

2020 Economic Study

Draft Scope of Work and High-Level Assumptions for Production Simulations - Part I of II



Planning Advisory Committee Meeting

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Today's Presentation

- Recap the 2020 Economic Study Request
- Discuss the Proposed Scope of Work for Production Simulations
- Present Study Scenarios
- Review High-Level Assumptions
- Review Preliminary 2020 Economic Study Schedule



RECAP THE 2020 ECONOMIC STUDY REQUEST



One Economic Study Request Was Received in 2020

- ISO New England (ISO) received one request for an Economic Study
- Request made by National Grid (NGRID)
 - Presented to the [PAC](#) on April 23, 2020
- The goal of the NGRID request is to “Provide stakeholders analyses of potential pathways to best use the MWh of clean energy resources to meet state goals cost-effectively, leveraging transmission* and/or storage as needed”
 - Evaluate the potential economic benefits associated with the deployment of transmission* and/or storage under a range of assumed future resource portfolios
 - Assess changes to thermal unit capacity factors, spillage and emissions as related to different resource and dispatch scenarios
- The request is for a one-year study focusing on 2035

*Bi-directional transmission capability with neighbors



Goals of Requested Scenarios

NGRID requested to study three scenarios plus sensitivities with the following goals:

1. Renewable Build-Out (Base)
 - Understand the potential impacts on the renewable resource spillage, renewable capacity costs, load costs (Load Serving Entity Energy Expenses), and thermal generator economics of achieving current state policy targets for 2035
2. Renewable Build-out + Bi-directional Transmission
 - Explore how those impacts change in a future with more flexible, additional bi-lateral interconnection with neighboring regions, particularly Hydro Quebec (HQ) and associated high level transmission system upgrade needs/costs
3. Renewable Build-out + Storage
 - Explore how those impacts change in a future with additional battery storage within ISO-NE

Sensitivities:

- Assess how the impacts in all three scenarios are affected by further thermal retirements



Deliverables Requested

- NGRID's study goal is to provide insight on wholesale energy impacts, unit economics, utilization of resources, and role of bi-directional transmission capability with neighbors and battery storage in meeting the needs of a system with a high proportion of intermittent resources
 - Identification of bi-directional transmission capability with neighbors and storage capacity that may be needed in the region and high-level cost estimates
 - System production costs, load-serving entity expenses, congestion, interface flows, energy and ancillary service prices, and emissions as they relate to policy targets
 - Generation production and costs, renewable spillage, energy and ancillary service revenues, carrying costs, generation capacity factors, and the marginal fuel
 - Range of physical quantities of ramping/load following, regulation, and reserves available and needed



SCOPE OF WORK

Production Simulations

Production Simulations

- ISO will conduct simulations using the ABB GridView production simulation software for the year 2035
 - A DC model with full transmission system topology using bus-branch model and impedance values. However, only the selected interface limits (pipe) between Regional System Plan (RSP) subareas (bubbles) are monitored. All transmission line limits within each bubble are not monitored
- Production simulations will include three scenarios plus sensitivities under transmission constrained and unconstrained conditions
 - Base - Renewable Build-Out
 - Only imports from neighbours, except for the NY ties which will reflect assumed exports from ISO New England based on profiles provided by NGRID
 - Power Exchange - Renewable Build-out + Bi-directional Transmission capability with neighbors
 - Storage - Renewable Build-out + Storage
 - Only imports from neighbours except for the NY ties which will reflect assumed exports from ISO New England based on profiles provided by NGRID
 - Sensitivities - Multiple Sensitivities as needed



Production Simulations, cont.

- ISO will conduct sub-hourly production simulations associated with these scenarios using the Dartmouth Electric Power Enterprise Control System (EPECS) software to investigate ancillary reserve needs
- EPECS sub-hourly simulations will assess system operational impacts of the study scenarios taking unit commitment and economic dispatch into consideration to produce results relating to:
 - Load-following/Ramping
 - Regulation/Automatic Generation Control (AGC)
 - Operating Reserves
- The study scenarios will reflect load and resources based on assumptions provided by NGRID to meet an assumed Net Installed Capacity Requirement (NICR) for 2035
 - NICR for 2035 will be based on FCA 14 NICR percent reserve



GridView Production Simulation Metrics

- System-wide energy production by resource/fuel type
- System-wide production costs
- Locational Marginal Prices (average annual, monthly, on/off peak, etc.)
- Load-serving entity energy expense and uplift
- Congestion by interface (internal and external) and key lines of interest
- Native New England Resource CO₂ emissions, including marginal emissions
- Spillage
- Energy exports to neighboring systems
- Storage utilization

Disclaimer: All results use the 2015 weather year to create the shape of load, solar, and wind profiles (scaled to 2030 forecasted values). The results are specific to this weather year. If a different weather year is used for profile shapes the results will differ – the trends would be similar but specific numeric results will change.

EPECS Sub-hourly Simulation Metrics

- Load-Following/Ramping
- Regulation/AGC
- Operating Reserves
 - Ten-Minute Synchronized
 - Thirty-Minute Operating
- Curtailment Performance
- Interface and New York Synchronous AC Tie-Line Performance
- Additional metric(s) to be determined



HIGH-LEVEL STUDY ASSUMPTIONS



Study Assumptions

Demand for All Scenarios

- Gross load (net of energy efficiency (EE) and electrification) are based on NGRID data extrapolated from the 2020 Capacity, Energy, Load, and Transmission (CELT) Report load to 2035
- Loads associated with Electrification (heat pumps and electric vehicles), and behind-the-meter photovoltaic (BTM PV) assumptions are provided by NGRID
 - Load could be increased by about 9,500 GWh for heating
 - Load could be increased by about 7,000 GWh for EVs (~2.2 million light-duty vehicles)
 - Load could be reduced by 8,000 MW (name plate) of BTM PV

Note: The data will be assigned with the 2015 year weather data for components of load that are impacted by weather



Study Assumptions – Resources

Base Scenario

- Existing resource assumptions - FCA 13 cleared resources minus retirements plus new resources cleared in FCA 14
- Existing external ties - Highgate, HQ Phase II, New Brunswick interconnections and NECEC assumed to import energy only. New York AC ties and Cross Sound Cable could be bi-directional
- Retirements
 - Mystic Units 7, 8 and 9
 - Millstone Point Unit 2 (based on its operating license expiration date of July 31, 2035)
 - Coal units
 - 75% of oil- and gas-fired generation including dual-fuel units based on performance/utilization metric
- Additions
 - Resource type, amount and location based on assumptions provided by NGRID
 - Additional land-based and offshore renewables, as required, to meet NICR and state emission policies

Note: FCA 13 is for Capacity Commitment Period 2022-2023 and FCA 14 is for Capacity Commitment Period 2023-2024

Study Assumptions – Resources

Power Exchange Scenario

- Existing resource and retirements - same as Base Scenario assumptions
- Existing external ties – treat them as bi-directional, if physically capable, with focus on HQ given likelihood of coupled supply and load in NY
- Additions
 - Additions or reductions to the added renewable resources in the base scenario could also take place according to what is needed if transmission is used differently
 - Add bi-directional external ties, if needed, to:
 - More effectively meet state emissions policies
 - Reduce emissions by importing energy to avoid fossil fuel generation in hours when in-region renewables are not available and exporting in hours when in-region renewables are abundant
 - Minimize renewable spillage

Study Assumptions – Resources

Storage Scenario

- Existing resource and retirements - same as Base Scenario assumptions
- Existing external ties – Same assumptions as the Power Exchange Scenario
- Additions
 - Additions or reductions to the added renewable resources in the base scenario could also take place according to what is needed if transmission is used differently
 - Add storage to:
 - More effectively meet state emissions policies
 - Reduce emissions by adding storage to avoid fossil fuel generation in hours when in-region renewables are not available and charging in hours when in-region renewables are abundant
 - Minimize renewable spillage

Transmission Assumptions

Interface Transfer limits

- The scenarios will be performed in two ways: with and without assuming internal transmission constraints
- Internal transmission constrained “bubbles” will be modeled using 2029 internal interface transfer capabilities, with the exception of the Surowiec-South interface limit (shown on the following slide)
 - Surowiec-South transfer limits assumed to be 2,500 MW
- Transfer Capability of external transmission interconnections will be modeled using 2029 external interface transfer capabilities
 - These values will be presented at the June PAC Meeting



Internal Transmission Interface Limits (MW)

Single-Value, Summer Peak^a, Non-Firm, Transmission Interface Limits for Use in Subarea Transportation Models

Interface	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Orrington South Export	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325
Surowiec South	1500	1500	1500	1500	1500	1500	1500	1500	1500	2500*
Maine-New Hampshire	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Northern New England-Scobie + 394	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
North-South	2725	2725	2725	2725	2725	2725	2725	2725	2725	2725
East-West	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
West-East	2200	2200	2200	3000 ^e	3000	3000	3000	3000	3000	3000
Boston Import (N-1)	5400	5700 ^b	5700	5700	5150 ^f	5150	5150	5150	5150	5150
Boston Import (N-1-1)	4500	4600 ^b	4600	4600	4300 ^f	4300	4300	4300	4300	4300
SEMA/RI Export	3400	3400	3400	3400	3400	3400	3400	3400	3400	3400
SEMA/RI Import (N-1)	1280	1280	1280	1800 ^e	1800	1800	1800	1800	1800	1800
SEMA/RI Import (N-1-1)	720	720	720	800 ^e	800	800	800	800	800	800
Southeast New England Import (N-1)	5400	5700 ^b	5700	5700	5150 ^f	5150	5150	5150	5150	5150
Southeast New England Import (N-1-1)	4500	4600 ^b	4600	4600	4300 ^f	4300	4300	4300	4300	4300
Connecticut Import (N-1)	3400 ^c	3400	3400	3400	3400	3400	3400	3400	3400	3400
Connecticut Import (N-1-1)	2200 ^c	2200	2200	2200	2200	2200	2200	2200	2200	2200
SW Connecticut Import (N-1)	2500	2800 ^d	2800	2800	2800	2800	2800	2800	2800	2800
SW Connecticut Import (N-1-1)	1750	1900 ^d	1900	1900	1900	1900	1900	1900	1900	1900

*2,500 MW limit requested at the Surowiec South Interface by National Grid, FCA 15 internal transfer capability of Surowiec South is 1,500 MW for the year 2029

Source: https://www.iso-ne.com/static-assets/documents/2020/03/a08.0_rc_2020_03_17_presentation.pdf



Internal Interface Transfer Limits (Notes)

- a) Limits are for the summer period, except where noted to be winter
 - The limits may not include possible simultaneous impacts, and should not be considered as “firm”
 - For the years within the FCM horizon (Capacity Commitment Period (CCP) 2024-2025 and sooner), only accepted certified transmission projects are included when identifying transfer limits
 - For the years beyond the FCM horizon (CCP 2025-2026 and later), proposed plan approved transmission upgrades are included according to their expected in-service dates
- b) Increase associated with the Greater Boston upgrades, with the Wakefield-Woburn 345 kV line in service (CCP 2021-2022 and later)
- c) Increase associated with the Greater Hartford/Central Connecticut upgrades
- d) Increase associated with the Southwest Connecticut (SWCT) upgrades
- e) Increase associated with the Southeast Massachusetts/Rhode Island (SEMA/RI) Reliability project upgrades
- f) Decrease associated with the updated load assumptions, updated Northern New England (NNE)-Scobie transfer capability and retirement of Mystic 7, 8 & 9

Common Production Simulation Assumptions

For All Scenarios

- FCM and energy-only generators will be modeled at their Seasonal Claimed Capability
 - These capabilities will be reduced to reflect potential forced outages
- All other demand and supply variables will be modeled through the use of specific profiles provided by NGRID or developed by ISO
 - Details will be presented in June
- Fuel prices for coal, oil, and natural gas will be based on 2020 forecasts from the Energy Information Administration (EIA) for New England
 - Details will be presented in June
- Emission allowance prices for carbon dioxide will be reflected for fossil-burning generation units
 - The ISO will review the need to update the assumptions used in the 2019 Economic Studies, and detailed assumptions will be presented in June

Threshold Prices Will Be Used to Decrease Production of Resources Modeled at \$0/MWh When There is Oversupply

- The 2020 study will use the following threshold prices:

Price-Taking Resource	Threshold Price (\$/MWh)
Behind-the-Meter PV	1.00
NECEC (1200 MW)	2.00
Utility Scale PV	3.00
Offshore Wind	4.00
Onshore Wind	4.25
New England Hydro	4.50
Imports from QC (Highgate & Ph. II)	5.00
Imports from NB	10.00

- Comparing to past Economic Studies, the split of the onshore and offshore threshold prices is to provide additional detail
- These threshold prices are used to facilitate the analysis of load levels where the MW amount of supply-side resources exceeds the system load
 - Assumed a \$0/MWh production cost
 - They are not indicative of “true” cost, expected bidding behavior or the preference for one type of resource over another

EXCLUSION OF THE 2020 ECONOMIC STUDY REQUEST

What the study will exclude



Exclusion of the 2020 Economic Study Request

- The study will not include an assessment of FCM outcomes. The ISO cannot support this type of work at this time due to the complexities of the capacity market and limitations of software.
 - In 2016, the ISO engaged a consultant to perform a similar assessment, but since that time there have been various market rule changes. These market rule changes would require the ISO to make too many critical assumptions, thus potentially resulting in misleading guidelines
- The study will exclude ancillary service prices
 - These values are not available in either EPECS or GridView outputs
- The study will not include an assessment of transmission upgrade needs for the interconnection of proposed renewables as done in the NESCOE 2019 Economic Study
 - The 2020 Economic Study requests that numerous resource types of different sizes and locations be added to the system making it nearly impossible to develop any meaningful results without lots of effort and many assumptions
 - For example, large quantities of solar generation are dispersed projects being interconnected to the distribution system through the distribution utilities interconnection process
 - Well-sized and well-located stand-alone storage proposals should not trigger the need for substantial upgrades
 - For offshore wind additions, the ISO will leverage study results of the NESCOE 2019 Economic Study when performing the 2020 Economic Study
 - Transmission interface limits may be changed in sensitivities simulations to identify transfer capability required to relieve congestion

PRELIMINARY 2020 ECONOMIC STUDY SCHEDULE



Preliminary Schedule

- June/July 2020 PAC Meeting
 - Finalize detailed production simulation assumptions for the three scenarios
- Third Quarter 2020
 - Present draft production simulations results
 - Identify sensitivity scenario(s) and assumptions
- Fourth Quarter 2020
 - Present sensitivity scenario(s) simulation results
 - Present draft ancillary services (EPECS) results
- First Quarter 2021
 - Present draft and final reports

Questions

