



Integrated Grid Planning

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Desired takeaways

- ▶ What's new about IGP
- ▶ Why distribution system planning is important
- ▶ This is new and difficult
- ▶ How others are approaching integrated distribution system planning
 - Common themes emerging
 - Notable examples
- ▶ Meaningful stakeholder engagement is critical
- ▶ Technical and modeling challenges
- ▶ Some takeaways



What's new



What's
new?

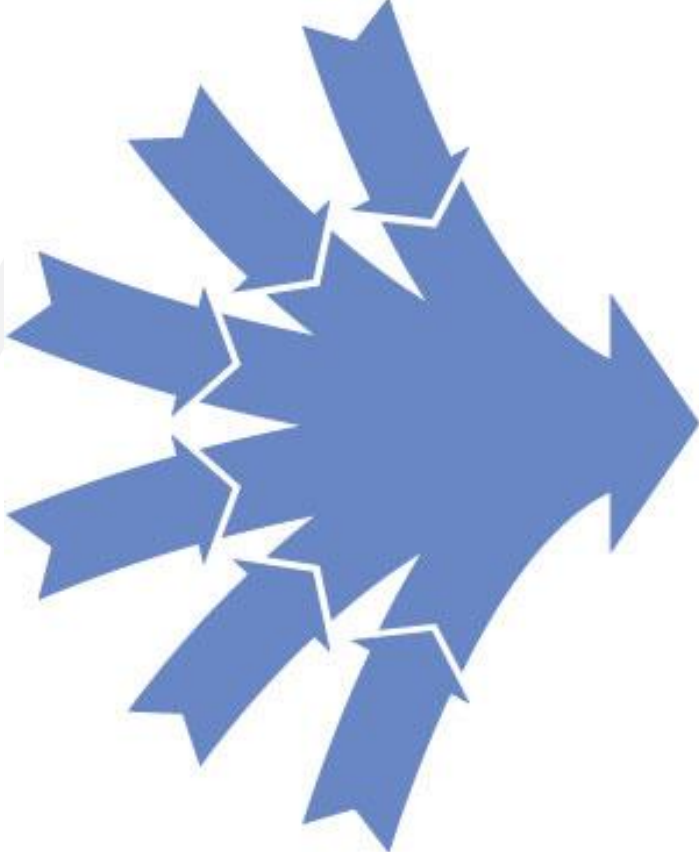
- ▶ Utilities have been doing Integrated Resource Planning for years
 - Whole system electricity demand is projected over planning horizon
 - Generation and demand side management options are evaluated for meeting whole system demand
- ▶ Transmission planning often performed as a companion side analysis in Integrated Resource Planning
- ▶ Utilities have always engaged in distribution system planning to assess needed physical and operational changes to local grids to maintain safe, reliable and affordable service
 - Typically short planning horizons and minimal involvement of regulators
 - Distribution system planning is not included in Integrated Resource Planning
- ▶ Drivers for enhanced distribution system planning include integrating higher levels of distributed energy resources (DER), replacing aging infrastructure and modernizing grids, allowing for greater customer choice and improved efficiency

Challenges to integrated planning

- ▶ To understand the impacts (benefits and costs) of distributed energy resources (DER), need to better understand the conditions, needs and opportunities at the distribution system level
 - Question: What's the “value” of rooftop solar?
 - Answer: It depends
- ▶ Great variability on the distribution system
 - One area could greatly benefit from new rooftop solar, whereas in another area increased customer solar would cause problems
- ▶ There's far less visibility on distribution system than transmission system
- ▶ Many more assets and moving parts on the distribution system
- ▶ Customers make their own choices about installing distributed generation
- ▶ Utility often doesn't know what's going on with customer generation

How are other states approaching integrated distribution system planning?

- ▶ Advanced distribution planning efforts across the country (NY, CA, MN) are still nascent, but early indications point to convergence around the following common themes:

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- Granular projections of load and DERs
 - Understanding the capacity of distribution circuits to safely and reliably “host” DER (hosting capacity)
 - Locational value of DER
 - Non-wires alternatives (NWA) to traditional investments
 - Increasing visibility into distribution system
 - Accurately representing distribution system in models that can be used for planning and operations
 - Extensive stakeholder engagement

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., CA, HI, MA, MN, NY)
- ▶ Ad hoc directive to file a distribution system plan (e.g., MI, MD)
- ▶ Requirements to conduct hosting capacity analysis (e.g., CA, HI, MN, NY)
- ▶ Consideration of cost-effective non-wires alternatives (e.g., CA, NY, RI)
- ▶ 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., IL, OH, PA, RI)
- ▶ 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)
- ▶ Investigation into DER markets (e.g., HI)

Notable examples

► New York

- Utilities required to file Distributed System Implementation Plans (DSIPs), including:
 - Hosting capacity analysis – publish online maps
 - Non-wires alternatives (NWA) – [NWA suitability criteria](#) and RFPs online; NWAs systematically incorporated into capital planning process
 - Energy storage

► California

- Utilities required to file [Distributed Resource Plans](#) every two years:
 - Locational net benefits analysis = system level benefits + location-specific
 - Integrated capacity analysis (aka Hosting capacity)
 - [Commission-approved DER adoption and distribution load forecasting methodology](#)
- [Report on improving T&D coordination for high DERs](#) from More Than Smart, CAISO, PG&E, SCE, SDG&E

Notable examples, cont.

- ▶ Washington – Opened a [rulemaking](#) to consider how Integrated Resource Planning can be expanded to include more distribution system planning
 - Commission issued a [policy statement on energy storage](#) and guidance for including storage in planning
- ▶ Oregon – Desire to link multiple related dockets/efforts through a [formalized distribution planning proceeding](#)
- ▶ Massachusetts – each distribution company must develop and implement a [10-year grid modernization plan](#)
 - Also, an [energy storage initiative](#) that requires a study and development of utility targets for energy storage
- ▶ Minnesota – Biennial grid modernization reports filed by utilities
 - Utility IDs 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 a general rate case)

Stakeholder engagement

- ▶ In California Distribution Resource Planning docket, two working groups were formed and detailed working group materials made available on websites:
 - Integration Capacity Analysis
 - Locational Net Benefits Analysis
- ▶ In New York, first step in the Distributed System Implementation Plan docket was to file a plan and timeline for a stakeholder engagement
 - A 15-organization advisory committee and nine implementation teams were instituted following:
 1. Customer Data
 2. DER Sourcing + Non-wires Alternatives Suitability
 3. Electric Vehicle Supply Equipment
 4. System Data
 5. Monitoring & Control
 6. NYISO/DSP
 7. Hosting Capacity
 8. Load/DER Forecasting
 9. Interconnection – technical and policy considerations

Technical and Modeling Challenges

- ▶ Detailed analyses require detailed data – “walk the line”
- ▶ Garbage in = Garbage out
- ▶ Important to validate and calibrate models and use the correct tools
- ▶ Real world example (from Emma Stewart at LLNL):
 - Study 1: “during the system impact study, we found the 1 MW PV site would cause flicker at a number of large customers, mitigation solutions presented cost \$1Million plus”
 - Study 2: re-did the original study and investigated data sources fully (distribution model, source impedance representing transmission, modeling technique used) and found original data was unvalidated, no data or best guess estimates.
 - Less costly solution proposed to mitigate risk and use full range of inverter capability
 - Site was approved and interconnected with less expensive option. No flicker issues were reported.
- ▶ Key point: Good data and accurate system models are important to avoid bad outcomes including unnecessary capital expenditures

Some takeaways

- ▶ Distribution system planning is not new, but distribution system planning is changing (planning horizon, level of detail, including DERs, greater regulatory involvement)
- ▶ 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.
- ▶ 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.
- ▶ Integration of distribution planning with demand-side management planning, integrated resource planning and transmission planning is nascent.
- ▶ Modeling tools that integrate resource, transmission and distribution planning together do not yet exist. This is a gap.
- ▶ Data matters and models need to be validated and calibrated
- ▶ Meaningful stakeholder engagement is important
- ▶ Today's event is a step in the right direction!



TAKEAWAY
LESSONS
LEARNED
HERE



Thank you!

Publications for more information

- ▶ U.S. Department of Energy's (DOE) Modern Distribution Grid initiative and report (www.doe-dsp.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)
 - *Value-Added Electricity Services: New Roles for Utilities and Third-Party Providers* (forthcoming), 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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