Future Grid Reliability Study

Additional Feedback on Modeling and Assumptions for Phase 1 Studies

Carissa P. Sedlacek

DIRECTOR, PLANNING SERVICES | SYSTEM PLANNING

Background

- Since fall 2020, stakeholders at the joint NEPOOL Markets Committee (MC) and Reliability Committee (RC) meetings have been developing a Framework document supporting their Future Grid Reliability Study (FGRS)
  - The ISO has participated in the joint MC/RC meetings in an advisory role, answering technical questions as they arose
  - At the September 1, 2020 meeting, the ISO explained its technical ability to support the various studies that may comprise the FGRS
  - On December 29, 2020, NEPOOL formally asked the ISO for feedback on the proposed FGRS Framework document studies
  - At the January 19, 2021 meeting, the ISO:
    - Confirmed they could perform the Phase 1 studies
    - Agreed to continue reviewing the Phase 1 study assumptions
    - Offered to examine whether the Phase 1 studies could be done sooner

Updates on Phase 1 Study Assumptions:

What has Happened Since the January 19, 2021 MC/RC Meeting?

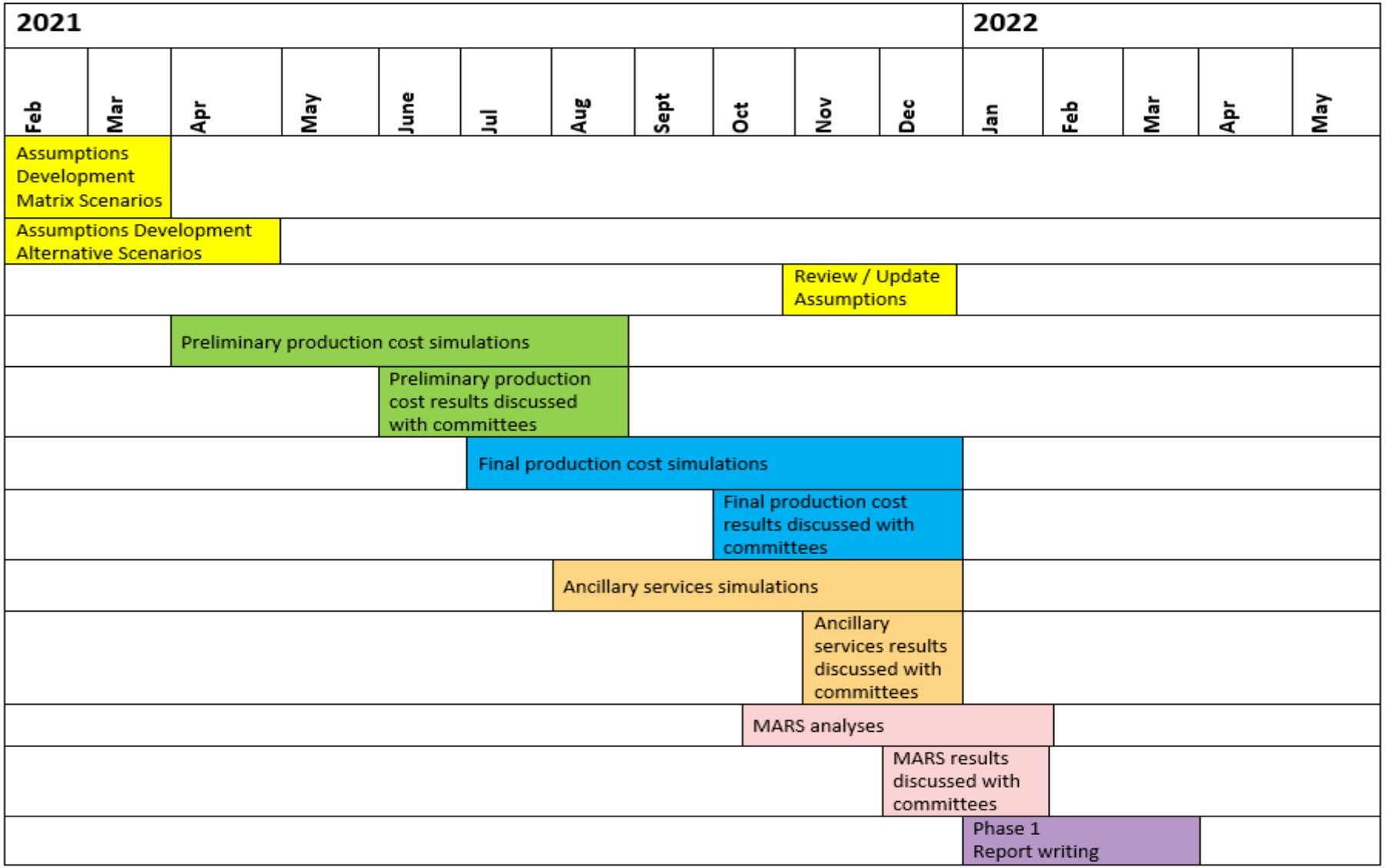
- Efforts continued to solidify the Phase 1 study assumptions for both the matrix scenarios and alternative scenarios
  - Related framework revisions led by Peter Flynn
  - Goal: to create a comprehensive list of assumptions to hand off to the ISO for Phase 1 study efforts as soon as practicable
- The ISO has had additional discussions with study proponents regarding Phase 1 study assumptions
  - Sought clarification and more detail so GridView and EPECS models can be developed sooner
- The ISO has further reviewed the Resource Adequacy Screen and Probabilistic Resource Availability Analysis assumptions related to the MARS runs and needs additional clarity
- The ISO developed two modeling presentations related to the Phase 1 studies for discussion today
  - Review of DNV GL data for modeling wind/solar resources
  - Electric Vehicle (EV) modeling

Schedule

Phase 1 Studies

- As requested, the ISO has reviewed the timeline with an effort to improve the proposed schedule
- The schedule has been shortened by two months
  - Includes additional overlap of studies
- Added “check-in” points for initial review and then further review of assumptions
  - Needed for sensitivities to matrix and alternative scenarios
- Added anticipated meetings with MC/RC (as the study proponent) and PAC
  - Schedule assumes the FGRS Phase 1 studies become a 2021 Economic Study

Schedule: Phase 1 Studies (updated)



Preliminary Committee Schedule

	2021											2022					
	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
MC/RC Meeting	X	X	X		X			X			X			X		X Final	
PAC Meeting			X	X	X	X	X		X	X	X	X			X Final		

- The PAC will meet regularly to discuss the 2021 Economic Study once the Phase 1 studies are underway
- The MC/RC will be invited to PAC to participate, and the MC/RC will also reconvene periodically to make decisions that may be needed to set direction for the study

2021 Economic Study Submittal Process

- Submittal of the FGRS Phase 1 study as the 2021 Economic Study requires a letter to be sent to PACMatters@iso-ne.com (attention Carissa P. Sedlacek, Director Planning Services – System Planning) by **April 1, 2021 at 5:00 pm**.
  - The Framework document and assumptions table should be an attachment to the letter requesting the Economic Study
- Upcoming key milestones
  - Submission of the FGRS Phase 1 studies as a 2021 Economic Study will NOT affect the timeline or the ISO efforts to work with stakeholders on study scope, assumption clarity or creating models

Key Milestone	2021 Due Dates
Submission of Economic Study Request	April 1 by 5 pm
ISO to contact all presenters of Economic Study Requests regarding logistics	April 5 by Noon
Stakeholder presentation materials are due to ISO	April 8 by Noon
Stakeholders present their requests to PAC	April 14
PAC to discuss the requests	May 19

Why use the Economic Study Process?

- Formally provides ownership of the request to the MC/RC members
  - NEPOOL has previously submitted an Economic Study - See 2016 Economic Study
- Provides an avenue for NEPOOL to get the FGRS Phase 1 study work done in a timely manner with clear structure
  - If the ISO did not use the Tariff-defined Economic Study structure as outlined in Attachment K, the ISO could get multiple Economic Study requests under the Tariff that could pre-empt non-Tariff request
- Using the PAC for presentation of FGRS Phase 1 study results should not slow the process
  - MC/RC members will be invited to PAC meetings
- "Scope Creep" is unlikely because the Framework document is already well defined

Phase 1 Studies Additional Clarifications

Production Cost and Ancillary Services Simulations

- As of February 12, the ISO has reviewed the assumptions documented to date
  - Some assumptions need further clarification
- The following slides outline the additional assumption details needed for the matrix and alternative scenarios
- After today's meeting, the ISO will continue to review proposed assumptions as they start to build the models, and will seek clarification as needed

Phase 1 Studies Additional Clarifications

Necessary Assumptions for both Gridview and EPECS

Load-Related Assumptions

- Confirmation that BTM PV Resources will use the same weather year data as wind and load?
- Matrix Scenario S2: Battery Energy Storage Systems (BESS) characteristics
  - Need to assign discrete ratings for BESS
    - A one-hour battery is able to discharge its full output over only one hour whereas an eight-hour battery can discharge its energy at full output for eight hours
  - Interconnection locations: Distribution of batteries across New England system is still needed

System Topology

- Matrix Scenario S2: Unclear what is meant by “relatively unconstrained flows” for the New England system
  - Recommend removing all system constraints for consistency with other scenarios

Phase 1 Studies Additional Clarifications, cont.

Necessary Assumptions for both Gridview and EPECS

Resource Mix

- Will nuclear and Municipal Solid Waste (MSW)/Landfill Gas (LFG) resources be treated as "must-run units" as they have in prior economic studies?
- Alternative A Scenario: Is the intention to use the room between the existing tie import profiles and the physical maximum of the tie for importing "banked energy?"
  - Energy Banking: Utilize the ties to export energy and lower renewable build-out spillage during periods of low demand. Then, during periods of high demand, import the energy back to New England.
- Matrix Scenario S2: Need specific breakdown of where new PV and wind resources will be located.
- There seemed to be interest in testing *varying* amounts or types of reserves. If so, there needs to be more clarity in what stakeholders are seeking.

Phase 1 Studies Additional Clarifications, cont.

Necessary Assumptions for EPECS

Background

- EPECS simulator consists of four simulation layers addressing different user-defined time scales. The four layers and time scales currently used are:
  - Day-ahead resource scheduling as a security-constrained unit commitment (SCUC)
  - Four-hour-ahead, real-time security-constrained resource scheduling as a real-time unit commitment (RTUC)
  - Fifteen-minute-ahead, real-time balancing as a security-constrained economic dispatch (SCED)
  - Real-time physical power flow with integrated regulation service using one-minute time steps

Phase 1 Studies Additional Clarifications, cont.

Necessary Assumptions for EPECS

- Forecast error allocation for wind, solar, and load in SCUC (day ahead), RTUC, and SCED simulations is needed
  - The ISO can provide recommendations for values for these parameters
  - Recommend using the same forecast error for all scenarios
- In the 2020 Economic Study, hydro resources were modeled using GridView's hydro dispatch model rather than a profile. Should the same approach be used for the FGRS?
  - Or should a static hydro profile be used as an input to EPECS?
- SCUC, RTUC, SCED, 30-minute operating reserve (TMOR) and 10-minute spinning reserve (TMSR) time steps and horizons can be customized
  - The ISO can provide recommendations for values for these parameters
- Should we use “do not exceed limits” to limit reserve fluctuations?
  - Note: Reduces the total need for reserves, thereby reducing overall variability
  - The ISO can provide recommendations
- Should the program attempt to minimize regulation reserve exceedances and system imbalance through re-dispatch?
  - Note: The error is mainly caused by forecast uncertainty. The ISO can allow the EPECS program to do more with dispatch to address this issue.

Phase 1 Studies Additional Clarifications, cont.

Necessary Assumptions for EPECS

- Confirmation that the ISO should run full 2040 year studies rather than focus on shoulder periods only
- In EPECS, only regulation reserves are available in real time to respond to system imbalances; while storage exists in the cases, it is dispatched in SCUC and RTUC
  - If participants want a real-time proxy for how battery storage could respond, they should specify it as regulation reserves (or understand we're going to use it as a proxy)
  - How much regulation reserves do they want available to respond in real time?

Phase 1 Studies Expected Results

Energy Production and Ancillary Services Simulations

- When performing economic studies, two primary simulation tools are used by the ISO for the power system production-cost simulations: Gridview and EPECS
  - The GridView model is used for energy-production simulations and the EPECS model for ancillary-services simulations
- GridView performs transmission and security-constrained optimization of the system resources against spatially-distributed loads to produce a realistic forecast of the utilization of power system components and flow patterns in the transmission grid
  - GridView can use either cost-based inputs based on physical quantities or resource owner-determined bids; only cost-based inputs have been used to date
  - Gridview cannot model the distribution system
- The following slide lists the commonly-reported metrics

Phase 1 Studies Expected Results, cont.

Energy Production and Ancillary Services Simulations

- Economic Metrics
  - Production Cost
  - Load-Serving Entity Energy Expense (LSEEE or LSE Energy Expense)
  - Uplift
  - Congestion Costs
    - Congestion
    - Congestion with FTR/ARR Adjustments by Financial Transmission Rights (FTR)/Auction Revenue Rights (ARR)
  - Locational Marginal Prices (LMP)
  - Gross Revenues
  - Net Revenue/Contributions to Fixed Costs (CTFC) by Fuel Type and Technology
- Investment Metrics
  - Relative Annual Resource Cost (RARC) given an assumption such as Annual Carrying Charges (e.g., assuming 16% to 18% of capital cost per year)
- Transmission Metrics
  - Interface Flow
    - MW Flows
    - Percent of Interface Transfer Limit
  - Hours at Interface Transfer Limit
  - Congestion
  - Bottled-In Energy Behind Transmission Transfer Limits
- Operational Metrics
  - Energy Production by Resource Type (GWh)
  - Energy Production by Fuel Type
  - Fuel Setting the Marginal Price
  - Net Load Ramp
  - Reserves
  - Capacity Factor by Unit Class
  - Annual spillage by resource
- Emission Metrics
  - System Emission Targets
    - Carbon Dioxide (CO_2)
    - Nitrous Oxides (NO_X)
    - Sulfur Dioxide (SO_2)
  - Renewable Resource Production vs. RPS Targets

Phase 1 Studies Additional Clarifications

Resource Adequacy Screen and Probabilistic Resource Availability Analysis

Background

- The ISO uses the Multi-Area Reliability Simulation (MARS) model to conduct the Resource Adequacy Screen and Probabilistic Resource Availability Analysis
- MARS is a sequential Monte Carlo simulation program that computes the reliability of a power system comprising a number of interconnected areas containing resources and load
- Through simulating the system chronologically and repeatedly (multiple replications), the MARS program assesses the ability of the system to serve load under a wide range of possible system conditions
  - MARS considers the availability of resources, expected load, and inter-area transfer limitations

Phase 1 Studies Additional Clarifications, cont.

Necessary Assumptions for MARS

Certain modeling assumptions are unique to the MARS analysis and need to be defined:

- Allocation of weather-related uncertainty associated with load forecast, including gross load, ASHP load, EV, and BTM-PV
  - With the assumed increase in the penetration of weather-sensitive load (e.g., ASHP), additional volatility may need to be incorporated in the load model for the winter
  - Should the same weather-related uncertainties used for FCA 16, adjusted for winter, be used for the FGRS Phase 1 study?
- Uncertainty associated with the output of VERs and their correlation with load
  - Sufficient representation of their impacts on establishing resource adequacy for the system, including considerations of extreme events
  - May be able to use the *new* DNV GL wind/solar profiles

Phase 1 Studies Additional Clarifications, cont.

Necessary Assumptions for MARS

- Tie benefits assumptions from external control areas
  - Current tie benefits assumptions used in FCM are annualized equivalent values, reflecting the expected LOLE risks and the need for emergency assistance during the summer, with most assistance provided by winter-peaking neighbors of Quebec and Maritimes
  - If the New England system is expected to evolve to winter peaking or dual summer/winter peaking in the scenarios under study, do stakeholders prefer using seasonal tie-benefits assumptions?
    - Possible to derive some reasonable assumptions based on the past FCM tie-benefits study results
    - Unrealistic to conduct a tie-benefits study due to the efforts required and the tight schedule
- Additional discussions are warranted
  - Next month, the ISO will provide additional detail and potential options

Phase 1 Studies Expected Results

Resource Adequacy Screen and Probabilistic Resource Availability Analysis

- Resource Adequacy Screen
  - Objective: Focus on resource adequacy of each planned, resource-mix scenario in accordance with the LOLE criterion, and identifying:
    - Additional resource/capacity needs in terms of the amount of proxy unit(s), if short
    - Surplus in terms of additional load carrying capability (ALCC), if long
  - Metrics (**expected** reliability indices for as-is and at-criterion condition):
    - Loss-of-Load **Expectation** (LOLE)
    - **Expected** Loss-of-Load Hours (LOLH)
    - **Expected** Unserved Energy (EUE)
  - Produce representative system net ICR for MC/RC selected scenarios
    - Based on current market rules
  - Create System Marginal Reliability Impact (MRI) curves for MC/RC selected scenarios

Phase 1 Studies Expected Results, cont.

Resource Adequacy Screen and Probabilistic Resource Availability Analysis

- Probabilistic Resource Availability Analysis
  - Objective: To understand reliability risks under various system conditions
  - Metrics
    - Boundary of risks: probability distribution of the expected reliability risks identified in Resource Adequacy Screen
    - Timing of risks: season, month, hours during the day
    - Expected frequency of outages
    - Expected outage duration
    - Location of risks: assuming reserve sharing among all subareas
    - Statistics of flows across major interfaces

Next Steps

- The ISO will continue to review the FGRS Phase 1 study portion of the Framework document, including assumptions, to identify additional areas for clarification
  - This work will continue through March
- The ISO is accepting 2021 Economic Study requests now through April 1, 2021
  - May require the Framework document being split into two separate documents highlighting the Phase 1 and Phase 2 work separately