2025 Probabilistic Assessment

Narrative Guide

# General Instructions

Please adhere to the following guidelines when addressing the narrative questions below. Some questions will require specific actionable items or studies:

* Provide complete and accurate information in response to each question. **These should be specific to the execution of ProbA and describe the input assumptions. References to the LTRA can be used to avoid duplicative effort.**
* Provide a discussion of any variances/differences from the studies that underly the LTRA responses and ProbA data assumptions.
* Provide links to any documentation (e.g. studies, assessments) that will help explain your answers. If the study is non-public, please provide it directly to NERC staff.
* Do not modify the questions.
* Narratives should also include assumptions made on Demand-Side Management (DSM) modeling within the load shapes and forecasts. See the DSM section.
* The ProbA narrative summary to be used in the 2025 Long-Term Reliability Assessment and the Summary of Inputs and Assumptions table in the Appendix section will be produced by the assessment area after these answers have been reviewed in the peer review process and further reviewed by NERC and made consistent in style.
* Confidentiality – All responses will be posted to a secure site.
* Please contact NERC staff with any questions regarding this request.

# Model Discussion

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| **MD1- Provide general details describing the software model and the assumptions used in ProbA.** Responses here and additional information are to be summarized in the ProbA methods and assumptions matrix below.* Generally, describe the software model utilized for conducting the ProbA including its key attributes, details of the simulation,type, and number of trials/iterations of Monte Carlo, and convolution methods. Highlight any differences from the LTRA data that is based on other probabilistic modeling, such as capacity contributions, reserve margins, etc. Responses to the narrative questions can cite the LTRA.
* Highlight any differences from the LTRA data that is based on other probabilistic modeling approaches, such as capacity contributions, reserve margins, etc. Responses to the narrative questions can cite the LTRA where applicable. This is to focus on data differences. Differences in results are to be summarized below.
* Discuss any common mode failure, correlation or weather dependent modeling.
* Discuss whether the impacts of weather driven variations in load and Variable Energy Resources are modeled exogenously or endogenously to the model. If endogenous, what is contained in the input file, and if exogenous, how is it modeled. Refer to LTRA if discussed in that narrative.
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# Demand

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| **D1- Provide details describing the demand modeling assumptions.** Summarize differences from the LTRA descriptions and provide links to any online documents and/or LTRA. * Provide a load modeling description of the ProbA model, including details on the 50/50 base forecast and the uncertainty levels
* Discuss how Load Forecast Uncertainty (LFU) is developed. Describe any sources of load variability that are currently not incorporated—or only partially incorporated—in the LFU. (For example, resources on the distribution system such as PV Distributed Energy Resources (DER).)
* Discuss how demand growth is accounted for in the model
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# Demand-Side Management

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| **DSM1- Explain how Controllable and Dispatchable Demand Response programs are modeled in ProbA.** Provide a narrative on modeling methodology.* How are limitations associated with controllable DR accounted for in the model (e.g., approaches described in technical guidance)? Include limitations based on program performance and/or contractual obligations as a load modifier or energy limited resource.
* If the probabilistic approach is not available and a net value of MW reduction impact is used in the model, provide details of how the net value is calculated.
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# Distributed Energy Resources (DERs) Forecast

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| **DER1- Provide details on how DERs are modeled in the ProbA and how they are differentiated from Variable Energy Resources (VERs).** * Provide any references or applicable documentation for how DERs are modeled in the ProbA. Are they modeled as embedded in the forecast, modeled as load modifiers, or as capacity resources?
* Highlight any modifications made to these methods or assumptions since the 2024 ProbA.
* Behind the Meter (BTM) Generation is a generating unit or multiple generating units on the customer’s side of the retail meter that serve all or part of the retail load with electric energy. There is a wide array of methodologies on how the BTM generators can be incorporated in each Assessment Area. Discuss whether there are BTM resources other than the BTM solar PV data assumed in the ProbA and indicate whether they are provided in the LTRA data form.
* If there are BTM resources other than solar PV embedded in the demand model data, discuss those resources on a grouped basis.
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# Generation/Capacity Resource Modeling

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| **G1 - Describe the development of thermal resource models.** * Discuss how the capacity ratings were developed. Are there seasonal/monthly ratings derived from testing/performance, or other methods? Does the methodology align with the LTRA?
* Discuss how outage rates are developed. Include whether it is a derate, forced outage rate, transition rate, energy profile, or other method. Are they by individual unit, class average, fuel type, etc. Do they vary by season/month?
* Describe how Scheduled Outages are modeled. Is the schedule developed by the model or externally done? Describe whether they are fixed or random events.
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| **G2 - If applicable, describe any modeling of Net Demand Ramping in the ProbA. (see RAS white paper:** [**Essential Reliability Services Forward-Looking Net Demand Ramping Assessment**](https://www.nerc.com/comm/PC/Reliability%20Assessment%20Subcommittee%20RAS%202013/Measure6_Pilot_Recommendation_July_2020.pdf)**).** * Provide information on any detailed hourly ramping and flexibility attributes of the model and associated data construct.
* If a detailed ramping model is not employed, describe any approaches to determine ramping needs or identification of flexible capacity in the ProbA results, if any.
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| **G3 – Describe all methods and assumptions used to model Variable Energy Resources (wind, solar, and hydro), and Energy Storage (stand alone and hybrid) for the ProbA.** Response should include:* Describe the modeling methods and data construct for these resources. Provide a description of the level of detail and modeling construct:
	+ If used, describe how the Effective Load Carrying Capability (ELCC) or Capacity Contribution is modeled across the year. If available, monthly or seasonal ELCCs, Capacity Contribution that are used.
	+ If used, describe the hourly profiles (time series) for these resources and the basis for the profiles, based on years of history (include number of years), or synthetic methods.
	+ If used, describe the methodology for the determination of the probability distribution function and seasonal accredited values for VER.
* Highlight any modifications made to these methods or assumptions since the 2024 ProbA.
* For energy storage resources, how are supply duration and state of charge modeled? Is there a minimum supply duration required, and if so, what is it? (e.g., 2-hour battery discharge capability). How is the capacity contribution of stand-alone battery storage and hybrid resources determined?
* Describe methodologies on modeling energy limited resources.
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| **G4 - Describe any probabilistic studies conducted by your assessment area to identify risks as a result of inverter-based resource (IBR) performance issues.** Discuss how you modeled loss of these resources in the ProbA?. |
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| **G5 - How are confirmed and aggregated generator retirements and resource additions modeled in the ProbA?** Describe any differences from their treatment in the LTRA including derations or probabilistic treatments**.** If Tier 2 and Tier 3 resources are modeled in the ProbA, describe how. |
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| **G6 – Generator Fuel Supply Issues. How are natural gas limitations and electric-gas interoperability issues considered in ProbA?** Describe the modeling for identified adverse reliability impacts (e.g., resource adequacy, energy risk, planning or operational impacts, etc.) resulting from generator fuel supply and/or fuel deliverability constraints (any fuel type). Include a description of planning assumptions for the following factors, or discuss considerations:* Normal and extreme winter conditions
* Different seasonal impacts on fuel supply and delivery.
* Firm vs. non-firm gas supply and transportation capacity, and how this can affect generation availability and output in the assessment area during normal and extreme conditions
* Generation contingencies that are studied based on planner’s understanding of natural gas system vulnerabilities, including historic constraint points along the relevant gas transportation systems.
* Projected gas-fired capacity additions
* Deration of generation capacity to reflect potential limitations due to extreme cold weather.
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# Capacity Transfers

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| **Are there any severe scenarios from other planning studies in which the capacity transfers would be limited (e.g., a wide-area extreme hot or cold event) that are explicitly modeled in the ProbA base case?** |
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| **CT2- Describe the model developed for capacity transfers during peak and non-peak hours with neighboring assessment areas.*** Outline the methods and assumptions for capacity transfers, especially those to prevent double counting and to recognize internal and external transmission and capacity constraints.
* Highlight any modifications made to these methods or assumptions since the 2024 ProbA.
* Discuss the treatment of firm, non-firm, and emergency assistance transfers.
* Variability of transmission path limits either deterministically or probabilistically.
* Does the assessment area have any reserve sharing agreements in place and modeled?
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# Transmission Modeling

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| **T1- Summarize any major transmission projects that are included the ProbA base case.** Discuss transmission additions and retirements for years 2027 and 2029 that are included in the modeling: explain any differences between the modeled transmission additions and retirements and explain the differences between the transmission addition and retirement data provided for the current LTRA. |
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| **T2- Describe transmission limitations or transmission constrained areas modeled in the ProbA*** How are reliability impacts to planning and operations impacting resource adequacy within the assessment period captured. How are the transmission limits determined?
* Describe the modeling approach, including how limitations are developed and included, reflecting deliverability and availability of resources, whether it is a nodal, zonal, or other methodology used.
* How are grid enhancing (controllable devices, etc.) modeled in ProbA?
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## Emergency Operating Procedures (EOP)

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| **EO1- Describe the modeling of EOPs in ProbA.** EOPs provide plans for system operators when responding to capacity and energy emergencies on their respective systems. These procedures include alerts, warnings, as well as event levels to mitigate capacity and energy deficiencies in real-time. Describe how the following EOP considerations are included in the probabilistic assessment: * The number of steps, description, priorities, and the variability in the amount of load or capacity shortage relief obtainable at each step.
* Describe the methodology used to determine the amount of EOP benefits for each EOP step and whether the amount varies throughout the year or is limited to a number of calls or diminishes from non-response.
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# Prob A Results

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| **PR1 - Provide a discussion of the results of the 2025ProbA. If the Probabilistic Base Case results indicated measurable loss of load hours (LOLH), EUE, or other reliability metrics (measure) either at peak net demand hour or outside of this hour, describe the conditions and reliability factors contributing to the risk.** *Discuss the relationship between the key drivers, variable hourly loads, and available resources and how they influenced the reported value of the probabilistic reliability metric. Include the following:* * Time of day of occurrence(s) or period of day *(e.g. morning, afternoon, evening, overnight)*
* Reliability factors or reliability risk drivers that cause the loss of load or resource adequacy risk, including:
	+ Off-peak capacity limitations (e.g., solar PV reductions in non-peak hours)
	+ Off-peak demand changes (e.g., large motor loads increase in non-peak hours)
	+ Limited fuel or energy availability
	+ Resource outages outside of the reported peak hour
	+ Transmission limitations
	+ Any other factors identified in the ProbA
* Discuss the visualization of risk hours and adjacent hours to help with the above. The visualization are developed from the provided 8760 hourly data files
* Resource, system changes or planning strategies that are being implemented or considered to mitigate loss of load or resource adequacy risks. These could be based on LTRA or Probabilistic Assessment Base Case results
* Any other trends or areas of interest
* Explain how the probabilistic results compare to the deterministic results of the LTRA. Discuss any notable differences or insights.
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# Proposed Summary Narrative (publicly releasable for the 2025 LTRA)

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| **Provide a proposed Prob A narrative write-up for each assessment area, including information based on the responses to the above ProbA requests.** This will include pertinent highlight bullets of findings to be included in the LTRA dashboard section, and a draft ProbA section for the LTRA based on the responses to the ProbA narrative guide above. How do the probabilistic results compare to the deterministic results of the LTRA? Discuss any notable differences or insights.* Risk Identification and key drivers
* Energy assessment, including non-peak hour risk
* Demand plots including LFU
* Distributed Energy Resources contributions
* Visualization of critical hourly periods based on the provided ProbA data file
* Monthly plots
* Table and discussion of metrics (LOLH, EUE, NEUE) and margins
* Icicle plot of hourly margins showing surplus and deficits
* Any other proposed charts/graphs to support findings
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**Appendix A**

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| **Inputs and Assumptions Summary** | **NPCC** | **PJM** | **SERC** | **MISO** | **Manitoba** | **Sask.** | **SPP** | **ERCOT** | **WECC** |
| Name of software tool used |  |  |  |  |  |  |  |  |  |
| Model type: Monte Carlo/Convolution |  |  |  |  |  |  |  |  |  |
| System representation # of connected assessment areas# of connected external areas |  |  |  |  |  |  |  |  |  |
| Weather years modeled |  |  |  |  |  |  |  |  |  |
| Load forecast and modeling |  |  |  |  |  |  |  |  |  |
| Load forecast uncertainties modeled |  |  |  |  |  |  |  |  |  |
| Hydroelectric generation |  |  |  |  |  |  |  |  |  |
| Thermal generation |  |  |  |  |  |  |  |  |  |
| Demand Side Management |  |  |  |  |  |  |  |  |  |
| Demand Response deployment criteria |  |  |  |  |  |  |  |  |  |
| Wind modeling, capacity value |  |  |  |  |  |  |  |  |  |
| Solar modeling, capacity value |  |  |  |  |  |  |  |  |  |
| Energy Storage modeling, capacity value |  |  |  |  |  |  |  |  |  |
| Simulation count per hour |  |  |  |  |  |  |  |  |  |
| Capacity transfers |  |  |  |  |  |  |  |  |  |
| Generator forced outages |  |  |  |  |  |  |  |  |  |
| Generator planned outages |  |  |  |  |  |  |  |  |  |
| Any reserve assumptions |  |  |  |  |  |  |  |  |  |
| Region specific Reliability Standards |  |  |  |  |  |  |  |  |  |
| Other |  |  |  |  |  |  |  |  |  |