U.S. DEPARTMENT OF ENERGY

Integrated Distribution System Planning Overview

Training for States on Distribution System and Distributed Energy Resources Planning

Presented by Lisa Schwartz and Natalie Mims Frick

November 29, 2023

Agenda

- Define distribution planning and types of plans filed
- Distribution planning framework
- Planning objectives and priorities
- Stakeholder engagement, equity and justice
- Plan requirements
- Example state practices

For more information, see Berkeley Lab's Integrated Distribution System Planning website

Distribution Planning and Types of Plans Filed

What is distribution system planning?

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

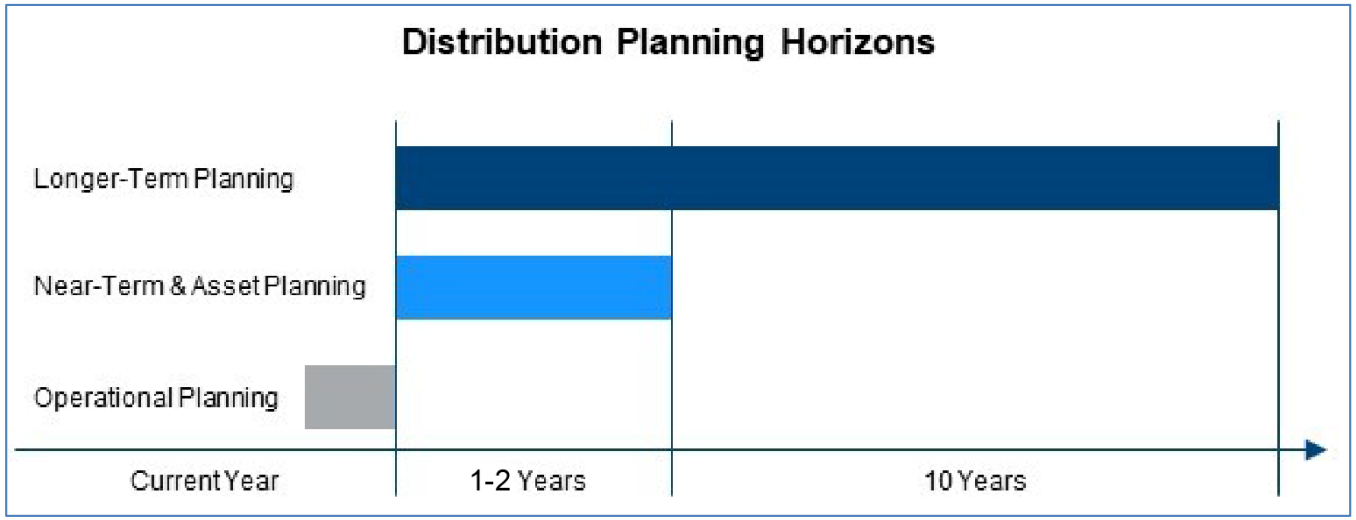
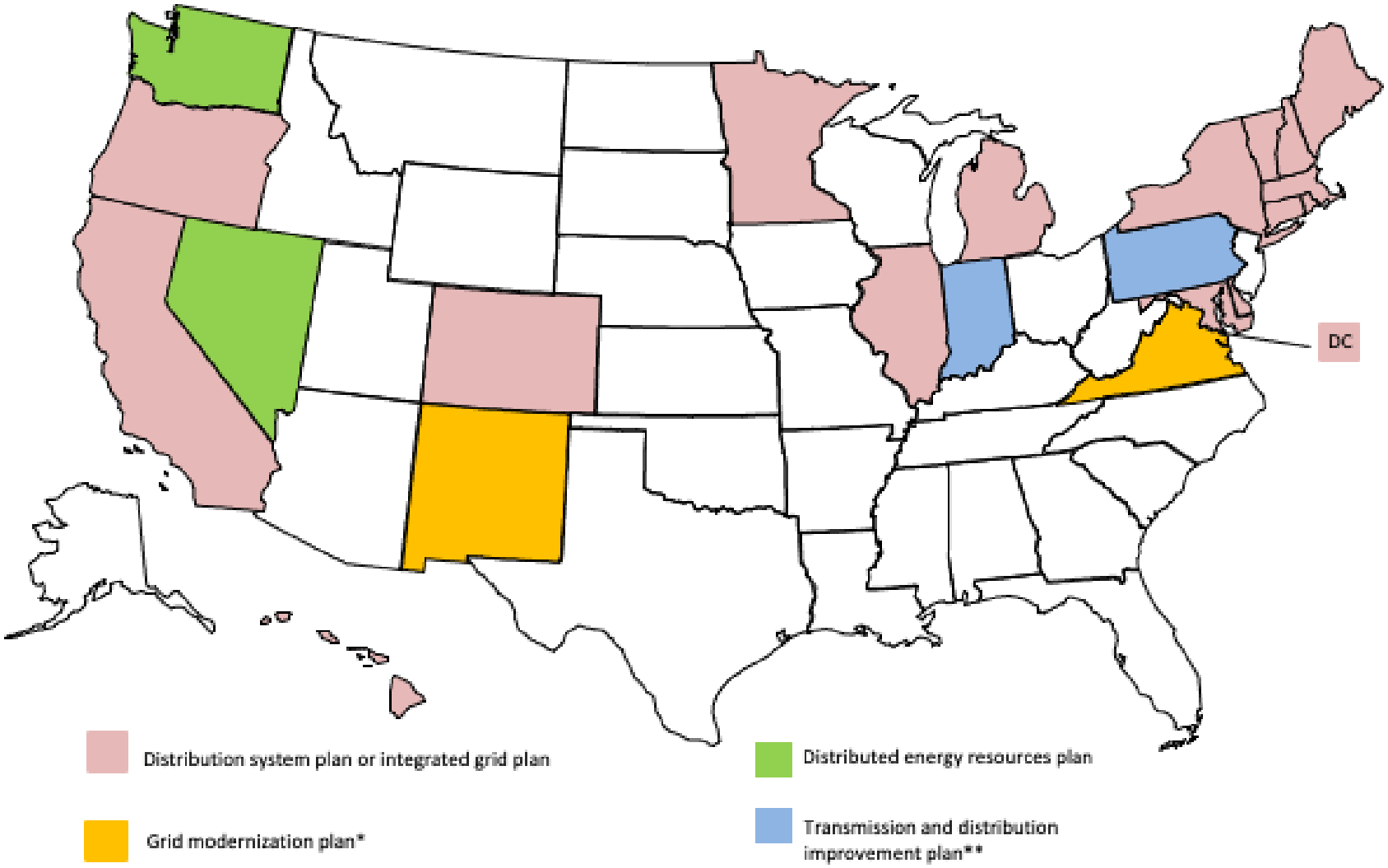


Figure: DOE 2020

States requiring regulated utilities to file distribution plans



*Some states that require distribution system plans also require grid modernization plans (e.g., Minnesota and California).
**Indiana also includes storage.

Source: *State Energy Offices' Engagement in Electric Distribution Planning to Meet State Policy Goals*

Types of distribution plans filed (1)

Distribution system improvement plans

Enables expedited cost recovery for certain system improvements

- Indiana's Transmission, Distribution, and Storage System Improvement Charge can include new or replacement transmission, distribution, or utility storage projects for safety, reliability, system modernization, or economic development.
- Pennsylvania's Distribution System Improvement Charge can be used to recover costs to repair, improve, or replace eligible distribution property.

Distributed energy resources (DERs) plan

Evaluates benefits and costs of DERs, considers ways to increase deployment of cost-effective DERs, and facilitates better integration of DERs in distribution planning

- Regulated utilities in Nevada must submit a Distributed Resource Plan to the Public Utilities Commission every three years as part of their integrated resource plan.
  - Evaluate locational benefits and costs of DERs, including distributed generation systems, energy efficiency, energy storage, electric vehicles (EVs), and demand response technologies
  - DER forecasting and hosting capacity analysis that inform grid needs assessment
  - Propose infrastructure upgrades and non-wires alternatives for identified grid constraints

Types of distribution plans filed (2)

Grid modernization plan

Reasoned strategy linking technology deployment roadmap to stated objectives

- Examples: CA, MA, MN, NM, RI, VA
- A primary focus today is replacing aging infrastructure with advanced grid technologies.
- Plans may include a request for approval of grid modernization investments and programs, with expedited cost recovery.

Integrated distribution system plan (IDSP)

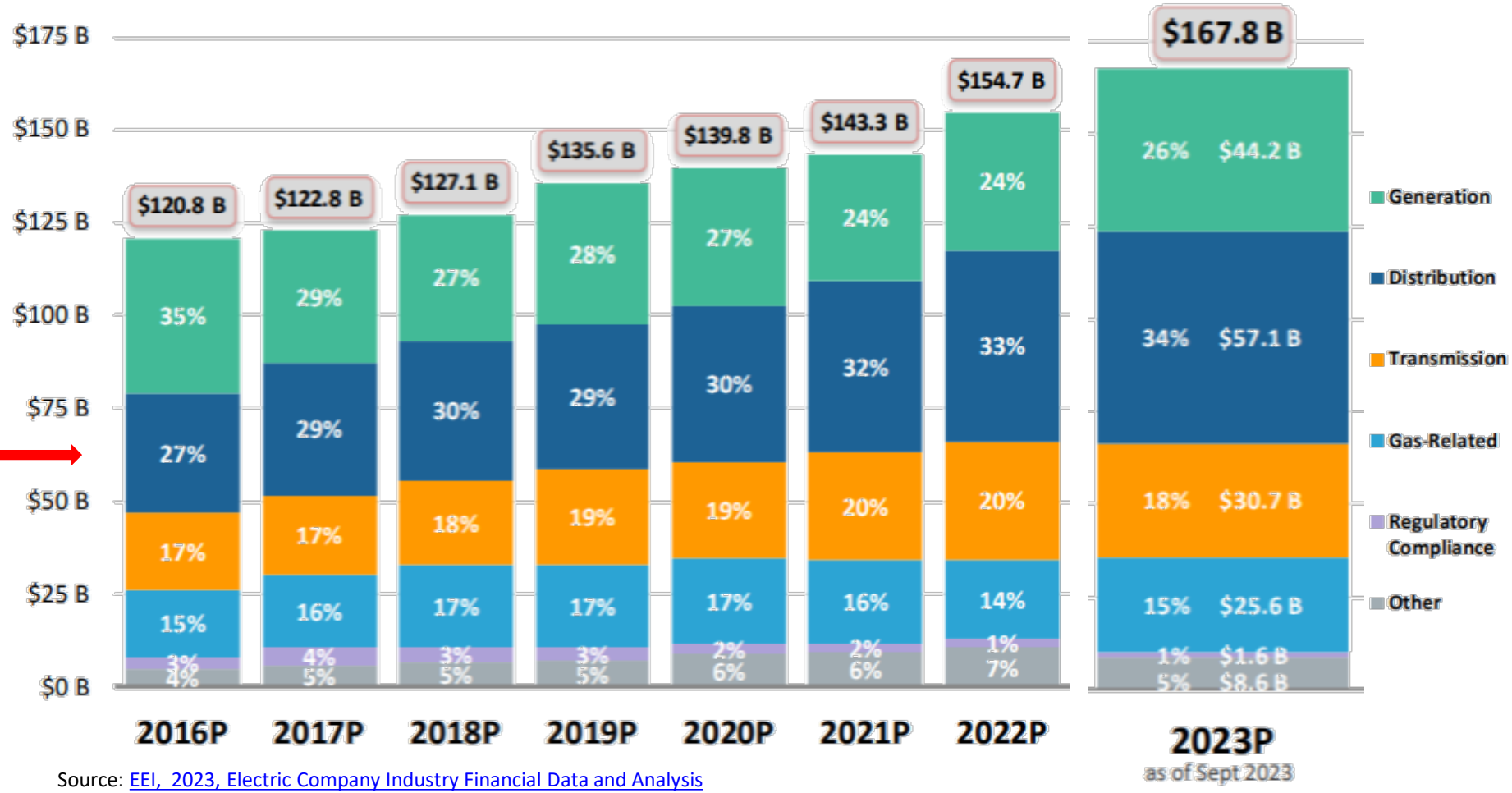
Systematic approach to satisfy customer service expectations and state objectives

- Includes grid mod strategy and DER planning
- May coordinate across planning domains (e.g., HECO's 2023 Integrated Grid Plan, Maine Integrated Grid Plan statute)

Source: EPRI

Why are states increasingly interested in distribution system planning?

Distribution system investments account for the largest portion of capex — for example, 34% in 2023 (projected $57.1B), for U.S. investor-owned utilities.



Source: EEI, 2023, Electric Company Industry Financial Data and Analysis

What are the potential benefits from an improved planning process?

- Makes transparent utility plans for distribution system investments in a holistic manner, before showing up individually in rates
- Provides opportunities for meaningful engagement with stakeholders and (for regulated utilities) regulators to improve outcomes
- Considers uncertainties under a range of possible futures (scenarios)
- Considers all solutions for least cost/risk (including DERs)
- Enables consumers and third-party providers to propose grid solutions and participate in providing grid services (e.g., grid-interactive efficient buildings)

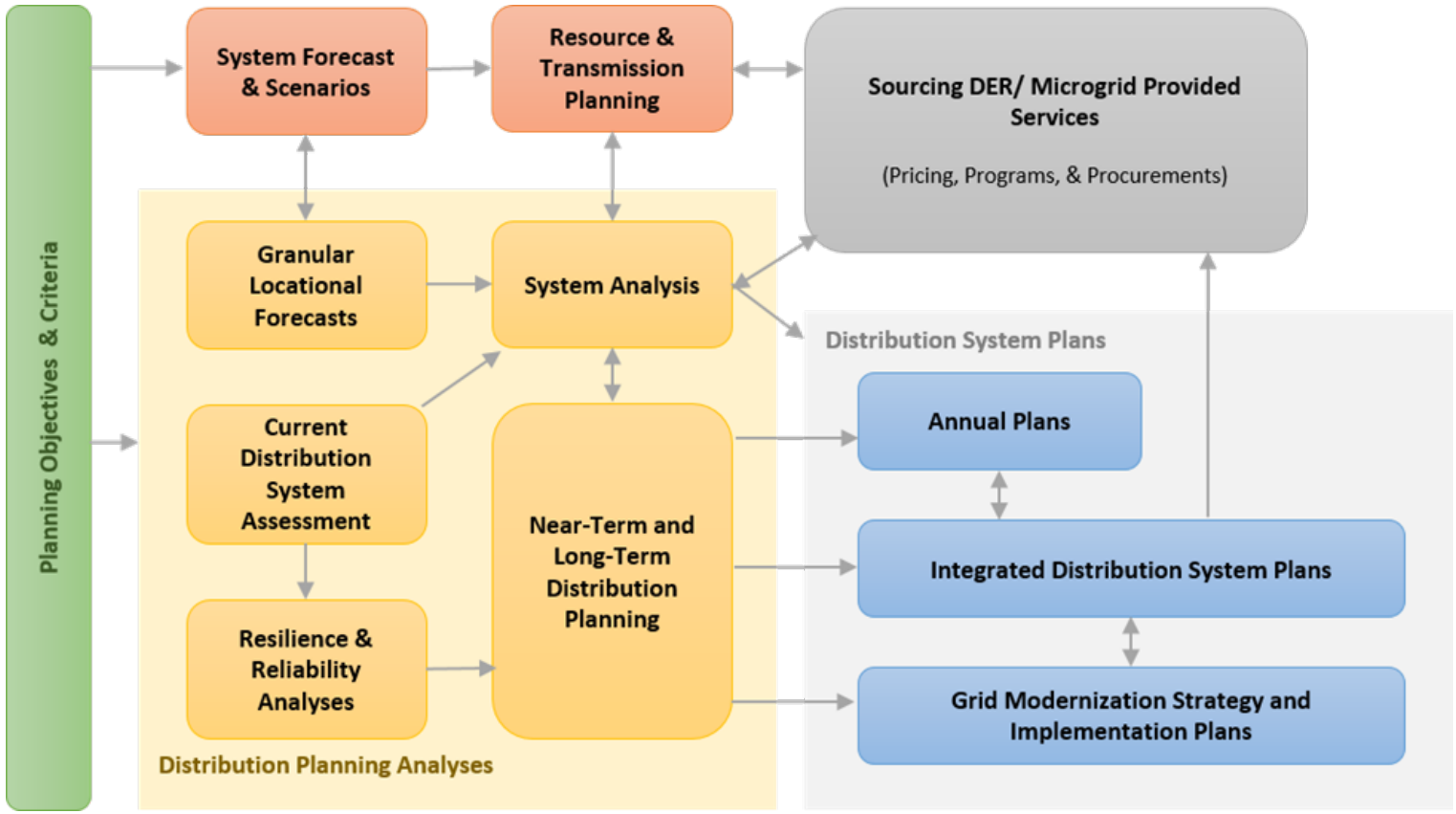
Source: Con Edison

Distribution Planning Framework

Objectives-based planning

Shared understanding among stakeholders of strategies for incorporating objectives and priorities in planning

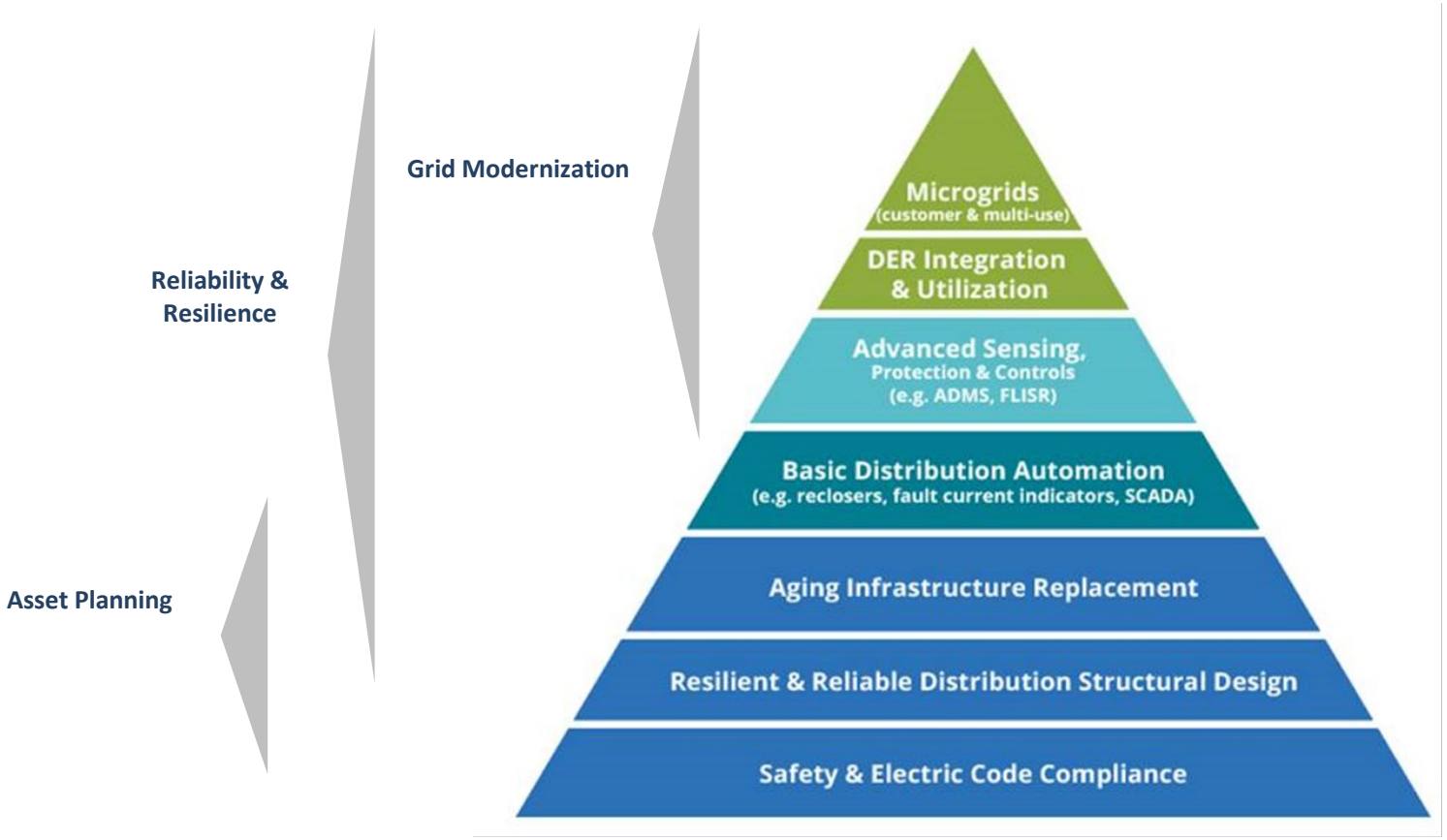
State policies and community and customer needs drive planning objectives and criteria.



Source: Modern Distribution Grid Guidebook, Volume 4, June 2020

Investment categories

Grid modernization layers on top of and integrates with foundational grid infrastructure.



Source: De Martini

Start with principles and objectives instead of picking technologies

- Planning starts with principles and objectives and the capabilities needed to achieve them. That determines functionality and system requirements.
- Holistic, long-term planning:
  - Supports state goals
  - Addresses interdependent and foundational technologies and systems
    - *Core components* — e.g., Advanced Distribution Management System, Geographic Information System, Outage Management System
    - *Applications* to support other grid modernization projects — e.g., smart meters, DER management
  - Considers proactive grid upgrades to facilitate customer choice

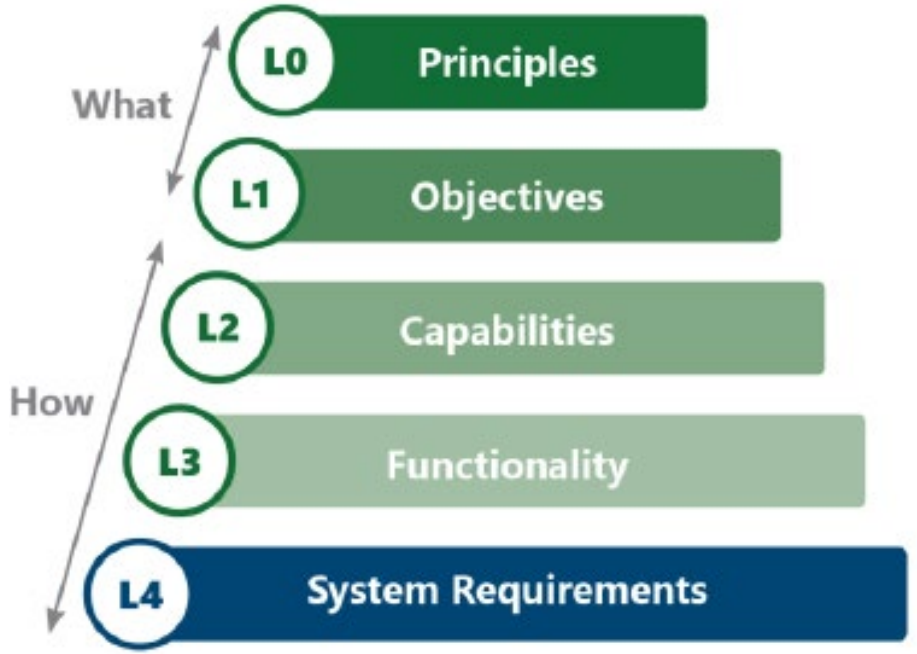
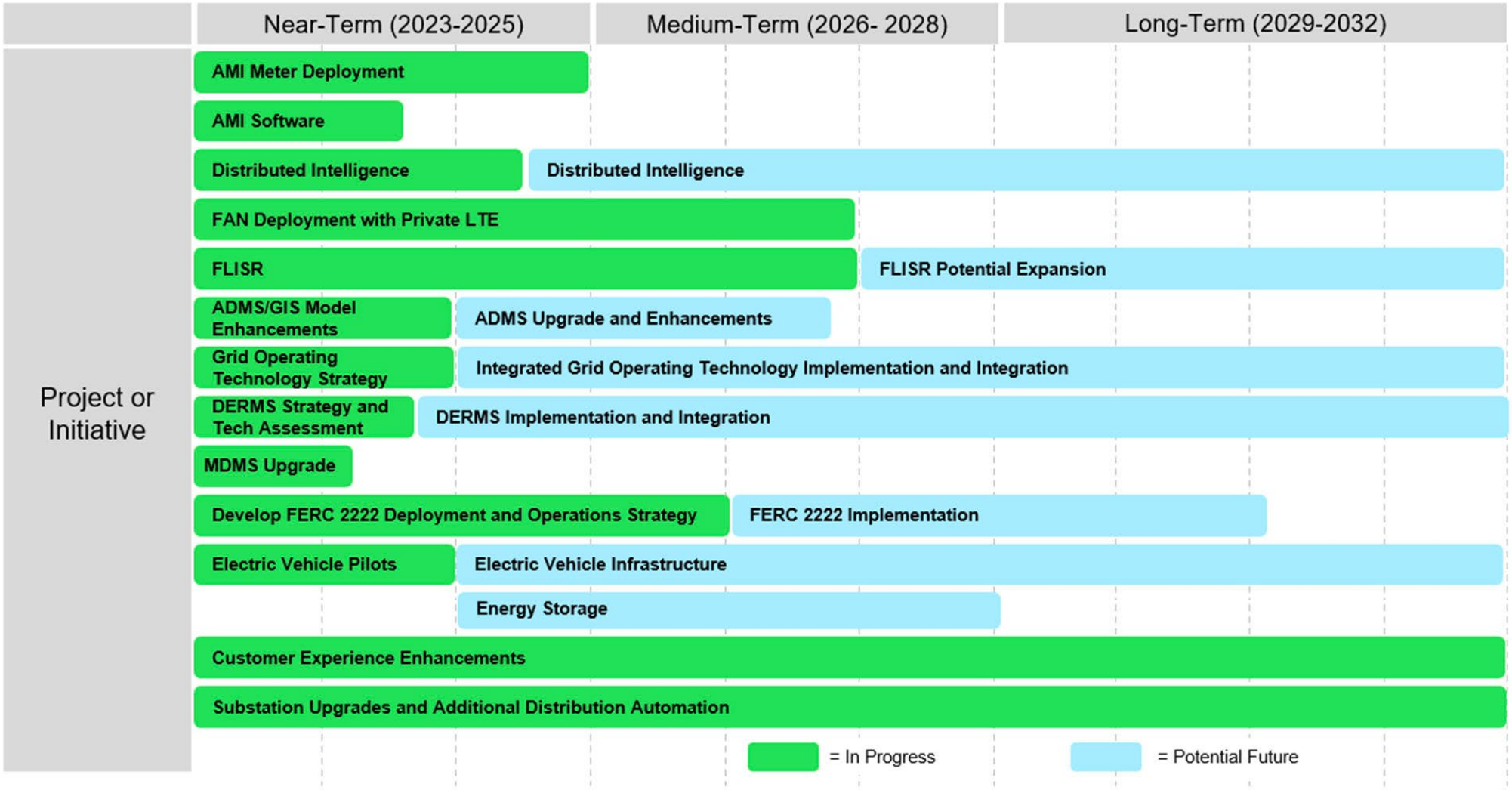


Figure: DOE 2020

For example state principles, see Minnesota Public Utilities Commission Staff Report on Grid Modernization (2016)

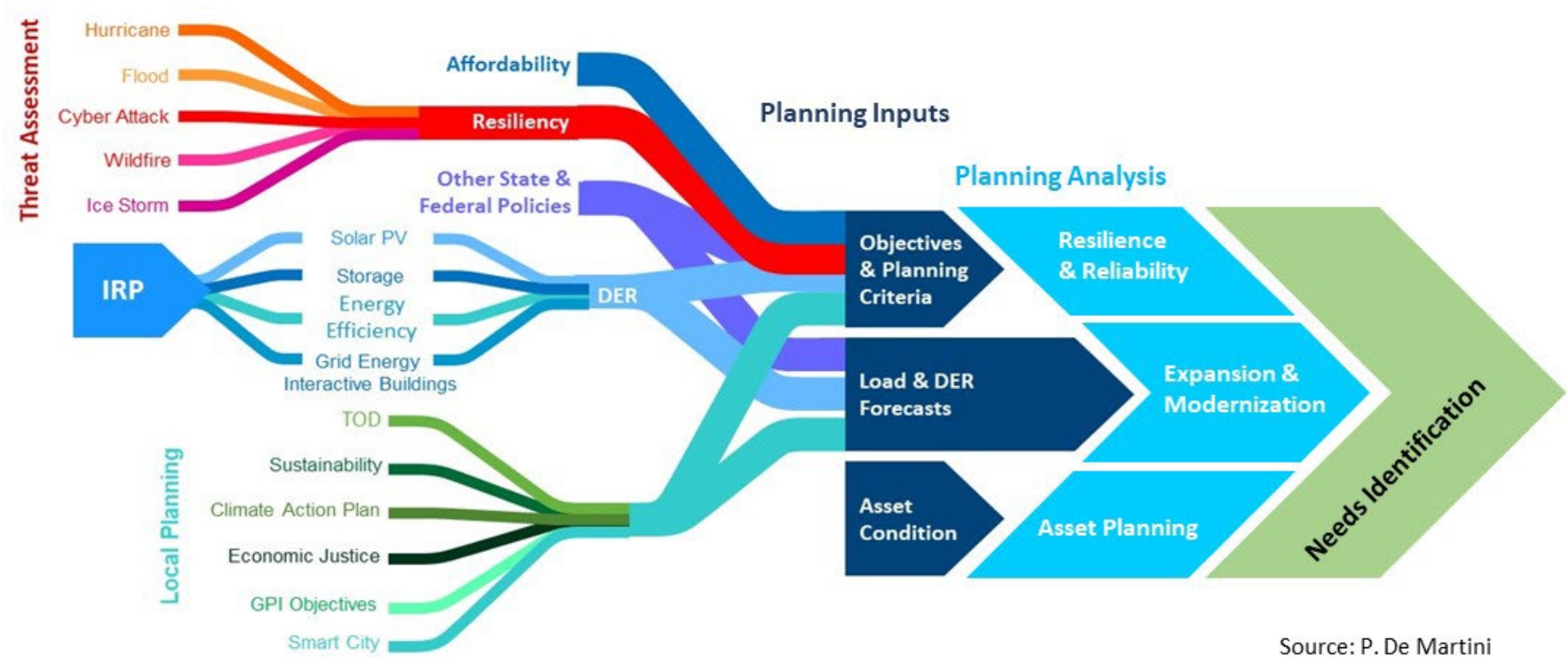
Example technology roadmap



Source: Xcel Energy (2023)

Emerging distribution system planning inputs

Distribution planning is increasingly dependent on resilience planning, bulk power system planning, local planning, and using DERs.



Source: P. De Martini

Integrating planning processes

- NY Distributed System Implementation Plans support 2019 Climate Act and 2022 Scoping Plan
- CA rulemaking on Distribution Resources Planning (DRP) in part required grid mod plans filed with GRCs (2018 decision). New rulemaking to support high levels of DERs (including managed EV charging):
  - Utility roles and responsibilities
  - Utility and aggregator business models
  - More holistic planning process
  - Grid mod investments, smart inverters to provide grid services, and aligning GRC filings with infrastructure needs in DRP
- MN requires grid modernization plan and transportation electrification plan filed with Integrated Distribution Plan
- HI requires planning across domains (G, T, D), aligned with sourcing — procurement, pricing and programs (HECO's 2023 Integrated Grid Plan)

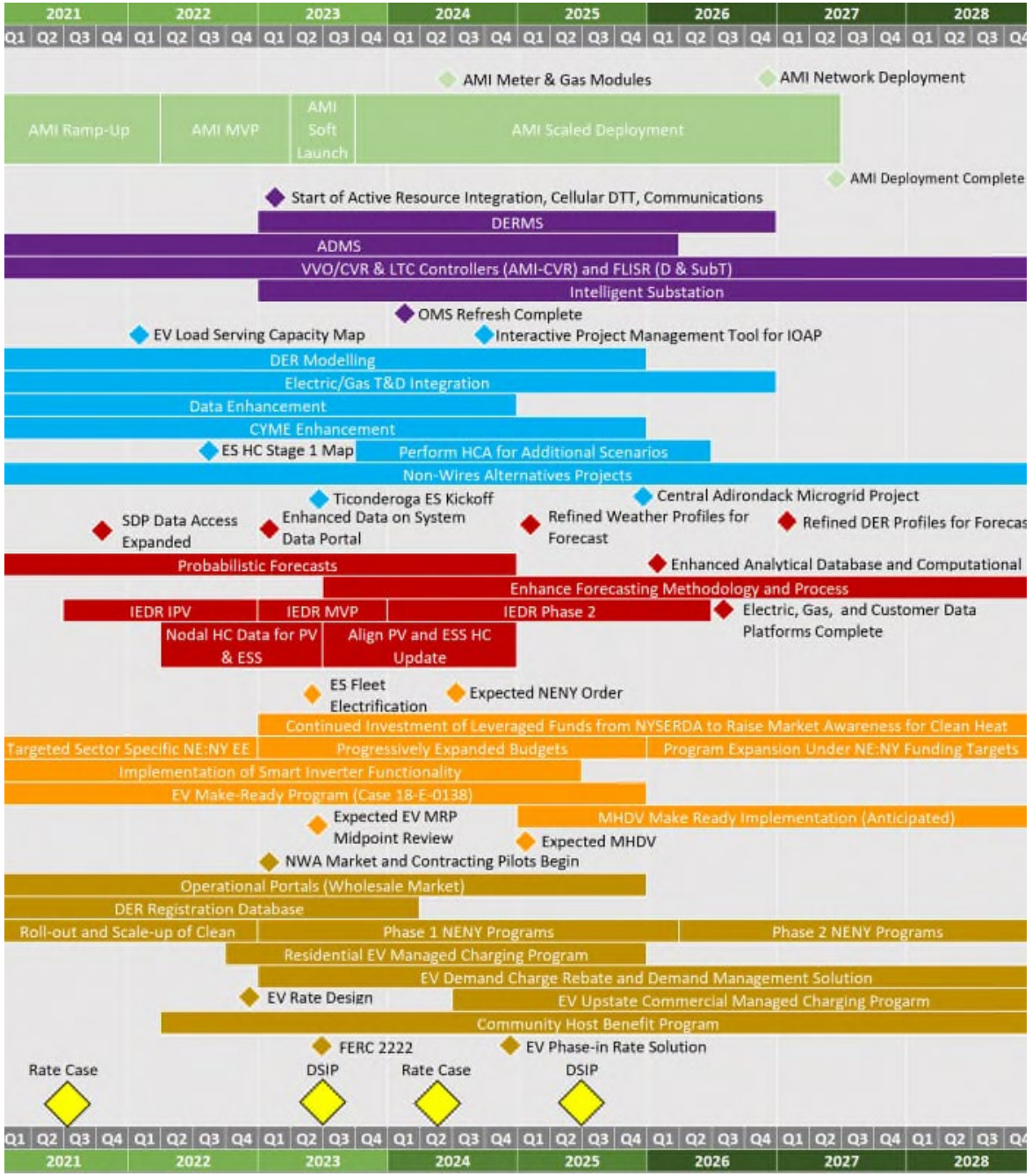
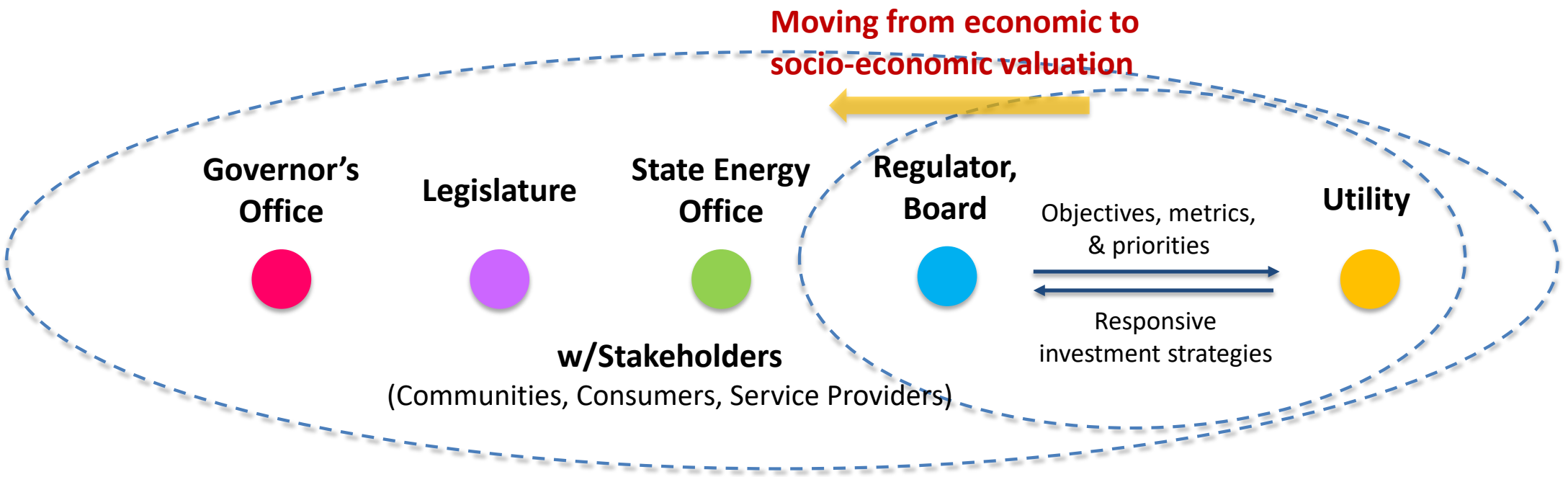


Figure source: National Grid Distributed System Implementation Plan (June 2023)

Planning Objectives and Priorities

Formulation of objectives and priorities

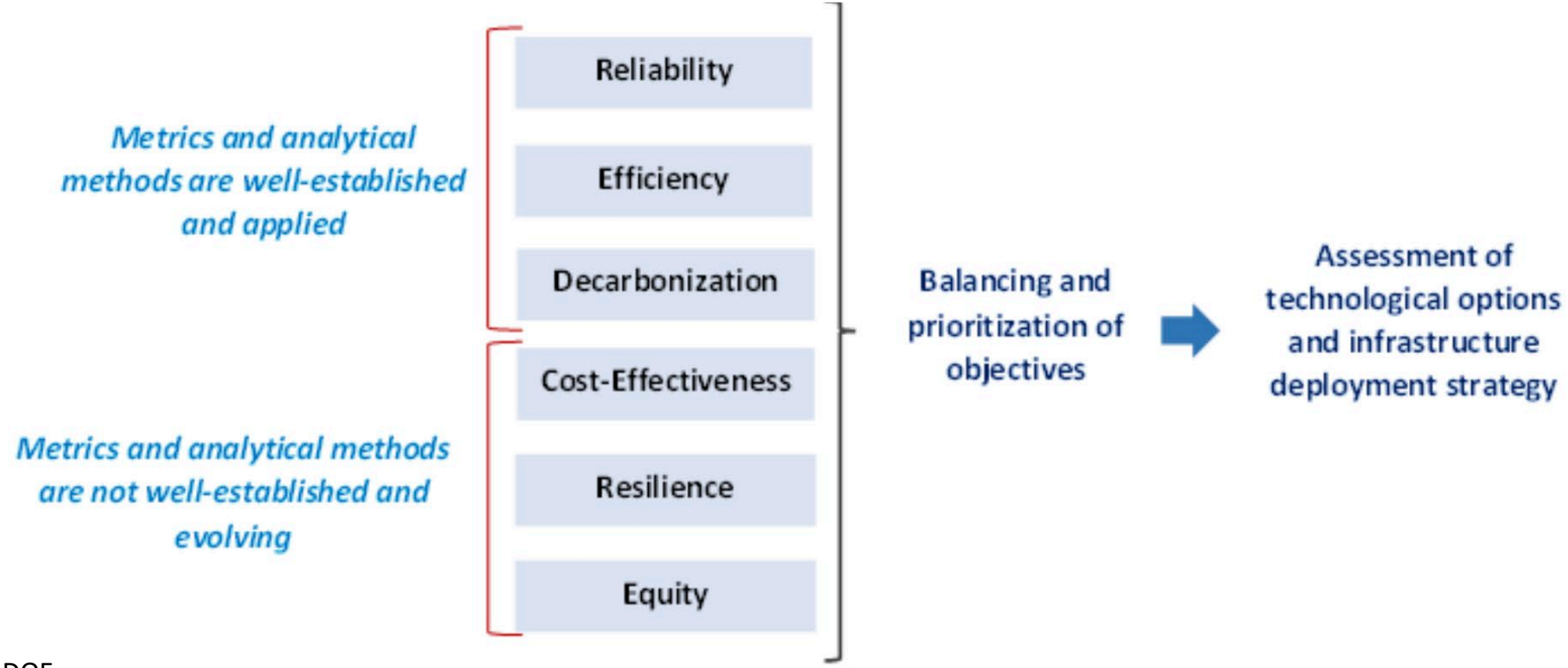
Collaborative efforts are required to enable formulation of equitable strategies for transitioning to a decarbonized and resilient electricity delivery system.



Source: DOE

Planning objectives

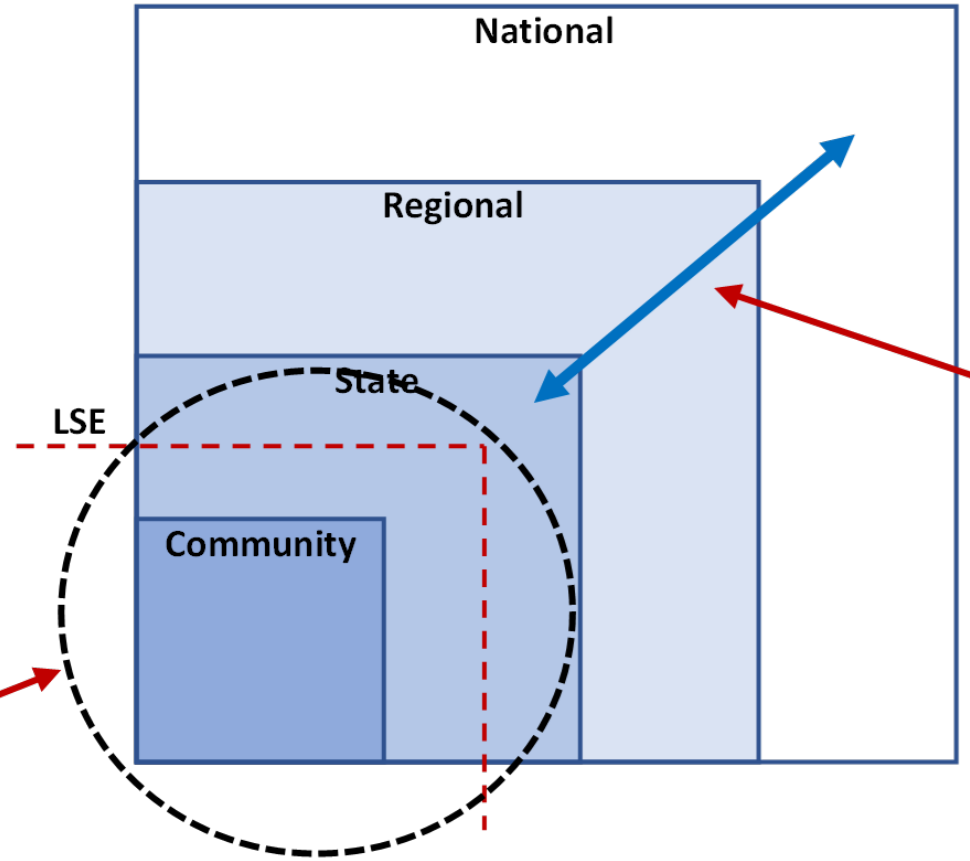
A well-designed integrated distribution system planning process provides a framework for translating policy objectives into holistic infrastructure investment strategies.



Source: DOE

Scale of integrated planning

Address community and state objectives and align with regional planning efforts



Alignment of community and state strategies with regional, multi-state strategies

IDPs align community and state policy goals into multi-year investment strategies

Source: DOE

Development of goals and priorities

- Many states have established requirements for grid planning, by legislation or regulation.
- 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 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.

Source: Sunrun

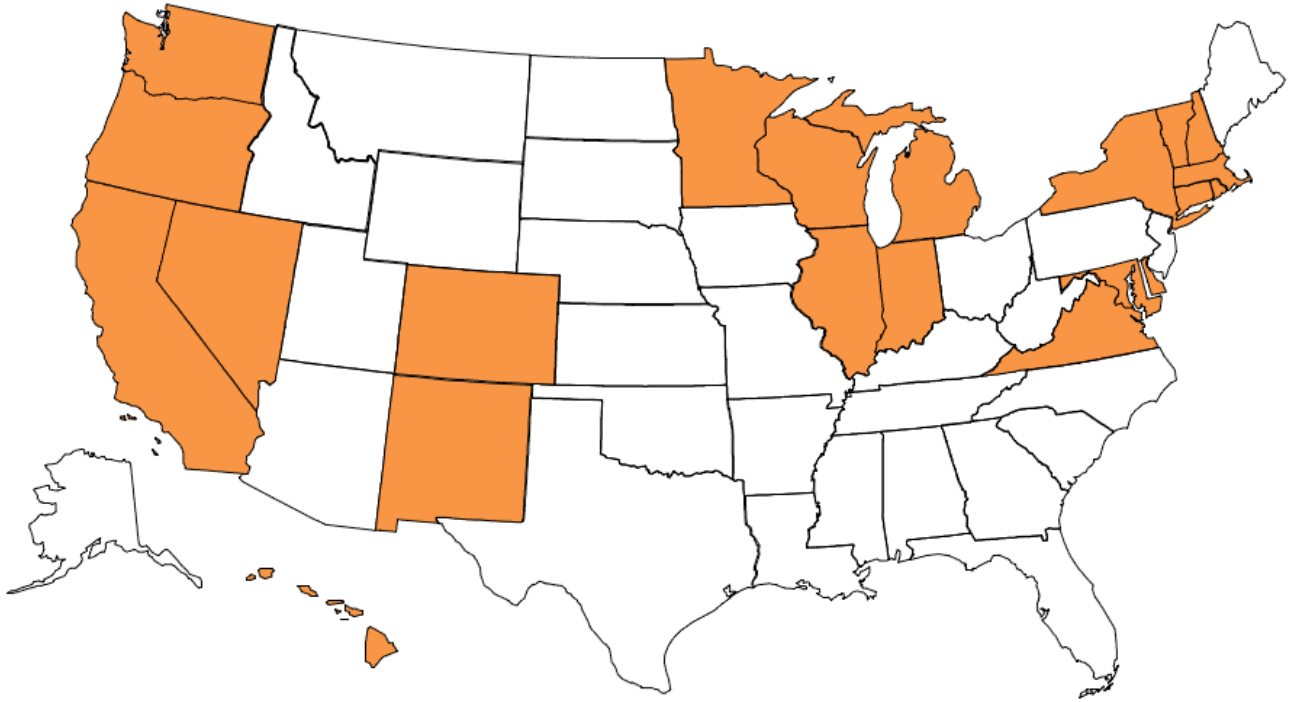
Common themes in grid planning goals and objectives

Berkeley Lab reviewed goals and objectives for grid planning for 21 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 access to data.
- 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

- 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."
- Objectives or goals related to compensation focus on fairly and appropriately compensating customers (and utilities) for the value DERs provide to the electricity system.

Support DER integration and utilization of grid services

- **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).**
- **Some states discuss DER integration more broadly — e.g., achieving renewable energy goals, sustainability.**
  - One of the goals of the District of Columbia's grid modernization effort is to create a more sustainable energy delivery system.
  - 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.

Photo courtesy of Sunrun

- **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."**

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).
  - 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.
- **Three states include supporting a *clean energy transition* as an objective or goal (CT, IL, MA).**

- **In Illinois, one of the objectives of the Multi-Year Integrated Grid Plan is "to support efforts to bring the benefits of grid modernization and clean energy …. to all retail customers."**
- **The Department of Public Utilities in Massachusetts provided a vision for grid modernization in the state, including to "build on…progress of our energy goals by maximizing the integration of solar, wind, and other local renewable energy sources of power."**
- **One of the objectives of Connecticut's Equitable Modern Grid Framework is to enable a cost-effective, economy-wide transition to a decarbonized future.**

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…."
- Among the expectations in California for Distributed Resource Plans was to "enable customer choice of new technologies and services that reduce emissions and improve reliability in a cost-effective manner…"
- 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.
- One of the objectives of Connecticut's Equitable Modern Grid Framework is to enable a cost-effective, economy-wide transition to a decarbonized future.

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).

Emerging objectives: Transportation and building electrification

- **Many states are taking action to equitably accelerate building and transportation electrification.**

- **Variety of approaches to address electrification in distribution system planning:**
  - States can require electrification analysis in distribution system plan filings.
    - For example, the Massachussets Climate Act requires the Department of Public Utilities to direct utilities to develop an Electric Sector Modernization Plan to proactively upgrade distribution and transmission systems to accommodate increased building and transportation electrification. The plan must describe improvements to the distribution system that will facilitate transportation or building electrification.
  - Utilities can address electrification in distribution system plans through scenario analysis (e.g., DTE Electric).
  - States can require utilities to file transportation electrification plans (e.g., Nevada legislation).

- **Coordinating building and transportation electrification and distribution system planning can maximize potential benefits to:**
  - Enhance knowledge-sharing across internal utility teams
  - Provide opportunities for the state to issue guidance across related processes
  - Provide greater confidence in validity of resulting plans
  - Lower barriers to participation, improve understanding, and provide greater transparency for communities and stakeholders
  - Streamline discussion and improve strategic outcomes

Emerging objectives: Maximize use of federal funds

- **Several Bipartisan Infrastructure Law (BIL) funding mechanisms impact distribution system planning — for example:**
  - State Energy Program funding now requires states to demonstrate they are engaged in transmission and distribution planning.
  - State Energy Security Plans must assess a variety of risks. Information from the assessment can inform distribution planning.
  - Grid Resilience and Innovation Partnership (GRIP) grants provide funding to strengthen grid resilience and reliability. Several grants awarded to states and municipal, cooperative, and investor-owned utilities will improve distribution planning and operations.
  - The National EV Infrastructure Formula Program provides funding to states for deployment of EV charging infrastructure. Applications must consider distribution system upgrades.

- **Inflation Reduction Act (IRA) may drive a variety of changes in utility distribution system planning assumptions.**
  - Production and investment tax credits will lower clean energy and storage costs and may accelerate adoption of renewable energy and storage technologies on the distribution system.
  - Customer incentives may accelerate the adoption of building and transportation electrification and efficiency technologies.

- **PUC and utility action on BIL, IRA and DSP related issues to-date includes:**
  - Minnesota PUC ordered utilities to discuss in integrated distribution plans (among other plans) how the utility will maximize the benefits of IRA and how IRA has impacted the utility's EV, DER and electrification assumptions (Docket 22-624).
    - Xcel Energy's 4th Integrated Distribution Plan discusses changes to EV and solar assumptions due to IRA (Docket 23-452).
  - In its order on Xcel Energy's Demand Side Management and Beneficial Electrification plan, the Colorado PUC directed the utility to establish a timeline to create or update a potential study to consider the effects of the IRA.
  - DTE discussed its GRIP grant applications in its 2023 Distribution Grid Plan.
  - ComEd acknowledged BIL and IRA funding in the EV integration and grid operations sections of its 2023 Multi-Year Integrated Grid Plan.
  - Orange & Rockland discussed BIL federal EV infrastructure funding for the state and IRA consumer EV tax incentives in its 2023 Distribution System Implementation Plan.

Stakeholder Engagement and Equity and Justice

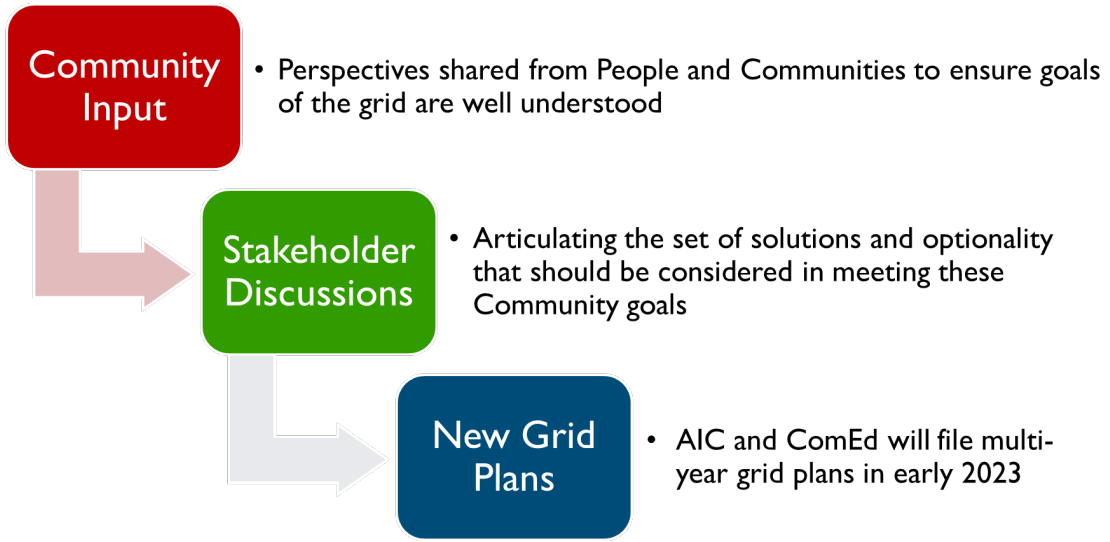
Stakeholder engagement in distribution planning

Benefits

- Improve quality of proceedings and outcomes
- Develop solutions with broad support
- Build trust among parties

Requirements

- *Before plan is filed:* Can include significant input through working groups (e.g., CA, DC, HI, MI, NH, NY) and stakeholder meetings
- *After plan is filed:* Stakeholders file comments, utility provides periodic updates



Source: Multi-Year Integrated Grid Plan Workshop Facilitator's Report: *Synthesizing the Input Collected through 15 Workshops*

Examples of stakeholder engagement in distribution system planning

- New York - Surveys, newsletters, webinars, meetings, and designated website
- Oregon - Utilities must host ≥4 stakeholder workshops before filing a distribution system plan and file a community engagement plan. A technical working group holds regular meetings for stakeholders before and after plan filings.
- Illinois - Utilities must hold ≥6 workshops run by an independent facilitator as part of the integrated grid planning process. At the conclusion of workshops, the facilitator prepares a draft and final report describing the process and areas of consensus and disagreement. The facilitator also provides recommendations to the Commission regarding the utility's plan. Stakeholders can comment on the report.
- Hawaii - Stakeholder council, technical advisory panel, working groups

Example process improvements for stakeholder engagement (1)

Among opportunities for improvement

- Include non-traditional stakeholders
- Provide intervenor compensation
- Consider equity in identifying and assessing grid solutions
- Engage communities in resilience strategies

Based on feedback from stakeholder engagement in the distribution planning process, DTE created reliability improvement maps (figures on the right).

The Massachusetts Grid Modernization Advisory Council suggested improvements to stakeholder engagement in its November 2023 draft recommendations to the electric utilities.

- Lack of standardization of terms across plans may make it difficult for stakeholders to evaluate the plans.
- Simple summary tables can synthesize information for stakeholders unfamiliar with the distribution system.
- It is not clear "how stakeholder engagement and working groups will support the distribution system planning process."
- The proposed Community Engagement Stakeholder Advisory Group may be duplicative of other efforts and create stakeholder fatigue.

Exhibit 17.1.1 Electric Reliability Improvement Map (DTE Service Territory)

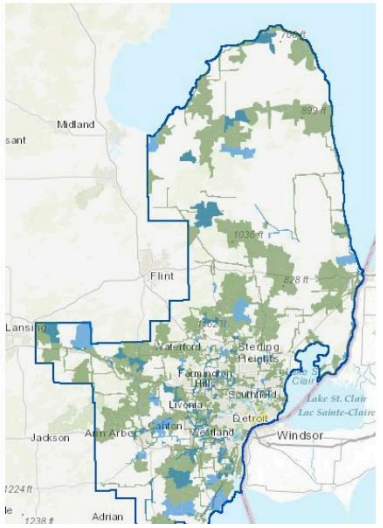
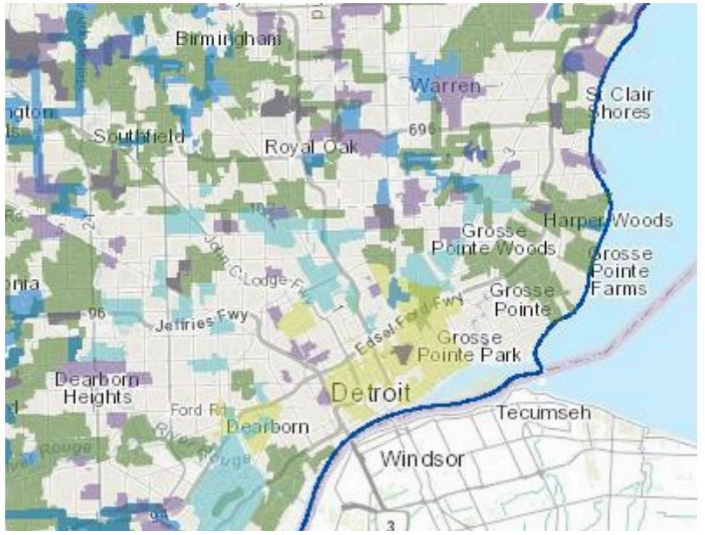


Exhibit 17.1.2 Electric Reliability Improvement Map (Metro Detroit)



	Tree Trimming	Tree limbs and branches are responsible for nearly 70% of the time our customers spend without power. That's why we're surging our efforts to trim overgrown trees in your neighborhood to keep you safe and the energy grid reliable.
	Strengthen Power Lines	We're upgrading and strengthening power lines to ensure the electric system in your neighborhood is more resilient and reliable.
	Utility Poles Maintenance	We're inspecting and repairing utility poles and replacing cross arms and other pole top equipment to ensure our system delivers the power you need when you need it.
	Rapid Response	Tree trimming and pole top equipment repairs/replacements to quickly improve reliability in communities experiencing emergent issues in between planned maintenance schedules.
	Modernizing & Rebuilding the Grid	Modernizing electrical substation equipment, as well as the underground and overhead infrastructure that delivers power to you, including replacing poles and wiring. Tree trimming will be completed, as necessary, in advance of pole replacements.

Source: DTE Electric

Example process improvements for stakeholder engagement (2)

The Minnesota PUC ordered Xcel Energy to file a summary of the stakeholder process for its next integrated distribution plan and list next steps by August 2023.

- The PUC required at least four stakeholder meetings. The utility held six meetings to cover all of the content in the plan.
- The utility observed that fewer participants attended workshops when the content was more detailed and technical.
- To encourage participation, Xcel asked stakeholders about preferred meeting format.
- Participants could submit questions during the registration process or during workshops.
- Xcel concluded that it may not be possible to develop "a shared vision for the distribution grid of the future."

Stakeholder workshop series generated new ideas for Xcel on:

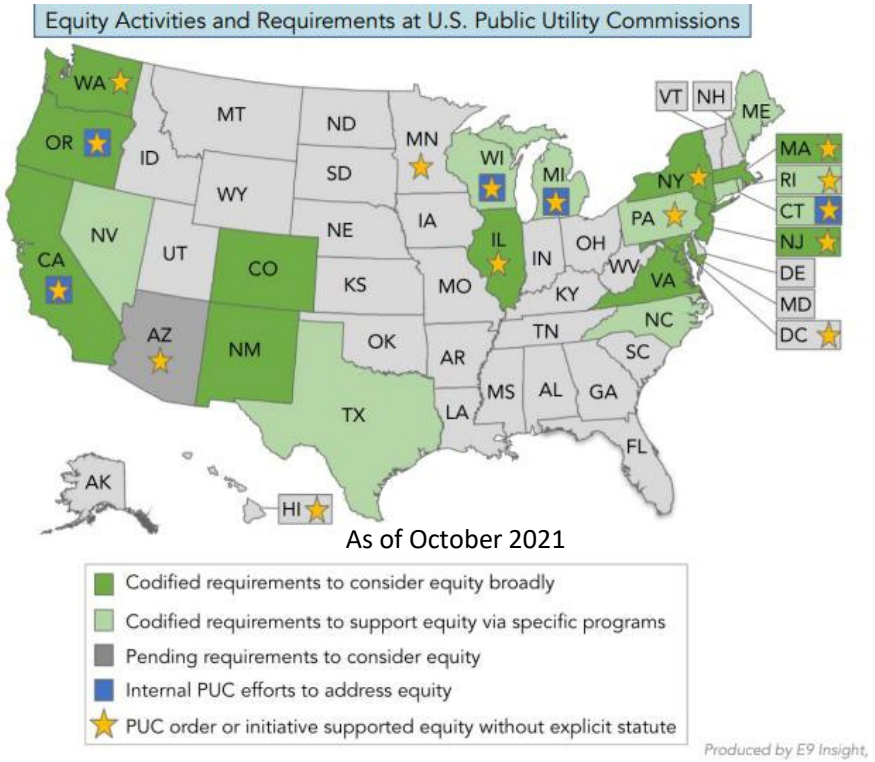
- How to prioritize projects
- Reflecting distribution system constraints in forecasting
- Reflecting benefits of distributed PV for reducing system peak
- Considering multi-value projects

Stakeholder information available in Docket 21-M-694 (eDockets)

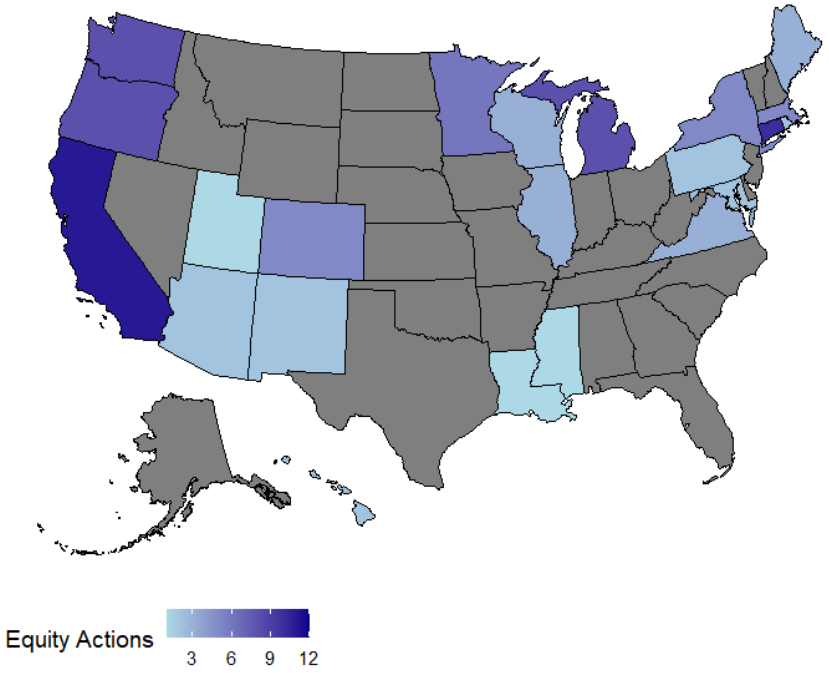
Energy equity and justice (1)

Many states are adopting equity and justice provisions that apply to regulated utilities, including for 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

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Energy equity and justice (2)

OR – Compensating intervenors and engaging communities

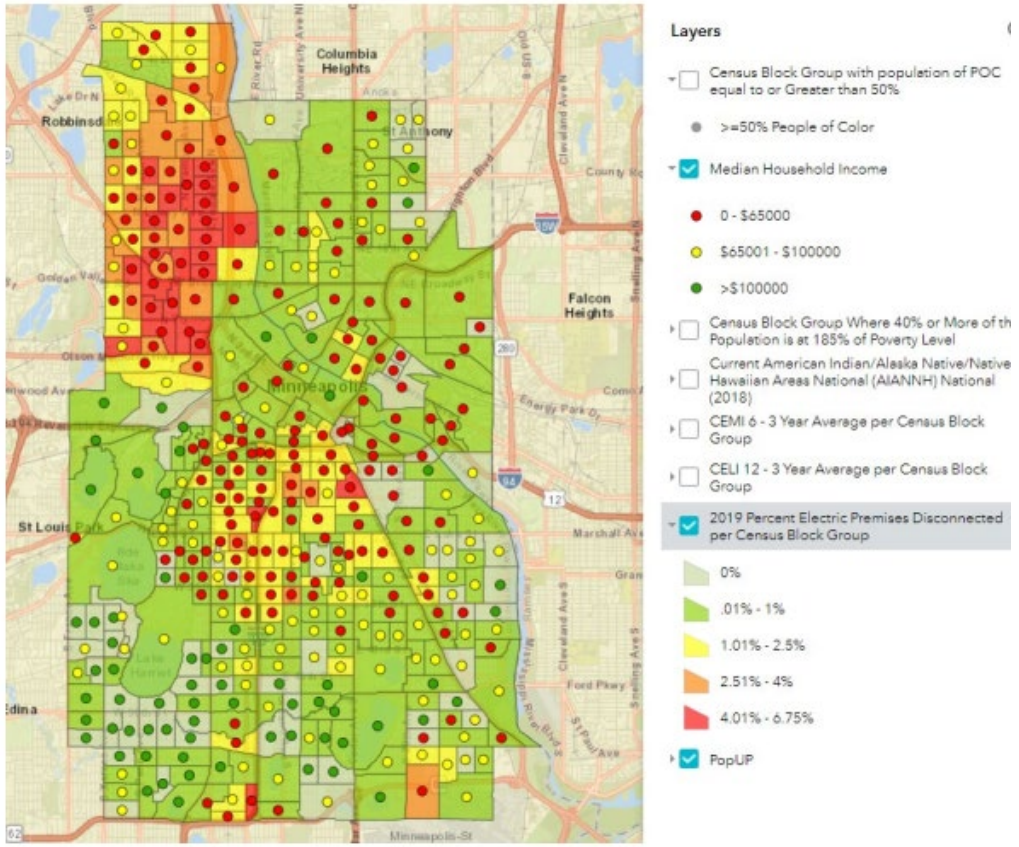
- HB 2475 (2021) provides OPUC the authority to provide financial assistance to organizations that represent broad customer interests, including environmental justice organizations, in regulatory proceedings.
- Order 20-485 initially requires consultation with community-based organizations (CBOs) before 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 the utility's first distribution plan.

MN – Mapping metrics and demographic data

- The 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 – Assessing equity impacts

- The 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.

Planning Requirements

Procedural elements*

Frequency of filing

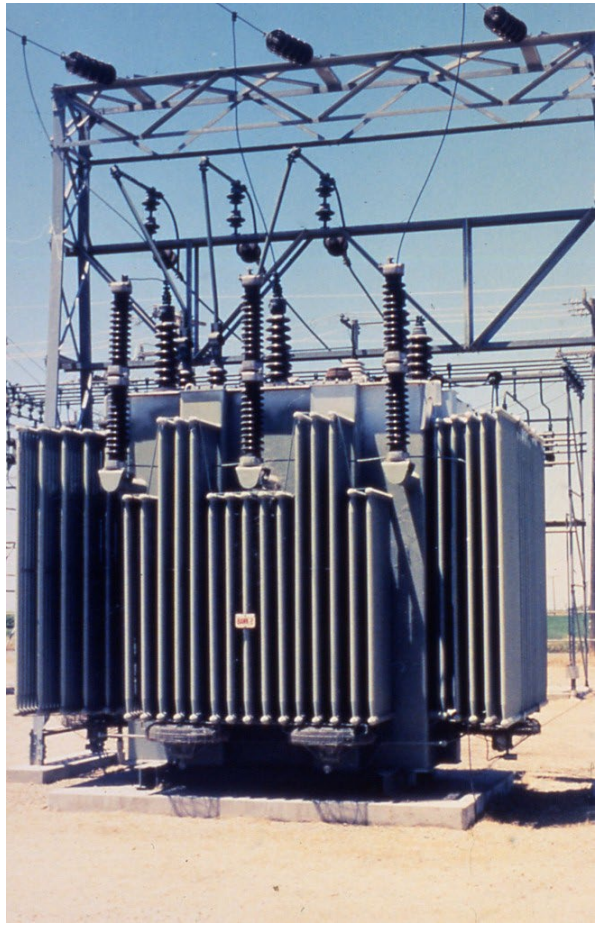
- Typically annual or biennial
- *Considerations:* alignment with utility capital planning, workload, tracking progress on goals and objectives, integrated resource plan filing cycle

Planning horizon

- Action plan: 2–4 years
- Long-term investment plan: 5–10 years

Confidentiality

- Level of specificity for hosting capacity
- Peak demand/capacity by feeder
- Contractual cost terms
- Bidder responses to non-wires alternatives solicitations
- Proprietary model information



Source: EPRI

*Previous slides covered requirements for stakeholder engagement and equity.

Substantive elements (1)

Baseline information on current state of distribution system

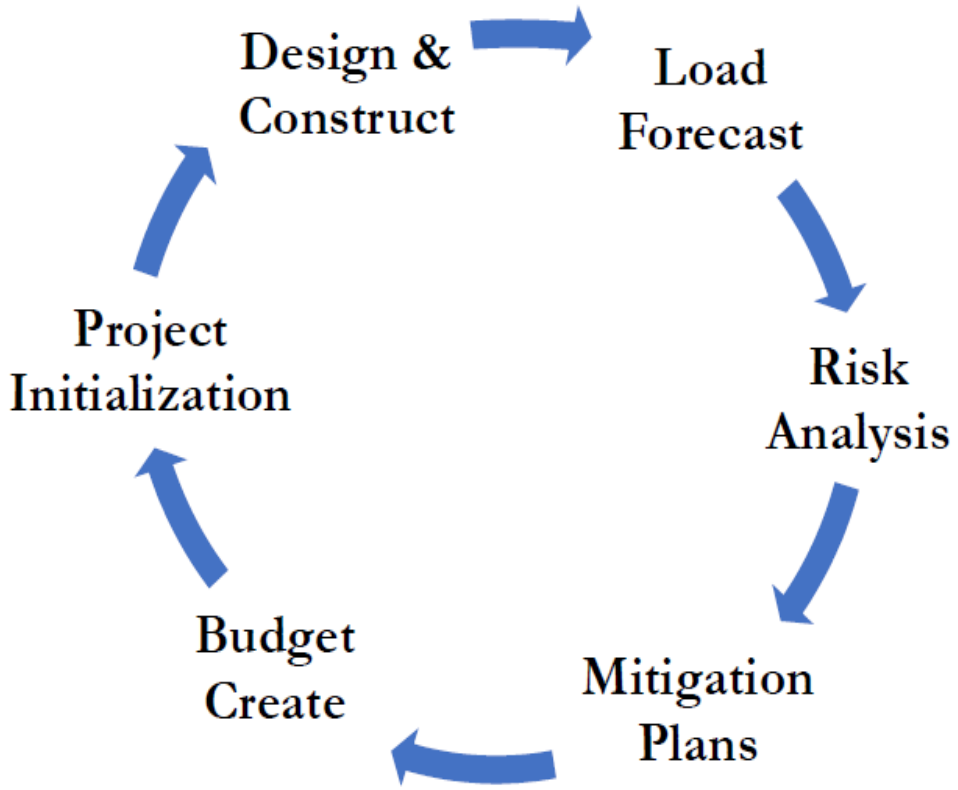
- Such as system statistics, reliability performance, equipment condition, historical spending by category

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
- Event management



Source: Xcel Energy

Substantive elements (2)

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.
  - New NARUC resources on grid data sharing

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.

Substantive elements (3)

DER forecast

- Types, sizes, amounts and locations

Hosting capacity analysis*

- Maps showing where interconnection costs will be low or high; supporting data provide details
- Use cases: guidance for DER developers, interconnection screens, distribution planning

Geotargeting DER programs

- Efficiency, demand flexibility, distributed PV and storage, and managed EV charging to meet location- and time-dependent distribution needs

Grid needs assessment and analysis of non-wires alternatives**

- Existing and anticipated capacity deficiencies and constraints
- Traditional utility mitigation projects
- A subset of these planned projects may be suitable for non-wires alternatives to defer or avoid infrastructure upgrades for load relief, voltage issues, reduction of power interruptions, or resilience.

**Amount of DERs that can be interconnected without adversely impacting power quality or reliability under existing control and protection systems and without infrastructure upgrades*

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

Substantive elements (4)

Grid modernization strategy and technology roadmap

Near-term action plan

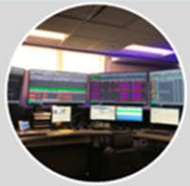
Long-term utility vision and objectives

Discussion of how distribution planning is coordinated with other types of planning

Summary of stakeholder and community engagement

Proposals for pilots

- Resilience projects (e.g., solar + storage, community microgrids)
- Time-varying pricing (e.g., for EV charging)

Grid Visibility and Control		Network	Meters
Advanced Distribution Management System (ADMS)	**Fault Location, Isolation and Service Restoration (FLISR)**	**Field Area Network (FAN)**	**Advanced Metering Infrastructure (AMI)**
			
• Advanced centralized software or the "brains," enhances the operation of the distribution grid • Enables improved reliability, management of DERs, and improved efficiency when operating the grid • Enables enhanced visibility and control of field devices (including customer meters via AMI)	• ADMS provides fault location prediction and the automatic operation of intelligent grid devices • Reduces outage durations and the number of customers impacted by an outage • Enabled by intelligent field devices, FAN, and ADMS	• Two-way communications network • Connects intelligent grid devices and smart meters with software • Enables enhanced remote monitoring and control of intelligent field devices and advanced meters	• Focused on the deployment of smart meters and software • Provides near real-time communication between software and meters • Data and AMI functionality enable new products and services and improves customer experience

Source: Xcel Energy (2023)

Example State Practices

Example state practices (1)

Source: Portland General Electric

- Establish planning goals, objectives, and priorities with stakeholder engagement
- Build on work by other states, tailored to your state's interests
  - Forthcoming Berkeley Lab/PNNL report and catalog of state distribution planning requirements
- Host presentations to increase stakeholders' understanding
  - Colorado, Illinois, Maine, Massachusetts, Michigan, New Mexico, Oregon
- Engage stakeholders and communities in the planning process
  - Joint Utilities of NY stakeholder plan and timeline
  - Oregon's community engagement plans – see Portland General Electric distribution plan
- Ask utilities to respond to a questionnaire to gather baseline information on their distribution system and planning practices
  - Minnesota utilities; Oregon utilities and third-party energy efficiency administrator and stakeholders; New Jersey

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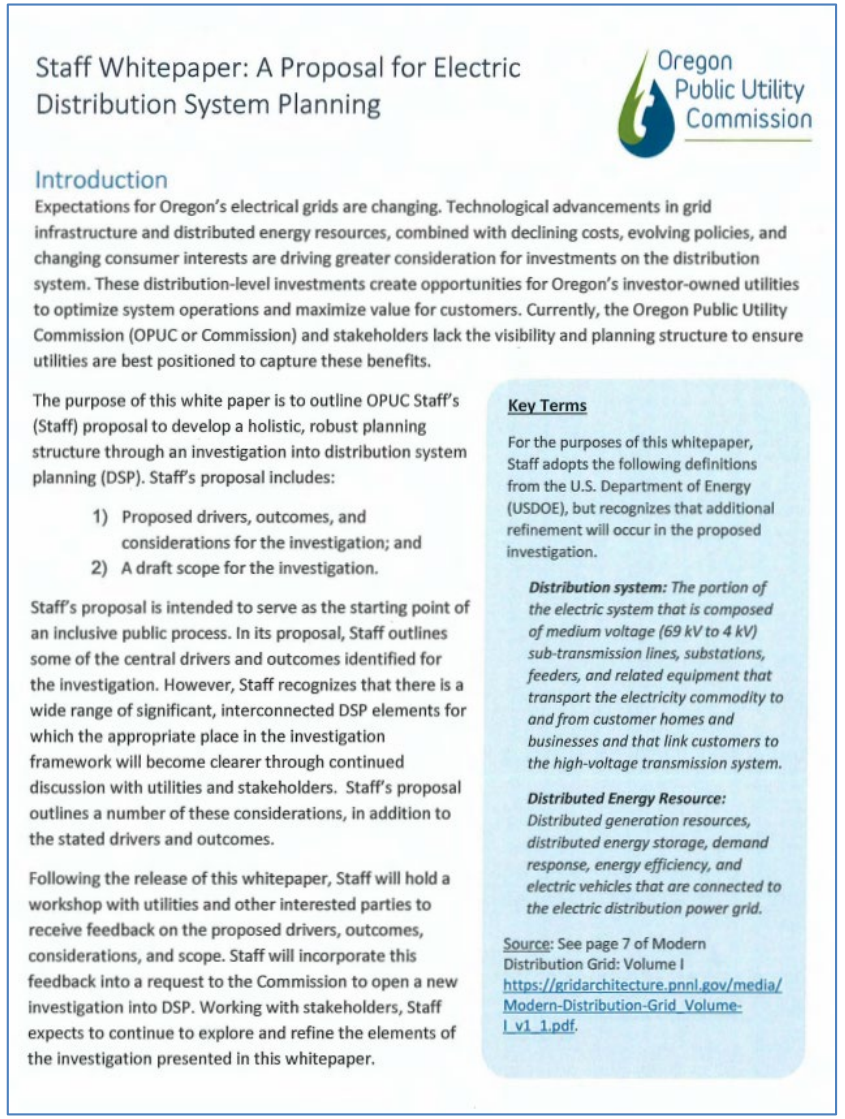
Example state practices (2)

- Determine whether any current filings can be integrated/consolidated in DSP filings
  - Oregon PUC suspended smart grid filings (e.g., order on PGE's DSP)
  - Minnesota PUC integrated grid modernization plans and transportation electrification plans into DSP
- Prepare a white paper to lay out a vision for DSP processes and provide guidance for utility filings
  - Minnesota – Defined grid modernization for Minnesota, proposed a phased approach, and identified principles to guide it
  - New York – Proposed changes in filing requirements for effective interaction with the PSC's Coordinated Grid Planning proceeding to achieve the state's climate goals
  - Oregon – Outlined rationale and key drivers for opening a DSP investigation, desired outcomes and future planning process, near-term scope and schedule for investigation, and planning considerations



Staff Whitepaper: A Proposal for Electric Distribution System Planning

Oregon Public Utility Commission

Introduction

Expectations for Oregon's electrical grids are changing. Technological advancements in grid infrastructure and distributed energy resources, combined with declining costs, evolving policies, and changing consumer interests are driving greater consideration for investments on the distribution system. These distribution-level investments create opportunities for Oregon's investor-owned utilities to optimize system operations and maximize value for customers. Currently, the Oregon Public Utility Commission (OPUC or Commission) and stakeholders lack the visibility and planning structure to ensure utilities are best positioned to capture these benefits.

The purpose of this white paper is to outline OPUC Staff's (Staff) proposal to develop a holistic, robust planning structure through an investigation into distribution system planning (DSP). Staff's proposal includes:

1) Proposed drivers, outcomes, and considerations for the investigation; and
2) A draft scope for the investigation.

Staff's proposal is intended to serve as the starting point of an inclusive public process. In its proposal, Staff outlines some of the central drivers and outcomes identified for the investigation. However, Staff recognizes that there is a wide range of significant, interconnected DSP elements for which the appropriate place in the investigation framework will become clearer through continued discussion with utilities and stakeholders. Staff's proposal outlines a number of these considerations, in addition to the stated drivers and outcomes.

Following the release of this whitepaper, Staff will hold a workshop with utilities and other interested parties to receive feedback on the proposed drivers, outcomes, considerations, and scope. Staff will incorporate this feedback into a request to the Commission to open a new investigation into DSP. Working with stakeholders, Staff expects to continue to explore and refine the elements of the investigation presented in this whitepaper.

Key Terms

For the purposes of this whitepaper, Staff adopts the following definitions from the U.S. Department of Energy (USDOE), but recognizes that additional refinement will occur in the proposed investigation.

Distribution system: *The portion of the electric system that is composed of medium voltage (69 kV to 4 kV) sub-transmission lines, substations, feeders, and related equipment that transport the electricity commodity to and from customer homes and businesses and that link customers to the high-voltage transmission system.*

Distributed Energy Resource: *Distributed generation resources, distributed energy storage, demand response, energy efficiency, and electric vehicles that are connected to the electric distribution power grid.*

Source: See page 7 of Modern Distribution Grid: Volume I https://gridarchitecture.pnnl.gov/media/Modern-Distribution-Grid_Volume-I_v1_1.pdf.

Example state practices (3)

- Host work groups to help develop and refine requirements — and address emerging planning issues
  - Hawaii – Stakeholder council, technical advisory panel, and working groups
  - Maine – Working groups on forecasting, solutions evaluation criteria, and data availability/collection
  - Oregon – DSP Work Group serves as a forum to identify, articulate, discuss and, when possible, resolve technical and other questions that arise. The primary objective is finding solutions to barriers that would otherwise inhibit completion of the utilities' plans.
  - New Jersey – Third-party facilitated working groups with electric distribution companies and stakeholders will make recommendations for integrated DER planning — *forthcoming*
- Consider pilots for new processes and technologies
  - Non-wires alternatives (Oregon)
  - Resilience — Resilient Minneapolis project (Minnesota)
  - Hosting capacity analysis — start with solar PV, expand to other DERs, and specify use cases*
  - Time-based rates — for general service rates and managed electric vehicle charging (e.g., Oregon, Minnesota, Hawaii, New York)

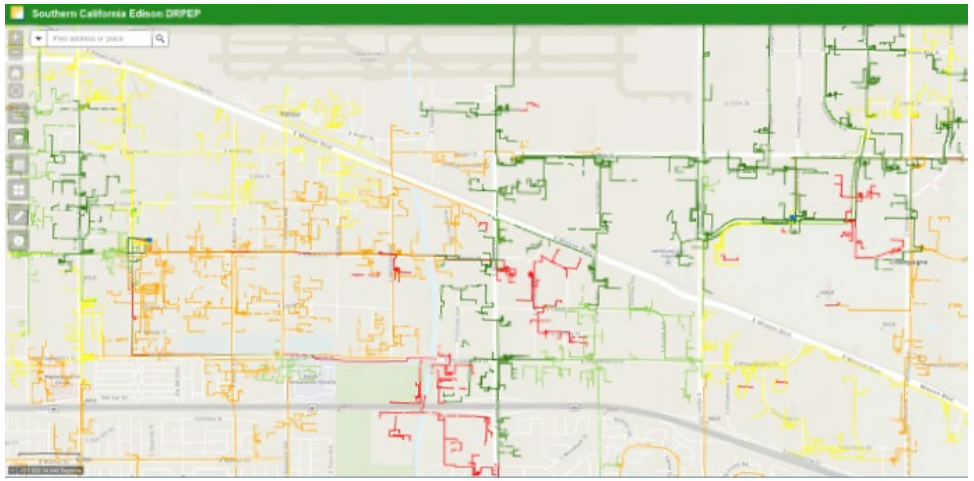


Figure source: Southern California Edison

*See Minnesota PUC orders in Docket Nos. 15-962, 18-684, 19-666, and 21-694

Questions to ask

- Have clear state objectives been established for distribution system planning?
- Are other types of planning (e.g., resource planning, transmission, energy efficiency, grid modernization, electrification, carbon, resilience) coordinated with distribution planning?
- Are there opportunities to improve diversity of participating stakeholders, data access, and consideration of stakeholder and community feedback?
- How are DERs considered — e.g., in grid modernization strategy, technology roadmap, as non-wires alternatives?
- How is electrification of transportation and buildings considered in distribution planning?
- How are utilities incorporating BIL and IRA impacts into distribution planning assumptions?
- Are State Energy Offices, PUCs and utilities working together to maximize federal dollars for distribution system improvements?

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Follow Energy Markets & Policy on Twitter: @BerkeleyLabEMP

Resources for more information

Berkeley Lab's Integrated Distribution System Planning website, including slides and recordings for previous trainings

U.S. Department of Energy, *Modern Distribution Grid* guidebooks

S. Murphy, L. Schwartz, C. Reed, M. Gold, and K. Verclas, *State Energy Offices' Engagement in Electric Distribution Planning to Meet State Policy Goals*, National Association of State Energy Officials, 2023

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Berkeley Lab, Pacific Northwest National Lab and NARUC, Peer-Sharing Webinars for Public Utility Commissions on Integrated Distribution System Planning, 2023

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