PUC Distribution Planning Practices

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Grid planning

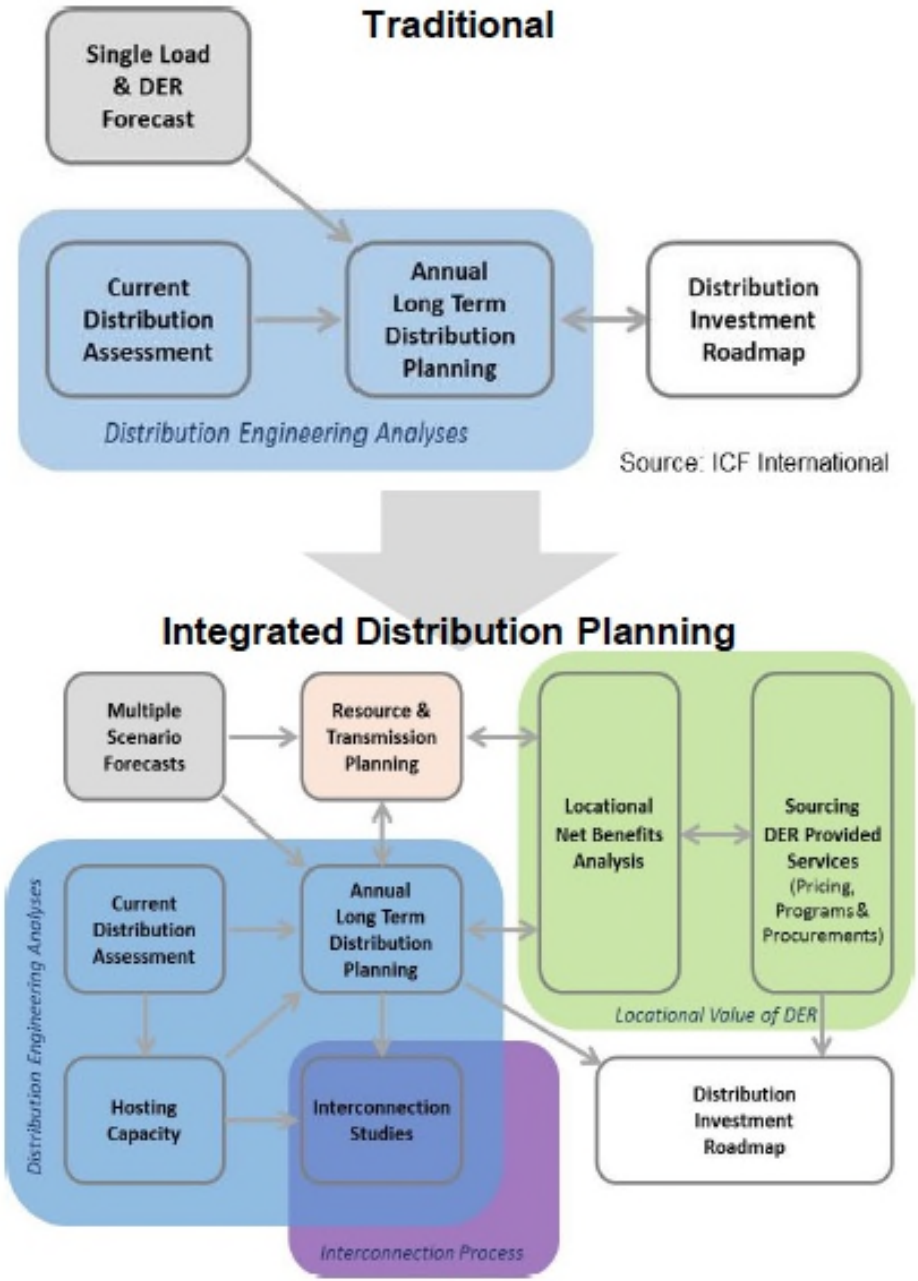
Electric grid planning activities

- *Distribution planning* is focused on assessing needed physical and operational changes to local grid.
  - Can support growth of distributed energy resources (DERs) and grid modernization
- *Integrated resource planning* (in vertically integrated states) is focused on identifying future investments to meet bulk power system reliability and public policy objectives at a reasonable cost.
  - Can consider scenarios for DERs and impacts on need for, and timing of, utility investments
- *Transmission planning* is focused on identifying future transmission expansion needs and options for meeting those needs.
  - Can anticipate operational challenges at transmission-distribution interface* and solutions

**Boundary between wholesale & retail markets; meshed high-voltage network & radial, lower-voltage feeders; and federal & state regulatory jurisdiction*

Planning enhancements: "Integrated distribution planning"

- Develop multiple scenarios to address uncertainty in customer loads and DER growth and types
- Identify distribution hosting capacity
- Identify potential to use services from DER providers and the grid investments required to enable these services
- Evaluate alternatives to grid upgrades (e.g., for load relief)
- Engage stakeholders
- Coordinate distribution planning with other processes



[DOE's Modern Distribution Grid initiative]

I. Customer and State Policy Driven Functionality
II. Advanced Technology Market Assessment
III. Decision Guide

Emerging distribution planning elements

- Projecting loads and DERs in a more granular way
- Analyzing hosting capacity — amount of DERs that can be interconnected without adversely impacting power quality or reliability under existing control and protection systems and without infrastructure upgrades
- Assessing locational value of DERs
- Analyzing non-wires alternatives (NWAs) to traditional investments
- Increasing visibility into distribution system
- Accurately representing distribution system in models for planning and operations
- Engaging stakeholders

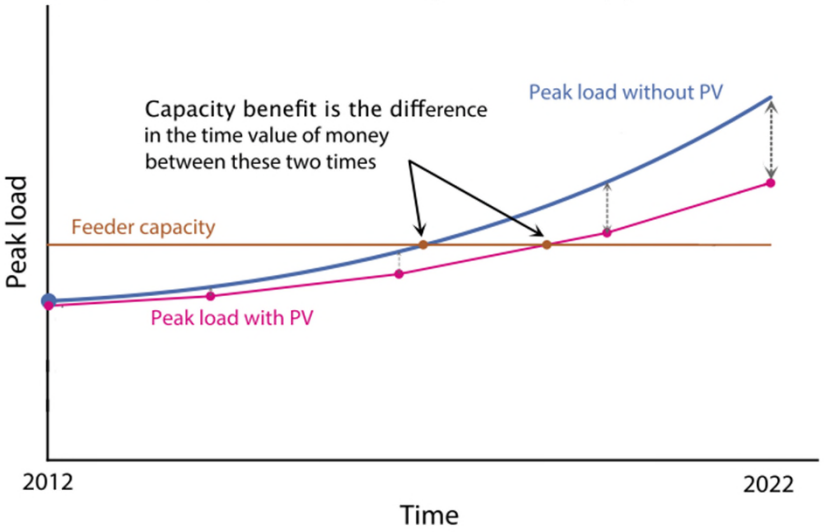


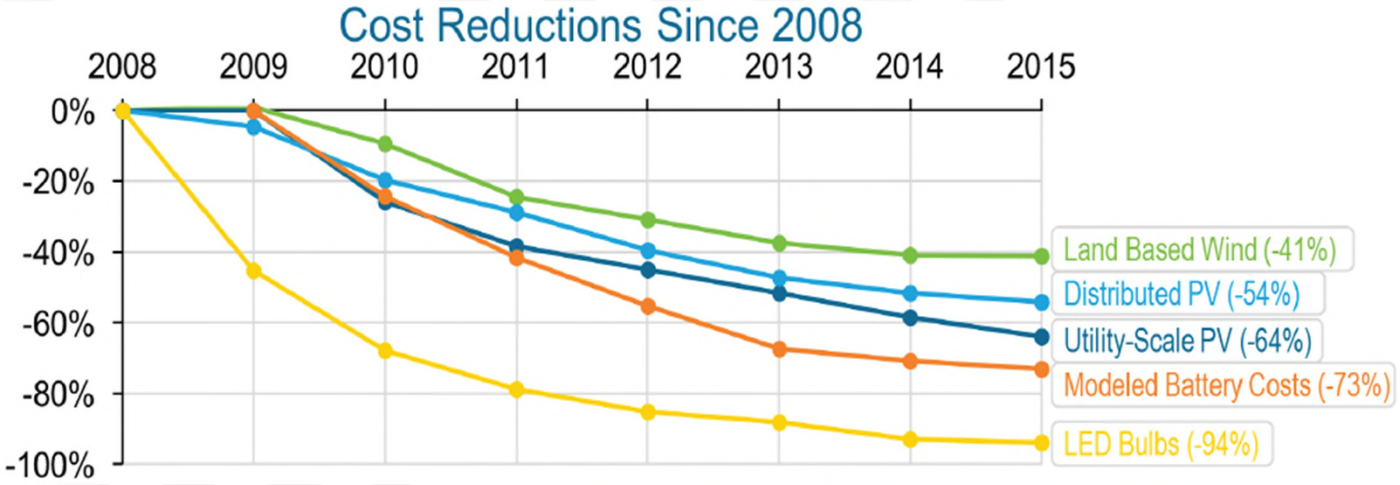
Figure adapted from Cohen, M.A., P.A. Kauzmann, and D.S. Callaway. 2016. "Effects of Distributed PV Generation on California's Distribution System, Part 2: Economic Analysis." *Solar Energy*, Special Issue: Progress in Solar Energy, 128(April): 139–152.

Increasing state engagement in distribution system planning

State drivers for improved distribution planning

GRID MODERNIZATION LABORATORY CONSORTIUM
U.S. Department of Energy

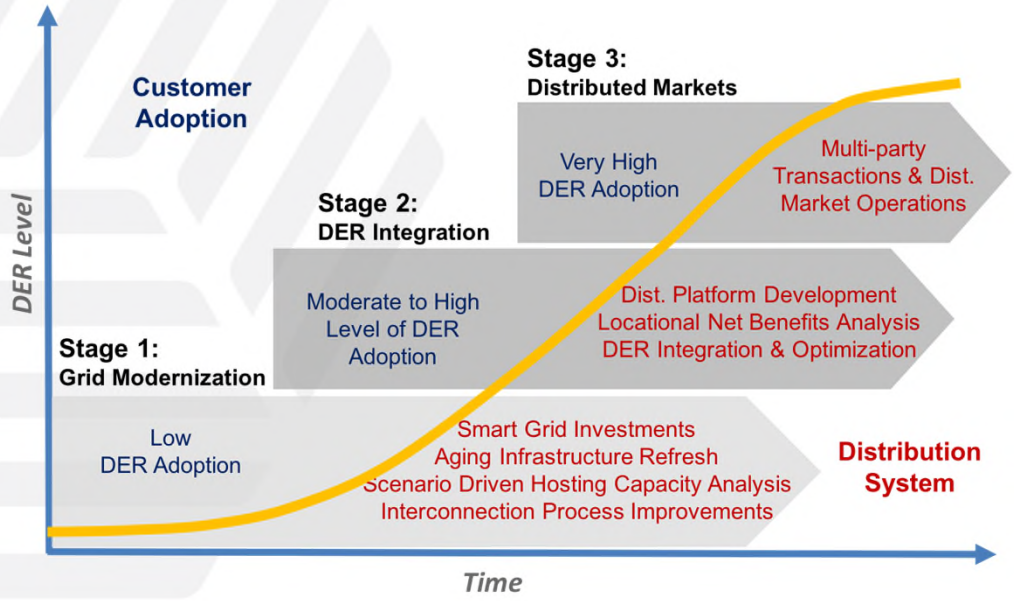
- More DERs — cost reductions, policies, new business models, consumer interest
- Resilience and reliability
- More data and better tools to analyze data
- Aging grid infrastructure and utility proposals for grid investments
- Need for greater grid flexibility in areas with high levels of wind and solar
- Interest in conservation voltage reduction and volt/VAR optimization
- Alternatives to traditional solutions that may provide net benefits to customers



DOE, Revolution Now

State benefits from improved distribution planning

- Makes transparent utility plans for distribution system investments before showing up individually in rider or rate case
- Provides opportunities for meaningful PUC and stakeholder engagement
  - Can improve outcomes
- Considers uncertainties under a range of possible futures
- Considers all solutions for least cost/risk
- Motivates utility to choose least cost/risk solutions
- Enables consumers and service providers to propose grid solutions and participate in providing grid services



Graph from De Martini and Kristov, for Berkeley Lab

Barriers to state engagement in distribution system planning — and potential solutions

- Asymmetry of resources and technical expertise
  - *Can leverage stakeholder input, and train and educate staff*
- Data availability and sharing
  - *Can identify data gaps, begin building on information available through other filings (e.g., reliability, DSM, IRP) and increase transparency*
- Time consuming
  - *Can take incremental steps and reap early benefits*
- Major storm or event can derail planning activities
  - *Can build in regular activities to keep distribution planning updates on track*
- Uncertainty with fast-changing technologies, consumer behavior
  - *Can plan for multiple possible futures (probabilistic models)*
- Granularity – Many disparate distribution system components
  - *Can focus on "hot spots"*
- Novel processes — e.g., non-wires alternatives
  - *Can get started through pilots*

Some considerations for establishing a regulatory process for distribution planning

- Statutory requirements, regulatory precedent
- Priorities, phasing, related proceedings
- What's worked elsewhere, tailored to your state
- Recognize differences across utilities
- Regulatory clarity with flexibility built-in
- Quick wins, early benefits for consumers
- Long-term, cohesive view to achieve goals
- Pilots vs. full-scale approaches (including economy of scale, rate impacts)
- Utility distribution investments are large
  - $32B nationally among Edison Electric Institute members in 2016

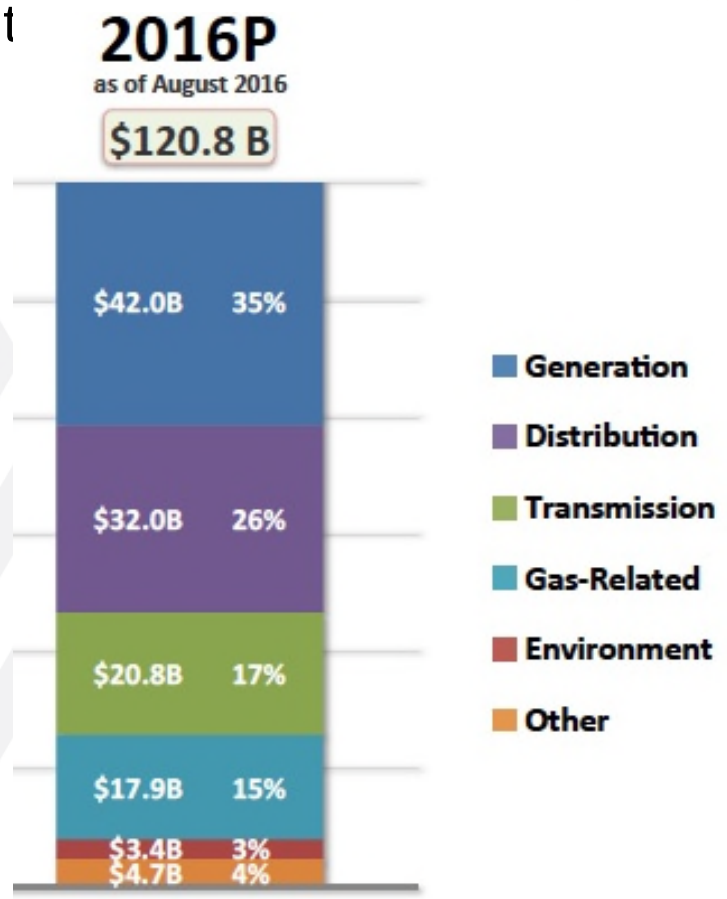


*Figure from EEI, *Delivering America's Energy Future, 2/8/17*. Source: EEI Finance Department, company reports, S&P Global Market Intelligence (August 2016)

Variety of state approaches

State Engagement in Distribution System Planning

Homer, Cooke, Schwartz, Leventis, Flores-Espino, Coddington, *State Engagement in Electric Distribution Planning*, PNNL, Berkeley Lab, and NREL, December 2017

	States with advanced practices					Other state approaches									
	California	Hawaii	Massachusetts	Minnesota	New York	D.C.	Florida	Illinois	Indiana	Maryland	Michigan	Ohio	Oregon	Pennsylvania	Rhode Island	Washington
Statutory requirement for long-term distribution plans or grid modernization plans[a]	✓			✓					✓							
Commission requirement for long-term distribution plans or grid modernization plans[a]		✓	✓		✓					✓	✓					
No planning requirements yet, but proceeding underway or planned						✓							✓		✓	✓
Voluntary filing of grid modernization plans								✓				✓		✓		
Non-wires alternatives analysis and procurement requirements	✓				✓										✓	
Hosting capacity analysis requirements	✓	✓		✓	✓											
Locational net benefits analysis required	✓				✓											
Smart grid plans required													✓			
Required reporting on poor-performing circuits and improvement plans							✓	✓				✓		✓	✓	
Storm hardening requirements							✓			✓						
Investigation into DER markets		✓														

(a) For one or more utilities.

For a summary by topic with some updates, see Cooke and Homer (PNNL) and Schwartz (LBNL), *Distribution System Planning – State Examples by Topic*, May 2018

States are advancing distribution system planning in a variety of ways. Here are some *examples*.

- Requirements for utilities to file distribution system or grid modernization plans (CA, HI, IN, MA, MD, MI, MN, NV, NY)
- Requirements to conduct hosting capacity analysis (CA, HI, MN, NY)
- Consideration of cost-effective non-wires alternatives (CA, NY, RI)
- Locational net benefits analysis for DERs (CA, NY, HI, NV)
- Investigations into DER procurement strategies (CA, HI, NY)
- Storm hardening and undergrounding requirements (MD, FL)
- Requirements for utilities to report on poor-performing circuits and improvement plans (many states — e.g., FL, IL, OH, PA, RI)

New York

- Reforming the Energy Vision - Utilities file Distribution System Implementation Plans with stakeholder engagement
  - PSC 4/26/18 staff whitepaper: Guidance for 2018 DSIP Updates
- Non-wires alternatives
  - Brooklyn and Queens Demand Management project ($200M) enabled $1.2B deferral of traditional network upgrades (41 MW customer-side, 11 MW utility-side)
  - Incorporating NWA criteria into T&D capital planning – Utilities must routinely identify candidate projects for NWA solutions (load relief, reliability)
  - Utilities issue requests for proposals for NWAs
- Value Stack tariff
  - Location-specific relief zones
  - Payments to DER projects based on energy, capacity, environmental, demand reduction and locational system relief value
- Hosting capacity maps for all circuits ≥12 kV

California

- AB 327 (2013), PUC proceeding on distribution resource plans (DRPs)
- 2014 PUC order on DRPs
- Feb. 2018 order on Distribution Investment Deferral Framework (DIDF)
  - Annual process for third party-owned DERs to defer or avoid traditional capital investments in distribution systems
  - "The central objective of the DIDF is to identify and capture opportunities for DERs to cost-effectively defer or avoid traditional IOU investments that are planned to mitigate forecasted deficiencies of the distribution system."
  - IOUs file annually detailed Grid Needs Assessment and Distribution Deferral Opportunity Report. 2018 GNAs filed June 1st.
  - Distribution Planning Advisory Group – Stakeholder feedback on reports
  - Annually by Dec. 1, each IOU recommends distribution deferral projects for solicitations via the Competitive Solicitation Framework Request for Offers.

- *Locational Net Benefits Analysis*
  - Net benefits DERs can provide at a given location, using an avoided cost calculator as a framework for system-level values plus PUC-required, location-specific methods for avoided T&D costs
  - Public Tool and Heat Map to identify optimal locations for installing DERs
  - To prioritize candidate distribution deferral opportunities
  - Demo projects underway to test analytical tools
  - LNBA working group
- *Integration Capacity Analysis* – to identify how much generation can be installed on a line section w/o distribution upgrades
- DER Adoption and Distribution Load Forecasting methodology
- Grid Modernization Investment Guidance (staff whitepaper)

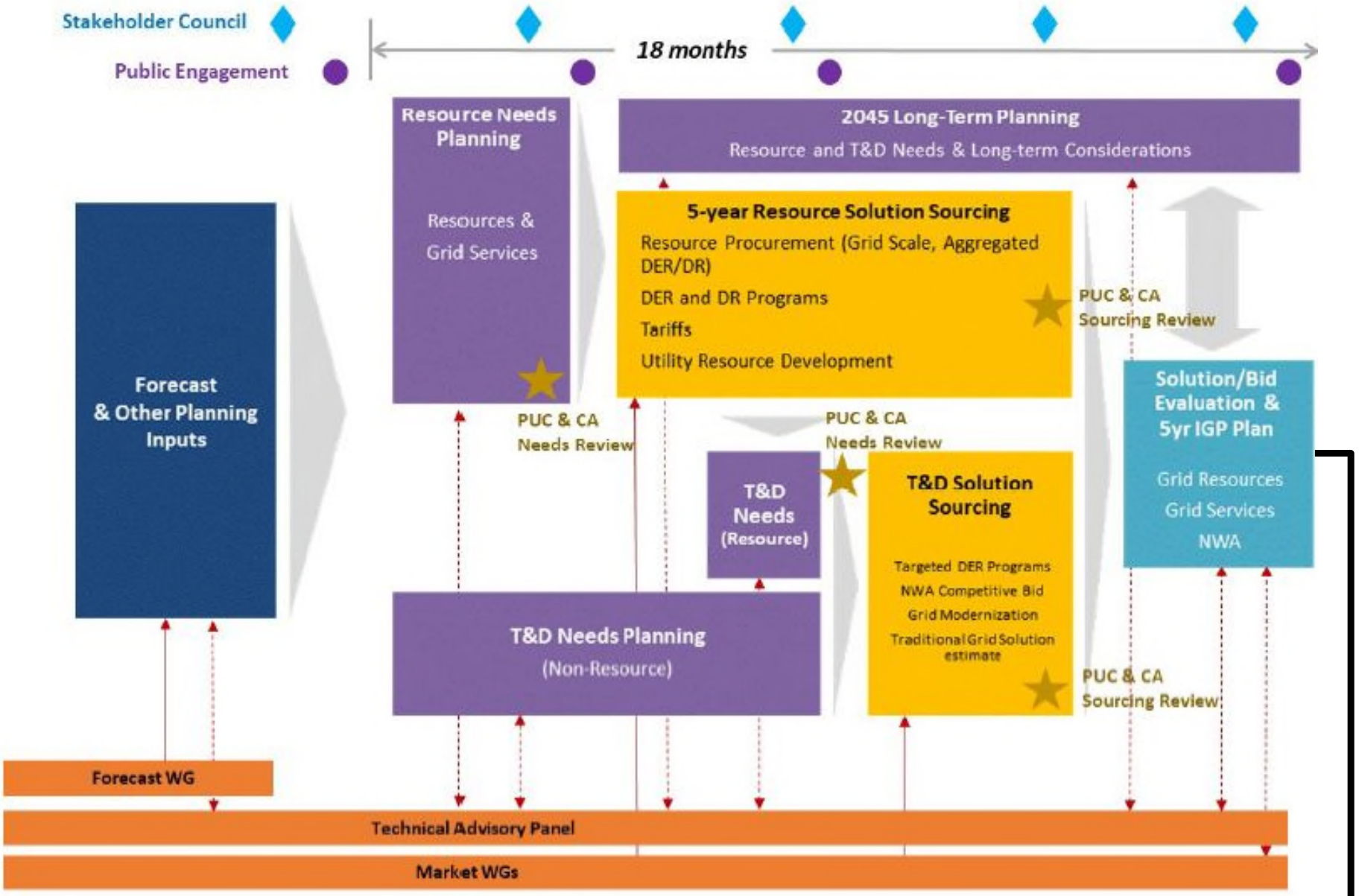
Minnesota

- Biennial Distribution Grid Modernization Reports (Minn. Stat. §216B.2425)
  - Utility identifies projects it considers necessary to modernize its T&D systems
  - May ask Commission to certify grid modernization projects as priority projects, a requirement for utility to recover costs through a rider (outside of a general rate case)
  - Distribution study to identify interconnection points for small-scale DG and system upgrades to support DG development; no formal Commission action required
- Xcel Energy filed 1st Biennial Distribution Grid Modernization Report in 2015 (Docket No. E-002/M-15-962)
  - Commission order certified an advanced distribution management system and required initial hosting capacity analysis by 12/1/16 — analysis of each feeder for DG ≤1 MW and distribution upgrades necessary to support expected DG (based on IRP filings and Community Solar Gardens process)
  - Staff issued briefing papers on 1st hosting capacity analysis filed by Xcel Energy
  - Commission decision requires hosting capacity analyses Nov. 1 each year and provided guidance
  - Xcel Energy filed 2nd hosting capacity analysis 11/1/17 in Docket 17-777
- PUC initiated inquiry in May 2015 on Electric Utility Grid Modernization with a focus on distribution planning (Docket No. CI-15-556)
  - Staff Report on Grid Modernization (March 2016)
  - DOE sponsored report on integrated distribution system planning for MN
  - Utility questionnaire on current practices, planning status and possible improvements; stakeholder comments

- MN PUC staff proposed DSP requirements for Xcel (Docket 18-251, 6/8/18)
  - Annual DSP filing by Nov. 1; PUC accepts or rejects plan by June 1
  - 15-year Distribution System Modernization and Infrastructure Investment Plan, including 5-year action plan, based on internal business plans and DER future scenarios
    - Low, medium, high scenarios, specifying methods and assumptions
  - Stakeholder engagement – Utility holds at least one "timely" meeting prior to filing; PUC staff also may convene a stakeholder meeting during public comment period
  - Data specified for filing
    - Baseline distribution system, financial data and DER deployment
  - Non-wires alternatives
    - For projects >$5M, analyze how NWAs compare in viability, price and long-term value
    - Specify project types (e.g., for load relief or reliability), timelines and cost thresholds
  - Hosting capacity analysis (already required by law) – Include in plan a discussion of how analysis advances customer-sited DERs and other customer benefits
- Proposed requirements for other 3 regulated utilities
  - Docket Nos., 18-253 (Otter Tail), 18-254 (Minnesota Power), 18-252 (Dakota Electric)
  - File biennially beginning Nov. 1, 2019
  - Simpler hosting capacity analysis requirements (Excel spreadsheet by feeder with daytime minimum load — daily if available — or peak load, specifying times)

Hawaii

- PUC rejected piecemeal investment proposals and required Hawaiian Electric Companies (HECO) to file a comprehensive grid modernization plan
- Order No. 34281 (Jan. 2017) provided guidance for developing a scenario-based grid modernization strategy that provides a holistic vision to inform review of discrete grid modernization project applications submitted by the utility.
- HECO filed a final Grid Modernization Strategy on Aug. 29, 2017
  - PUC approved the plan in Order No. 35268 (Feb. 7, 2018)
- HECO issued *Planning Hawai'i's Grid for Future Generations: Integrated Grid Planning Report on* March 1, 2018
  - Proposed new "Integrated Grid Planning" process integrates customer, distribution, transmission and bulk power resource levels of the system
    - Stakeholder involvement
    - Optimized solutions for resource adequacy and grid services, based on procurement processes including NWA solutions
    - Incremental deployment of grid modernization technology
- PUC goal is identifying and procuring an optimal mix of distributed and grid scale resources to increase customer value and reduce risk
  - 18-month planning process intended to result in a 5-year integrated plan



Regulatory Approval:
Seek PUC approval of Integrated Grid Plan's 5-year plan & related applications

Michigan

- In early 2017 rate proceeding orders, PSC directed utilities (Consumers Energy - Case No. U-17990 and DTE Electric - Case No. U-18014) to file draft 5-yr distribution investment & maintenance plans
  - "to increase visibility into the needs of maintaining the state's system and to obtain a more thorough understanding of anticipated needs, priorities, and spending"
  - Desire to evaluate significant and necessary investments to aging distribution systems to ensure they are safe, reliable, and resilient long into the future, as opposed to merely evaluating such costs over a 12-month snapshot of time
  - DTE Electric and Consumers Energy filed draft plans and parties commented
  - DTE Electric final plan filed Jan. 31, 2018; Consumers Energy final plan filed March 1, 2018
- 4/12/18 order requires 5-year plan by Indiana Michigan Power Co., consolidates into one docket plans for all utilities, and requests stakeholder feedback on how DSP can inform ratemaking and other regulatory processes

Nevada

- SB 146 (2017) requires distributed resource plans that:
  - Evaluate locational benefits and costs of DERs
  - Propose or identify standard tariffs, contracts or other mechanisms for deployment of cost-effective DERs that satisfy distribution planning objectives
  - Propose cost-effective methods to effectively coordinate existing approved programs to maximize locational benefits and minimize the incremental costs of DERs
  - Identify any additional spending necessary to integrate cost-effective DERs into distribution planning to yield net benefits to customers
  - Identify barriers to DER deployment
- Docket 17-08022
  - NV Energy files 1st DRP in April 2019 as amendment to June 2018 resource plan
  - NV Energy filed proposed regulations 6/1/18, following stakeholder feedback
  - Filed every 3 years as part of resource plan, with annual updates
  - Grid needs assessment with analysis of non-wires alternatives, 6-year load and DER forecasts (with annual updates), hosting capacity analysis made public 2x/year with maps and data, interconnection process improvements, locational net benefits analysis, cost recovery for approved plan in “appropriate separate rate proceeding”

Washington

- On 4/17/18, WUTC staff proposed rules for electric utilities and requested comments and posed questions for both electric and natural gas utilities
  - "…it is imperative that the IRP principle of comparing disparate resources on even terms is applied to distribution system planning"
  - "…adopt changes to the current [IRP] rule, or create a new rule, that will increase transparency of utility planning to meet distribution system needs that ensures that utilities make investments on a least-cost, least-risk basis."
  - Each electric utility must develop an IRP "that cohesively plans for meeting resource needs through investments in … generation, transmission, and distribution systems."
  - Stakeholder engagement via advisory group
  - DSP consists of 1) 10-year capital investment plan; 2) long-term plan on how utility is improving distribution system operations and transparency; 3) report on tools and practices to facilitate integration of DERs – **All an input to IRP**
    - Facilitate DER integration through probabilistic forecasts of customer-owned DERs, identify potential tariffs and rate designs to compensate customers for value and provide accurate price signals, and identify pilot programs

Non-wires alternatives (NWAs)

Investments in energy efficiency, demand response, distributed generation and storage that provide specific services at specific locations in order to defer, mitigate or eliminate the need for traditional distribution infrastructure investments

Natalie Mims Frick contributed research for these NWA slides.

New York Joint Utilities NWA Criteria

- The Joint Utilities provided suitability criteria for NWA projects in March 2017 and described how the criteria will be applied to projects in their capital plans in a supplemental filing on May 8, 2017.
- Similar criteria provided by ConEd, O&R Utilities and Central Hudson

Criteria	Potential Elements Addressed	
Project Type Suitability	Project types include Load Relief and Reliability*. Other categories currently have minimal suitability and will be reviewed as suitability changes due to State policy or technological changes.	
Timeline Suitability	**Large Project**	36 to 60 months
	Small Project	18 to 24 months
Cost Suitability	**Large Project**	≥ $1M
	Small Project	≥ $300k

*Reliability projects entail projects for remote single source regions or customer-requested enhanced reliability projects. Source: Central Hudson NWA Opportunity website

Examples of NY NWA RFPs

- The NY Joint Utilities' supplemental filing describes how utilities use their procurement processes to award contracts for NWAs. Information on the Joint Utilities NWA process is here and on the REV Connect website.

Utility	Project Name	Project Type	Size	Procurement and development
Central Hudson	Philips Road/ Substation	Load relief	Large (5 MW)	RFP issued: 11/2014 Timeline: 42 mo.
Central Hudson	Coldenham/ Distribution Feeder Upgrade	Load relief	Small (1 MW)	RFP issued: 3/2017 Timeline: 34 mos.
NYSEG	Java 2nd Transformer and 12 kV Conversion	Load relief and reliability	Not provided	RFP issued: 2016 Timeline: 3/2019
Con Ed	West 42nd St Load Transfer	Load relief	42 MW	RFP issued: 12/2017 Timeline: 12 MW by May 2021

Con Ed RFP response requirements include proposed solution description; project schedule and acquisition plan; detailed costs associated with proposed solution; risks, challenges and community impacts; and professional background and experience with the proposed solutions. "Failure to deliver load relief committed as part of any solution may result in liquidated damages to ConEd as provided by the contract."

Oregon

- Pacific Power and Energy Trust of Oregon (ETO)* are using targeted energy efficiency to possibly defer a substation upgrade.
- 2-year pilot (Q3 2017 to Q2 2019) targets efficiency measures for 3,000 customers to reduce substation load. Goals of the pilot:
  - Measure and quantify peak demand savings
  - Document and evaluate ability to replicate the strategies in other regions served by Pacific Power and ETO
  - Develop processes for coordinated implementation between Pacific Power and ETO
  - Determine if any changes need to be made to improve targeted deployment of efficiency for deferral of traditional distribution system upgrades

Commercial	Industrial	Residential
• Lighting direct installation for commercial, multifamily • Standard incentives	• Lighting • Operations & maintenance • Standard incentives	• Energy Saver Kits • Smart thermostats • Online Home Energy Reviews

*ETO is the third-party administrator for energy efficiency programs.

Rhode Island

- PUC created Least Cost Procurement Standards in July 2017 (Docket 4684) with guidelines for incorporating NWAs into utility System Reliability Procurement (SRP) plans. NWA implementation costs, as well as other types of expenditures, are recovered in SRP.
- In August 2017, National Grid filed its Efficiency and System Reliability Procurement Plan. The SRP plan highlighted the use of NWAs for:
  - Highly utilized distribution systems
  - Areas where construction is physically constrained
  - Areas where the utility anticipates demand growth
- Investigation Into the Changing Electric Distribution System (Docket No 4600) produced a Guidance Document in October 2017 on how the PUC will consider distribution system investments in National Grid regulatory proceedings.
- Power Sector Transformation Initiative Phase I report, November 2017
- Power Sector Transformation Docket (4780) – recent settlement

Some takeaways

Some takeaways

- Most states have not begun to directly engage in longer-term utility distribution planning. States further down the path are still early in the process.
- Some PUC distribution planning processes are tied to greater utility assurance of cost recovery for distribution investments that are included in approved plans.
- Beyond affordability and reliability, common drivers for a state distribution planning process include facilitating higher levels of DERs, harnessing them to provide grid services for customers, enabling consumer engagement, and improving review of utility distribution investments.
- Common *emerging* elements of distribution planning include DER forecasting, hosting capacity analysis, DER locational valuation, and engaging stakeholders.
- Some states are taking steps toward including NWAs in distribution planning and competitive procurements to meet certain types of grid needs (e.g., load relief).
- Integration of distribution planning with other types of planning is nascent.

Resources

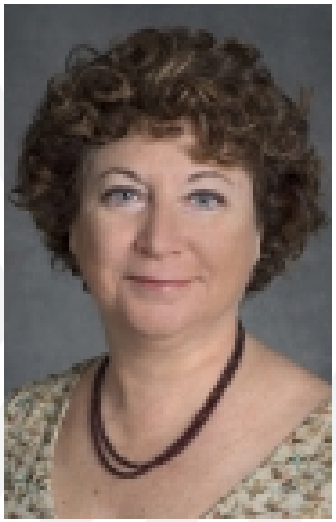
Technical assistance for states

- DOE's Solar Energy Technologies Office, in partnership with Berkeley Lab, Pacific Northwest National Laboratory and National Renewable Energy Laboratory, recently launched a three-year analytical support program for PUCs on topics related to distribution utility planning and regulatory, policy, programmatic and technology assessments of DERs. Applications for year 1 were selected in October 2017. Applications for the next round of support will be solicited late summer 2018.
- Berkeley Lab's Electricity Markets and Policy Group provides independent and unbiased technical assistance to state utility regulatory commissions, state energy offices, tribes and regional entities in these areas:
  - Energy efficiency (e.g., policy frameworks, implementation strategies, resource planning approaches, utility cost recovery, and evaluation)
  - Renewable energy resources
  - Demand response (e.g., time-varying pricing)
  - Utility regulation (e.g., financial impacts to utilities and utility customers)
  - Grid modernization and broader issues on electricity system decision-making

Publications for more information

- Alan Cooke, Juliet Homer, Lisa Schwartz, *Distribution System Planning – State Examples by Topic*. Pacific Northwest National Laboratory and Berkeley Lab, May 2018
- Juliet Homer, Alan Cooke, Lisa Schwartz, Greg Leventis, Francisco Flores-Espino and Michael Coddington, *State Engagement in Electric Distribution Planning*, Pacific Northwest National Laboratory, Berkeley Lab and National Renewable Energy Laboratory, December 2017
- U.S. Department of Energy's (DOE) Modern Distribution Grid initiative and report (www.doe-dspx.org)
  - Volume I: Customer and State Policy Driven Functionality
  - Volume II: Advanced Technology Market Assessment
  - Volume III: Decision Guide
- Paul De Martini (ICF) for Minnesota Public Utilities Commission, *Integrated Distribution Planning*, 2016
- *Summary of Electric Distribution System Analyses with a Focus on DERs*, by Y. Tang, J.S. Homer, T.E. McDermott, M. Coddington, B. Sigrin, B. Mather, Pacific Northwest National Laboratory and National Renewable Energy Laboratory, 2017
- Berkeley Lab's Future Electric Utility Regulation report series — in particular:
  - *Distribution Systems in a High Distributed Energy Resources Future: Planning, Market Design, Operation and Oversight*, by Paul De Martini (Cal Tech) and Lorenzo Kristov (CAISO)
  - *The Future of Electricity Resource Planning*, by Fredrich Kahrl (E3), Andrew Mills (Berkeley Lab), Luke Lavin, Nancy Ryan and Arne Olsen (E3)
  - *Value-Added Electricity Services: New Roles for Utilities and Third-Party Providers*, by Jonathan Blansfied and Lisa Wood, Institute for Electric Innovation; Ryan Katofsky, Benjamin Stafford and Danny Waggoner, Advanced Energy Economy; and National Association of State Utility Consumer Advocates

Contact



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