PUC Distribution Planning Practices

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In this presentation

► Increasing state engagement in distribution planning
  □ Drivers
  □ Benefits
  □ Considerations for establishing a regulatory process
  □ Variety of approaches
  □ Possible places to start

► Survey of states outside New England
  □ States with advanced distribution system planning practices
  □ More state approaches to distribution system planning

► Some takeaways

► Additional slides (beyond what we cover today)
  □ Principles for grid modernization (MN PUC)
  □ Electric grid planning activities
  □ Integrated planning considerations
  □ Resources for more information - technical assistance for states and publications
Increasing state engagement in distribution planning
State drivers for improved distribution planning

- More distributed energy resources (DERs) due to:
  - Cost reductions
  - Public policies
  - Third-party providers
  - Consumer interest in control over energy costs and sources

- Resiliency and reliability

- More data and better tools to analyze data

- Aging grid infrastructure and proposals for grid investments

- Need for greater grid flexibility with high levels of wind and solar

- Interest in distribution efficiency improvements
  - Conservation Voltage Reduction and Volt/VAR Optimization

- Pilots demonstrating cases where alternatives to traditional distribution solutions provide net benefits to customers
State benefits from improved distribution planning

- Makes transparent utility 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 third parties to propose grid solutions and participate in providing grid services

Graph from DeMartini and Kristov, for Berkeley Lab (see “Publications”)
Some considerations for establishing a regulatory process for distribution planning

► Statutory requirements, regulatory precedents
► 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
States are advancing distribution system planning in a variety of ways.

- Requirements for utilities to file distribution system/grid modernization plans with stakeholder engagement (e.g., NY, CA, MA)
- Ad hoc directive to file a distribution system plan (e.g., MI, MD)
- Requirements to conduct hosting capacity analysis (e.g., MN, CA, NY)
- Consideration of cost-effective non-wires alternatives (e.g., NY, CA)
- Locational net benefits analysis for DERs (e.g., NY, CA)
- Investigations into DER procurement strategies (e.g., HI, NY, CA)
- Requirements for utilities to report regularly on poor-performing circuits and propose investments (e.g., PA)
- Storm hardening and undergrounding requirements (e.g., FL)
- Reliability codes and annual compliance reports (e.g., OH, IL)
- Smart grid reporting (e.g., OR, WA)
Possible places to start

► **Take early integration steps** - Consistency in inputs (e.g., assumptions, forecasts), scenarios and modeling methods — updated in time — across distribution planning, transmission planning and integrated resource planning (IRP, in vertically integrated states)

► **Account for all resources** – Consider energy efficiency, demand response (including direct load control, smart thermostats and time-varying pricing), distributed generation and energy storage, alongside traditional distribution solutions

► **Specify DER attributes** – In order to meet identified needs

► **Test new sourcing and pricing methods** – e.g., competitive solicitations, tariffs, programs

► **Analyze multiple possible futures** – e.g., loads, DERs, markets
Possible places to start - 2

► **Phase in hosting capacity analysis** – To facilitate distributed generation integration and indicate better or more difficult locations

► **Pilot evaluation of locational impacts** – Identify where DERs might offer greatest benefits

► **Plan integration of utility systems in advance** – Specify how any proposed investments (e.g., advanced metering infrastructure, automated distribution management systems) will be used with other systems, in distribution planning and for the benefit of consumers.

► **Education and training** – You are doing that right now!

Figure adapted by Berkeley Lab from EPRI (2015), *Distribution Feeder Hosting Capacity: What Matters When Planning for DER?*
Survey of states outside New England
States advancing distribution planning

► New York – Reforming the Energy Vision

- Utilities filing Distribution System Implementation Plans with stakeholder engagement

- Expansion of non-wires alternatives (NWAs)
  - Brooklyn and Queens Demand Management project ($200M) enabled $1.2B deferral of traditional network upgrades (41 MW customer-side, 11 MW utility-side)
  - Focusing on NWA suitability criteria - Utilities incorporating NWA criteria into transmission and distribution capital planning – Must routinely identify projects that are candidates for NWA solutions (load relief, reliability, etc.) and post to websites with information including timing
  - Issue requests for proposals for NWAs
NY, cont.

- **Value Stack tariff**
  - Demand relief values being calculated and location-specific relief value zones identified
  - Payments to be made to DER projects based on energy, capacity, environmental, demand reduction and locational system relief value
  - Future:
    - Hosting capacity maps for all circuits ≥12 kV by 10/1/17
    - Updated marginal cost of service studies
    - Interconnection portal online for developers
    - Two energy storage projects per utility required by end of 2018
States advancing distribution planning - 3

► California

- AB 327 and PUC order on distribution planning
- Distribution Resource Plans
  - Locational Net Benefits Analysis - Specify net benefits DERs can provide at any given location, using E3’s Distributed Resource Avoided Cost Calculator as framework for system-level values and PUC-required, location-specific methods for avoided T&D costs
  - Integration Capacity Analysis – “Streamlined” hosting capacity analysis to identify how much generation can be installed on a line section w/o distribution upgrades. 9 functional requirements for demos
  - DER Adoption and Distribution Load Forecasting methodology
  - Grid Modernization Investment Guidance (staff whitepaper)
  - Distribution Investment Deferral to establish annual process for third party-owned DERs to defer or avoid traditional capital investments in distribution systems
- Demo projects: Integrated capacity analysis, locational benefits (2), distribution operations with high DERs and microgrids
CA, cont.

- **Utility incentive mechanism pilot for DERs** – Utilities earn 4% on customer or third-party DER projects that cost-effectively defer distribution system investments; Pilot - one to four projects each IOU
  - Also addresses cost effectiveness framework

- **Integrated Resource Planning rulemaking** to set GHG targets for load serving entities; CPUC staff to do initial modeling

- **SCE Grid Modernization Plan** – As part of 2018 rate case SCE proposed $1.9 billion to modernize grid for DERs; Commission decision Jan 2018

- **Report on improving T&D coordination** for high DERs from More Than Smart, CAISO, PG&E, SCE, SDG&E

- **Energy storage mandate** (AB 2514) - target of 1,350 MW of energy storage by 2020
Hawaii

- **Clean Energy Initiative**
  - 100% RPS by 2045
  - Reducing electricity consumption by 4,300 GWh by 2030, enough electricity to power every home for more than two years

- High penetration levels of distributed solar PV and isolated island grids

- **Investigations into DERs** including procurement
  - No more net metering – three new tariff options:
    - Customer self-supply
    - Customer grid-supply (Smart Export tariff)
    - Time-of-use tariff

- HPUC rejected piecemeal investment proposals and required HECO to file a comprehensive [Grid Modernization Plan](#)

- **Demand response** tariffs in process that will provide capacity, fast frequency response, regulating reserves and replacement reserves

- PUC **inclinations** on future of utilities

- **Study on alternative utility and regulatory models** underway. Contractor selected by HI Energy Office; report due December 2018
States advancing distribution planning - 6

► DC – Modernizing the Energy Delivery System, staff report issued in Jan 2017 included two draft NOPRs for Commission to consider

► WA – Rulemaking considering resource planning changes: consideration of DERs including energy storage; distribution system modeling; RFP, avoided costs; smart grid reporting (with sunset of current reporting requirements)

► OR – Utilities must submit smart grid implementation plans biennially and annually report on projected construction budgets for T&D projects >$10 million; staff proposed Commission open investigation to adopt process for distribution system planning (5- to 10-year planning horizon)
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 distributed generation (DG) and distribution system upgrades to support continued DG development; no formal Commission action required

  - Commission order certified an advanced distribution management system (ADMS) and required initial hosting capacity analysis by 12/1/16 — analysis of each feeder for DG ≤1 MW and potential distribution upgrades necessary to support expected DG (based on utility’s 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 provides guidance for next analysis: reliable estimates and maps of available hosting capacity at feeder level; details to inform distribution planning and upgrades needed for efficient DG integration; detailed information on data, modeling assumptions and methodologies
MN, cont.

- PUC initiated inquiry in May 2015 on Electric Utility Grid Modernization with a focus on distribution planning (Docket No. CI-15-556)
  - Series of stakeholder meetings that continued through fall 2016
  - DOE sponsored a consultant report on integrated distribution system planning for MN
  - Questionnaire on utility planning practices with stakeholder comments and responses
    - How do Minnesota utilities currently plan their distribution systems?
    - What is the status of each utility’s current plan?
    - Are there ways to improve or augment utility planning processes?

- Staff Report on Grid Modernization (March 2016)
  - Tees up 3 questions
    - Are we planning for and investing in the distribution system we will need in the future?
    - Are planning processes aligned to ensure future reliability, efficient use of resources, maximize customer benefits and successful implementation of public policy?
    - What commission actions would support improved alignment of planning and investment?
  - Proposes principles for grid modernization (see “Additional slides”)

More state approaches to distribution planning

► Colorado
- PUC approved an unopposed settlement agreement on Xcel Energy’s grid modernization proposal, including Advanced Metering Infrastructure (AMI), Integrated Volt-VAr Optimization Infrastructure and associated components of an advanced communications network, including a Field Area Network and Home Area Network.

► Pennsylvania
- Utilities can propose a Distribution System Improvement Charge to recover reasonable and prudent costs to repair, improve or replace certain eligible distribution property by filing Long Term Infrastructure Improvement Plans.
  - e.g., see FirstEnergy LTIIP
- Distribution reliability code directs PSC to regulate distribution inspection & maintenance plans, requires utilities to report quarterly on worst-performing circuits and make annual compliance filings (see 2016 PA reliability report).
More state approaches to distribution planning - 2

► Illinois

- Utilities file annual reliability reports, ICC assesses utility report ≤3 years
- Energy Infrastructure Modernization Act authorized investment plans for grid hardening and smart meters
  - Utilities file annual Grid Modernization Action Plans with formula rates for ICC approval — e.g., see ICC order on 2016 Ameren plan
- ICC kicked off NextGrid initiative in March 2017, a consumer-focused study on topics such as leveraging Illinois’ restructured energy market, investment in smart grid technology, and recent law expanding renewables and efficiency
  - ICC resolution invited stakeholders to comment on an independent facilitator and topics to be considered as part of the initiative
  - Series of workshops to kick off 18-month process

► Indiana

- In February 2017, Southern Indiana Gas & Electric filed a $500 million, 7-yr T&D modernization plan including AMI, distribution automation, and advanced distribution management system (ADMS)
More state approaches to distribution planning - 3

**Maryland**

- Distribution planning is one of six topics* addressed in PC 44 - Transforming Maryland’s Electric Grid proceeding.
  - RFP for consultant to study benefits & costs of distributed solar in IOUs’ service areas
- Orders in Case No. 9406 (BGE rate case) and Case No. 9418 (Pepco rate case) require a five-year distribution investment plan within 12 months
  - BGE distribution investment plan filed; Pepco plan forthcoming

**Michigan**

- PSC ordered 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.”
- DTE Electric and Consumers Energy filed plans; comments were due 9/6/17
- Utilities to address “electric distribution system conditions, including equipment age and useful life; system goals and related reliability metrics; local system load forecasts; and maintenance and upgrade plans”

*Other topics: rate design, EVs, competitive markets/customer choice, interconnection process and energy storage
Ohio

- PUCO’s **PowerForward initiative** is reviewing technological and regulatory innovation that could enhance the consumer electricity experience.
  - Workshops with industry experts “to chart a path forward for future grid modernization projects, innovative regulations and forward-thinking policies”
- Duke’s **electric security plan** includes a rider for “new offerings designed to advance programs, services, and initiatives reflective of … PowerForward”
- AEP’s amended **electric security plan** includes installation of EV charging stations, microgrids and smart lighting controls
- FirstEnergy – **PUCO approved Distribution Modernization Rider** (3/31/16; $132.5M/yr for 3 yr); **Grid Modernization Business Plan** filed 2/29/16 includes 3 scenarios with full deployment of AMI and ADMS, plus Distribution Automation and Integrated Volt/VAR Control to varying degrees
- **Distribution system reliability code, distribution circuit performance codes** and annual reliability compliance filings
Conclusion
Some takeaways

► Most states have not yet begun to directly engage in longer-term (5- to 10-year) utility distribution system planning. And states further down the path are still early in the process.
   • Approaches range from a cohesive set of requirements to an order in a utility rate case.
► Some PUC distribution planning processes are tied to greater utility assurance of cost recovery for distribution investments that are included in approved plans.
► Beyond universal interest in affordability and reliability, common state drivers for a state distribution system planning process include improving system efficiency, enabling greater consumer engagement, and integrating DERs.
► Common emerging distribution system planning elements include DER forecasting, DER locational value, hosting capacity analysis, and engaging stakeholders (including third-party service providers) to help identify solutions.
► Some states are taking steps toward: 1) including non-wires alternatives in distribution planning and competitive procurements to meet certain grid needs and 2) modifying utilities’ annual capital planning process to account for DER options.
► Integration of distribution planning with demand-side management planning, integrated resource planning and transmission planning is nascent.
Additional slides
Minnesota staff – Principles for grid modernization

► 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, new services, and opportunities for adoption of new distributed technologies
► Ensure optimized utilization of electricity grid assets and resources to minimize total system costs
► Facilitate comprehensive, coordinated, transparent, integrated distribution system planning

Staff Report on Grid Modernization, March 2016
Electric grid planning activities

- **Distribution planning** is focused on assessing needed physical and operational changes to local grid.
  - Can support DER growth and net benefits for all

- **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 begin anticipating operational challenges at transmission-distribution interface* and solutions

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*Boundary between wholesale & retail markets; between meshed high-voltage network & radial, lower-voltage feeders; and between federal & state regulatory jurisdiction
Integrated planning and analysis within and across the transmission, distribution and customer/3rd party domains

From *Integrated Distribution Planning* (see “Publications”)
Resources for more information
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 selected this month (September 2017); the next round of support will begin in about a year.

► 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., financing, EM&V, utility programs, behavior-based approaches, cost-effectiveness, administrative options, program planning and design, cost recovery)
- Renewable energy resources
- Demand response (e.g., time-varying pricing), smart grid and grid modernization
- Utility regulation and business models (e.g., financial impacts to utility and utility customers)
- Transmission and reliability, resource planning
Publications for more information

► 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

► Integrated Distribution Planning, by Paul De Martini, ICF, for the Minnesota Public Utilities Commission, August 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, April 2017

► JS Homer, Lisa Schwartz, AL Cooke, Greg Leventis and Francisco Flores-Espino, State Engagement in Electric Distribution Planning (forthcoming), Pacific Northwest National Laboratory, Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory

► 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)
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