Planning for a Modern Distribution System

2024 Cohort

A NARUC-NASEO Initiative

Workshop #2 Report Out

This document covers the report-out from Workshop #2, which took place on September 17, 2024 from 2-4:30 pm Eastern Time.

This document summarizes the content covered in the workshop. For additional detail, please see the accompanying workshop slides and recordings.

The workshop agenda included the following:

Session
Welcome: Overview of today
Group Activity: What questions do you have about load or DER forecasting?
Presentation: Load and DER Forecasting, Julieta Giraldez
Breakout activity: Understanding your state's forecasting practices
Breakout activity: Tools for state decisionmakers to engage with utility forecasts and scenarios
Reflection, Closing, and what's ahead

This report-out includes the following:

- Summary of Julieta Giraldez's presentation on load and DER forecasting at the distribution level
- Summary of breakout activity discussions
- Additional resources

This cohort and associated activities are part of the DOE-sponsored *NARUC-NASEO DER Integration and Compensation Initiative*.

U.S. Department of Energy
Project Sponsor

National Association of Regulatory Utility Commissioners
Project Lead

National Association of State Energy Officials
Project Lead

RMI
Project Delivery Partner

Berkeley Lab
Project Delivery Partner

Load and DER Forecasting – Overview of Current Landscape and Future Considerations

The tables below summarize the presentation from Julieta Giraldez on the current landscape of forecasting at the distribution level. If you are interested in hearing more from Julieta Giraldez on this topic please see her extended presentation as a part of the NARUC/NASEO Distribution Planning Training.

1. Current Landscape of Distribution Load and DER Forecasting	
What has changed in load forecasting for distribution planning?	• Before now, there has been flat demand and past consumption has been a good indicator of future consumption • Going forward, changes in weather and behind the meter tech adoption means old econometric modeling methods will not be sufficient • New federal/state/local goals also influence adoption, and must be converted into quantifiable assumptions
How does forecasting impact distribution planning?	• Distribution planning typically has a forecast that is separate from the load forecasting department and has focused only on peak load at the substation/feeder level • The peak load is used to identify when the forecast exceeds the infrastructure rating, and a solution is needed

Going from "base-load" to "net-load"	• Base load is the existing peak load
	• Net load is the load when accounting for demand-side modifiers, including:
	   ○ Economic growth & new customer business
	   ○ Energy efficiency, solar, battery storage, EVs, Building electrification
	• Accurately forecasting base load should include weather normalization
	• For DER forecasts (load modifiers) - need to know where, what kind, time horizon, temporal impact, and the targeted penetration level
	• For base load and net load can leverage both a top-down and bottom-up approach

Future Considerations	• Scenario modeling – helps account for uncertainty and examine how different variables can affect the future. Components to vary include:
	   ○ Adoption rates – how quickly consumers may adopt various DER technologies
	   ○ Technological developments – potential advancements in DER technology, for example
	   ○ Policy and Regulatory changes – changes in building code requirements, for example
	   ○ Market dynamics – changes in market prices or customer preferences
	   ○ Incentive structure – different incentives or pricing structures for DERs
	   ○ Future weather – make sure future extreme weather events are accounted for
	• Low-hanging fruit improvements include:
	   ○ Weather-normalize peak load
	   ○ Map customer counts by service class to substations to apply load & DER growth rate by service class
	   ○ Use DER/technology adoption models
	   ○ Use load shapes or directly leverage customer AMI data
	   ○ Perform 8760 forecasts for load with and without DER impacts
	   ○ Forecast multiple scenarios

What has changed in load forecasting for distribution planning?	• Before now, there has been flat demand and past consumption has been a good indicator of future consumption • Going forward, changes in weather and behind the meter tech adoption means old econometric modeling methods will not be sufficient • New federal/state/local goals also influence adoption, and must be converted into quantifiable assumptions

2. Questions state decisionmakers and leaders can ask utilities about their forecast components

Base Load forecasting	• How is SCADA data cleaned or processed? • Is the load weather normalized?
Economic Growth	• Where is the percent growth assumption coming from? • Do you perform econometric trend analysis? If so, what variables and data are used in the model?
New customer business load additions	• How are large load additions defined and tracked? o For example, new C&I development, upgrades to existing sites, large multi-unit residential developments, grid-charging battery storage, or EV charging sites ~ > 500 KW • Increasing concern in many states on proactive planning for step-loads due to economic development, transportation electrification and data centers
DER Forecast	• Where do the targets for DERs come from? • What DERs are explicitly forecasted and modeled in the peak load forecast? • Is 8,760 hourly behavior modeled or value contribution to adjust peak load? • What are the behavioral assumptions to determine DER profiles?
Future Considerations	• Do you perform a single point peak load forecast, or do you consider a range of scenarios and probabilistic methods to determine infrastructure needs? • What weather data is used in your distribution planning load forecast? Does it include the effects of climate change?

3. Q&A from participants

Are there examples of how utilities are valuing the solar/battery storage load reductions in their forecasts?	California Annual Grid Needs Assessment (PG&E's 2023 GNA)
With respect to DER forecasting across different types of utilities, they have different capabilities for providing forecasting, what's the minimum we should establish given cost concerns?	The most important forecasting components are: • Solar (we have enough market data now to be confident that will show up and impact demand) • Building electrification and their impacts on the timing of peak loads (could shift from summer to winter peak, depending on where you are), and • Transportation electrification Note: NY launched a proceeding last month on how to get ahead of potential investments needed to keep up with EV and building electrification loads.
Can you speak to any examples of good short term forecast scenarios? (short term = 5-10 year forecast in this case)	California, Salt River Project Integrated System Plan, and Hawaii Integrated Grid Plan are all good examples. It is important to build these specific to your region based on what you feel like are your biggest risks, lots are around transportation electrification.
How successful have utilities been in securing enough NWAs to defer or replace capital expansion projects?	In the past, we have tried to find an alternative solution for an area that is at capacity, so the NWS options have not "penciled out." For example, CA ran deferral investment framework but had very few successful procurements (see the Kevala Report which evaluated the process). We should be valuing DERs and NWS in areas that are at 70-80% capacity to proactively plan around future problem areas. There is ongoing research on how to further improve NWS screening methodologies.
When doing distribution system forecasting, how do you take into account that there are already feeders that the utility considers to be at capacity for distributed solar?	Folks on the call have not yet seen solar models that account for the hosting capacity, but it could be taken into account as an input to the adoption model. This was done recently in the context of EV charging to incentivize chargers going into areas with capacity.

Breakout Group Discussion Overview

Breakout Session #1 - Participants were placed into a breakout room where they brainstormed what questions, guidelines, and resources would be needed for the following forecast elements:

1.   Forecasting Time Horizon
2.   Temporal Granularity
3.   DER Integration
4.   Spatial Granularity

Breakout Session #2 - Participants self-selected into a breakout room where they brainstormed strategies for setting expectations, assessing forecasts, and next steps for the following forecast elements:

1. Load Forecasts

2. DER Forecasts

3. Forecasting Scenarios

Breakout Session #1

The table below summarizes the discussions that were had for each of the breakout 1 planning elements:

Planning element	Participants brainstormed questions, guidelines and resources:
Forecasting time horizon (3 years vs 5 years vs 10 years)	**Questions you can ask:** - Request a bottom-up distribution planning load forecast - How would the addition of DERs affect a longer-term load forecast? - How are utilities modeling and planning to manage bidirectional flows, especially as demand increases? **Supportive guidelines:** - Requirement to submit distribution plans - Require both short- and long-term planning horizons - Engage stakeholders in utility forecasting process **What resources would be helpful:** - Technical appendix of how the modeling was conducted, what the inputs are, etc. - Actions to enable utilities to adopt proactive planning/forecasting
Temporal granularity (single hour vs 8760)	**Questions you can ask:** - What load profiles are you using to generate your load and distributed generation forecasts? - How can DER planning fit into an ELCC analysis? **Supportive guidelines:** - Require utilities to provide technical appendix describing their locational and temporal modeling inputs. **What resources would be helpful:** - Guidance on if 8760 is even realistic to model anymore - Data and visuals to show what is happening where in sufficient detail to understand peak reduction relative to total load.
DER Integration	**Questions you can ask:** - What assumptions do utilities have on customer adoption, use cases, etc.? - How big of a role do utilities expect DERs to play in future load profiles? - What do you assume to be the "saturation point" for each feeder? How would investments (IVVM, etc.) change this? - What is the resource adequacy and peak impact values of DERs? - At what point would DER integration at the feeder level reach a point where it can impact investments? **Supportive guidelines:** - Model a range of options of adoption rates, given uncertainty **What resources would be helpful:** - Options for ensuring third party contractors are reliable over the long term - Locational Value Studies - Guidance for aligning DER integration with utility interests

Breakout Session #1 (continued)

The table below summarizes the discussions that were had for each of the breakout 1 planning elements:

Planning element	Participants brainstormed questions, guidelines and resources:
Spatial granularity (entire system vs substation vs individual customer)	**Questions you can ask:** - How are utilities tracking which large load additions are trying to interconnect, and what information is available on these potential large loads? - How can we co-optimize Tx and Dx across different spatial scales? - How are event dispatch options evaluated and selected (e.g., bulk system as demand response to reduce system peaks vs distribution system to optimize efficiency at the distribution level, which will then also impact system peaks)? - What density of DERs can to support distribution level dispatch rather than system level dispatch? **Supportive guidelines:** - Proactive planning to support build that will be there first/in time to support electrification. - Granular forecasting is essential to support EV deployment at sufficient spatial scale. **What resources would be helpful:** - Provide a template for a bottom-up forecasting effort, including guidance for how policymakers can engage - Having the state and/or consultants run the optimizations and provide the outputs to utilities, rather than asking utilities to model. - Net load capacity maps and data. - Examples of granular forecasting to help support any investment cases. - In Washington State, Puget Sound Energy created a Hosting Capacity Heat map to provide visibility and transparency into the generation capabilities of a given area. The Hosting Capacity Map is available to customers and developers looking to add a new DER in PSE's service territory.
Accounting for uncertainty (scenarios, probabilistic, forecasting)	**Questions you can ask:** - What questions could a Monte Carlo analysis answer, and would this approach help model uncertainty? - How did the utilities develop the scenarios in their forecasts? What assumptions were made? - How did the utility model or account for different electrification or demand flexibility scenarios? - Under a least-cost decarbonization scenario, what is the optimized levels of DERs? - What is the impact of opt-out capability at the customer level in planning for DER dispatch? **Supportive guidelines:** - Provide scenario examples and decision matrix **What resources would be helpful:** - Better models to integrate T&D optimizations

Breakout Session #2

The tables in this section summarize the discussions around each forecasting topic

Topic #1: Scenarios	
Expectations Up-front guidance for forecasts	**What do you know about the current approach to developing scenarios in your state?** - Some states have existing rules for load forecasts scenario development. - Some scenarios include: (1) Policy Driven, (2) DER Penetration Levels, (3) BAU,(4) Best Case, (5) Worst Case **Where would you like additional clarity?** - How do scenarios transition into actual investments? - IS DER value incorporated into NWA analysis? **How can you ensure state goals, utility programs, or other DER initiatives are accounted for in scenario development?** - Some state s have locational incentives to ensure we are meeting density of controllable DERs in high constraint areas - Incorporating existing clean energy policy goals into scenario development, as well as establishing new regulatory requirements seems to be needed to ensure state policy goals are met. - Some participants comments that scenarios move us away from just being based on historical data, and should look also at future trends, for example: Weather patterns, various communities, organizations, and businesses are making different decisions. Such as coastal communities planning on moving en masse to an inland location. - Transparency on utility plans and data sharing is important to ensure state goals are incorporated into IDSP. **How can you provide guidelines on what should be reported out on? Are there states/examples you can use for guidance?** - Feedback from robust stakeholder engagement. - Connecting utility needs with transportation needs - ie: areas of high curtailment connecting to charging infrastructure. - Ensure planning data is shared across state entities. - Ensuring scenarios align with emergency needs. - Consider locational incentives.
Assessment What can you look for once you receive a forecast?	**What input data can you ask about to help understand the scenario?** - Does the scenario include data as it relates to the retirement and/or replacement of fossil-fuel resources? - Projected areas of high grid constraints. - How are local government policies being incorporated into load forecasts? - Does the forecast include the impact of energy efficiency programs? - How to determine what investments should be tax-based vs rate-based. - For different DER adoption levels, what assumptions are being used? - AMI from customers to understand demand and future scenario development. **What methodology questions can you ask to assess how realistic a scenario is?** - Are capabilities of AMI enabled to the point we can gain important information for DER/Load forecasting? - How AMI data is being used to create these scenarios, if at all? - How are IRPs and IDSP coordinated under the scenarios? - What are the assumptions about future prices of fuels like natural gas, coal, or oil?
Next steps	**What resources would be helpful to support evaluating forecasts?** - Greater engineering expertise. - Adequate support to review lengthy utility plans. **Are current venues sufficient to provide guidelines/feedback on forecasts? If not, what type of venues can you recommend/develop to provide more robust feedback?** - Processes that take place under Distribution Planning vs Rate Cases should be made very clear to all parties.

Topic #2: Load Forecasts

Expectations Up-front guidance for forecasts	**What do you know about the current approach to developing distribution load forecasts in your state?** - Some states already require detailed forecasts at a range of time horizons, such as 5 years, 10 years, and out to 2050, using DER forecasts, markets trends, and state policies. - For other utilities, the process is opaque, and outputs and methodology are unclear. **Where would you like additional clarity?** - What is the line between forecasting for transmission or distribution for big industrial users? e.g. data centers are often brought up as distribution, even if they are using energy at the scale of transmission. - How to better forecast demand from large load and capacity factors e.g. electrolysis - Understanding load patterns. How are utilities incorporating programs and EE with load? - How to get good forecasts without expensive tools. Is there a trigger when investing in the tools makes a lot of sense? - What do you need to know to make sure the new tool is value for money? - Technical details of what's included in the forecast. **How can you ensure state goals, utility programs, or other DER initiatives are accounted for in the forecast?** - Some states' distribution investments are funded by a tracker, which may be subject to periodic review. - Have the PUC require that forecasts include state goals. - Building investment programs that have variable certainty. - Building state goals and objectives into forecasting processes. - Require a coordinated forecasting approach between agencies and utilities. **How can you provide guidelines on what should be reported out on? Are there states/examples you can use?** - Provide analysis of possible unexpected changes and uncertainties. - Requiring a number of scenarios on varying levels of electrification.
Assessment What can you look for once you receive a forecast?	**What input data can you ask about to help understand the forecast?** - Incoming step loads, load letters. - Degree of certainty of step loads. - Load forecast software such as LoadSEER or Encompass can be made available to PUC staff. - Utilities may provide guidance and walk throughs on load forecasting software. **What assumptions can you ask about? How can you determine how important these assumptions are?** - Are load management programs being incorporated into forecasts? - Customer adoption rates for DERs. - What policy goals are you incorporating in the forecast? - Multiple scenarios can be developed with different energy efficiency projections. - Assumptions on EVs need to be cognizant that they can both form part of load growth but can also contribute to DER grid services if used bidirectionally. **What methodology questions can you ask to assess how thorough the forecast is?** - ISOs/RTOs operating in some state release forecasts, so these can be assessed in comparison to the utility plans. - Some PUCs ask for BCAs of software investments. **What can you compare this with to see if it's reasonable?** - The Wood Mackenzie report can be used to understand the quality of plans. - States can require assessment of historical plans to see if they true-up to see what actually happened. - Comparisons can use weather normalization to understand comparisons. - Some utilities provide an evaluation of forecast accuracy and sensitivities.
Next steps	**What resources would be helpful to support evaluating forecasts?** - Options to understand technical software. - Compilation of similar utility situations (rural utility in X type of location, X demographics, and what have they done) - As granular as possible forecasts from neighbors - what happens over state lines. **Are current venues sufficient to provide guidelines/feedback on forecasts? If not, what type of venues can you recommend/develop to provide more robust feedback?** - Need a stakeholder group (not just utility presentations; actual engagement with stakeholders) - Some participants sought more technical sessions to understand IDSP processes.

Topic #3: DER Forecasts

Expectations

Up-front guidance for forecasts

What do you know about the current approach to developing DER forecasts in your state?
- Some utilities/entities do not have visibility in DERs they don't control and won't "count" on them for grid services, e.g., some RTOs won't allow resources they don't control to be included in resource adequacy demonstrations.
- Some states are using meter data to identify specific DERs adoption trends.
- In some states, changing RTO/ISO resource accreditations make modeling and prediction challenging.

Where would you like additional clarity?
- Some participants sought greater information on interconnection requests to utilities.
- Some participants sought support on how storage is forecasted.
- Valuing customer rooftop solar and solar + battery, and how this impacts utility plans for utility-scale solar.

How can you ensure state goals, utility programs, or other DER initiatives are accounted for in the DER forecast?
- Comprehensive stakeholder processes for DER forecasts, including early identification of key stakeholders
- Capacity expansion modeling can be a valuable tool.
- Having visibility into where state incentive programs have already been deployed.
- Changing priorities as commissioners are appointed or leave posts, mean that a consistent and clear policy direction is not always available.

How can you provide guidelines on what should be reported out on? Are there states/examples you can use?
- Transparency on DER forecasting (i.e., methodology).
- The regulations and requirements for IDSP plans can be developed through a stakeholder (workgroup) process.
- Some participants noted it can be difficult getting information from third parties that regulators don't regulate.

Assessment

What can you look for once you receive a forecast?

What input data can you ask about to help understand the forecast?
- DER adoption rates & load shapes - AMI data, local EV charging patterns
- Weather normalization
- Inclusion of formulas, identify variable, include assumptions, etc.
- When requesting data, this should be presented in unlocked excel files rather than PDF text
- Technology costs and trajectory.

What assumptions can you ask about? How can you determine how important these assumptions are?
- Storage assumptions, energy efficiency assumptions, and building codes.
- Climate resiliency models (e.g., future years).
- Managed charging assumptions & scenarios.
- Retail Rate assumptions - How long do you assume that NEM 1.0 will continue? Sensitivity analysis of TOU impact on peak load: opt-out vs. opt-in programs. How do residential rates impact your DG solar adoption estimates?
- Policy considerations (implementation of TOUs, environmental goals), what policy assumptions are used and why?

What methodology questions can you ask to assess how thorough the DER forecast is?
- Which data and assumptions are speculative?
- Was this forecast developed by your load forecasting department?
- Was this a propensity-based, proportional allocation, or adoption model?
- How have you engaged the local community, and have you incorporated their perspectives?
- Did you determine the growth rate at each substation? If so, how was this done?

What can you compare this with to see if it's reasonable?
- State goal integrated grid plan.
- The true up of prior forecasts to actual changes observed.

Next steps

What resources would be helpful to support evaluating forecasts?
- More staff, including technical expertise and licenses to allow staff use of IDSP software
- Facilitators for managing stakeholders and utilities and getting the most valuable inputs from stakeholder groups.
- Utility engineers translating forecasts in clearer and more presentable terms.
- Open and transparent process to review and impact utility forecasts. Are rate cases the most effective avenue?
- Consultant or Technical Assistance via National Lab.
- List of tools state PUCs/Energy Offices should have to evaluate DER/load forecasts.
- Comprehensive cost information for all investments.

Are current venues sufficient to provide guidelines/feedback on forecasts? If not, what type of venues can you recommend/develop to provide more robust feedback?
- More "voluntelling" about IDSP processes when discussions fall silent.
- Expert working groups and consultant support to develop feedback.
- Informal settings get more authentic feedback, anonymity in responses produces results.
- Information overload is real. Intervenors should try to avoid writing "textbook slides".

Resources for more information

Direct technical assistance
- For TA on distribution system planning and grid resilience planning: Contact Lisa Schwartz: lcschwartz@lbl.gov
- For TA on other electricity topics, please see: Resources and Assistance for State Energy Offices and Regulators program

Upcoming training opportunities
- Next round of in-person IDSP trainings with NARUC and NASEO begin December 2024. Dates and locations of the trainings are listed below. **NARUC and NASEO will send out an announcement when registration opens for each of the trainings.**
  - *December 11-12, 2024 - East - Charlotte, NC*
  - *March 11-12 (or March 12-13), 2025 - Midwest (tentatively Detroit, MI)*
  - *April 23-24, 2025 - West (tentatively Salt Lake City, UT)*
- Next round of in-person grid resilience trainings with NARUC and NASEO begin in Q1 of 2025

Publications and other online resources
- Cody Davis Presentation on DER Planning
- Julieta Giraldez Presentation on Distribution Load Forecasting
- See Berkeley Lab's website for additional presentations and links to recordings for prior trainings (scroll below diagram to "Regional and state trainings and presentations")
- NREL guide to understanding power system models
- U.S. Department of Energy's Distribution Grid Transformation website
- State Requirements for Electric Distribution System Planning – online catalog and interactive map and forthcoming report covering more topics
- NARUC/NASEO Blueprint for State Action for comprehensive electricity planning

Contact Information ✉

NARUC
Danielle Sass Byrnett:
DByrnett@naruc.org

Jeff Loiter:
JLoiter@naruc.org

NASEO
Kirsten Verclas:
KVerclas@naseo.org

Rodney Sobin:
RSobin@naseo.org