How to Make Optimal Investments for a Reliable and Sustainable Grid

Regional Preconference Workshop

Grand Rapids, MI

NRECA
America's Electric Cooperatives

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Integrated Distribution System Planning

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Agenda

- Berkeley Lab's role and activities in Integrated Distribution System Planning (IDSP)

- Current practices
  - *Example goals and objectives*
  - *Examples of integrating with other plans and processes*
  - *Scenario analyses*

- Berkeley Lab tools and resources

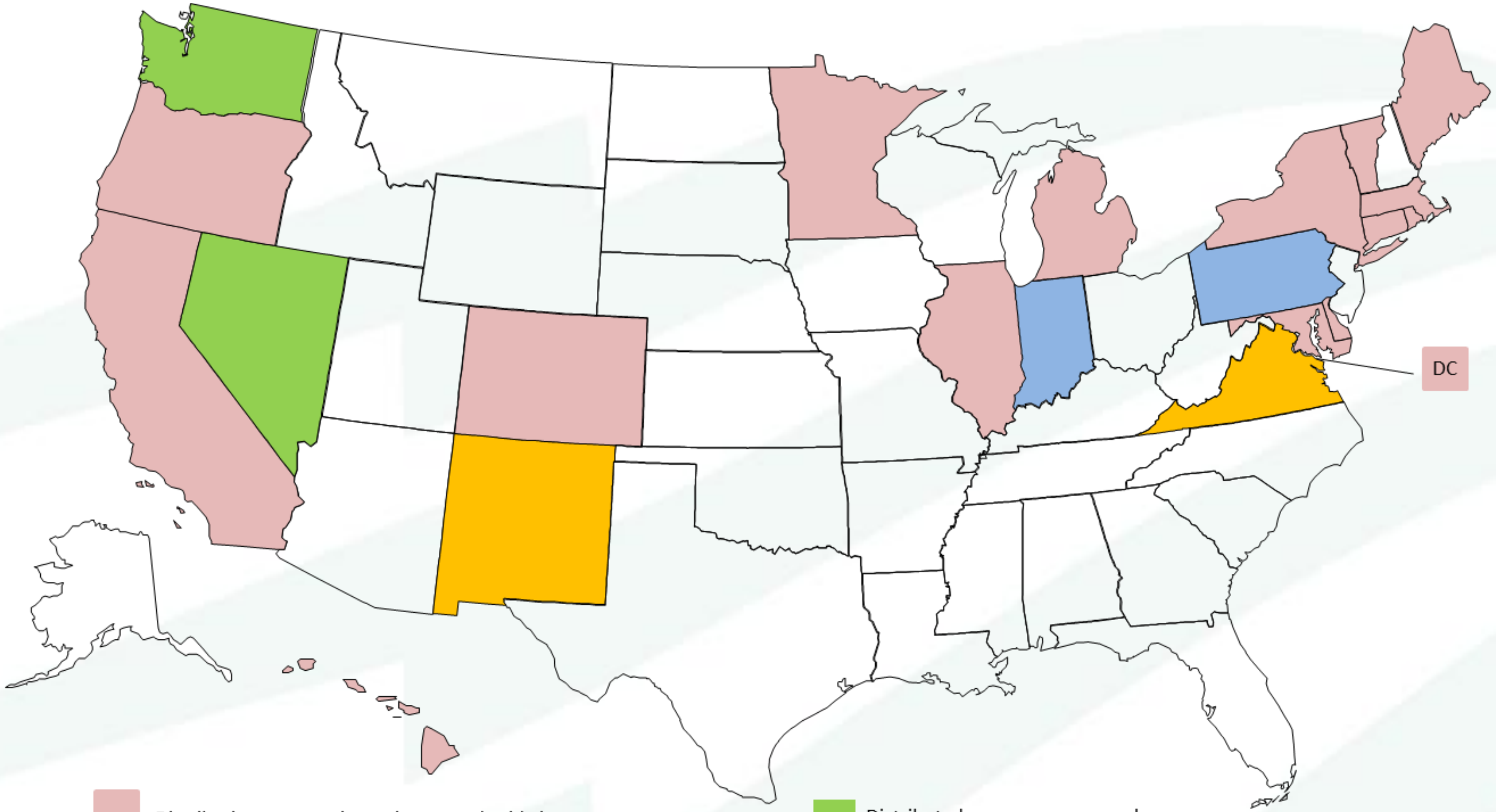
Berkeley Lab's role and activities in IDSP

In partnership with NARUC, NASEO, NASUCA, NRECA, and other national and regional organizations, Berkeley Lab conducts training, technical assistance, and research and develops tools to advance distribution system planning.

Training	Technical Assistance	Research & Tools
We **offer educational opportunities** that provide foundational information, address cutting-edge issues, disseminate advanced planning practices and new DOE-funded research, and **facilitate peer-sharing**.	We **provide unbiased technical expertise and research-based information** to help states address key institutional issues related to advancing distribution system technologies, investing in grid infrastructure, and applying robust planning methods and processes.	We conduct research and provide tools focused on three areas: **current IDSP practices and gaps, emerging best practices, and planning guidance.**

Website: https://emp.lbl.gov/projects/integrated-distribution-system-planning

Current practices – *Based on review of state requirements for regulated utilities to file distribution system plans*



Distribution system plan or integrated grid plan

Distributed energy resources plan

Grid modernization plan*

Transmission and distribution improvement plan**

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

See Extra Slides for descriptions and examples

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

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Example state policy goals and objectives for IDSP (1)*

- **Improve grid reliability and resilience** (CA, CT, DC, DE, HI, IN, MA, MI, MN, NM, NV, RI, VA, VT)
  - CO – “review and evaluate the utility’s investments in the distribution grid to ensure that they cost-effectively support grid adequacy, reliability and resilience….”
  - IN – “promote safety, reliability and economic growth by encouraging cost-effective modernization of utility infrastructure”
  - VA – “measures to enhance physical electric grid reliability and security”
- **Increase customer choice and engagement** (CA, CT, DC, HI, IL, MA, MN, NY, RI, VT)
  - MN – “Enable greater customer engagement, empowerment, and options for energy services”
  - NY – “Serve as a source of public information regarding distribution service provider plans and objectives, including specific system needs allowing market participants to identify opportunities”
  - VT – “empower consumers to manage their energy choices”
- **Accelerate deployment of new technologies and services** (CA, CT, IL, MI, MN)
  - CT – “investigate the comprehensive and competitive inclusion of electric storage as well as other innovative technologies”
  - IL – “promote opportunities for third-party investment in nontraditional, grid-related technologies and resources”

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*Adapted and updated from Mims Frick et al. 2023, “Distribution System Planning: Goals & Objectives”

Example state policy goals and objectives for IDSP (2)

- **Support DER integration** (CA, CO, DC, HI, IL, MA, MN, OR, VA)
  - CA – "identify optimal locations for the deployment of distributed resources"
  - HI – "Maximizing interconnection of distributed generation to the State's electric grids on a cost-effective basis at non-discriminatory terms and at just and reasonable rates…."
  - ME – "Support integration and utilization of DERs to enable load flexibility and resilience"
- **Reduce greenhouse gas (GHG) emissions/support clean energy transition** (CO, CT, DC, HI, IL, MA, OR)
  - RI – "Address the challenges of climate change and other forms of pollution"
  - MA – "proactively upgrade distribution and transmission systems to accommodate increased building and transportation electrification"
- **Other goals**
  - Affordability (CO, CT, DC, IL, MI, RI), equity (CO, IL, MN, OR, WA), economic development (IL, IN), and stakeholder engagement and transparency (CA, DC, HI, IL, MI, NY, OR)

Current practices – *Examples of integrating distribution planning with other types of planning and processes*

- NY Distributed System Implementation Plans support 2019 Climate Act and 2022 Scoping Plan

- CA rulemaking on Distribution Resources Planning 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)

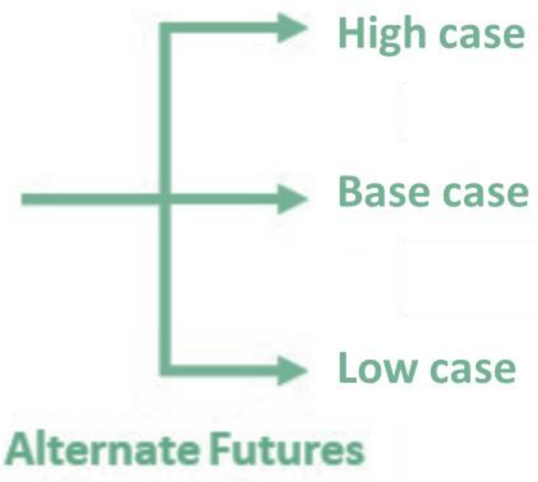
Current practices – *Forecast Scenario analyses (1)*

Forecast Scenarios to Inform Planning Analysis

- Distribution system studies beyond a five-year horizon introduce greater uncertainty, given the reliance on forecasts for system changes (e.g., load, DER adoption, electrification).

- Understanding the potential impact of several different forecast outcomes can improve strategic decisions for longer-term distribution system planning.

Source: LBNL, 2024, Interactive Decision Framework for Integrated Distribution System Planning



Create 3 possible future scenarios

Develop a base case, a high and low case from the DER, load, and other related forecasts

Create a range of potential future scenarios

Requires probabilistic techniques and detailed information to develop sensitivities

Current practices – *Implementation Scenario analyses (2)*

Scenario analyses for implementation planning

- Applying plausible high-impact scenarios to stress test implementation plans is a well-established approach to assessing the flexibility needed in plans and testing their robustness under different potential conditions.

- This stress testing through scenarios also allows for identifying the least-regret investments.

DTE (MI) 2023 DSP Grid Modernization Scenarios

Scenario	Description
Electrification	High electrification of transportation, buildings, and industrial processes
Increasing CAT Storm	Increased frequency and intensity of catastrophic (CAT) storm threats to electric infrastructure
DG/DS	High adoption of distributed generation (DG) solar PV and distributed storage (DS) as batteries behind the meter (BTM)

Sources: LBNL, 2024, Interactive Decision Framework for Integrated Distribution System Planning
DTE 2023 Distribution System Plan

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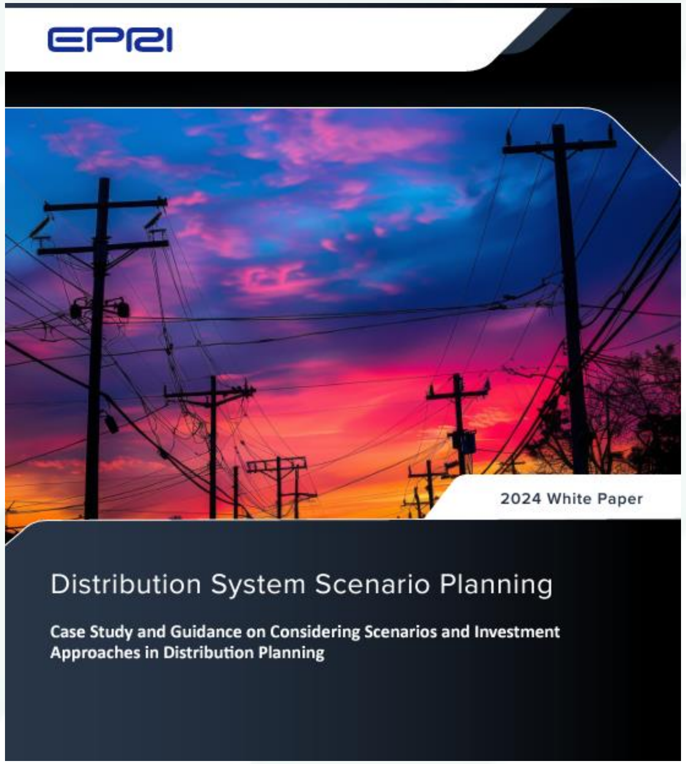
Current practices – *Scenario analyses (3)*

Making decisions based on scenario analyses
Approaches to balance risk profiles and resource constraints

Approach	Description
No regrets	Proceed with actions necessary on all/most scenarios
Most likely	Apply "likelihood factors" to move forward with initiatives that are more likely to be necessary
Worst case	Address the full range of risks that develop in any of the scenarios
Leveraged	Proceed with actions with a higher operational risk (No regrets/Most likely) and scale project to address a worst-case scenario
Staged	Proceed with worst case actions but advance the necessary elements in multiple phases

Source: EPRI, 2024, Distribution System Scenario Planning, adapted from Table 2

EPRI resource on distribution system scenario planning



https://www.epri.com/research/products/000000003002030781

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Current practices – *Scenario analyses (4)*

Best Practices

- Use scenarios to understand the impact on timing, scope, and scale of grid needs to determine the plan flexibility required
- Develop longer-term strategies and implementation plans identifying least-regrets and on-ramps/off-ramps to address uncertainty
- Apply scenarios to stress-test whether plans have sufficient flexibility to change as needed and are robust with respect to least-regrets investments

Source: LBNL, 2024, Interactive Decision Framework for Integrated Distribution System Planning

Current practices – *Scenario analyses (5)*

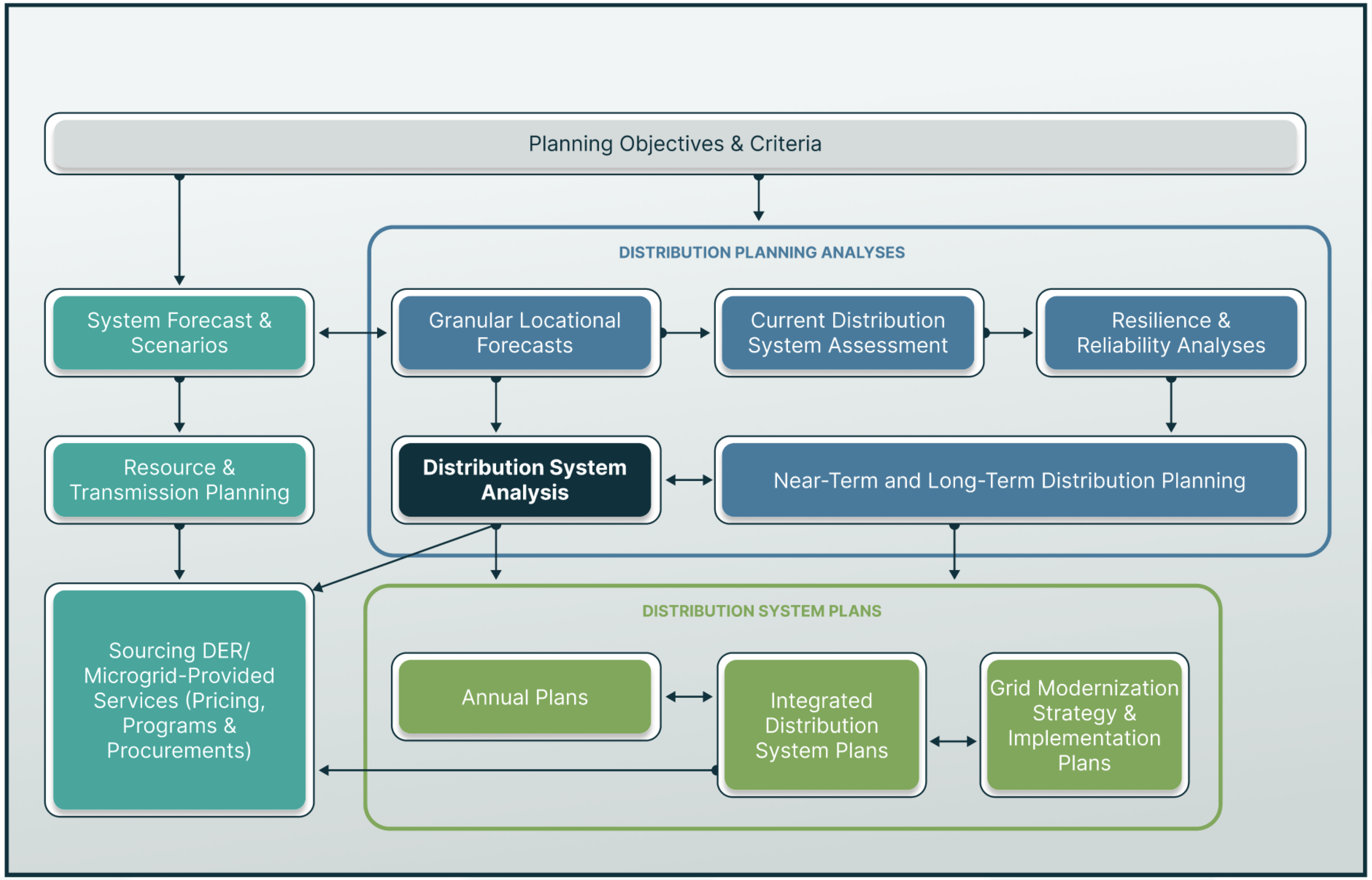
- Several states provide guidance for using scenario analyses in distribution planning — for example:
  - OR (proposed revised guidance)
    - Regulated utilities must include high/medium/low DER and EV adoption scenarios when conducting feeder-level forecasts of DER and EV adoption
  - VT
    - The Department of Public Service requires that load forecasts for integrated resource planning, including distribution system planning, account for levels of building and transportation electrification that result from compliance with state climate policy

- Utilities are implementing various scenario methods in distribution planning
  - DTE (MI)
    - Developed planning scenarios related to electrification, catastrophic storms, distributed generation, and distributed storage
  - Eversource (MA)
    - Developed low/high DER saturation scenarios to support planning and identify capacity upgrades

Berkeley Lab tools and resources (1)

Interactive IDSP Framework

- Hosting Capacity Analysis
- Value of DERs
- Interconnection
- Forecasting Loads and DERs/EVs
- Distribution Investment Strategy
- Functional Requirements Analysis
- Procurements
- Geotargeting Programs
- Stakeholder Engagement
- Equity Considerations
- Multi-Objective Decision-making
- Cost-Effectiveness Framework for Investments
- Threat-Based Risk Assessment
- Worst-Performing Feeder Analysis
- Asset Management Strategy
- Coordinated Planning
- Scenario Analysis

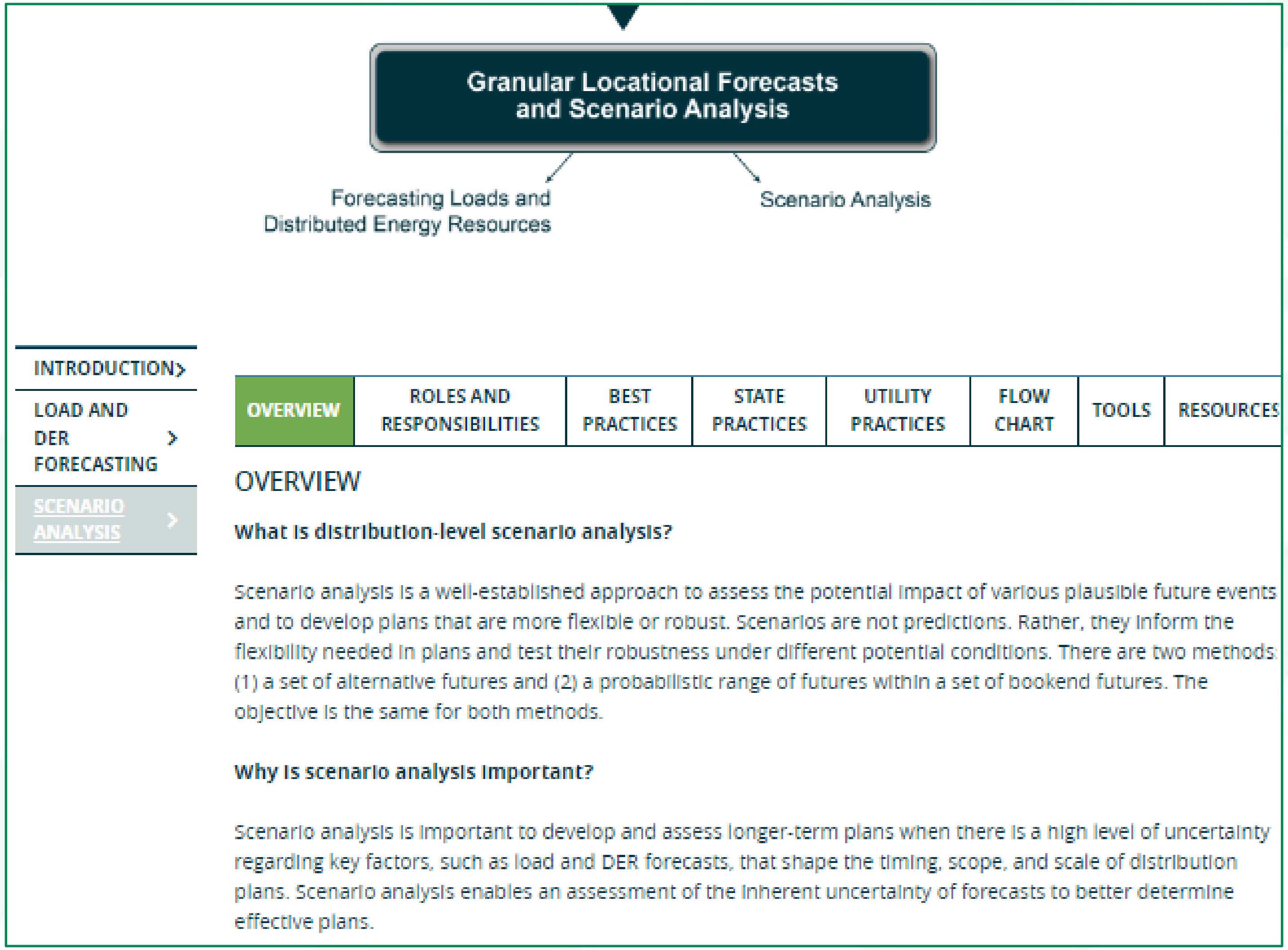


https://emp.lbl.gov/projects/integrated-distribution-system-planning

Berkeley Lab tools and resources (2)

Interactive IDSP Framework
What's included for each topic?

- Overview
  - What is it?
  - Why is it important?
  - Key questions (Q&A)
- Roles and Responsibilities
- Best Practices
- State Practices
- Utility Practices
- Flow Chart (e.g., inputs/ outputs)
- Tools
- Annotated Resources List

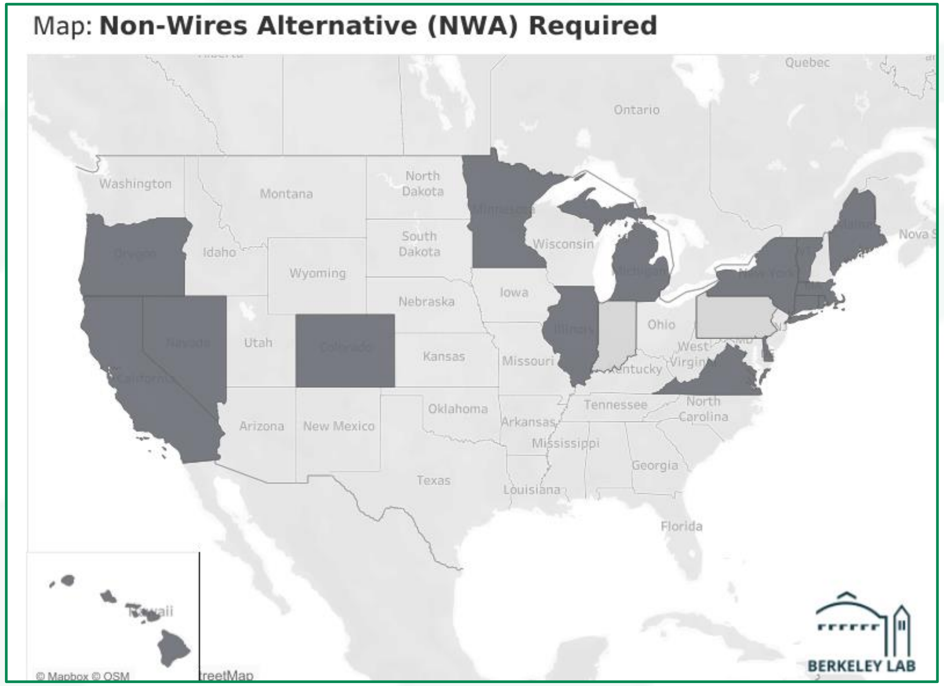


Berkeley Lab tools and resources (3)

State Distribution Planning Requirements *Data Visualization & Online Catalog*

- Dataviz, online catalog, and document library summarize legislative and regulatory requirements for electric utilities to file some type of distribution system plan in 19 states and DC.
- Data visualization provides **an interactive interface** to identify state-by-state requirements for:
  - Types of distribution plans filed
  - Filing frequency/Planning horizon
  - Non-wires alternatives/Hosting capacity analyses
- Detailed information by state:
  - Legislative and regulatory requirements, proceedings, and orders
  - Filed utility plans and type of regulatory action taken
  - State planning goals and objectives
  - Term of action plan

https://emp.lbl.gov/state-distribution-planning-requirements



Berkeley Lab tools and resources (4)

Grid Resilience Plans – *Report & Template*

- Provides an overview of state requirements and emerging best utility practices for resilience planning
- Provides a standard template that utilities and states can adapt
- Key template elements
  - A vulnerability assessment
  - Description of proposed resilience programs
  - Projected costs and rate impacts

https://emp.lbl.gov/publications/grid-resilience-plans-state

Berkeley Lab tools and resources (5)

Forthcoming

- Presentations from IDSP trainings (for states), beginning December 2024
  - Slides from the March 2024 training are posted here; recordings are here and here
- Interactive online diagram for grid code best practices
- Report on distribution system planning data, metrics and analyses
- Report on resilience planning data, metrics and analyses
- Emerging best practices for integrated resource planning

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For more information

Download publications from the Energy Markets & Policy: https://emp.lbl.gov/publications
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Extra Slides

Current practices – *Types of distribution plans filed*

- **Distribution system improvement plans**
  Enables expedited cost recovery for certain system improvements
  - 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
- **Grid modernization plan**
  Reasoned strategy linking technology deployment roadmap to stated objectives
  - Plans may include a request for approval of grid modernization investments and programs, with expedited cost recovery. Examples: CA, MA, MN, NM, RI, VA
- **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)

Role of State Energy Offices

State Energy Offices can play a range of roles to advance and support distribution system planning

Supporting Activities	Direct IDSP Activities	Participation in Regulatory Proceedings
• Energy-related plans • Studies and reviews • Stakeholder engagement • Grant programs	• Evaluate electrification impacts on distribution • Provide plan review guidance • Establish advisory councils	• Policy content • Cost-effectiveness • Reliability & resilience • DER data
• Hawaii State Energy Office's Energize Kakou initiative shared information and gathered input to empower community participation in the clean energy transition	• Massachusetts Department of Energy Resources commissioned a Technical Potential of Solar Study to inform PV development	• Example State Energy Offices: Colorado, Connecticut, Minnesota, and Rhode Island

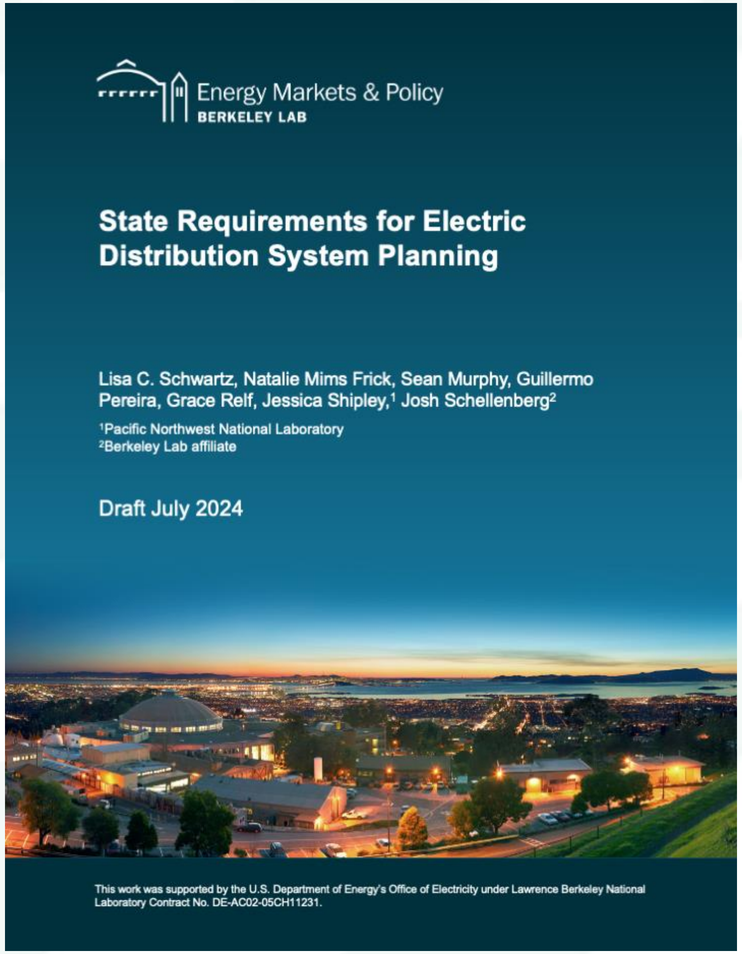
Source: *State Energy Offices' Engagement in Electric Distribution Planning to Meet State Policy Goals*

State Distribution Planning Requirements Report (Forthcoming)

- State goals and objectives
- Procedural requirements
- Stakeholder engagement
- Forecasting loads and DERs
- Hosting capacity analysis
- Baseline information requirements
- Grid modernization strategy
- Grid needs assessment
- Non-wires solutions
- Reliability and resilience analyses
- Equity
- Pilots
- Coordination with other planning processes

Reviews state requirements and utility approaches and offers best practices.

Includes links to legislation; regulatory requirements, proceedings, and orders; and filed utility plans.



https://emp.lbl.gov/publications/state-requirements-electric