The New Frontiers in System Planning

- Today's Speakers
- Hon. Jeff Ackermann, Colorado
- Natalie Mims Frick, Lawrence Berkeley National Lab
- Hon. Nancy Lange, Minnesota
- Hon. Andrew McAllister, California Energy

Commission

The New Frontiers in System Planning

Hon. Jeff Ackermann

Colorado

NARUC – NASEO Task Force on Comprehensive Electricity Planning





Task Force Co-Vice-Chairs

Task Force Co-Chairs





Hon. Jeff Ackermann Chairman Colorado Utilities Commission

Dr. Laura Nelson Director Utah Office of Energy Development



Hon. Beth Trombold Commissioner Public Utilities Commission of Ohio

Dr. Andrew McAllister Commissioner California Energy Commission

What's Happening in the Electricity System Right Now?



Electricity Planning and Investment Decisions are Inter-Related



With greater alignment of electricity planning processes, states & utilities could:

- Improve reliability and resilience
- Optimize use of distributed and existing resources
- Avoid unnecessary costs
- Support state priorities
- Increase transparency of investment decisions

NARUC-NASEO Task Force

Purpose: Develop new pathways for aligned electricity planning

- 4 workshops over 2 years (start spring 2019)
 - Two member-only workshops
 - Two member-stakeholder workshops

• 12 to 15 states

- Commission and state energy office from each state working together
- Participants TBA February 2019

Targeted Outcomes

- **1. Innovation**: Pioneer new tools and roadmaps for aligning planning to meet your state's needs
- 2. Action: Apply learnings to directly benefit your state
- **3. Replication**: NARUC and NASEO publish templates to support all members

Participants will be supported by each other, technical experts, and facilitators

The New Frontiers in System Planning

Natalie Mims Frick

Berkeley Lab





The New Frontiers in System Planning

Presented by Natalie Mims Frick Authors: Lisa Schwartz and Natalie Mims Frick

National Association of Regulatory Utility Commissioners Annual Meeting – Nov. 14, 2018

This presentation was supported by the U.S. Department of Energy's Office of Electricity, Transmission Permitting and Technical Assistance, under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231



In this presentation

- Electric grid planning activities
- Distribution system planning and integration with other processes
- Integrated resource planning
- Alignment across planning processes: opportunities and challenges
- Resources for more information







Electric grid planning activities (1)

Distribution planning

 Assess needed physical and operational changes to local grid

Integrated resource planning (in

vertically integrated states)

 Identify future investments to meet bulk power system reliability and public policy objectives at reasonable cost

Transmission planning

 Identify future transmission expansion needs and options for meeting those needs.





Electric grid planning activities (2)

- Demand-side management (DSM) planning
 - Identify opportunities to use energy efficiency and demand response to meet future energy and capacity needs



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Integrated distribution planning

- Assesses physical and operational changes to the distribution system necessary to enable safe, reliable, and affordable service that satisfies customers' changing expectations and use of DERs, generally in coordination with resource and transmission planning
- Includes stakeholder-informed planning scenarios to support a reliable, efficient, and robust grid in a changing and uncertain future



Energy and grid-related services provided by DERs

Impact	DER Capability/Service	Key Function
Bulk Level Impact	Energy Production/Load Reduction	Produce electricity
	Generation Capacity	Meet extreme peak
	Frequency Regulation/Load Following/Balancing	Respond rapidly to balance supply and demand
	Spinning Reserve/Non-spinning Reserve	Reliability – provide ability to respond to unforeseen forces outages and/or changes in loads
Locational Impact	Locational Capacity for T&D	Provide or defer need for additional T&D peaking capacity
	Voltage Regulation	Maintain power quality/reduce losses

Adapted by Tom Eckman for Berkeley Lab from Smart Electric Power Alliance. <u>Beyond the Meter – Addressing the Locational Valuation</u> <u>Challenge for Distributed Energy Resources, Establishing a Common Metric for Locational Value</u>. September 2016.





Foundational Elements of Distribution System Planning With DERs

Enabling Capabilities and Components	Analysis Areas
Validated and calibrated feeder models	Multiple scenario forecasts of load and DER projections
Data and grid state	Hosting capacity analysis
Time-series power flow analysis (TSPFA)	DER interconnection studies
	Cost-benefit analysis
	Non-wires alternatives
	Locational value analysis
	Optimization of DER type, location and sizing
Specific Components or System Modeling Considerations	Advanced Capabilities
Smart inverters	Cloud computing
Energy storage	Advanced distribution management systems
Demand response	Distributed energy resources management systems
Transactive energy	Fast TSPFA
Microgrids	Convergence of planning and operations
Grid edge control	Transmission and distribution co-simulation
Architecture, Communication Systems, Cybersecurity	Process and Coordination
Architecture	Coordination framework
Communication systems	Connecting physical system analysis to financial models
Cybersecurity	Prioritizing analyses

Homer et al., Electric Distribution System Planning with DER and Grid Modernization - Tools and Methods (forthcoming)

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Integrated planning informs grid modernization strategy

Cyclical integrated distribution planning informs initial grid modernization strategy and updates.



Grid modernization strategy and implementation plans inform subsequent long-term and near-term integrated distribution planning.

Source: USDOE





Drivers for improved distribution planning

More DERs — cost reductions, policies, new business models, consumer interest

Resilience and reliability

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

Non-wires alternatives may provide net benefits to customers

Utility investments: Distribution 29% (\$35.7B) of 2017 EEI member investments*



*<u>http://www.eei.org/resourcesandmedia/industrydataanalysis/industryfinancialanalysis</u> /QtrlyFinancialUpdates/Documents/EEI Industry Capex Functional 2018.07.17.pptx

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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







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Examples: States advancing distribution system planning

- Requirements for utilities to file distribution system or grid modernization plans (CA, HI, IN, MA, MD, MI, MN, NV, NY)
 - *Integrated* distribution planning is nascent.
- □ Consideration of cost-effective non-wires alternatives (CA, NY, RI)
- Requirements for hosting capacity analysis (CA, HI, IL, MN, NY)
- Locational net benefits analysis for DERs (CA, HI, NV, NY)
- DER procurement strategies (CA, HI, NY)
- Storm hardening, under-grounding (MD, FL)
- Requirements for utilities to report on poorperforming circuits and improvement plans (many states)









Example: Hawaii's integrated grid planning

- Order No. 34281 (Jan. 2017) PUC guidance for scenario-based grid modernization strategy to inform review of utility applications for grid modernization projects
- □ HECO filed <u>final Grid Modernization Strategy</u> on 8/29/17
 - PUC approved plan in <u>Order No. 35268</u> (2/7/18)
- HECO issued <u>Planning Hawai'i's Grid for Future Generations: Integrated Grid Planning Report</u> on 3/1/18 (filed 7/12/18)
 - 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 investigating plan under <u>Docket No. 2018-0165</u> (Order No. 35569)
- Objective: Identifying and procuring an optimal mix of distributed and grid scale resources to increase customer value and reduce risk







Regulatory Approval:

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

DERs in distribution planning: Non-wires alternatives

- Investments in energy efficiency, demand response, distributed generation and storage that provide specific services at specific locations to defer, mitigate or eliminate need for traditional distribution infrastructure
- Example: New York utilities provided <u>suitability criteria</u> (project type, timeline, cost) and described <u>how the</u> <u>criteria will be applied</u> to projects in capital plans



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DERs in distribution planning: Hosting capacity analysis

- □ Amount of DERs that can be interconnected without infrastructure upgrades
- □ Some states require regulated utilities to do it (CA, HI, MN, NY)
 - e.g., Minnesota statute requires Xcel Energy to conduct hosting capacity analysis; utility files annually - 2018 filing in <u>Docket 18-684</u>
- Some utilities do it on their own motion
 - e.g., Pepco
- Power system criteria to meet
 - Thermal
 - Power quality/voltage
 - Protection
 - Reliability/safety

Use Case	Capability
Development Guide	Identify areas with potentially lower interconnection costs
Interconnection Technical Screens	Augment or replace rules of thumb; determine need for detailed study
Distribution Planning Tool	Identify potential future constraints and proactive upgrades

Table adapted from ICF International, 2018





Integrated resource planning is required in most states





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DERs in integrated resource planning

- Some regulators explicitly require utilities to consider at least one type of DER in IRP or other long-term planning.
- □ Examples:
 - Washington requires utilities to use identified DERs as inputs to IRP.
 - Oregon's order on Portland General Electric's 2016 IRP required the utility to "work with Staff and other parties to advance distributed energy resource forecasting and distributed energy resource representation in the IRP process."
 - New Orleans requires Entergy New Orleans to consider storage and other DERs as potential supply-side resources in IRP.
 - New Mexico requires energy storage to be considered with other resource options in IRP.
 - Massachusetts issued an order that clarified the objective of including DERs to "facilitate the interconnection of distributed energy resources and to integrate these resources into the Companies' planning and operations processes."
 - California, Georgia, Iowa, Indiana, Kentucky, Michigan, Nebraska, Nevada, New Mexico and Oregon require consideration of combined heat and power in IRP.

Source: Berkeley Lab (forthcoming)





Berkeley Lab's Resource Planning Portal (1)

RESOURCE PLANNING PORTAL

- Web-based tool that allows users to:
 - Input electric utility planning information in a consistent format
 - Benchmark planning assumptions across jurisdictions
 - Output results in a standardized format (e.g., maps, loads and resources tables)
- 39 western U.S. utilities (2003-17)
- 10 eastern U.S. utilities adding now
- >117 electric resource plans and supplemental surveys
- □ ~1/3 U.S. installed capacity (>370 GW)

http://resourceplanning.lbl.gov/

Resource	Capacity (GW)
Natural Gas	123.7
Coal	73.6
Hydro	46.9
Unknown	43.7
Nuclear	31.4
Wind	18.7
Renewable	12.3
Solar	8.6
Thermal	4.1
Demand	
Response	8.8



Example output: Projected installed capacity

- Talk across planning groups within the utility
- Apply consistent inputs, scenarios and modeling methods where possible across distribution planning, transmission planning, integrated resource planning and DSM planning
- Account for all resources across planning processes
 - Use customer adoption-based DER forecasting
 - Specify DER attributes needed to meet identified distribution needs
 - Incorporate NWA analysis into distribution system planning
- □ Analyze multiple possible futures e.g., loads, DERs
- Plan integration of utility assets and systems
 - Specify how proposed investments will be used with legacy and future utility systems, for planning and customer benefit





- Disparate statutory and regulatory requirements
- □ **Planning dimensions** (following examples from Xcel's IDP, 11/1/18)
 - "Distribution planning is primarily concerned with location, and resource planning is primarily concerned with size, type and timing of resources – with transmission planning somewhere in the middle."
 - "Unlike IRPs, five-year plans are considered long-term in a distribution context...."
 - Unexpected loss of power plant often covered by RTO/ISO system; loss of distribution component often causes power outage to customers
 - "[D]istribution loads and resources are evaluated for each major segment of the system – on a feeder and substation-transformer basis – rather than in aggregate, like occurs with an IRP."

Planning tools

- More accurate modeling tools are time-consuming, expensive and require data on the physical and electrical characteristics of distribution systems, spread across multiple utility business units.
- Modeling tools must be able to capture both the individual and combined characteristics of DERs.





Resources for more information

- Alan Cooke, Juliet Homer, Lisa Schwartz, <u>Distribution System Planning State Examples by Topic</u>. Pacific Northwest National Laboratory and Berkeley Lab, May 2018
- Juliet Homer, Alan Cooke, Lisa Schwartz, Greg Leventis, Francisco Flores-Espino and Michael Coddington, <u>State Engagement in Electric</u> <u>Distribution Planning</u>, Pacific Northwest National Laboratory, Berkeley Lab and National Renewable Energy Laboratory, December 2017
- Paul De Martini (ICF) for Minnesota Public Utilities Commission, Integrated Distribution Planning, 2016
- 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
- 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
- J.S. Homer, Y. Tang, J.D. Taft, D. Lew, D. Narang, M. Coddington, M. Ingram, A. Hoke. *Electric Distribution System Planning with DER and Grid Modernization Tools and Methods* (forthcoming)
- HECO, <u>Planning Hawai'i's Grid for Future Generations: Integrated Grid Planning Report</u>, March 2018
- ICF International, 2018 Integrated Distribution Planning Utility Practices in Hosting Capacity Analysis and Locational Value Assessment, prepared for U.S. Department of Energy, July 2018
- National Association of State Energy Officials, <u>Combined Heat and Power: A Resource Guide for State Energy Officials</u>, 2013
- N.M. Frick, Schwartz, L., and Taylor-Anyikire, A. A Framework for Integrated Analysis of Distributed Energy Resources: Guide for States. Berkeley Lab, forthcoming
- Several reports in Berkeley Lab's <u>Future Electric Utility Regulation series</u>
 - 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)
 - <u>The Future of Electricity Resource Planning</u>, 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

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The New Frontiers in System Planning

Hon. Nancy Lange

Minnesota

The New Frontiers in System Planning

Hon. Andrew McAllister California Energy Commission

Audience Questions (submit through the app)

More Information on NARUC-NASEO Task Force

Today

- See press release and charter
- Flyer



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Soon

 Commissioners' Webinar week of December 10th – watch for announcement through Committee Lists



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Please complete the session survey in the meeting app

B4 – The New Frontiers...

Look under the "polls" button