective decision-making framework to evaluate these considerations.

**The objective is to achieve the highest value per dollar expended –
“value-spend efficiency”**

Development of multi-objective distribution plans

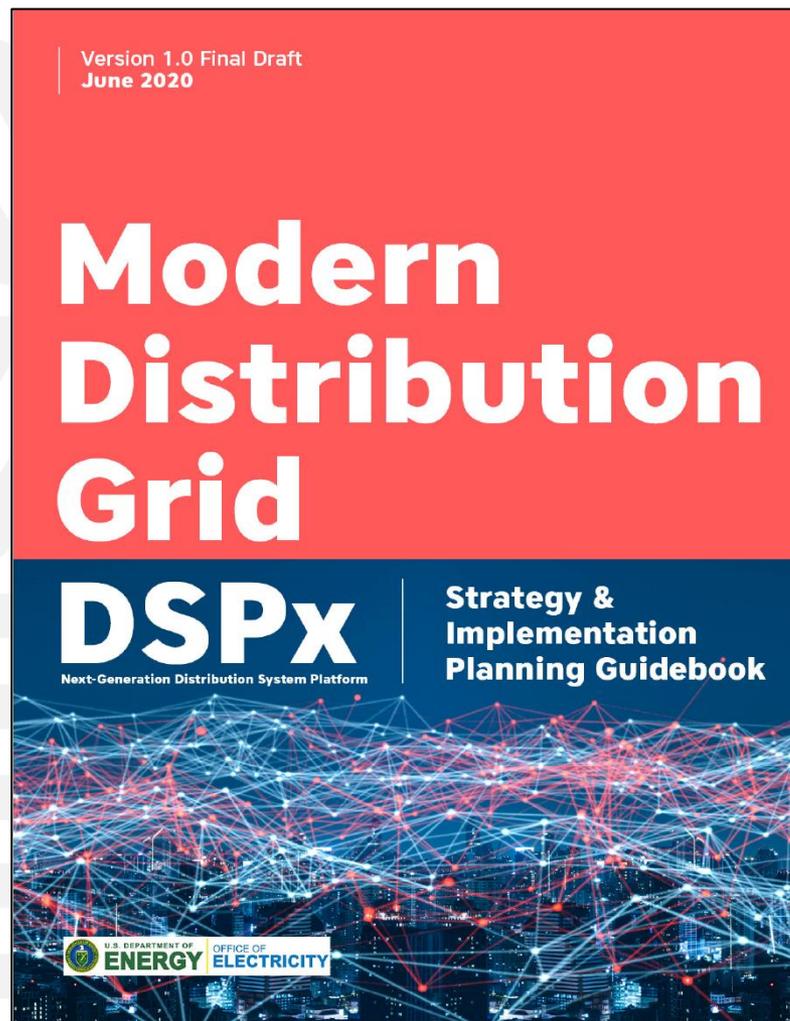
Integrated distribution planning should address the development of prioritized and optimized multi-year distribution plans.



DOE's Modern Distribution Grid guide

- ▶ Volume IV of the guide includes an economic evaluation framework for grid modernization investments.
 - Aims to inform approaches to evaluating economics and managing costs and risks of grid modernization investments
- ▶ No textbook approach — multiple reasonable paths to achieving the same broad goals

U.S. Department of Energy. *Modern Distribution Grid Volume IV: Guidebook (final draft)*

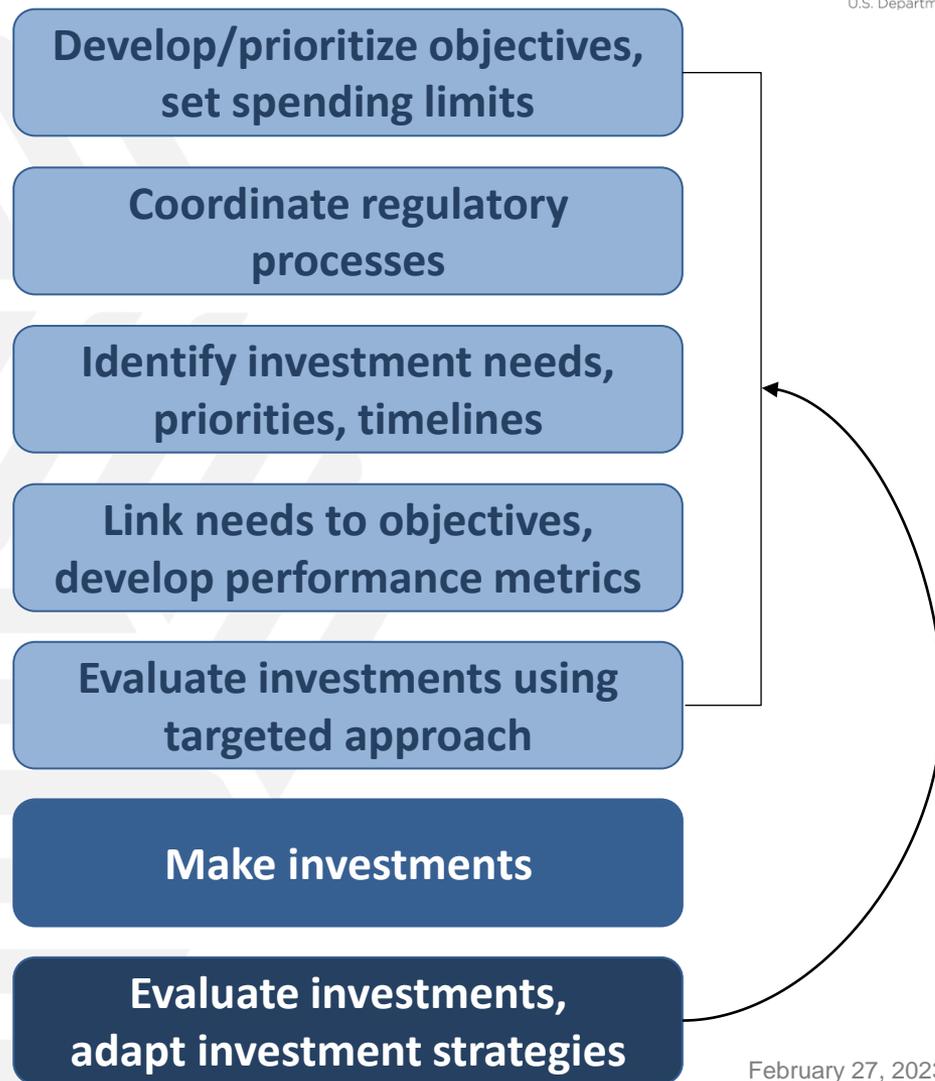


Economic evaluation framework

- ▶ Framework has three basic stages:



- ▶ Stakeholder input throughout the process can help regulators reduce information asymmetry, improve outcomes



Strategies for managing costs and risks: stakeholder initiatives and utility planning

- ▶ *Developing objectives and priorities for grid modernization through stakeholder initiatives*
 - Examples: Hawaii ([Grid Modernization Strategy](#)), Michigan ([MI Power Grid](#)), New York ([Reforming the Energy Vision](#)), Rhode Island ([Power Sector Transformation](#))
- ▶ *Providing greater transparency on needs, priorities, costs, and risks by requiring utilities to develop long-term grid modernization plans, with nearer-term action plans*
 - Examples: California ([Grid Modernization Plans](#)), Hawaii ([Grid Modernization Strategy](#)), Massachusetts ([Grid Modernization Plans](#)), Minnesota ([Integrated Distribution Plans](#))

Strategies for managing costs and risks: analysis, pilots, metrics, and incentives

- ▶ *Requiring utilities to conduct alternatives analysis and risk scoring for investments*
 - Example: Minnesota PUC required Xcel Energy to conduct alternatives analysis and risk-ranking of investments in its Integration Distribution Plans (Docket 18-251, [Order Accepting Report and Amending Requirements](#))
- ▶ *Encouraging and approving well-designed grid modernization pilots*
 - Examples: Austin Energy ([advanced distribution management system](#)), Xcel Minnesota ([advanced metering and time-of-use pricing](#)), Rocky Mountain Power Utah ([customer-sited solar + battery demand response](#)), Oregon ([storage](#)), New York State Electric & Gas ([flexible interconnection](#))
- ▶ *Using budget caps to limit potential rate impacts*
 - Example: Massachusetts DPU pre-authorized specific categories of grid-facing utility investments for three-year term, [subject to a budget cap](#)
- ▶ *Designing performance metrics and linking these to utility incentives*
 - Examples: Illinois ICC [created performance metrics for grid modernization](#) that are linked to utility earnings; Minnesota PUC ([Docket 17-401](#)) required Xcel Energy to develop performance metrics and a reporting schedule



Evaluating the Cost-Effectiveness of Grid Modernization Investments

Grace Relf, Hawaii Public Utilities Commission
NARUC Webinar on Integrated Distribution Planning
February 27, 2023

Hawaii Public Utilities Commission



Presentation Roadmap

- The Hawaii Context
- Integrating Distributed Energy Resources (DERs)
- Advanced Metering Infrastructure (AMI)
 - Evaluating cost-effectiveness
 - Performance Incentive Mechanism (PIM)



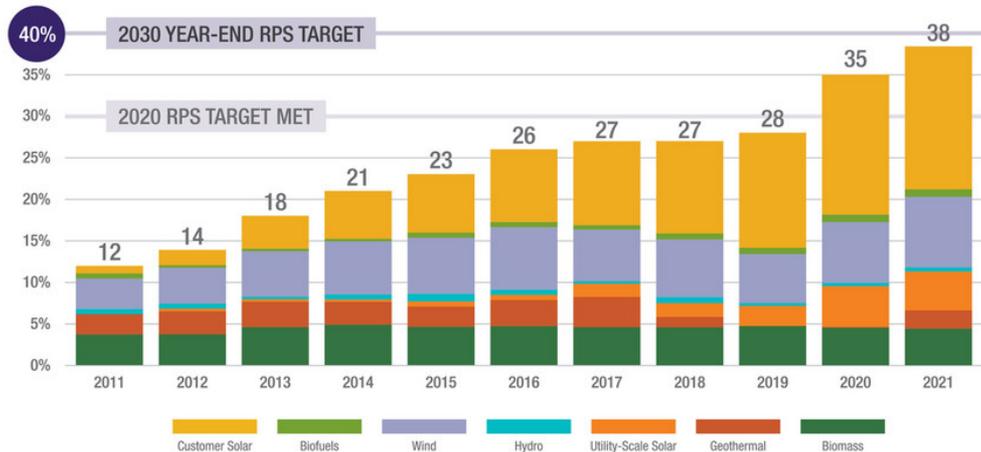
Setting the stage: State Policy

- 100% carbon neutrality goal by 2045
- Climate change emergency



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RENEWABLE PORTFOLIO STANDARD PROGRESS



Source: HECO 2021 Sustainability Report



Setting the stage: Regulatory Context

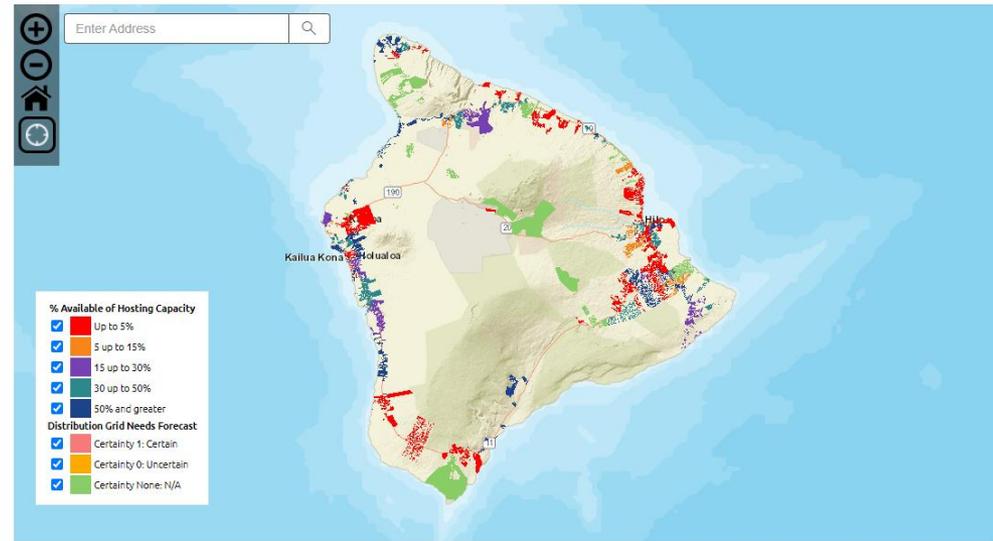
- Regulated entities:
 - Vertically integrated investor-owned utilities on each island – together, the Hawaiian Electric Companies (HECO)
 - Kauai Island Utility Cooperative (KIUC)
 - Independent energy efficiency administrator – Hawaii Energy



Investments for Integrating DERs

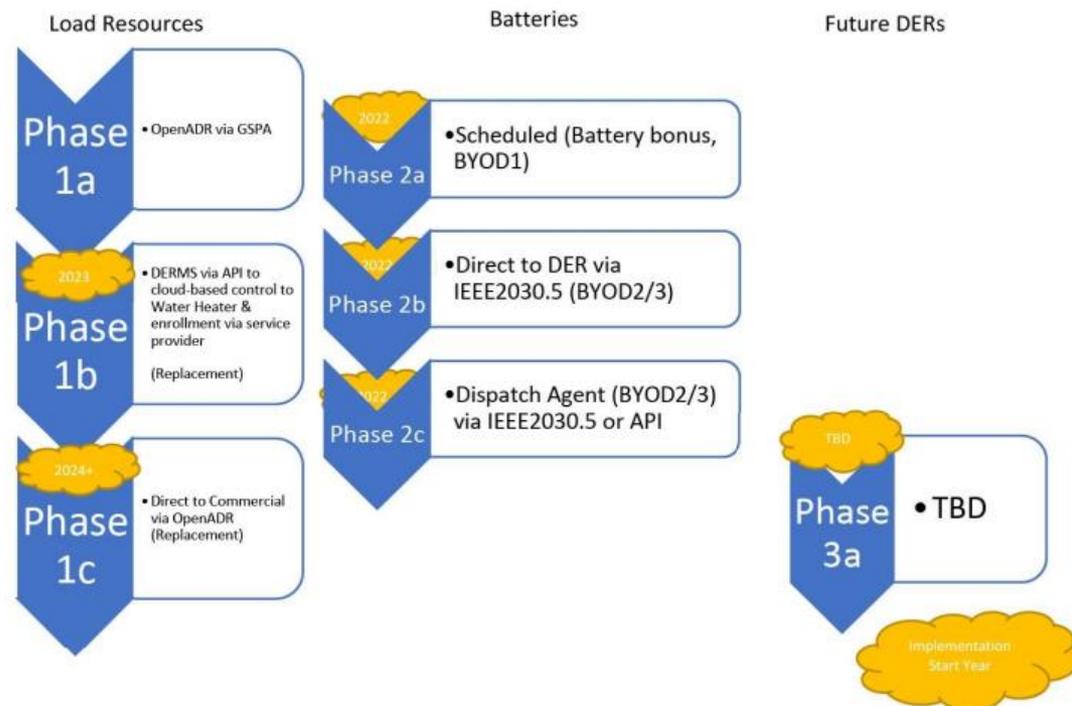
- Distribution planning is part of Integrated Grid Planning (IGP)
- DERs are already being dispatched for grid services by the utility & aggregators
- Valuation of DER grid services is occurring via IGP modeling
 - “Freeze” scenario assumes no DER growth & calculates avoided costs

Hawaii Island Locational Value Map (LVM)



Investments for Integrating DERs

- Existing costs recovered via a surcharge
- New costs covered via approved rate base budget, including:
 - Customer Interconnection Tool
 - Billing updates
 - New software
- Exploring a PIM for DER grid services



Advanced Metering Infrastructure (AMI)

- Full deployment expected 2024
- Companies are required to track all costs and benefits
- Costs are recovered as a “major project” expense, net of benefits
- Methodology for quantifying benefits expected 2024

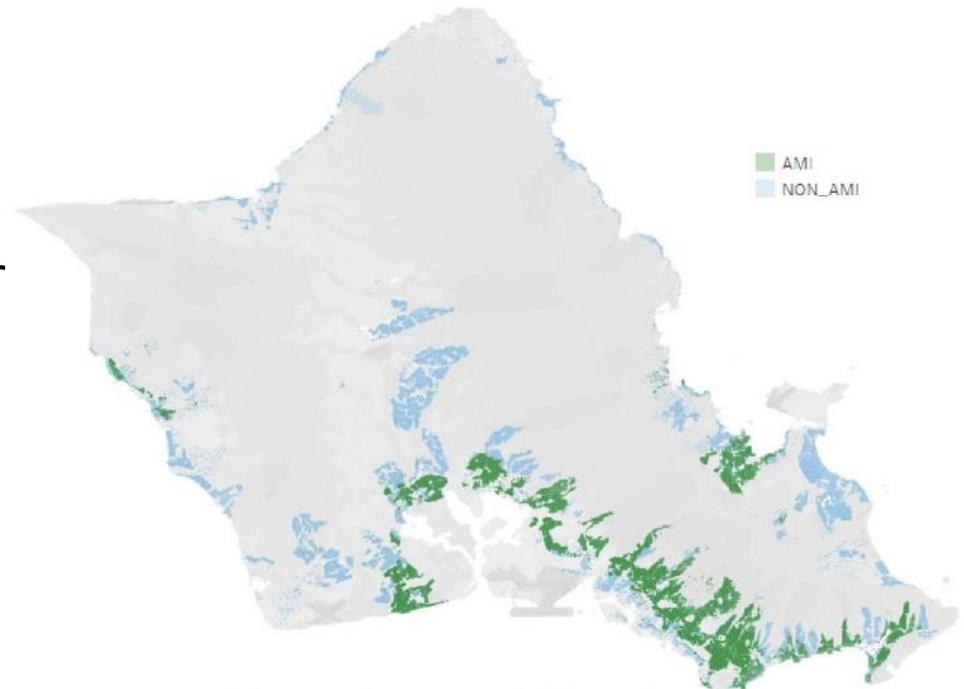


Figure 7 – Map of Oahu AMI Meters Installed

Categories of AMI Benefits

- Reliability
 - Identify & restore power outages
 - DER integration
- Economic
 - Reduce operating costs
 - Increased customer programs and tools
- Customer Satisfaction
 - Energy usage portal & data access
 - Improved billing accuracy

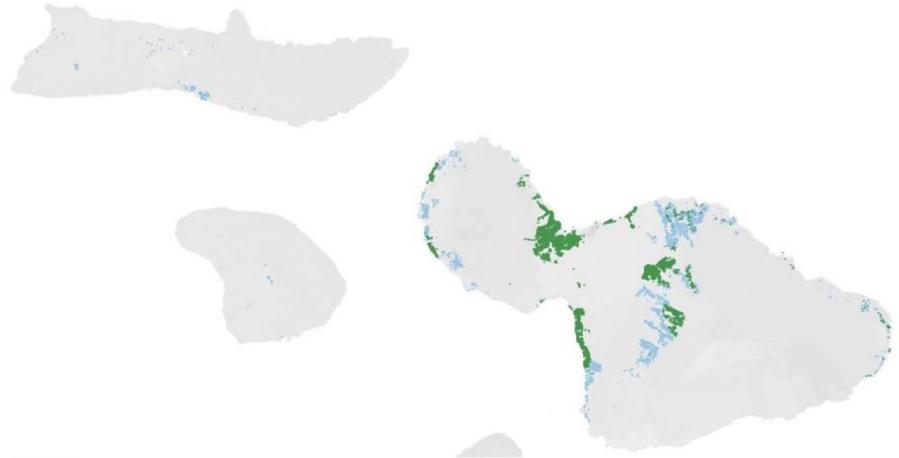


Figure 15 – Map of Maui County AMI Meters Installed

Advanced Metering Infrastructure PIM

- Reward for customers with AMI delivering at least 2 of 3 identified benefits:
 - Customer authorization to share data with 3rd parties
 - Customer enrollment to receive energy usage alerts
 - Customer enrollment in a next-generation DER or time-of-use program
- Potential rewards are between \$1 and \$2 million for meeting the following targets (% of total customers delivering at least 2 benefits):
 - 2021: 2.5 – 5%
 - 2022: 10 – 15%
 - 2023: 20 – 30 %



Performance

- AMI PIM:
 - Companies have requested modifications to the PIM citing challenges to benefit implementation
 - Requested modification of the target denominator
 - Requested modification to the benefits included

2021 AMI Utilization PIM Performance <i>Number of customers by Company with advanced meters installed and delivering the benefits listed below, divided by number of total customers, by end of year.</i>			
Benefit Category	HECO	MECO	HELCO
“Customer Authorization” Benefit	0.00%	0.00%	0.00%
“Energy Usage Alert” Benefit	0.03%	0.02%	0.03%
“Program Participation” Benefit	0.08%	0.08%	0.03%
At least two of the benefits listed above	0.001%	0.00%	0.00%



References

- Hawaii's PBR Framework; Docket No. 2018-0088
 - <https://puc.hawaii.gov/energy/pbr/>
- Locational value maps:
 - <https://www.hawaiianelectric.com/clean-energy-hawaii/integration-tools-and-resources/locational-value-maps>
- DER Docket; No. 2019-0323
 - <https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A22I30B53044E00517>
- Grid Modernization Phase 1; Docket No. 2018-0141
 - <https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A19C25B50035J00133>
 - <https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A22L30A84822H00493>





Mahalo!

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Evaluating Cost Effectiveness of Grid Modernization Investments: A Michigan Perspective

Joy Wang

Michigan Public Service Commission

February 27, 2023

Disclaimer

- All views expressed are solely my own and do not express the views of the Michigan Public Service Commission.
- The Commission speaks through its orders.

Agenda

- Michigan background
- Reviewing utility investments
 - Challenges
 - Approaches/Questions
- Current and Next Steps

Michigan Background: Rate Cases

- Projected test year
- Varied frequency
 - Annually for large electric utilities
 - About every 2-3 years for major gas utilities
 - Less frequently for smaller investor owned utilities (IOUs)
- Challenges
 - Limited visibility into the future (12 month test year)

Michigan Background: Distribution Plans

- To provide better visibility into investments long into the future
- Guiding principles
 - Safety
 - Reliability and resiliency
 - Cost effectiveness and affordability
 - Accessibility
- Time horizon: 5, 10, and 15 year horizons
- Filed in MPSC Case No. [U-20147](#) by three IOUs
 - Consumers Energy Mar 1, 2018 [June 30, 2021](#)
 - DTE Electric Jan 31, 2018 [Sept 30, 2021](#)
 - Indiana Michigan Power Apr 3, 2019 [Sept 30, 2021](#)
- Future distribution plans to be filed by:
 - Alpena Power Company by Sept 30, 2024
 - Northern States Power Company by Sept 30, 2024

Reviewing Utility Grid Mod Investments

- Reasonableness and prudence review in rate cases
 - Distribution plans informational only
- Projected test year provides forecasted costs and short outlook
- Frequency and volume of rate cases can be overwhelming
 - Ex. MPSC Case No. U-20836 DTE Electric rate case
 - Application filed on 1/21/2022
 - 3,711 pages of testimony and exhibits
 - Commission orders
 - Rate case: 11/18/2022
 - Denied petition for rehearing: 2/2/2023

Challenges in Reviewing Utility Grid Mod Investments

- High number of testimony and exhibit pages
- Still lacking investment details
 - Discovery/audit questions requesting information on:
 - Project descriptions
 - Business cases
 - Projected benefits and amounts
 - Further details on capital and O&M costs
 - Commission directions to provide more of the above

Challenges in Reviewing Utility Grid Mod Investments

- Past pilots not clearly defined & lacked clear findings
 - [2/8/2021 order](#) in No. U-20645 adopted definition of pilot and objective criteria for utility pilot review
 - *A pilot is a limited duration experiment or program to determine the impact of a measure, integrated solution, or new business relationship on one or more outcomes of interest.*
 - Objective criteria for review requires details on:
 - Pilot need and goals
 - Pilot design and evaluation plan
 - Project costs & benefits
 - Timeline
 - Stakeholder engagement plan

Challenges in Reviewing Utility Grid Mod Investments

- No uniform benefit-cost analysis (BCA) in MI currently
 - Utilities have own BCAs or project prioritization developed in house
 - What is included/excluded?
 - Comparisons across utilities difficult
- Interest in developing MI-specific jurisdictional BCA
 - In U-20898, Commission requested proposals for MI-specific uniform BCA requirements for evaluating pilot proposals
 - Received utility proposals in early Feb 2023

Review Approaches/Questions for Utility Grid Mod Investments

- Do project goals help meet the detailed need?
- What do the forecasted costs assume and why?
- How do projected benefits compare to costs?
- Did the Company spend the prior approved forecasted amount?
 - Did it over or underspend it? If so, why?
- If it was piloted, did the Company collect data to answer the initial questions to justify full deployment?
- What alternatives were examined? Why were they not selected?
- What is future functionality and longevity? Are stranded assets a concern?
- Does the project have internal approval to proceed?

Current and Next Steps

- Meetings with the utilities to better understand:
 - Advanced Distribution Management System capabilities
 - Distribution system investments
- Development of MI-specific jurisdictional BCA for pilots
- Pursue pilots to inform future innovation deployments
 - Expedited pilot review for innovative pilots approved on 2/23
 - Explore alternative business models
 - Approval of transit battery/eBus batteries pilot in

Questions?

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