Stakeholder Workshop #3

PROCEEDING TO IDENTIFY PRIORITIES FOR MAINE GRID PLAN FILINGS (Docket 2022-00322)

ELECTRIC POWER ENGINEERS

Workshop 3 Agenda (April 25, 2023)

1:00 – 1:10	**MPUC and EPE**: Process Goals and Priorities
1:10 – 2:10	**Natalie Mims Frick, LBNL**: Integrated Grid Planning: Themes and Experiences from Other Jurisdictions
2:10 – 2:40	**Angela Long, PGE:** Integrated Grid Planning in Oregon and at Portland General Electric
2:40 – 2:50	**Break**
2:50 – 4:20	**Panel:** Priorities for this proceeding and the final Commission Order
4:20 – 4:30	**MPUC and EPE:** Introduction to the Jade Roadmap, next steps

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MPUC Introduction

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Themes from Stakeholder Feedback: Integrated Grid Planning Goals

1. **Collaboration and Transparency**: There is a strong desire for increased collaboration and transparency in the grid planning process, including in developing clearly defined goals and objectives, establishing key assumptions and forecasts, building an evaluation framework, and ultimately meeting grid modernization goals. This includes inviting people in thoughtfully, including diverse voices and perspectives in the planning process, and holding educational sessions.
2. **Decarbonization and Grid Modernization**: There is a consensus on the need for a comprehensive, holistic planning process designed to achieve Maine's climate and renewable energy goals, and for a modernized grid that operates on clean renewable energy, with greater integration of renewables, distributed generation and demand response or controllable loads. This includes implementing grid modernization road maps and technologies to provide better system visibility, developing roadmaps for supporting beneficial electrification, identifying necessary transmission and distribution capacity upgrades to maximize the benefits of existing renewable generation, and expanding opportunities for new renewable generation.
3. **Safe, Reliable, Resilient and Affordable**: There is a consensus on the need for a safe, reliable, resilient, affordable, and secure system that avoids unnecessary spending and includes ratepayers in decision-making.

Themes from Stakeholder Feedback:
A desire for…

- **Better understanding** of changes to the current grid planning process
- **Outreach to those who do not typically participate** in Commission proceedings, integrating technical and non-technical knowledge, educational sessions.
- Specific processes for **forecast creation** and **solution evaluation**.
- **Technical workshops or working groups** focused on key assumptions, and scope of modeling.
- Review of **successful examples** from other parts of the country or internationally.

Themes from Stakeholder Feedback:
Biggest Challenges to Integrated Grid Planning to Meet the State Goals

Forecasting and Grid Visibility

- Uncertainty in electricity loads and DER growth.
- Understanding the grid on a 24/7/365 basis and turning goals into planning assumptions.

Interconnection & Grid Operations

- Maintaining grid reliability and stability while meeting goals.
- Handling larger loads and generation from multiple distributed and centralized resources.

Increasing Complexity

- Understanding how grid planning is informed by grid structure, market structure, rates, and technology implementation.
- Addressing roles and responsibilities of various entities, identifying priorities

Solutions Evaluation

- Prioritizing solutions with broad benefits to all ratepayers
- Involving the community in education and decision-making.
- Making marginal grid costs transparent and accessible to consumers and stakeholders.

Transmission

- Influencing what ISO-NE does
- Siting, permitting, and public acceptance for clean energy and transmission projects.

Natural Resources

- Protecting the environment and wildlife habitat while planning for the future grid.

Customer Experience

- Affordability, cost aversion, customer acceptance, and understanding how the grid works and costs.

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LBNL and PGE presentations

Natalie Mims Frick
Electricity Markets and Policy Department, LBNL

Angela Long
Senior Manager, Distributed Resource Planning, Portland General Electric

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Distribution System Planning: Goals & Objectives

Presentation to Maine Public Utilities Commission
Natalie Mims Frick
Contributions by Lisa Schwartz, Berkeley Lab
Elaine Prause and Raphael Breit, Regulatory Assistance Project

April 25, 2023

This work was funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy under Contract No. DE-AC02-05CH11231.

Agenda

- Benefits of transparent planning and process overview
- Goals, objectives and priorities for grid planning in other states
- State procedural and substantive requirements
- Putting all the pieces together – Minnesota example

Benefits of Transparent Planning and Process Overview

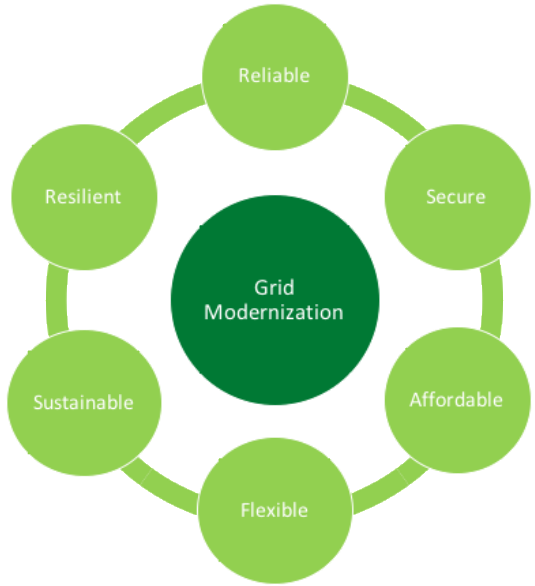
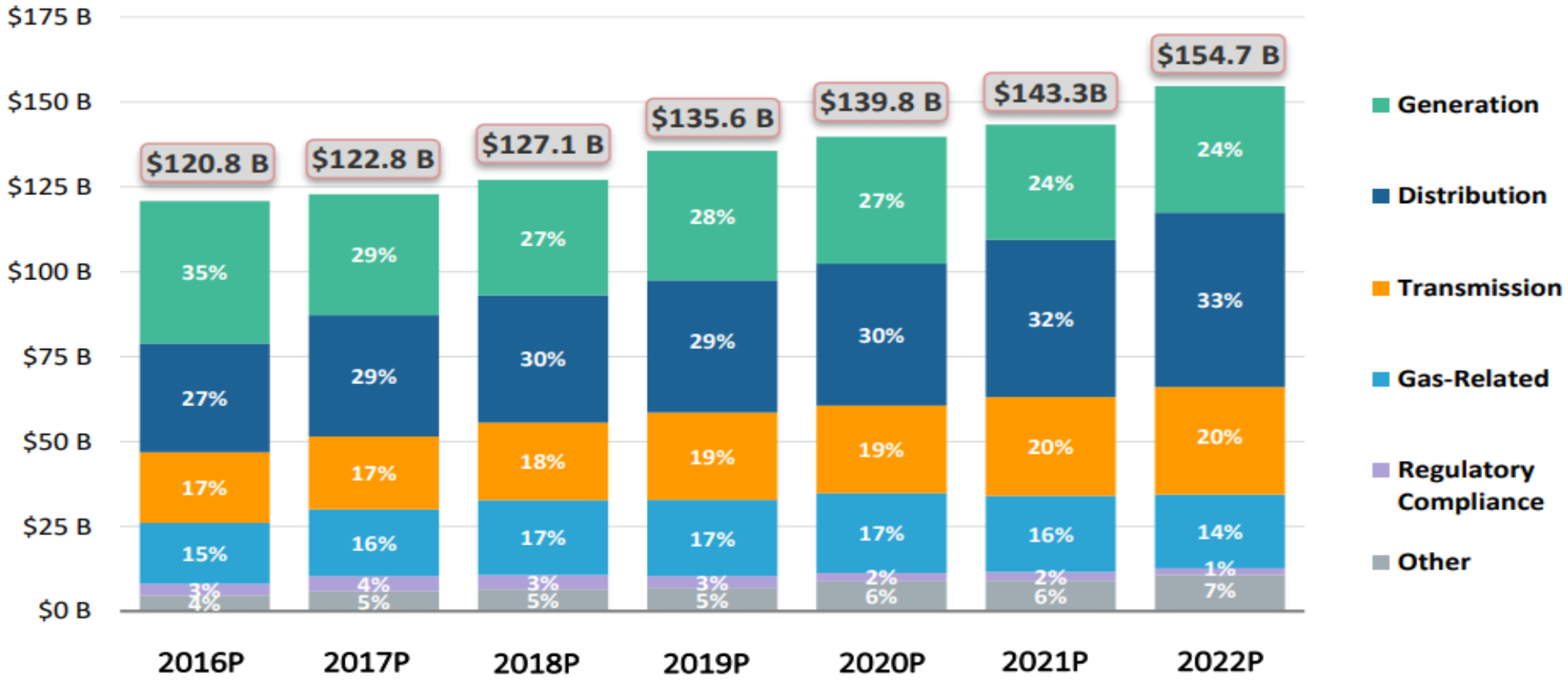


Figure source: U.S. Department of Energy's *Grid Modernization Multi-Year Program Plan*

Distribution system costs are rising steadily.



Source: EEI (updated Sept 2022)

Potential benefits from improved distribution planning processes

- Makes transparent utility plans for distribution system investments holistically, before showing up individually in general rate cases
- Provides opportunities for meaningful regulatory and stakeholder engagement
  - Can improve outcomes — more data, community input, review
- Considers uncertainties under a range of possible futures (scenarios)
- Considers all solutions for least cost/risk (including DERs)
- Motivates utility to choose least cost/risk solutions
- Enables consumers and 3rd party providers to propose grid solutions and participate in providing grid services

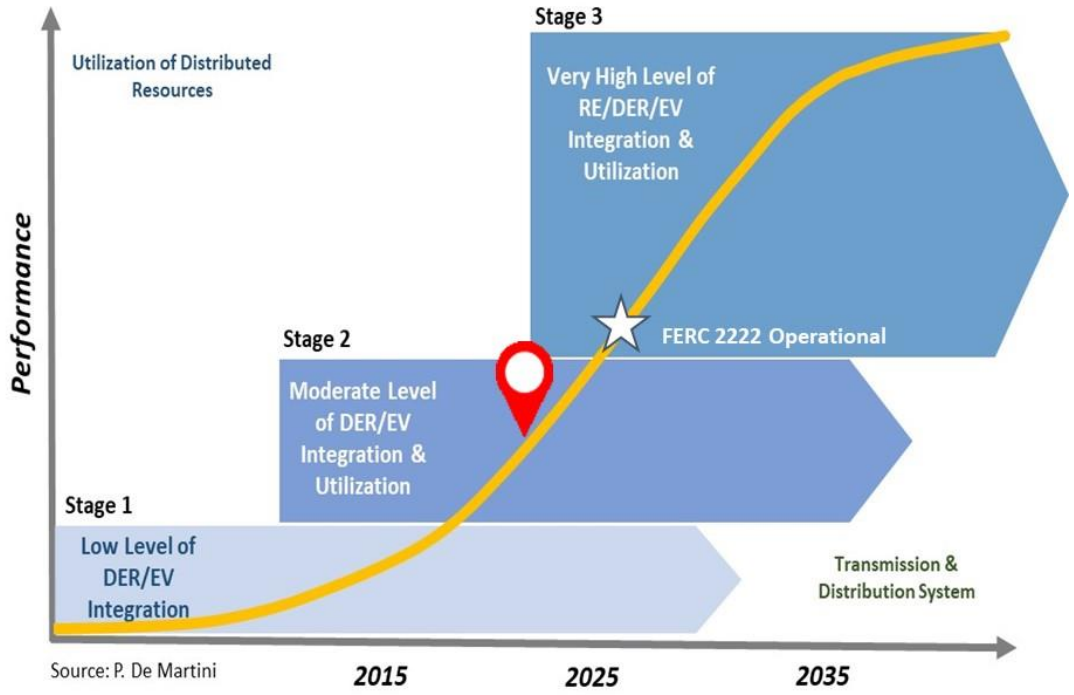
Distribution planning addresses higher levels of DER adoption

DER integration & utilization and electrification are expanding across the U.S. at different rates.

Stage 1: *Low DER adoption (<5% of peak)*. DER levels can be accommodated within existing distribution systems without material changes to infrastructure, planning and operations. Grid modernization addresses reliability, resilience, safety, and operational efficiency and enabling DER integration and utilization at low levels.

Stage 2: *Moderate adoption of DERs (5-20% of peak) including for wholesale & distribution services.* DERs — individually and in aggregations — are increasingly used as load-modifying resources for both distribution non-wires alternatives (NWAs) and wholesale capacity and ancillary services. Integrated distribution system planning and grid modernization are needed to enable real-time observability and operational use of DERs.

Stage 3: *Large-scale adoption of DERs (>20% of peak*), including for wholesale & distribution services, plus community microgrids.* Utilization of DER aggregations (virtual power plants) is optimized to support grid service requirements for distribution and transmission systems. Multi-use/community microgrids help support local energy supply and resilience. Ultimately, distribution system level energy transactions are enabled. This stage of DER utilization requires coordination across jurisdictions (e.g., FERC Order 2222) and infrastructure to support both grid and market operations.



Source: Paul De Martini, Newport Consulting

*Installed DER capacity as a percent of distribution system peak

Start with state principles and objectives instead of picking technologies

- Planning starts with state principles and objectives — and priorities. Then you can determine the capabilities needed to achieve them, as well as functionality and system requirements.
- Holistic, long-term planning — in the context of integrated grid planning:
  - Supports state goals — e.g., accountability; safe, reasonable and adequate service at just and reasonable rates; addressing the expected effect of climate change (LD 1959)
- Addresses interdependent technologies and systems, including core components (e.g., Advanced Distribution Management System, Geographic Information System, Outage Management System) and applications to enable other grid modernization projects.*
  - Considers proactive grid upgrades to facilitate customer choice

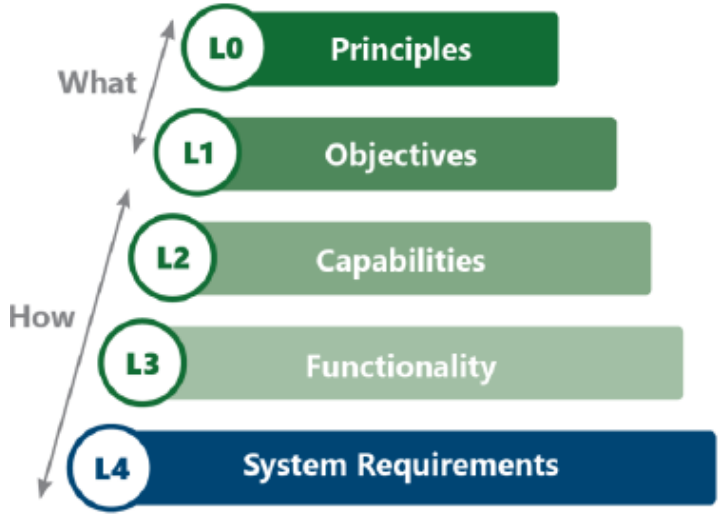


Figure: DOE 2020

- Other types of plans feed into integrated grid plans:
  - *Transmission plan* identifies future transmission expansion needs and options
  - *Electrification plan* informs grid needs for EV charging and building electrification
  - *Energy security plan* informs strategies for resilience from physical and cybersecurity threats
  - *Demand-side management plan* specifies the capabilities that distribution technologies and systems should provide to achieve multi-year targets for demand flexibility and energy efficiency

* See "Layering of Core Components and Applications" in *Extra Slides*.

Goals, Objectives, and Priorities for Grid Planning in Other States

Development of goals and priorities

- Many states have established requirements for grid planning, by legislation or regulation.
  - Regulatory commissions develop goals and objectives that reflect state policies and commission priorities.
- States set goals, objectives, and priorities that define long-term, high-level outcomes for grid planning and steps to achieve them.
- Goals for grid planning include traditional regulatory aims (e.g., safety, reliability, and affordability) as well as newer policy goals (e.g., transportation electrification, more renewable resources, and emissions reductions) and related outcomes such as greater asset utilization and improved integration and utilization of distributed energy resources (DERs).
- Several commissions set IDSP requirements in response to lack of information provided by regulated utilities.
- Grid planning objectives reflect the importance of transparency and stakeholder engagement.

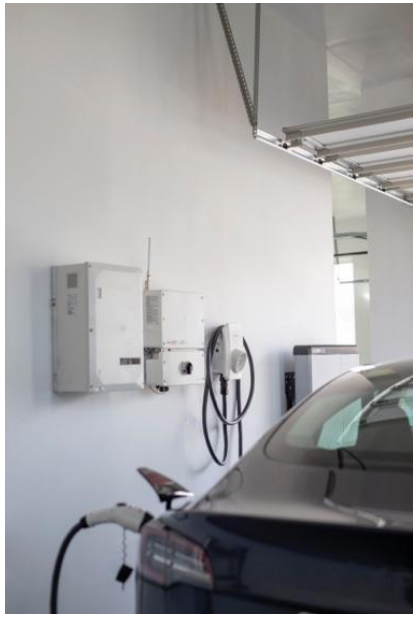
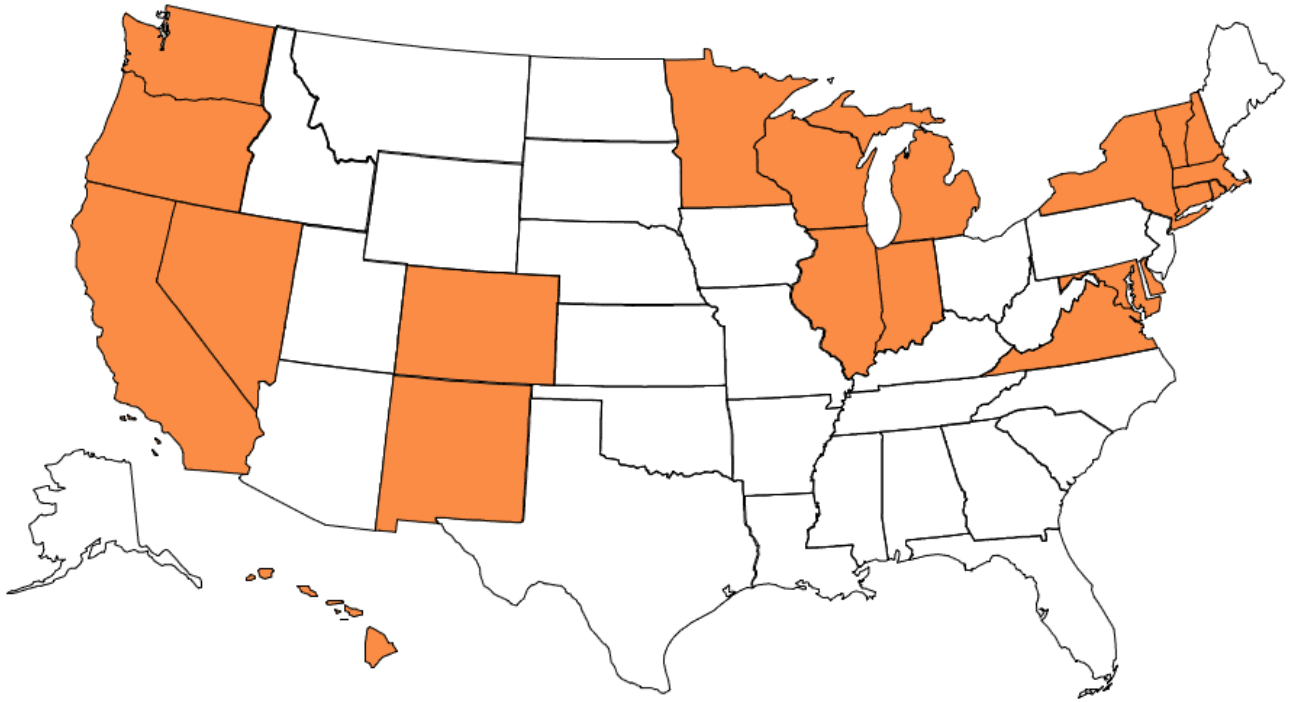


Photo courtesy of Sunrun

Common themes in grid planning goals and objectives

- We reviewed goals and objectives for grid planning for 20 other states and DC.
- Common themes emerge
  - Improve grid reliability and resilience
  - Increase customer choice and engagement in energy services
  - Support DER integration and utilization for grid services
  - Reduce greenhouse gas (GHG) emissions and support the clean energy transition
  - Accelerate deployment of new technologies and services to optimize grid performance and minimize electricity system costs
- Several of the themes overlap.



Improve grid reliability and resilience

- 15 states and DC have goals or objectives related to reliability or resilience.
  - 9 states and DC have an goal or objective related to reliability (CA, DC, DE, HI, IN, MA, NV, RI, VA, VT).
  - Five states have reliability *and* resilience goals or objectives (CT, MI, MN, NH, NM).
  - Resilience and reliability are always discussed together – there are not examples of resilience specific goals.
- Many states have goals to improve, enhance, or promote reliability or resilience (CA, CT, HI, IN, MA, MI, MN, NH, NM, VA). A few states and DC have a general goal of maintaining a reliable or resilient electricity system as the grid modernizes and/or more DERs are added to the grid (DC, DE, MN, RI).

- In **Colorado**, the IDP rules specify that the PUC will review and evaluate whether the regulated utilities' distribution system investments support reliability and resilience.
- The **Nevada** PUC requires the utilities to address reliability benefits in their DER plans.
- The **New Hampshire** PUC's first objective for a modernized distribution system is to "Improve reliability, resiliency, and operational efficiency."
- The goal of **Indiana's** grid modernization legislation is to "promote safety, reliability and economic growth by encouraging cost-effective modernization of utity infrastructure."

Increase customer choice and engagement in energy services

- 10 states identify customer choice and engagement in energy services as an objective or goal (CA, CT, HI, IL, MA, MN, NH, NY, RI, VT).
- Two states identify objectives related to compensating customers for the value of their DERs (WA, RI); DC and NH requires access to data.
- Two of the three grid modernization objectives for **Rhode Island** include customer choice, and one of the objectives in the distribution system planning docket is to "prioritize and facilitate increasing customer investment in their facilities… where that investment provides recognizable net benefits."
- The **Vermont** Commission described objectives and outcomes in terms of potential benefits. It identified one of the benefits of a smart grid as the potential to "increase energy efficiency, thereby reducing environmental impacts of energy consumption, and empower consumers to manage their energy choices."
- The **New York** PUC identified three distribution system implementation plan goals. The first is to "Serve as a source of public information regarding distribution service provider plans and objectives, including specific system needs allowing market participants to identify opportunities."

Photo credit: Marcela Gara, Resource Media

Support DER integration and utilization of grid services

Photo courtesy of Sunrun

- Eight states and DC have goals or objectives that support DER integration and utilization of grid services (CA, CO, DC, HI, IL, MA, MN, OR, VA).
- Legislation in **Virginia** requires that "any plan for electric distribution grid transformation projects shall include both measures to facilitate integration of distributed energy resources and measures to enhance physical electric grid reliability and security."
- The **Massachusetts** Department of Public Utilities set forth a vision for grid modernization. They identified four objectives to achieve the vision, including "To facilitate the interconnection of distributed energy resources and integrate these resources into the Companies' planning and operations."

- Some states discuss DER integration more broadly — e.g., achieving renewable energy goals, sustainability.
  - Utilities that are required to file Multi-year Integrated Grid Plans in **Illinois** must design their plans to meet multiple objectives, including to ensure coordination with the state's goal on renewable energy, support the achievement of the state's environmental goals, and support state policies that promote investments in renewable energy resources.
  - One of the goals of the **District of Columbia's** grid modernization effort is to create a more sustainable energy delivery system.

Reduce greenhouse gas emissions and support the clean energy transition

- Seven states (CA, CO, HI, IL, NH, RI, OR) and DC identify objectives or goals that relate to *reducing GHG emissions*.
  - Several jurisdictions link their goals or objectives to state emissions reduction goals (CO, HI, IL, OR) or climate action goals (DC). For example, in **Illinois**, one of the objectives of the Multi-Year Integrated Grid Plan is to achieve or support state environmental goals, including emissions reductions.
  - **Rhode Island** seeks to address "the challenges of climate change and other forms of pollution."
  - The **New Hampshire** PUC's grid modernization objectives include reducing "environmental impacts and carbon emission" in the state.
- Four states include supporting a *clean energy transition* as an objective or goal (CT, IL, MA, MI).

- One of the objectives of **Connecticut's** Equitable Modern Grid Framework is to enable a cost-effective, economy-wide transition to a decarbonized future.
- The MI Power Grid is a "multi-year stakeholder initiative to maximize the benefits of the transition to a clean, distributed energy resources" in **Michigan**. Distribution system planning is one piece of the initiative.

Accelerate deployment of new technologies and services to optimize grid performance and minimize electricity system costs

- Five states have a goal or objective to accelerate the deployment of new technologies and services to optimize grid performance and minimize electricity system costs (CA, CT, IL, MI, MN).
  - In **Illinois**, an objective of the Multi-Year Integrated Grid Plan is to “support efforts to bring the benefits of grid modernization and clean energy, including, but not limited to, deployment of distributed energy resources….”
  - Legislation in **California** required utilities to file distribution resource plans that “identify optimal locations for the deployment of distributed resources” and “identify barriers to the deployment of distributed resources."
  - In an order, the **Hawaii** Public Utilities Commission provided guidance on an integrated grid planning process which will “Evalute and optimize resource and T&D solutions…”

Other themes

- Stakeholder engagement and transparency are explicitly mentioned as objectives or goals in few states (e.g., MI). However, these aims are included in several state distribution system planning requirements (*see slides later in this presentation*).
- Affordability is mentioned in objectives or goals for several states (CO, CT, DC, IL, MI, NH and RI). Typically, the purpose is to maintain an affordable system for all customers.
- Equity is included in goals or objectives for grid planning for some states (CO, IL, OR) — as well as in Commission orders (MN) (*see slides later in this presentation*).

State Procedural and Substantive Requirements

Procedural elements*

- Frequency of filing
  - Typically annual or biennial
  - In some states, every 3 years (e.g., NV) or 5 years (MA)
- Planning horizon
  - 2-4 year action plan – OR (+ 5-10 year roadmap for investments, tools and activities)
  - 3 year action plan — NV (+ 6-yr forecasts), DE (+ 10-yr long-range plan)
  - 5 years – NY, CA (+ 10-yr grid modernization vision), HI (+ plan to 2045), MI (+ 10-15 yr outlooks), MN (+ 10-yr Modernization & Infrastructure Investment Plan)
  - 5-7 years – Indiana T&D and storage system improvements
- Stakeholder engagement

*See “Confidentiality” in Extra Slides

Stakeholder engagement (1)

- Of all electricity system infrastructure, people and communities are closest to distribution systems. This local system also is the source of most outages.

- Stakeholder engagement can:
  - Provide a venue for open discussion
  - Improve the quality of proceedings and their outcomes
  - Develop solutions with broad support
  - Build trust among parties

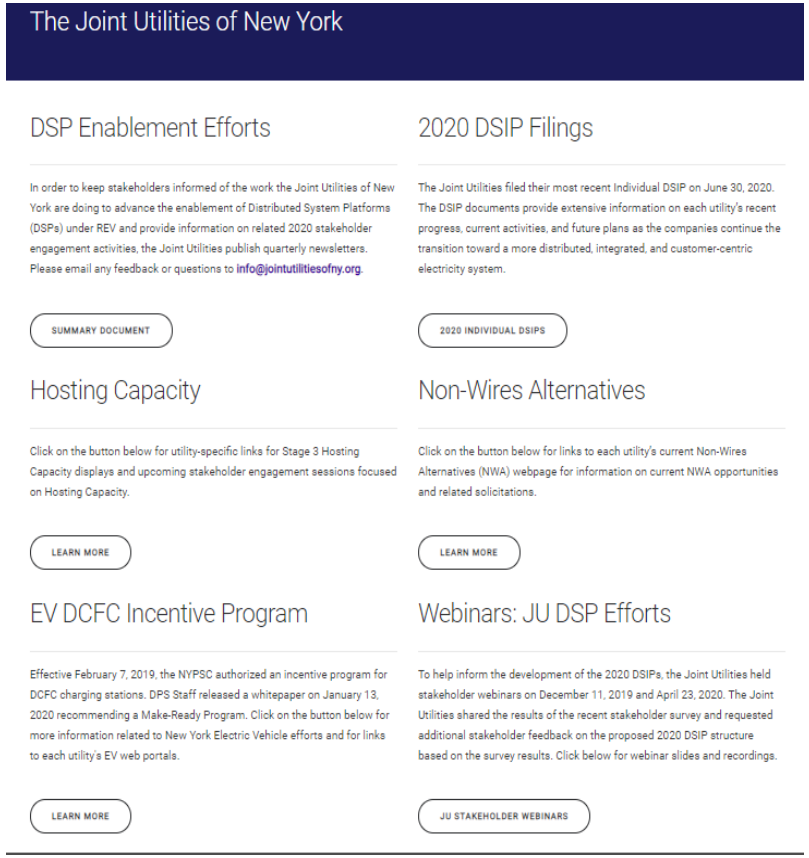
- Stakeholder engagement for distribution system planning is relatively nascent. Among opportunities to improve it:
  - Make the stakeholder process inclusive
  - Provide compensation, particularly for non-traditional stakeholders
  - Consider equity in identifying and assessing grid solutions

…"the Commission has repeatedly pushed Hawaiian Electric to employ best practices, focusing on stakeholder engagement, developing appropriate scenario and sensitivities, and pursuing complete transparency to enable effective review." HI PUC Order 37730

…"the Commission notes that many of the engagement mechanisms described in the Filing appear to be more geared towards the dissemination of utility information…the level of impact of stakeholder information has on the planning process is unclear. " NY PSC Order, September 2021, Case 20-E-197

Stakeholder engagement (2)

- Requirements
  - *Before plan is filed:* Can include significant input through working groups (e.g., CA, DC, HI, MI, NH, NY)
  - *After plan is filed:* Stakeholders can file comments, utility provides periodic updates
- Examples
  - New York - Surveys, newsletters, webinars, meetings, and designated website with links to various sources of information
  - Oregon - Utilities must host at least four stakeholder workshops before filing distribution system plan and file a community engagement plan. A technical working group holds regular meetings for stakeholders before and after plan filings.
  - Hawaii - Stakeholder council, technical advisory panel, working groups (*next slide*)

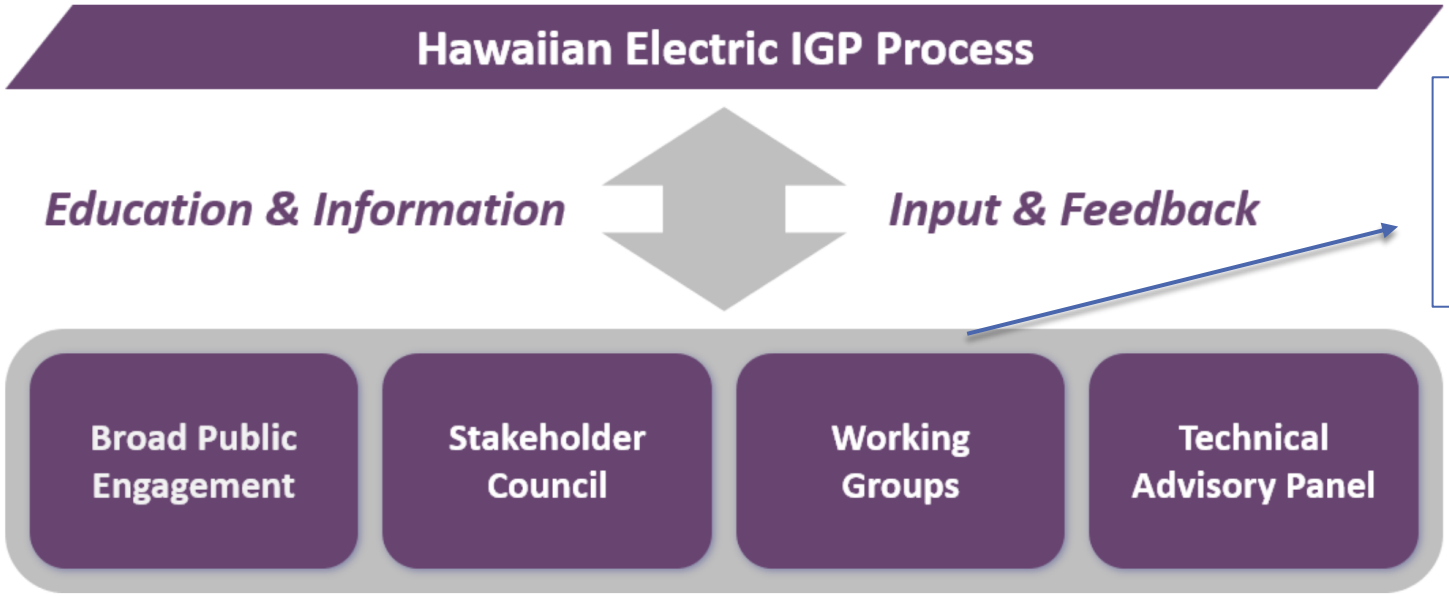


*See *Extra Slides* for Illinois

Hawaii – Integrated Grid Planning
Stakeholder Engagement

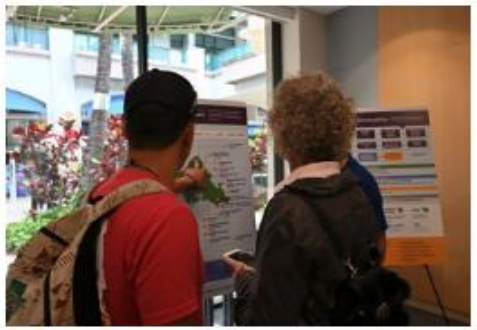
Integrated Grid Planning Stakeholder Council - Industry peer group of experts participating voluntarily to advise on processes, methodologies and technologies

Example meeting slides



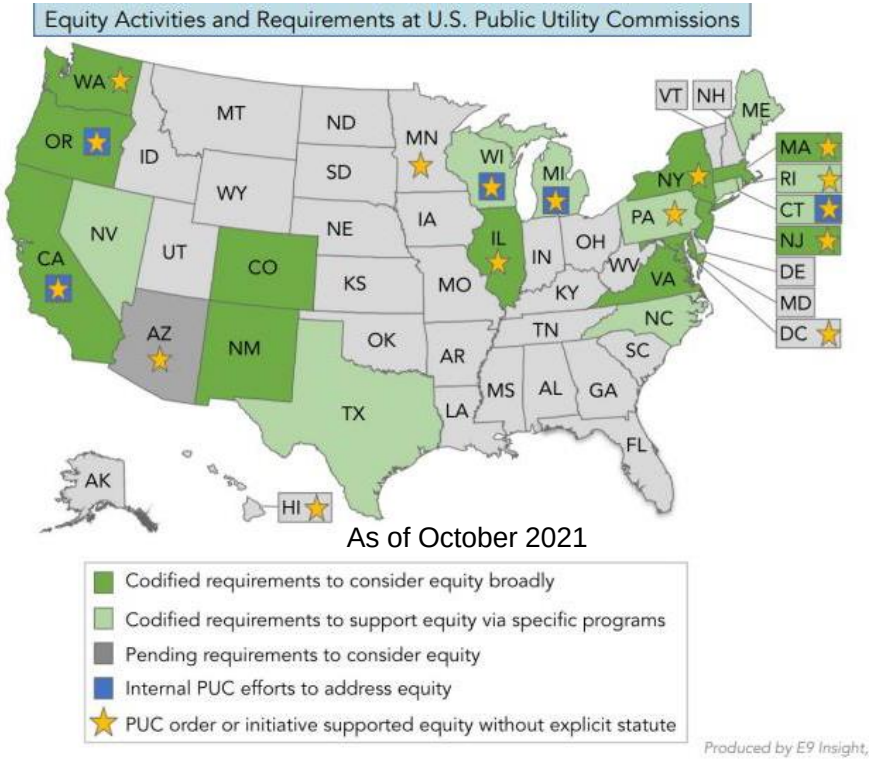
- **Forecasting assumptions**
- **Resilience**
- **Distribution planning**
- **Market***

*** To develop standardized contracts and agreements, define grid services, evaluate and optimize grid solutions, and define competitive procurement process**

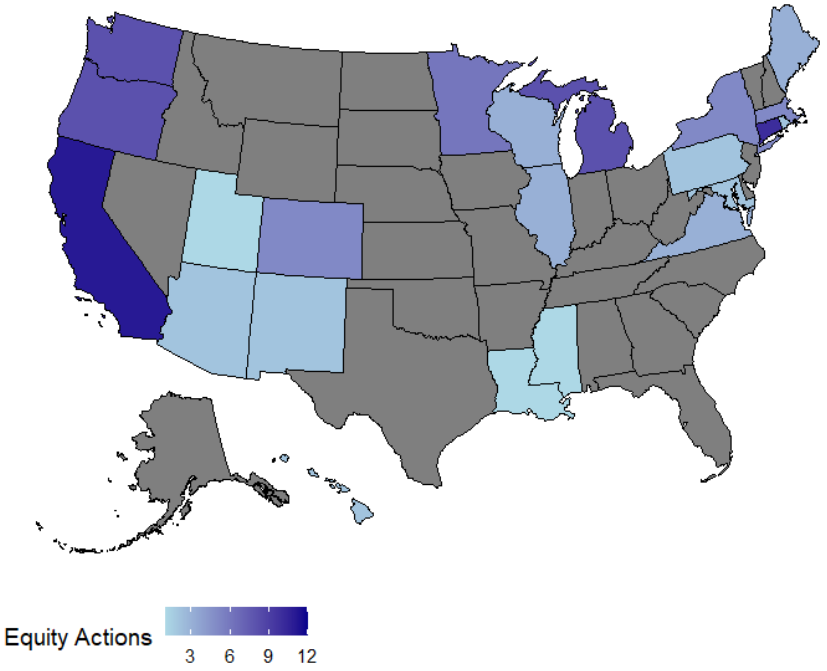


Energy equity and justice (1)

- Many states are adopting energy equity and justice provisions that apply to utility regulation, including planning.
  - To address social, economic and health disparities
  - Through legislation, governor's executive orders, PUC orders, or actions by other agencies*



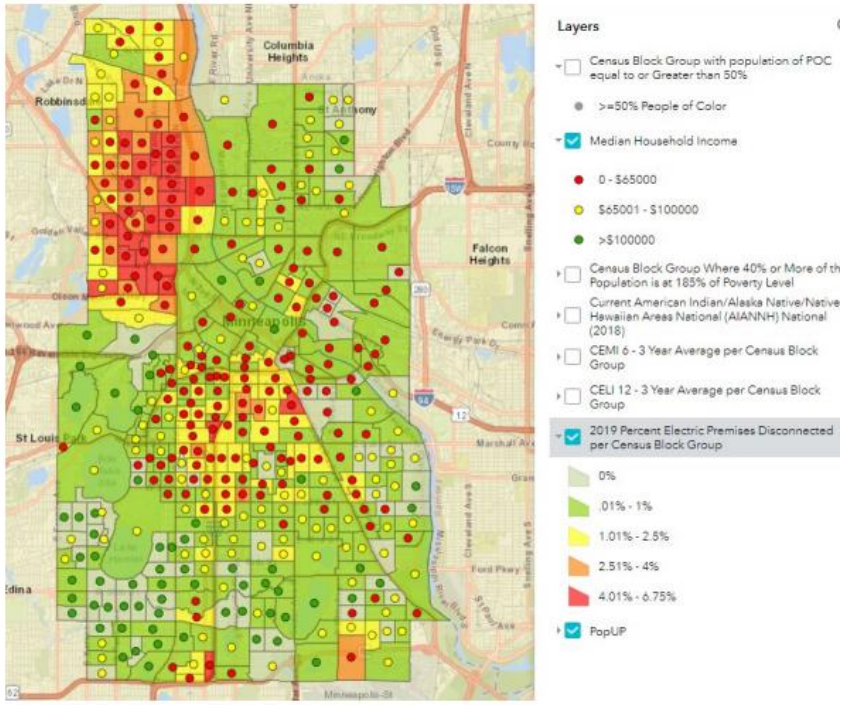
Almost half of U.S. states took action on energy equity between January 2020 and July 2022.



*See Farley et al. 2021, McAdams 2023, Hanus et al. 2023

Energy equity and justice (2)

- OR – Staged approach to stakeholder engagement in distribution planning
  - Order 20-485 initially requires consultation with community-based organizations (CBOs) before plan filing, plus a community engagement plan.* It evolves to active collaboration with CBOs and environmental justice communities so community needs (energy burden, customer choice, resilience) inform distribution projects.
  - Portland General Electric hired CBOs to recruit for and convene community workshops, develop educational materials, and conduct research for PGE's first distribution plan.
  - OR HB 2475 (2021) provides OPUC authority to provide financial assistance to organizations that represent broad customer interests, including environmental justice organizations, in regulatory proceedings.
- MN – PUC required Xcel Energy to map reliability and service quality metrics and demographic data to reveal any equity issues (Dec. 18, 2020, order in Docket 20-406).
- ME – Integrated grid planning law requires "An assessment of the environmental, equity and environmental justice impacts of grid plans."



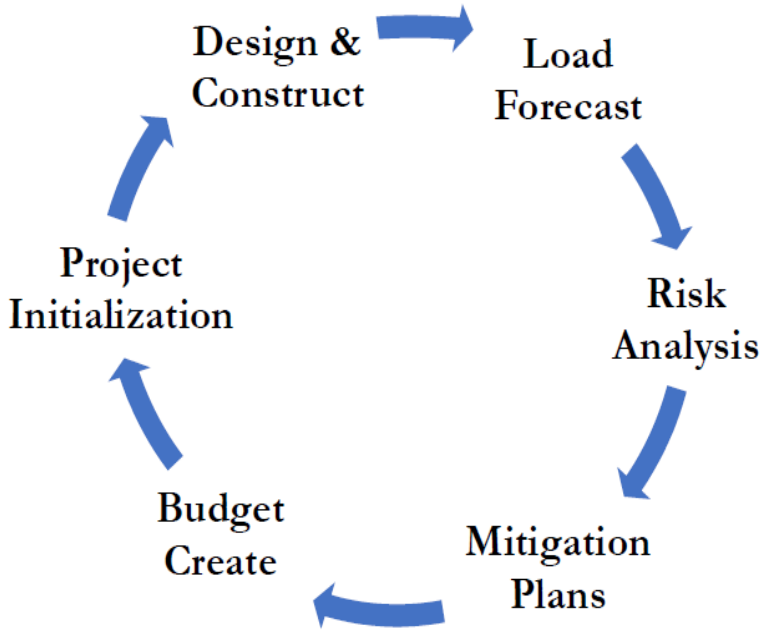
Source: Xcel Energy, Oct. 1, 2021, filing, Docket 20-406

*For example, see section 3.4 in PGE's 2021 Distribution System Plan.

See *Extra Slides* for Washington

Substantive elements (1)

- Baseline information on current state of distribution system
  - Such as system statistics, reliability performance, equipment condition, historical spending by category
- Description of planning process
  - Load forecast – projected peak demand for feeders and substations
  - Risk analysis for overloads and plans for mitigation
  - Budget for planned capacity projects
    - Asset health analysis and system reinforcements
    - Upgrades needed for capacity, reliability, power quality
    - New systems and technologies
    - Ranking criteria (e.g., safety, reliability, compliance, financial)
- Distribution operations — vegetation management and event management



Source: Xcel Energy 2021

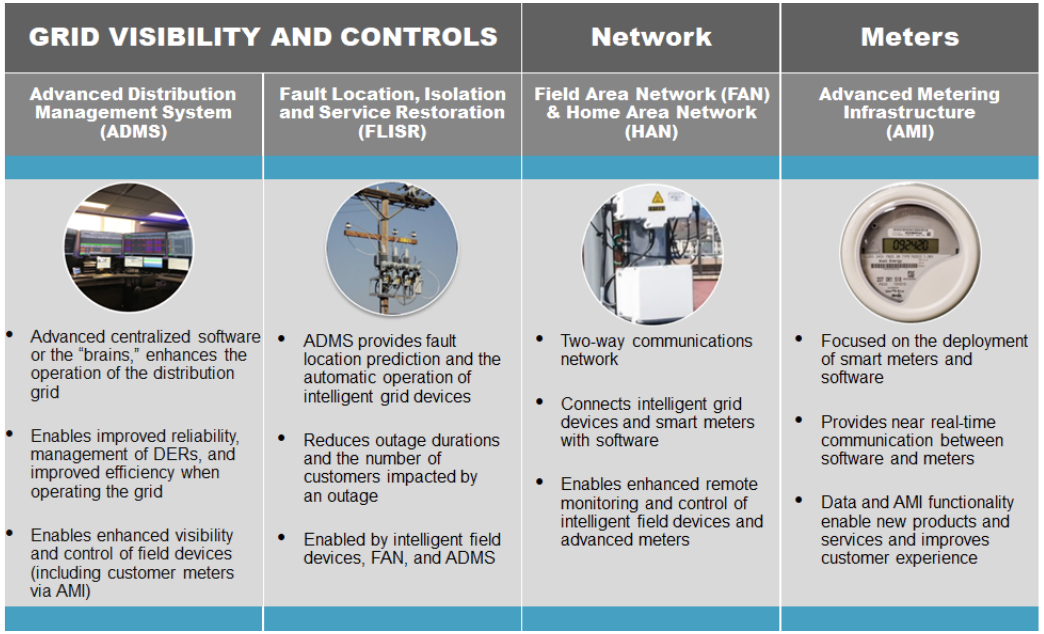
Substantive elements (2)

- DER forecast
  - Types, amounts and locations
- Hosting capacity analysis
  - Including maps
- Grid needs assessment and analysis of non-wires alternative (NWA)* to identify:
  - Existing and anticipated capacity deficiencies and constraints
  - Traditional utility mitigation projects
  - A subset of these planned projects that may be suitable for NWA to defer or avoid infrastructure upgrades for load relief, voltage, reducing interruptions, resilience

*DERs that provide specific grid services at specific locations to defer some traditional infrastructure investments

Substantive elements (3)

- Grid modernization strategy
  - Technology roadmap
  - Financial forecast associated with grid modernization plans
  - May include request for certification for major investments
- Action plan
- Additional elements
  - Long-term utility vision and objectives
  - Ways distribution planning is coordinated with transmission planning or integrated resource planning
  - Customer engagement strategy
  - Summary of stakeholder and community engagement
  - Proposals for pilots



Source: Xcel Energy 2021

Substantive elements (4)

- Data access
  - **Customer usage data** - AMI interval data for customers and third parties
  - Some states are requiring utilities to use or evaluate feasibility of the Green Button framework* (e.g., CA, CO, CT, DC, HI, IL, MI, NH, NY and TX).
    - Download My Data – standard enables customer to download their data
    - Connect My Data – data exchange protocol allows automatic transfer of data from utility to third party on customer authorization
  - Some states require specific aggregation levels for data sharing to protect privacy.
  - **System level data** – To support customer and third-party solutions
  - NY, NH, MN, OH, CA and DC are examples of jurisdictions with detailed system data sharing requirements.

Green Button

*The Green Button initiative is an industry-led effort to provide utility customers with easy and secure access to their energy usage information in a consumer-friendly and computer-friendly format.

Minnesota Example

Principles and planning objectives for DSP in Minnesota

- Maintain and enhance the safety, security, reliability, and resilience of the electricity grid, at fair and reasonable costs, consistent with the state's energy policies.
- Enable greater customer engagement, empowerment, and options for energy services.
- Move toward the creation of efficient, cost-effective, accessible grid platforms for new products and services, with opportunities for adoption of new distributed technologies.
- Ensure optimized use of electricity grid assets and resources to minimize total system costs.
- Provide the Commission with the information necessary to understand Xcel's short-term and long-term distribution system plans, the costs and benefits of specific investments, and a comprehensive analysis of ratepayer cost and value.

These objectives are repeated in all DSP orders and other commission communications.

Source: Minnesota Public Utilities Commission Staff Report on Grid Modernization, March 2016

How one state put together the pieces: Minnesota (1)

- Minn. Stat. §216B.2425 (2015) requires the largest utility (Xcel Energy) to submit biennial transmission and distribution plans to the Public Utilities Commission
  - To *"identify … investments that it considers necessary to **modernize the transmission and distribution system by enhancing reliability, improving security against cyber and physical threats, and by increasing energy conservation opportunities** …."*
  - May ask Commission to **certify priority projects and approve costs through a rider** — a finding that the project is consistent with requirements of statute, not a prudency determination
  - Analyze hosting capacity for *small-scale distributed generation resources* and *identify necessary distribution upgrades to support [their] continued development*
- Xcel Energy 1st grid modernization report (Docket 15-962)
- Xcel Energy 2nd grid modernization report (Docket 17-776)

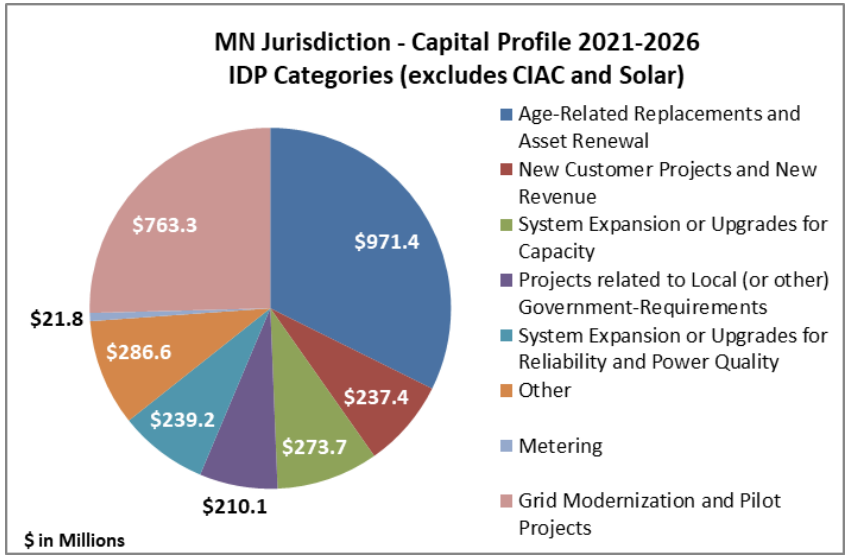
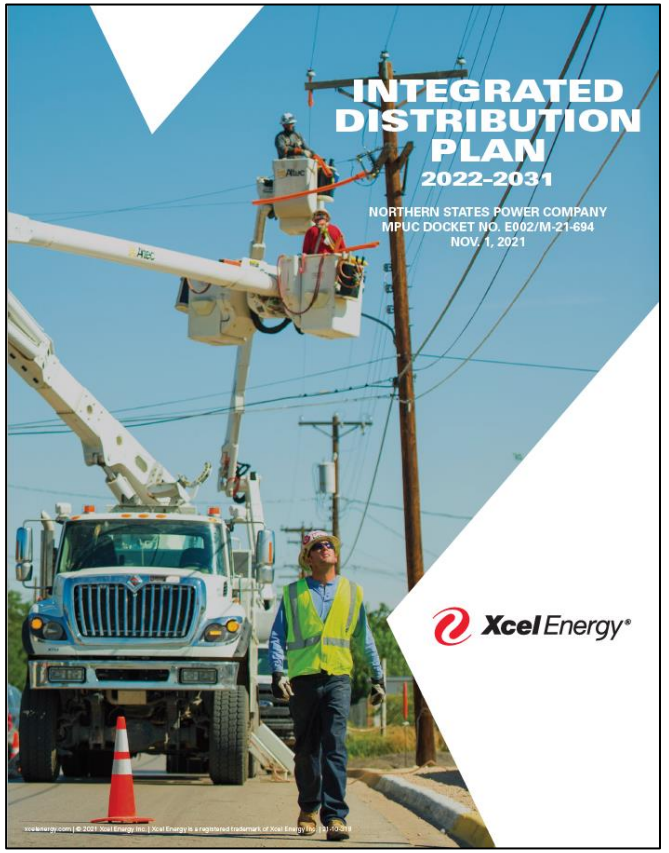


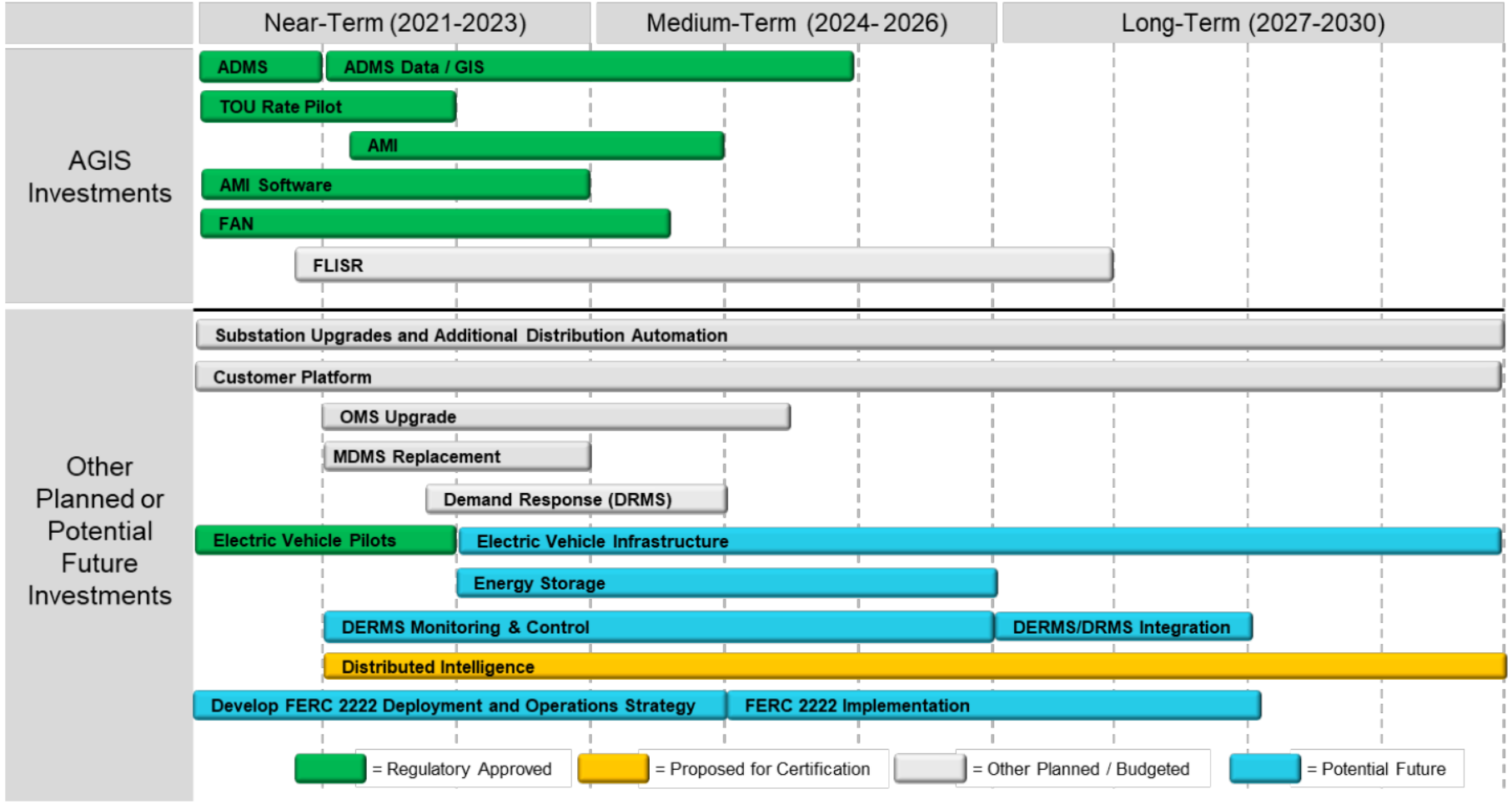
Figure: Xcel Energy 2021

How one state put together the pieces: Minnesota (2)

- Commission inquiry on Electric Utility Grid Modernization focused on integrated distribution planning (Docket CI-15-556)
  - Series of stakeholder meetings
  - Questionnaire to utilities on utility planning practices and stakeholder comments
  - Staff report defined grid modernization, proposed a phased approach, and identified principles to guide it
- The Commission established Integrated Distribution Planning (IDP) requirements for Xcel Energy (Docket 18-251) and smaller regulated utilities (Dockets 18-253, 18-254 and 18-252) — and principles.
- Xcel Energy filed its 1st IDP in 2018 (Docket 18-251), a 2nd IDP in 2019 (Docket 19-666), and a 3rd IDP in 2021 (Docket 21-694).
  - Grid modernization plan is now filed *with* biennial IDP filing.
  - Transportation electrification information and data will be filed in each utility's IDP beginning Nov. 1, 2023.



Illustrative Distribution System Investment Plan



Source: Xcel Energy 2021

AGIS – Xcel Energy's Advanced Grid Intelligence and Security initiative, ADMS – Advanced Distribution Management System, GIS – Geographic Information System, AMI – Advanced Metering Infrastructure, FAN – Field Area Network (visibility and control), FLISR - Fault Location, Isolation, and Service Restoration, OMS – Outage Management System, MDMS – Meter Data Management System, DERMS – DER Management System

Resources for more information

U.S. Department of Energy's (DOE) *Modern Distribution Grid*, Vol. IV, 2021

Berkeley Lab's integrated distribution system planning website: https://emp.lbl.gov/projects/integrated-distribution-system-planning

Berkeley Lab's research on time- and locational-sensitive value of DERs

A. Cooke, J. Homer, L. Schwartz, *Distribution System Planning – State Examples by Topic*, Pacific Northwest National Laboratory and Berkeley Lab, 2018

P. De Martini et al., *The Rising Value of Stakeholder Engagement in Today's High-Stakes Power Landscape*, ICF, 2016

P. De Martini et al., *Integrated Resilience Distribution Planning*, PNNL, 2022

T. Eckman, L. Schwartz and G. Leventis, *Determining Utility System Value of Demand Flexibility From Grid-interactive Efficient Buildings*, Berkeley Lab, 2020

N. Hanus et al., *Assessing the Current State of U.S. Energy Equity Regulation and Legislation*, Berkeley Lab/PNNL, 2023

C. Farley et al., *Advancing Equity in Utility Regulation*, Future Electric Utility Regulation Series, Berkeley Lab, 2021

N. Frick, S. Price, L. Schwartz, N. Hanus and B. Shapiro, *Locational Value of Distributed Energy Resources*, Berkeley Lab, 2021

J. Homer, A. Cooke, L. Schwartz, G. Leventis, F. Flores-Espino and M. Coddington, *State Engagement in Electric Distribution Planning*, Pacific Northwest National Laboratory, Berkeley Lab and National Renewable Energy Laboratory, 2017

J.S. Homer, Y. Tang, J.D. Taft, D. Lew, D. Narang, M. Coddington, M. Ingram, A. Hoke, *Electric Distribution System Planning with DERs — Tools and Methods*, Pacific Northwest National Laboratory and National Renewable Energy Laboratory, 2020

ICF, *Integrated Distribution Planning: Utility Practices in Hosting Capacity Analysis and Locational Value Assessment*, 2018

J. McAdams, *State Energy Justice Roundtable Series: Energy Justice Metrics*, NARUC, 2023

Smart Electric Power Alliance, *Integrated Distribution Planning: A Framework for the Future*, 2020

N.L. Seidman, J. Shenot, J. Lazar, *Health Benefits by the Kilowatt-Hour: Using EPA Data to Analyze the Cost-Effectiveness of Efficiency and Renewables*, Regulatory Assistance Project, 2021

Y. Tang, J.S. Homer, T.E. McDermott, M. Coddington, B. Sigrin, B. Mather, *Summary of Electric Distribution System Analyses with a Focus on DERs*, Pacific Northwest National Laboratory and National Renewable Energy Laboratory, 2017

T. Woolf, B. Havumaki, D. Bhandari, M. Whited and L. Schwartz, *Benefit-Cost Analysis for Utility-Facing Grid Modernization Investments: Trends, Challenges and Considerations*, Berkeley Lab, 2021

Xcel Energy, *2022-2031 Integrated Distribution Plan*, 2021

Questions?

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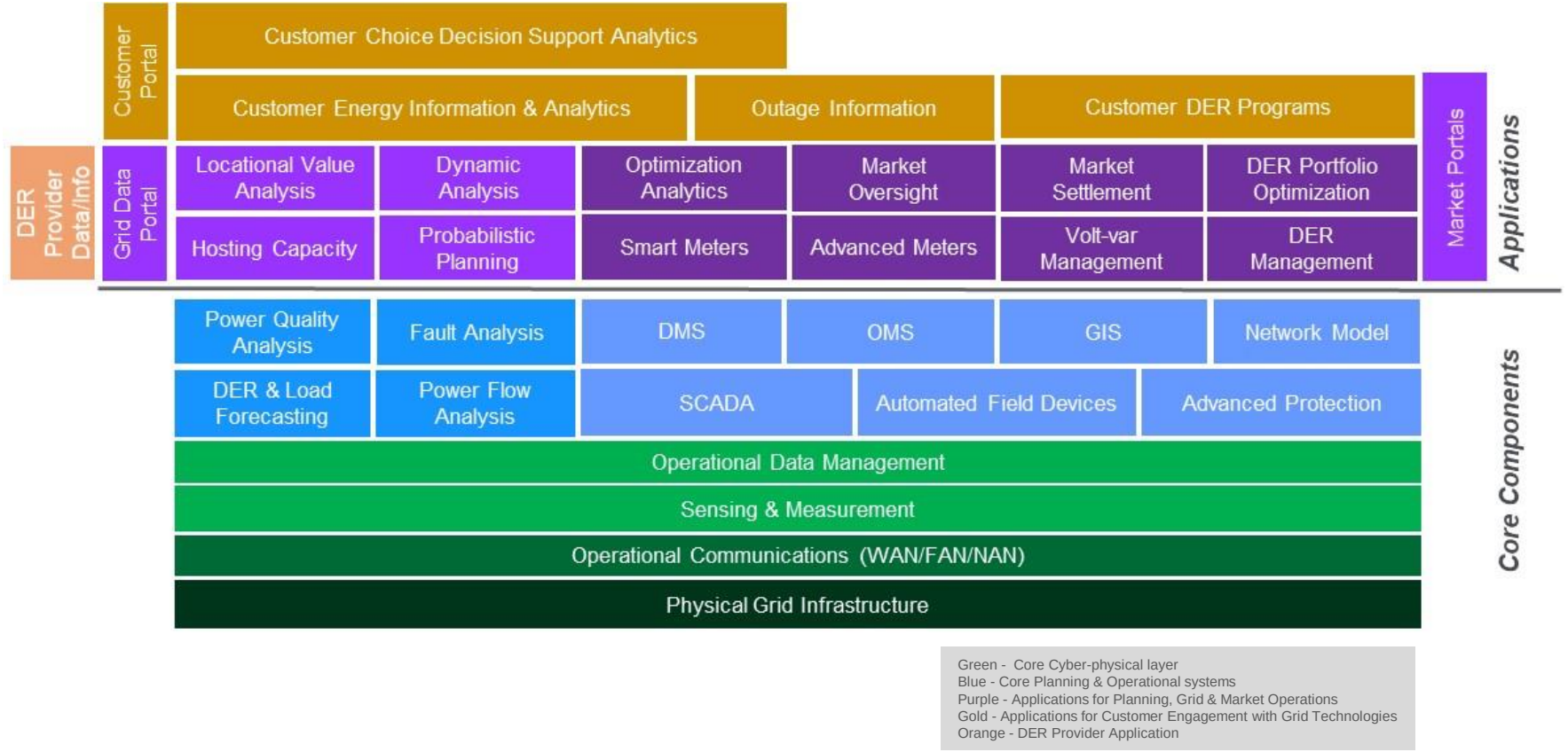
Extra Slides

Layering of core components and applications



Source: U.S. Department of Energy-Office of Electricity Delivery and Energy Reliability, 2017. *Modern Distribution Grid, Volume III: Decision Guide*.

Procedural elements - Confidentiality

- Confidentiality for security or trade secrets — for example:
  - Level of specificity for hosting capacity maps
  - Peak demand/capacity by feeder
  - Values for reliability metrics
  - Contractual cost terms
  - Bidder responses to solicitations for non-wires alternatives
  - Proprietary model information

Illinois – Stakeholder engagement in multi-year Integrated Grid Plans

- The Illinois Commission adopted multi-year integrated grid plan rules in December 2021 that apply to Ameren and ComEd (state's two largest utilities). A significant stakeholder engagement process informs the utility grid plans.
  - Before the workshops begin, utilities must provide the Commission with prescribed information, including preliminary proposals on capital investments the utility plans to make in the near future. The Commission will make the information publicly available on their website.
  - Workshops are designed to encourage diverse stakeholder representation, held during day and evening hours in a variety of locations and allow for remote access.
  - The workshop process should allow stakeholders to effectively and efficiently provide feedback and input to the utility. Stakeholders can submit data requests to the utility prior to each workshop on the topics addressed in the workshop, and the utility must respond within 14 days.
  - Minimum of six workshops administered and run by an independent facilitator
- At the conclusion of workshops, the facilitator prepares a draft report describing the process and areas of consensus and disagreement and provides recommendations to the Commission regarding the utility's plan. Stakeholders can comment on the report.

Energy equity and justice - Washington

- Washington's Clean Energy Transformation Act (SB 5116, 2019) requires utilities to file Clean Energy Implementation Plans that, in part, ensure equitable distribution of energy and non-energy benefits of the transition to clean energy.
  - The plans must include customer benefit indicators to demonstrate the utility's progress toward meeting this requirement in the following categories:
    - Energy benefits, non-energy benefits, reduction of burdens for highly-impacted communities and vulnerable populations, public health, environment, reduction in cost, reduction in risk, energy security, resilience
  - Utilities also must file multiyear rate plans that include equity performance measures.
  - The Act defines "vulnerable populations" and "highly impacted communities" — collectively "named communities" — and the process utilities must follow to map and engage with them.
    - Each utility has convened an Equity Advisory Group of CBOs and, in consultation with its advisors, listed specific characteristics for mapping and defining named communities.

Highly impacted communities and vulnerable populations
(named communities)

Energy benefits
- Improved participation in clean energy programs from named communities

Reduction of burdens
- Improved participation in clean energy programs from named communities
- Improved affordability of clean energy
- Increase in culturally- and linguistically-accessible program communications for named communities

Non-energy benefits
- Improved participation in clean energy programs from named communities
- Increase in quality and quantity of clean energy jobs
- Improved home comfort

Source: PSE 2021. Also see Avista's Plan.

Portland General Electric (PGE) Distribution System Plan

Angela Long, Sr. Manager of Strategy & Planning

April 2023 | MPUC Grid Plan Priorities Stakeholder Workshop 3 - Docket 2022-00322

PGE An Oregon kind of energy.℠

PGE at a glance

Quick Facts

Vertically integrated electric utility

- Generation: 3,300+ MWs
- Transmission: 153 substations
- Distribution: 695 feeders

~ 900K retail customers (2 million residents)

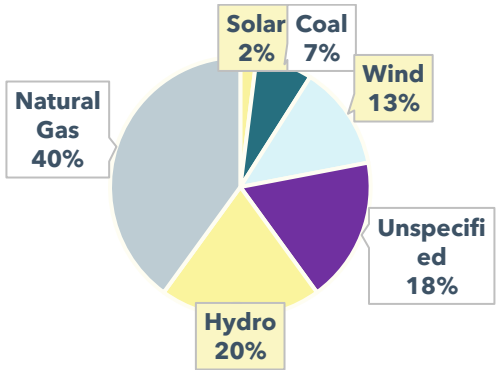
~ 75% state's commercial & industrial

~ 50% state's pop. (51 incorp. cities)

Net System Peak Load

- Summer: 4,441 MW
- Winter: 4,073 MW

35% of power served to customers came from non-emitting energy resources



2021 Resource Mix

Distribution system planning (DSP)

- Why is a DSP important? Without the DSP, a clean, equitable energy future cannot be realized.

- Regulators and partners see the DSP as the place where climate goals, community, and utility evolution can exist together in one holistic story. This is a shift to in utility planning.

- In partnership with customers, communities, partners, stakeholders, and the regulators, we lead the energy transformation to a safe, secure, reliable and resilient system, at fair and reasonable costs.

Traditional distribution planning

DER Programs

Interconnection

Load Forecasting

System Assessment

Grid Needs Identification

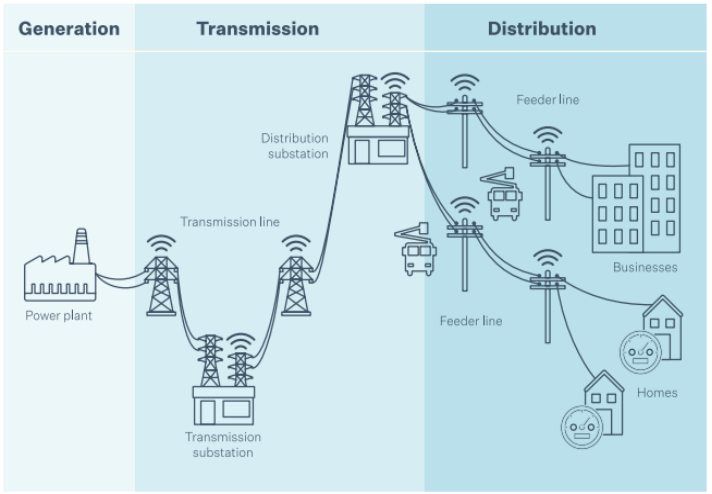
Solution Identification

Project Design and Construction

System Monitoring and Control

Traditional Distribution Planning

Traditional Energy Delivery



Evolution of planning

Equitable energy delivery

Distributed Energy Resource (DER) definitions

National Association of Regulatory Utility Commissioners (NARUC)

- A resource **sited close to customers** that can **provide all or some of their immediate electric and power needs** and can also be used by the system **to either reduce demand** (such as energy efficiency) or **provide supply** to satisfy the **energy, capacity, or ancillary service needs of the distribution grid**.
- The resources, if providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load.
- Examples of different types of DER include solar photovoltaic (PV), wind, combined heat and power (CHP), energy storage, demand response (DR), electric vehicles (EVs), microgrids, and energy efficiency (EE).

Source: NARUC's Distributed Energy Resources Rate Design and Compensation. A Manual Prepared by the NARUC Staff Subcommittee on Rate Design

Oregon Public Utility Commission (OPUC)

- Distributed energy resources includes distributed generation resources, distributed energy storage, demand response, energy efficiency, and electric vehicles that are connected to the electric distribution power grid.

Source: U.S. Department of Energy's Modern Distribution Grid Volume 1: Customer and State Policy Drive Functionality

Oregon DSP requirements

Initial guidelines established under Oregon Public Utility Commission (OPUC) Docket UM2005, Order 20-485 on December 23,2020. Final guidelines expected in Q1 of 2024.

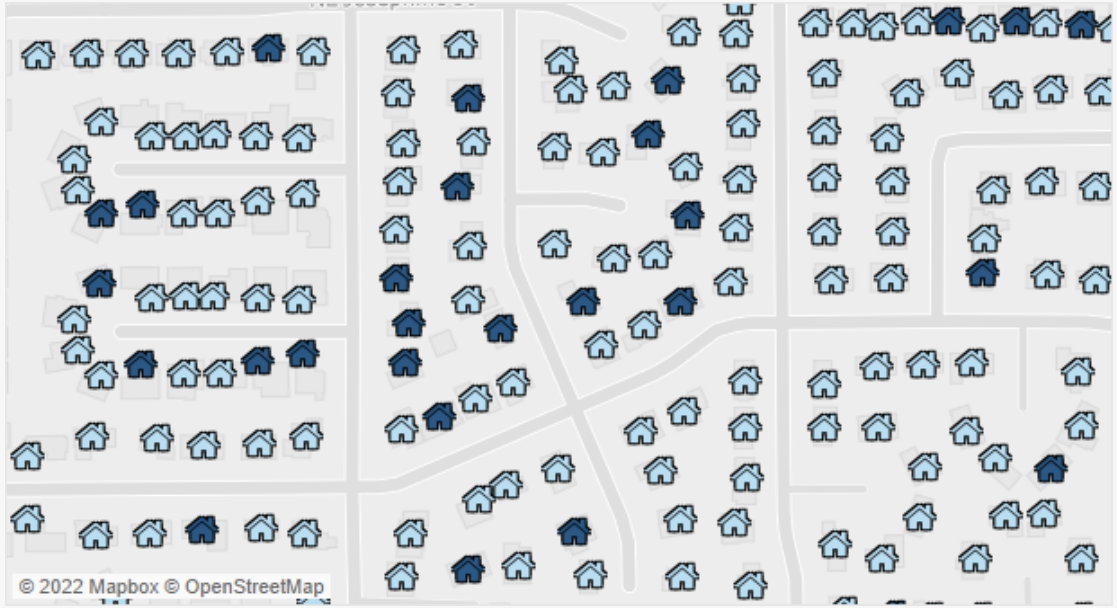
	DSP Part 1 October 2021	DSP Part 2 August 2022	
Transparency, visioning	**Baseline Data & System Assessment** Provide a fundamental understanding of the current physical status of the distribution systems, recent investment in those systems, and the level of DERs currently integrated into those systems.	**Forecasting of Load Growth, DER Adoption, and EV Adoption** Build on legacy load growth forecasting processes by forecasting DER and EV growth at the substation level.	Distribution planning actions
	Hosting Capacity Analysis Conduct system evaluations to identify generation constrained areas where it is difficult to interconnect DERs without system upgrades, present the results through a map on website, prepare an analysis of options for investing in sophisticated HCA	**Solutions Identification** In addition to proposing the equipment, technology or programs needed to meet identified grid needs, develop two or more pilot concept proposals in which non-wire solutions will be used in place of traditional utility infrastructure investments that are collaboratively developed with community stakeholders	
	Community Engagement Plan Develop a plan describing how engagement with community representatives was accounted for in development of the pilot concept proposals required in Solution Identification.	**Grid Needs** Present their methodology of comparing the current capabilities of a distribution system to the forecast demands on that system to meet future needs; including any resulting faults or constraints.	
	Long-term Vision Present a long-term (5-10 year) distribution system investment plans, and address broader goals related to maximizing reliability, customer benefits, and efficient operation of the distribution system.	**Near-term Action Plan** Present proposed solutions to address grid needs, and other investments in the distribution system, in the form of a 2-4 year Action Plan.	

We envisioned a new system

DSP Vision	21st century community-centered distribution system				
DSP Goals	Advance environmental justice goals		Accelerate DER adoption		Maximize grid benefits
DSP Strategic Initiatives	**Empowered communities** Enabling equitable participation in the clean energy transition through human-centered planning and community engagement	**Modernized grid** Optimizing a grid platform that is safe, secure and reliable through current and future grid capabilities	**Resilience** Strengthening the grid's ability to anticipate, adapt to, withstand and quickly recover from disruptive events	**Plug and play** Improving access to DER investments needed to accelerate customers' clean energy transitions through such activities as hosting capacity analysis	**Evolved regulatory framework** Evolving the regulatory framework needed to support utility investment in customer- and community-centered solutions

We developed a model to simulate site-level DER adoption

Site-Level Solar PV Adoption Forecast (Year 2030)

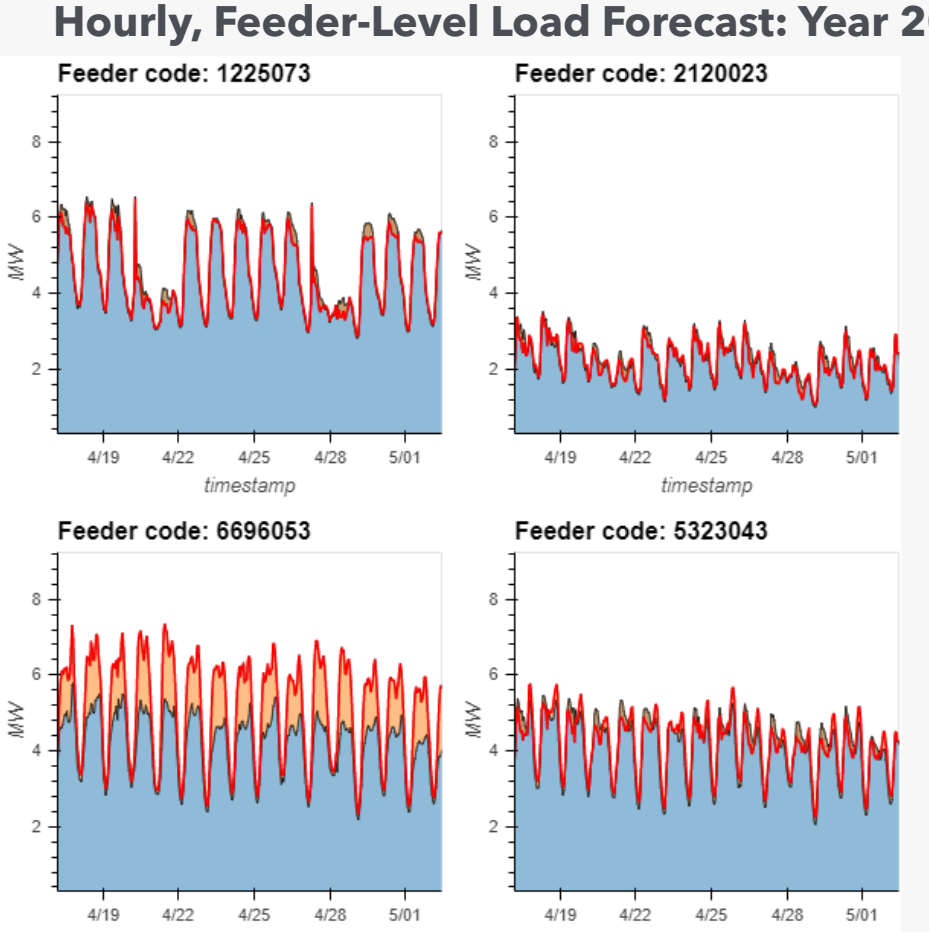


Our **locational DER adoption and load impacts** model: AdopDER.

- 40+ DERs: PV, Storage, TE, BE, DR
- Interactions between DERs
- Site-level adoption forecast
- Hourly, feeder-level load forecasting

Like the locational indices, AdopDER used in DSP proceeding.

And from DER adoption, we product an hourly, locational load forecast



We built a 30-year, hourly load forecast for almost 600 feeders.

DER and electrification will change the load profiles across the grid.

Example: Bottom left: In 2030, we expect a **30%-50% increase in load after DER adoption** on this feeder.

We then layered DEI and resilience on our feeder level forecast

Figure 25. Reference case rooftop solar PV adoption at the feeder level in 2030

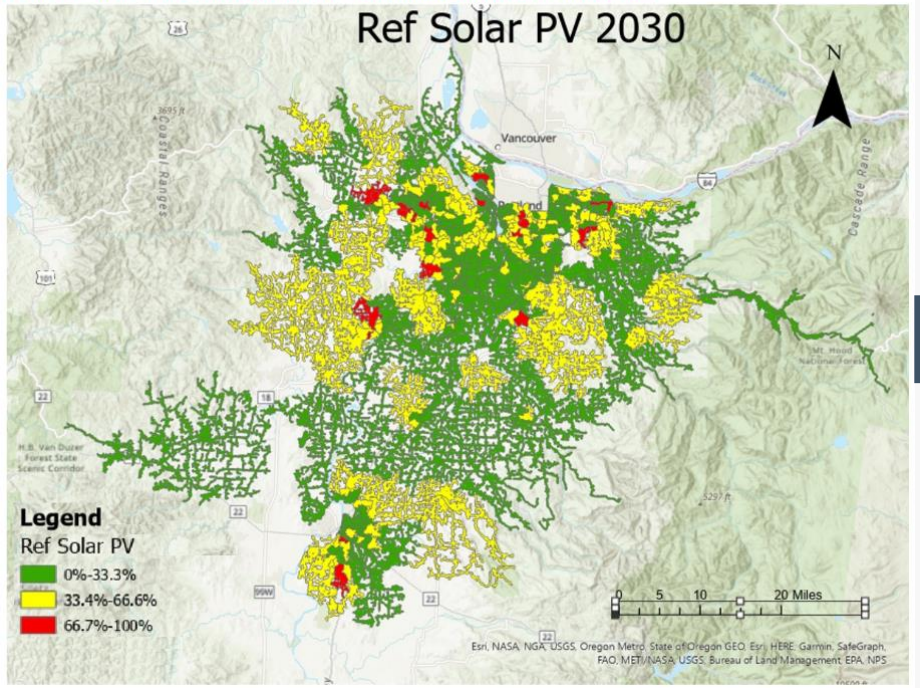
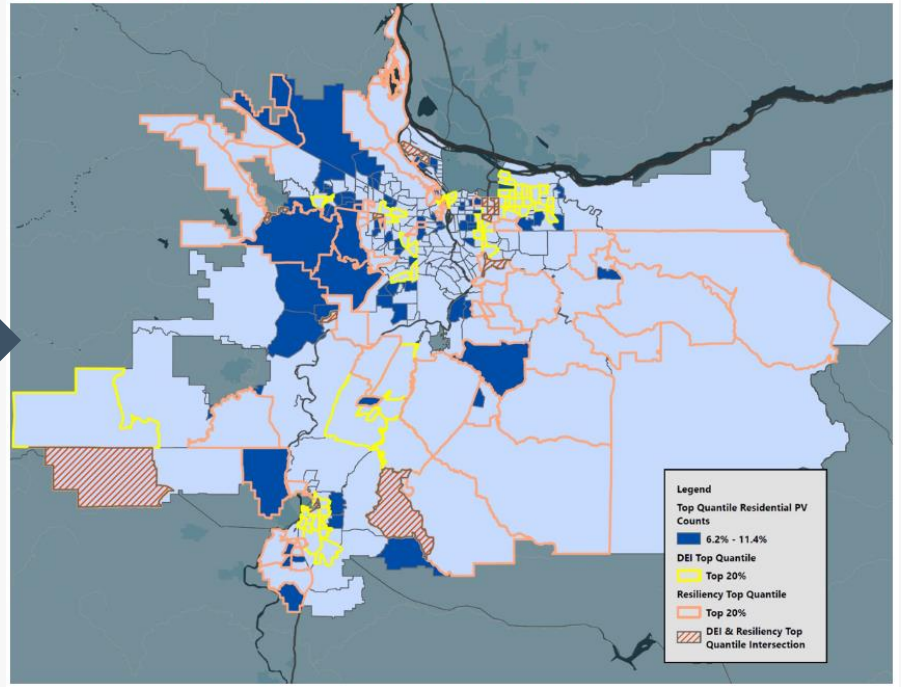


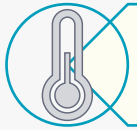
Figure 28. Solar PV locational adoption with DEI and Resiliency Index overlay



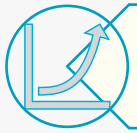
We evolved our ranking matrix for capital planning

Level 5: Safety and customer commitment

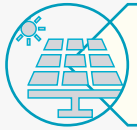
Level 4: Impacts to other facilities



Level 3: Heavy loading, telemetry, & substation risk



Level 2: Feeder risk, load growth, & redundancy

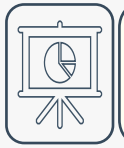


Level 1: System utilization & DG readiness

Equity is now incorporated into the Ranking Matrix, score ranges from 1 to 5

DSP Stakeholder Feedback stated Ranking Matrix levels were too lopsided in the scoring
For example, Level 5 could get a score of 75 due to the multiplier, while Level 1 could get a score of 1

Revamped ranking matrix to remove levels, and adjusted some numbers to reinforce the criticality for things like safety and customer-driven needs



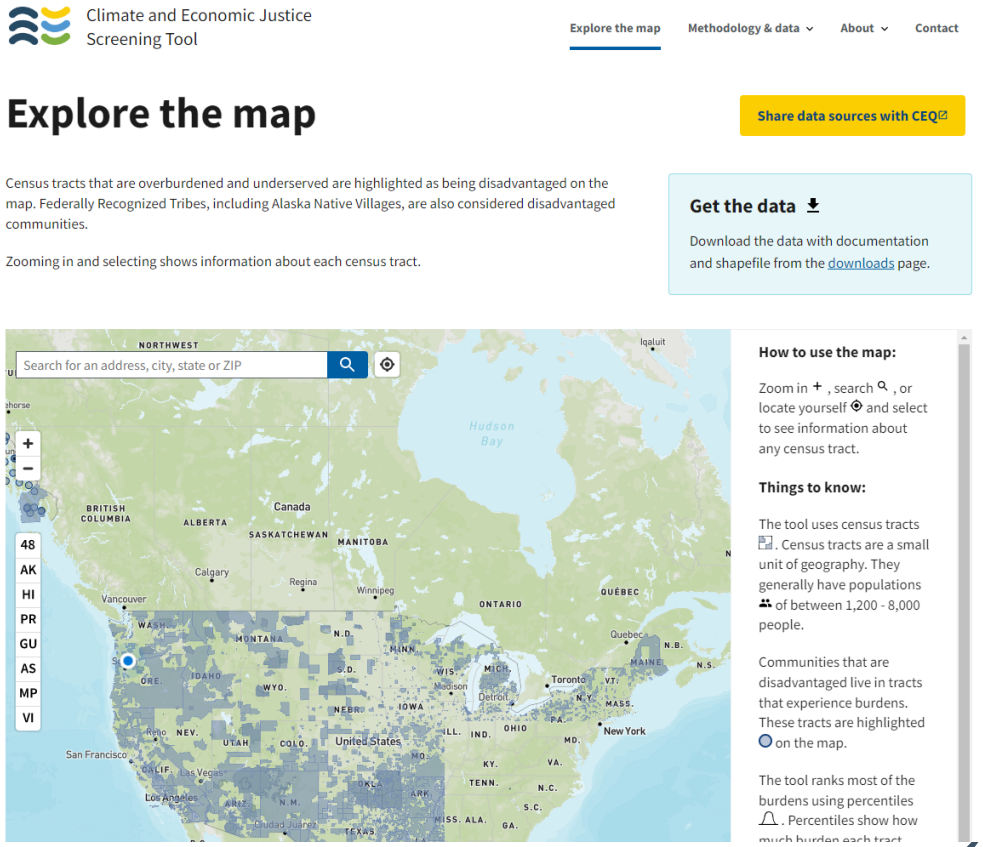
Result is the highest possible score for a single criterion in the matrix is a 20

New Tie Breaker criteria includes all the former Level 5 and Level 4 criteria, as well as Equity

There are a variety of tools that can identify disadvantaged areas

- Climate and Economic Justice Screening Tool (Council on Environmental Quality)
- LEAD (US Department of Energy)
- EJScreen (US Environmental Protection Agency)
- GEM (Greenlink)
- American Community Survey (US Census Bureau)
- Social Equity Analysis (ESRI)
- + others

Screenshot of Climate and Economic Justice



DERs use to be energy efficiency and demand response

California Demand Response Cost-effectiveness Protocol

Test	Perspective	Resources
Total Resource Cost Test (TRC)	Does the investment decrease costs for all customers?	
Ratepayer Impact Test (RIM)	Does the investment increase prices for non-participants?	
Utility Cost Test (UCT)	Does the investment raise the utility's revenue requirement?	
Participant Test (PCT)	Will the participant be better off with the investment (i.e. are savings on the bill greater than the cost of the efficiency gain)?	
Societal Cost Test (SCT)	What is the total net cost/benefit to society, including all collateral impacts?	All DERs

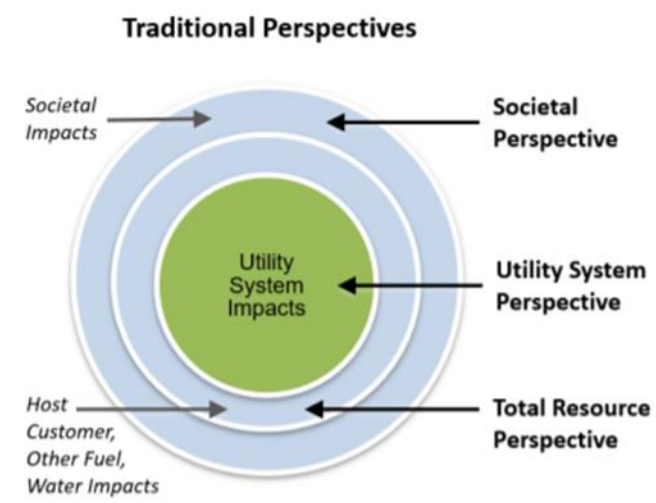
Now, DERs are inclusive of many things such as NWS, Community-based renewables, electrification

National Standard Practice Manual for Benefit-Cost Analysis of DERS

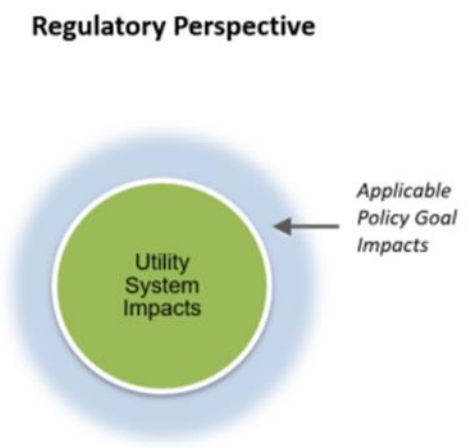
A jurisdictional perspective

Will the cost of meeting utility needs, while achieving policy goals, be reduced?

Figure 3-1. Cost-Effectiveness Testing Perspectives

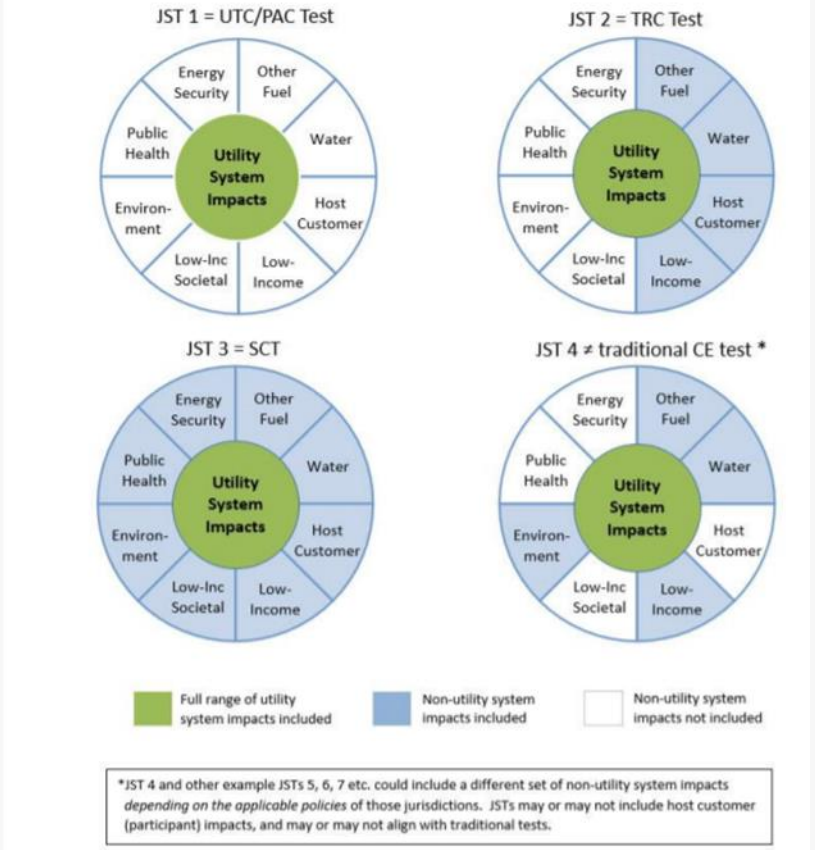


- Three perspectives define the scope of impacts to include in the most common traditional cost-effectiveness tests.



- Perspective of public utility commissions, legislators, muni/coop boards, public power authorities, and other relevant decision-makers.
- Accounts for utility system plus impacts relevant to a jurisdiction's applicable policy goals (which may or may not include host customer impacts).
- Can align with one of the traditional test perspectives, but not necessarily.

Figure 3-2. Example Jurisdiction-Specific Test Relative to Traditional Tests



We are still evolving the distribution system planning and the OPUC is finalizing the guidelines

PGE's DSP can be found at:

https://portlandgeneral.com/about/who-we-are/resource-planning/distribution-system-planning/dsp-resources-materials

Table 50. Evolution of DSP guidelines recommendations

Topic	Recommendation	Status
DER cost-effectiveness / standardized valuation framework	An updated cost-effectiveness model that includes social and environmental policy considerations supports design and evaluation of DER programs and assists in development and approval of non-wires solutions	Staff has recognized this need across multiple dockets. Staff notes its potential inclusion in DSP Guideline revisions in Order 22-083
Comparable treatment of NWS and traditional investments	Regulatory approval process and utility revenue mechanisms should provide explicit incentives to pursue NWS projects that maximize community benefits relative to traditional T&D solutions	Staff notes its potential inclusion in DSP Guideline revisions in Order 22-083
Community engagement metrics	Metric development should be informed by new Community Benefits & Impacts Advisory Group and consistent across engagement areas	Staff notes its potential inclusion in DSP Guideline revisions in Order 22-083. Similar metrics are also being considered in UM 2225 (HB 2021 Investigation into Clean Energy Plans)
System-level and customer data policy	Engage stakeholders in review of additional system attributes recommended by IREC in their DSP Part 1 comments [1]	Staff notes its potential inclusion in DSP Guideline revisions in Order 22-083
Docket integration	Consolidation of several reports and plans into comprehensive DSP guidance can eliminate redundancies	Initially proposed in PGE DSP Part 1 and recognized as need in Order 22-083. Consolidation will require update to guidelines and in some cases may require rule updates

Thank you

An

Oregon

Oregon

Oregon

Oregon

Oregon

kind of energy

Panel Discussion

Ethan Tremblay , Governor's Energy Office

Susan Chamberlin, Office of the Public Advocate

Ian Burnes, Efficiency Maine Trust

Chris Morin, Central Maine Power

Lisa Martin and Debbie Manning, Versant

ELECTRIC POWER ENGINEERS

Jade Cohort Roadmap

- Roadmap for an idealized Comprehensive Electricity Planning Process
- Developed by NARUC-NASEO Task Force on Comprehensive Electricity Planning in 2021
- Multiple Task Forces with members from three states, organized by similar market and regulatory structures
- Jade Cohort represents states with like Maine, with IOUs that don't own generation assets, retail competition, and an ISO market
- Full Roadmap: https://pubs.naruc.org/pub/151E6947-155D-0A36-3190-C87F6548D4C2

NARUC National Association of Regulatory Utility Commissioners

NASEO National Association of State Energy Officials

About Jade: A Fictional, Representative State

Structure	
Regulatory	**Our state's investor-owned utilities** do not own generation assets
Market	**Our state is located** within an RTO/ISO market
Planning Processes	**Our state is seeking to align** distribution planning processes
Additional Characteristics	
A few other characteristics you should know	• We have retail competition • The policy path in our state could be volatile/may not be locked in • Cold and ice can be high-impact resilience events
We are doing this because we want to	• Optimize utility investments and the integration of customer and third-party resources to achieve cost efficiency • Enhance operations and maintenance through increased visibility into the system and better utilization of data analytics • Increase transparency around distribution system planning, including capital investment strategy
While keeping in mind	• Generation assets and connections to G & T • Availability of resource and transmission assets, storage, and combinations of resources • Rate structures and beneficial values • Regulatory jurisdiction lines can be blurry between transmission and distribution • Effects of plans others make for transmission and generation
And trying to be responsive to	• State policy • Stakeholder interests

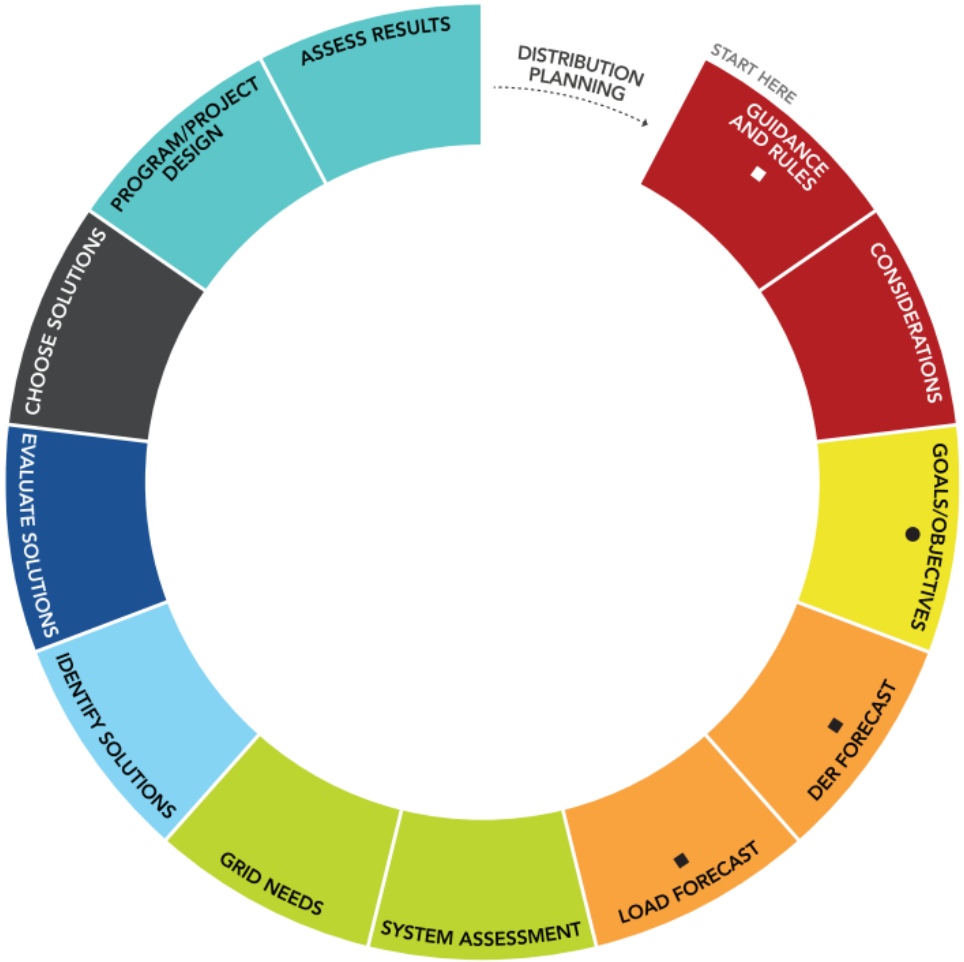
EPE ELECTRIC POWER ENGINEERS

Jade Roadmap Summary

Planning Categories

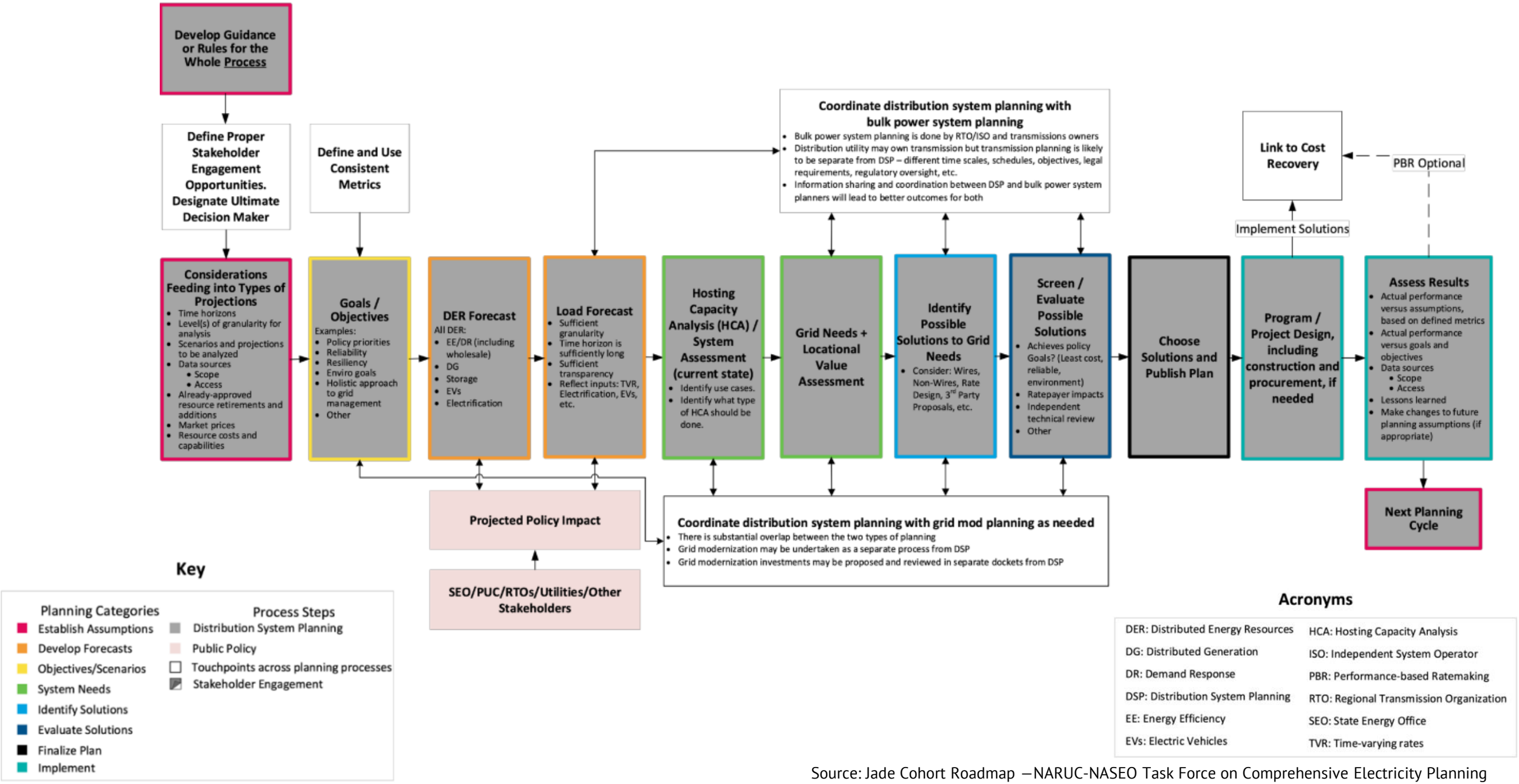
- Establish Planning Assumptions
- Describe the Future Trajectory
- Develop Forecasts
- Identify System Needs
- Identify Solutions to Address Needs
- Evaluate and Apply Criteria to Determine Preferred Solutions
- Finalize Solutions, Approve and Publish Plan
- Implement

- State Policy Inputs to Planning
- State Regulatory Role in Planning



ELECTRIC POWER ENGINEERS

Jade Cohort Flowchart of Idealized Comprehensive Electricity Planning Process



Source: Jade Cohort Roadmap —NARUC-NASEO Task Force on Comprehensive Electricity Planning

Next Workshop – Save the Date: June 7

Process questions, comments or suggestions can be sent to MaineGridPlanning@epeconsulting.com

Stakeholders may always file written comments under "MPUC Proceeding To Identify Priorities for Grid Plan Filings," Case Number 2022-00322: https://mpuc-cms.maine.gov/CQM.Public.WebUI/Common/CaseMaster.aspx?CaseNumber=2022-00322

ELECTRIC POWER ENGINEERS