2024 Economic Study

Preliminary Policy Scenario Results & Stakeholder-Requested Scenario Assumptions

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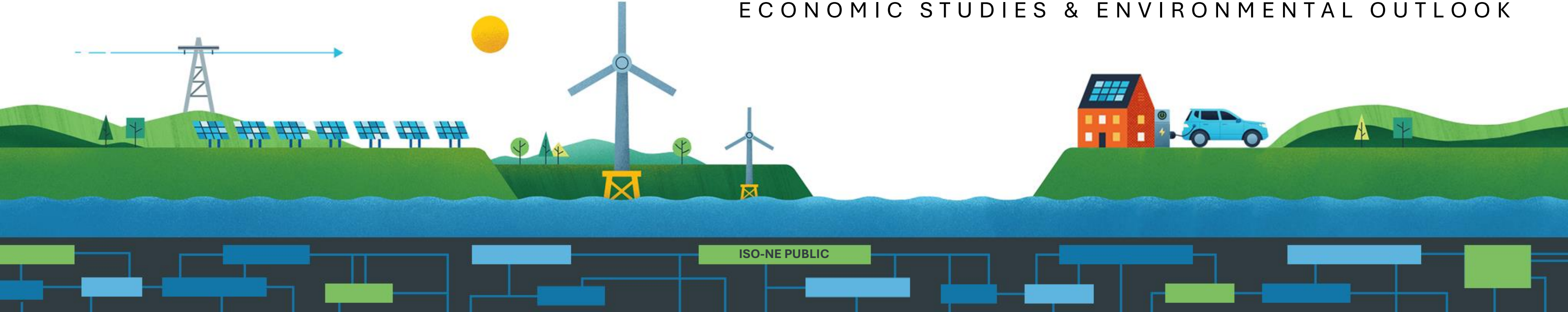
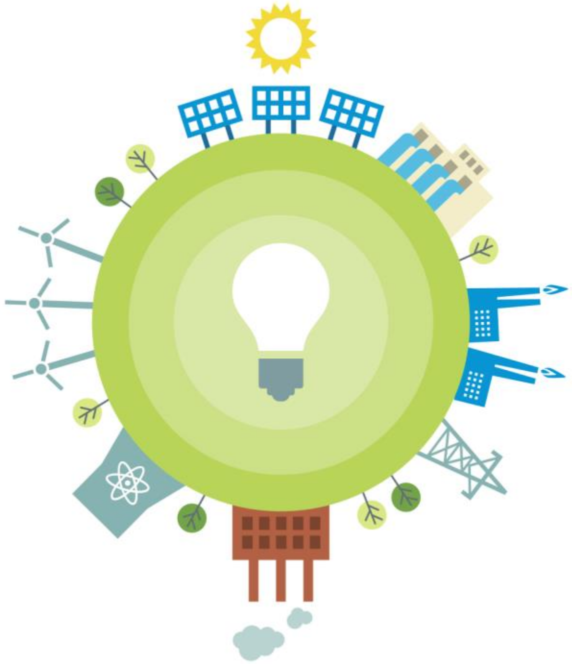
ECONOMIC STUDIES & ENVIRONMENTAL OUTLOOK



Overview of Presentation

- Overview of the 2024 Economic Study
- Policy Scenario Assumptions Update
- Policy Scenario Preliminary Results
- Stakeholder-Requested Scenario Assumptions
- Timeline and Next Steps



OVERVIEW OF THE ECONOMIC STUDY

Objective of the Economic Study Process

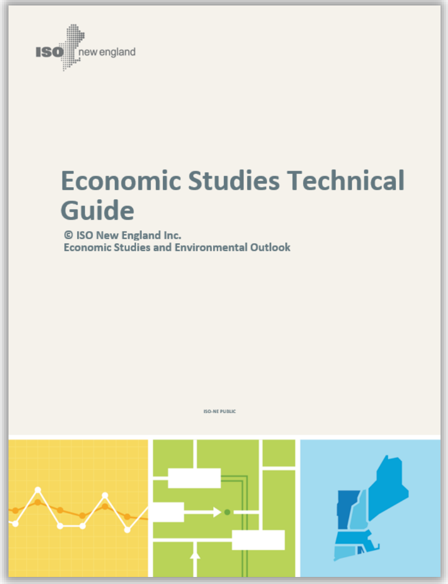
- Provide information to stakeholders to facilitate the evaluation of economic and environmental impacts of New England regional policies, federal policies, and various resource technologies on satisfying future resource needs in the region
  - Identify market efficiency issues on the PTF portion of the New England Transmission System and, as applicable, evaluate competitive solutions to alleviate identified system efficiency needs
- The 2024 Economic Study is anticipated to conclude by December 2025, but timeline may vary depending on outcomes of the System Efficiency Needs Scenario

Economic Study Reference Scenarios

- ✓ **Benchmark Scenario** – Model previous calendar year and compare it to historical system performance. This scenario's purpose is to test the fidelity of models against historical performance and improve the models for future scenarios
- **Policy Scenario** – Model future years (>10-year planning horizon) based on satisfying New England region and other energy policies and goals
- **System Efficiency Needs Scenario (SENS)** – Model future year (10-year planning horizon) based on the ISO's existing planning criteria to identify system efficiency issues that could meet the threshold of a system efficiency Needs Assessment and move on to the competitive solution process for System Efficiency Transmission Upgrades needs
- **Stakeholder-Requested Scenario** – Scenario with a region-wide scope that is requested by stakeholders and not covered by the other 3 scenarios or potential sensitivities on these 3 scenarios

Economic Studies Technical Guide

- The ISO published the first version of the Economic Studies Technical Guide (ESTG) on March 25, 2024
- This Technical Guide seeks to provide stakeholders, policy makers, and the public with a comprehensive document that describes the Economic Study process
  - The goal is to provide increased accessibility and understanding of the Economic Studies

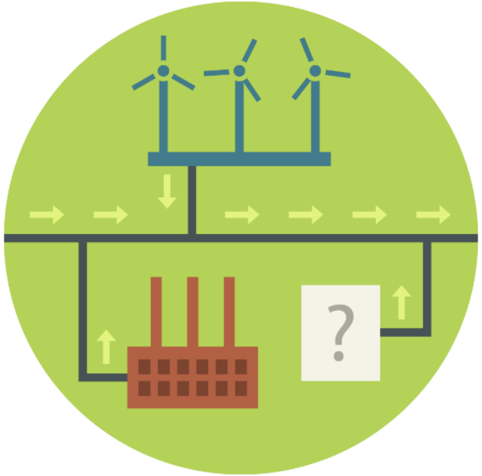


POLICY SCENARIO

Updated Resource Assumptions

Overview of the Policy Scenario

- The Policy Scenario will use Capacity Expansion to build new resources between 2033 to 2050
  - Resources will be built in annual blocks and the resulting expansion model will be tested every 5 years in production cost models
- The Economic Studies Technical Guide – Appendix B Data Source Spreadsheet provides further detail on Economic Study input assumptions



Policy Scenario Candidate Resources

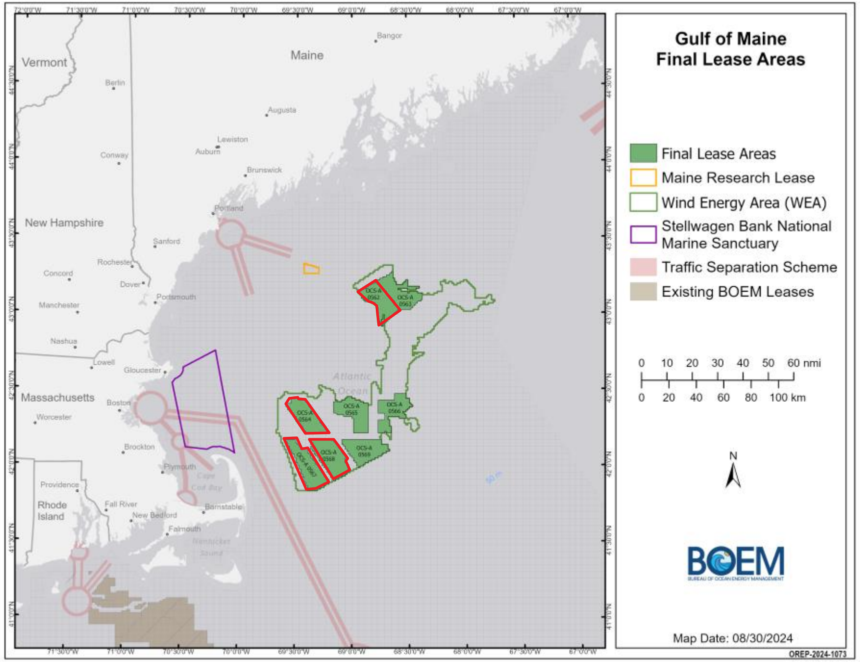
- Initial candidate resource assumptions including only wind, solar, and short-duration batteries were presented to the PAC in August
- During the Economic Planning for the Clean Energy Transition (EPCET) study, capacity expansion results showed that a wind/solar/battery only system will become progressively more expensive over time
- To more accurately represent a future resource mix, the Policy Scenario base case candidate resources will be expanded to include technologies that are:
  1. Zero-carbon
  2. Currently being constructed for grid interconnection in the U.S. **OR** have obtained lease agreements with New England
  3. Geographically feasible in New England

Floating Offshore Wind Planning and Modeling Assumptions

- Water depths in the Gulf of Maine necessitate the use of floating offshore wind (OSW) turbines, rather than the fixed turbines used for Block Island Wind and other planned offshore wind farms in southern New England
  - In October 2024, the U.S. Bureau of Ocean Energy Management (BOEM) held the first offshore wind lease auction for the Gulf of Maine. Four lease areas were won with a total capacity potential of 6.8 GW. The total financial investment by Avangrid Renewables and Invenergy NE Offshore Wind was over $21.9 million[1]

- Cost assumptions for floating offshore wind come from the 2024 NREL Annual Technology Baseline (ATB)
  - Build costs of fixed and floating offshore wind include a variable transmission cost adder based on distance to shore

- Offshore wind point of interconnection (POI) locations are based on the results of the 2050 Transmission Study. Additional one-time costs are added for POIs that have a required transmission upgrade



[1] https://www.boem.gov/renewable-energy/state-activities/maine/gulf-maine#:~:text=Gulf%20of%20Maine%20Offshore%20Wind,%2421.9%20million%20in%20winning%20bids.

100-Hr BESS Projects

- 100-hour iron-air batteries provide energy storage diversity alongside lithium ion (Li-ion) batteries and pumped storage hydro. 100-hour BESS were previously modeled in an EPCET Policy Scenario sensitivity
- Form Energy has announced several 100-hour battery projects in the U.S., expecting the first to begin operating by the end of 2025[1]
  - An 85MW/8500MWh iron-air battery in Northern Maine is expected to begin operating in 2028[2]

[1] https://www.utilitydive.com/news/iron-air-battery-developer-long-duration-storage-form-energy-collaboration-ge-vernova/730633/
[2] https://www.canarymedia.com/articles/long-duration-energy-storage/form-energy-set-to-build-worlds-biggest-battery-in-maine

100-Hr BESS Modeling Assumptions

- Cost assumptions and operational characteristics for the 100-hour batteries have been taken from the Form Energy whitepaper: *Clean, Reliable, Affordable: The Value of Multi-Day Storage in New England*
  - 4- and 8-hour battery cost assumptions are from the 2024 NREL ATB, which does not provide data for 100-hour batteries
- For all batteries, each unit built within each year has a 5% overnight capital cost escalation to reflect tightness in supply chains/labor and increases in interconnection cost

	Capital Cost	Fixed O&M Cost	Round trip efficiency	Size	VO&M Cost
100-Hour Iron-Air	$2,150/kW	$17.5/kW-yr	42.5%	200 MW 20,000 MWh	$3/MWh
4-Hour Li-ion	Declining ($1,389/kW in 2033; $1,036/kW in 2050)	Declining ($31/kW-yr in 2033, $22/kW-yr in 2050)	86%	100 MW 400 MWh	$3/MWh

Advanced Nuclear Projects

- Two projects recently supported by the U.S. Department of Energy's (DOE) Advanced Reactor Demonstration Program (ADRP) plan to connect to the grid in the next ten years[1]
  - Kemmerer, Wyoming: The 345MW TerraPower Natrium sodium-cooled fast reactor was the first advanced nuclear project to submit a construction permit to the U.S. Nuclear Regulatory Commission (NRC). Initial construction has begun on non-nuclear site features and the reactor could become operational as early as 2030[2]
  - Seadrift, Texas: X-energy plans to construct 4 units of their 80MW Xe-100 high-temperature gas reactors. The first unit is expected to be operational by 2030[3]. X-energy also received funding for the U.S.'s first advanced nuclear fuel fabrication facility[4]

[1] https://www.energy.gov/ne/articles/us-department-energy-announces-160-million-first-awards-under-advanced-reactor
[2] https://www.utilitydive.com/news/terrapower-smr-advanced-nuclear-reactor-bill-gates/718722/
[3] https://x-energy.com/seadrift
[4] https://x-energy.com/media/news-releases/x-energy-awarded-148m-investment-tax-credit-for-triso-x-fuel-fabrication-facility

Advanced Nuclear Projects, cont.

- Additionally, in Ontario, Canada, Ontario Power Generation is expecting to begin nuclear construction work on a 300MW GE Hitachi BWRX-300 small modular reactor (SMR) in early 2025. The boiling water reactor is located at the existing Darlington nuclear site and is set to begin operating in 2029[1]
  - Tennessee Valley Authority (TVA) has partnered with Ontario Power Generation under an agreement to coordinate best practices in advanced nuclear development and deployment. TVA holds an early site permit from the NRC with plans to construct a BRWX-300 SMR at the Clinch River nuclear site[2]

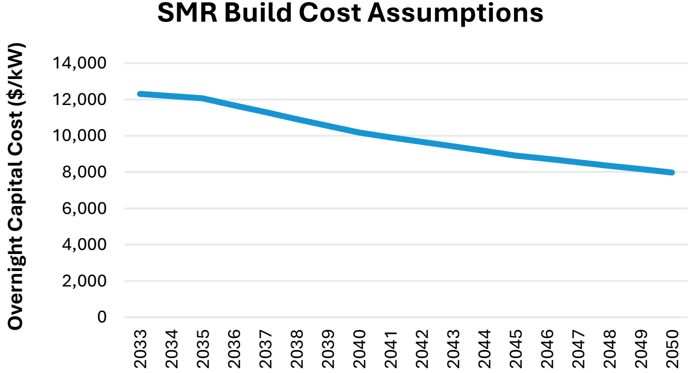
[1] https://www.world-nuclear-news.org/articles/additional-smrs-in-the-pipeline-for-darlington
[2] https://www.world-nuclear-news.org/articles/tva-approves-further-funding-for-clinch-river-smr

Advanced Nuclear Modeling Assumptions

- Given the approximate 10-year timeline for planning, permitting, and construction of current advanced nuclear projects, the Policy base case will assume 300MW small modular reactors (SMR) as candidate resources beginning in 2033
- The 2024 ATB includes cost and performance parameters for SMRs. Data is sourced from the Idaho National Labs Meta-Analysis of Advanced Nuclear Reactor Cost Estimations, which was sponsored by the DOE's Office of Nuclear Energy

Advanced Nuclear Modeling Assumptions, cont.

Property	Value
Max Capacity	300 MW
Heat Rate	9.18 MMBtu/MWh
Max Ramp Rate	30 MW/min
FO&M Cost	$136/kW-yr
Economic Life	30 yr



- Operating properties for SMRs are taken from the ATB and represent a variety of advanced nuclear reactor technologies
  - Cost assumptions are based on ATB's conservative cost estimates
  - See Appendix for build cost comparisons with EPCET study
- The forecasted cost of nuclear fuel is taken from the 2023 EIA Annual Energy Outlook
- The model is allowed to build SMRs in all zones except Boston
  - SMRs require significantly less land than traditional nuclear reactors. The Natrium and Xe-100 sites are 44 acres[1] and 30 acres[2], respectively

[1] https://www.terrapower.com/faq/
[2] https://x-energy.com/seadrift

Disqualified Base Case Candidate Technologies

- Hydrogen, as an electric power generation fuel, is not practical in New England
  - New England lacks the adequate geology to store significant quantities of hydrogen
  - Because of lower energy density hydrogen, dedicated hydrogen pipelines need to be built between generators and storage locations
- Similarly, effective carbon capture and storage (CCS) requires specific geologic formations that don't exist in sufficient quantities in New England
- New England's geothermal resources do not reach the temperatures required for geothermal power plants

POLICY SCENARIO

Preliminary Results

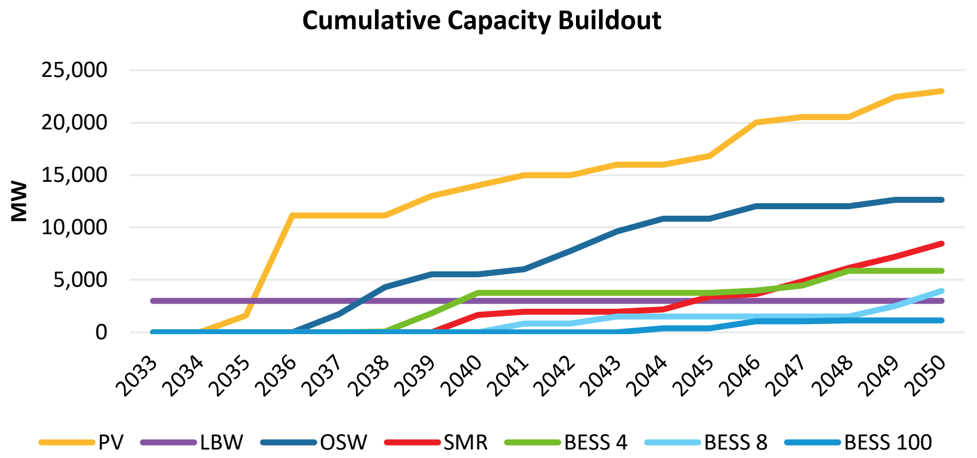
Capacity Expansion Overview

- The objective function of the capacity expansion engine is to minimize net present value (NPV) in the LT Phase
  - Net present value is composed of:
    - Production Cost (cost of system operation)
    - Capital Cost (annualized cost of construction)
- A carbon-constrained model was run where the capacity expansion engine attempted to reach a specified limit of carbon emissions (from gas, oil, and coal) per year
  - Based on state emission targets, the carbon constraint follows a glide path from 20 million tons in 2033 to 1 million tons in 2050
- The resource buildout is driven by the emissions constraint and increasing system demand
  - Candidate resources were:
    - Utility photovoltaic (PV)
    - Land-based wind (LBW)
    - Offshore wind (fixed and floating)
    - Small modular reactors
    - 4- and 8-hour Li-ion batteries
    - 100-hour iron-air batteries
  - LBW is restricted to 3000MW of new capacity due to limited siting availability. This is consistent with NESCOE's Longer-term Transmission Planning RFP

Resource Type	2033 Existing Capacity (MW)
Utility PV	1,518
BTM PV	12,571
LBW	1,399
OSW	1,744
Hydro	1,471
ADR	669
Nuclear	3,414
Internal Combustion	104
Gas Turbine	3,814
Steam Turbine (Non-Nuclear)	4,774
Combined Cycle	13,700
Pumped Storage	1,978
Battery Energy Storage	1,056

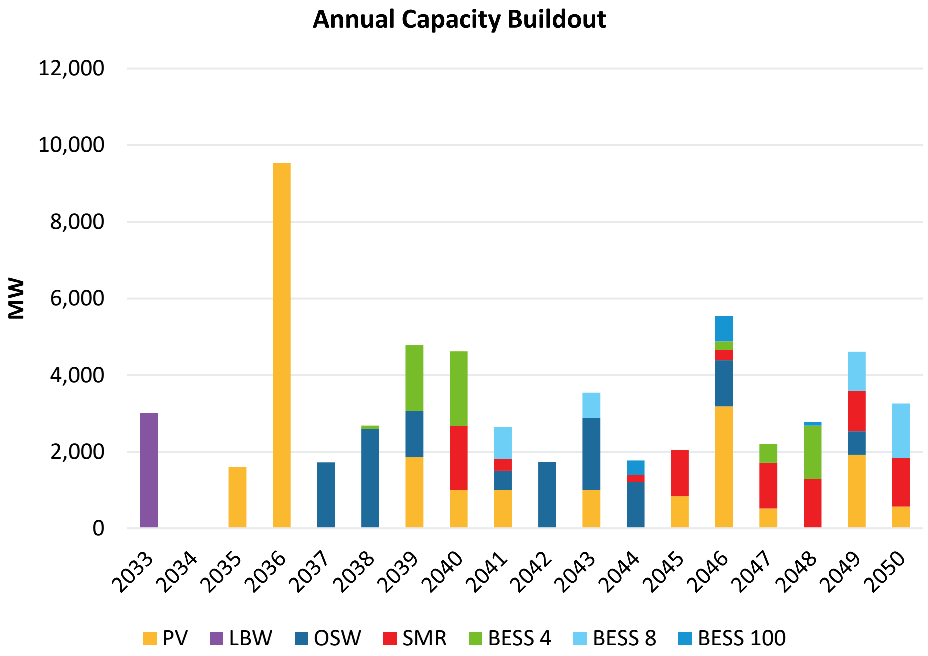
Carbon Constrained Buildout

Year	PV (MW)	LBW (MW)	OSW (MW)	SMR (MW)	BESS 4 (MW)	BESS 8 (MW)	BESS 100 (MW)
2035	1,608	3,000	0	0	0	0	0
2040	14,000	3,000	5,518	1,667	3,754	0	0
2045	16,826	3,000	10,825	3,387	3,754	1,508	376
2050	23,009	3,000	12,637	8,465	5,864	3,950	1,136



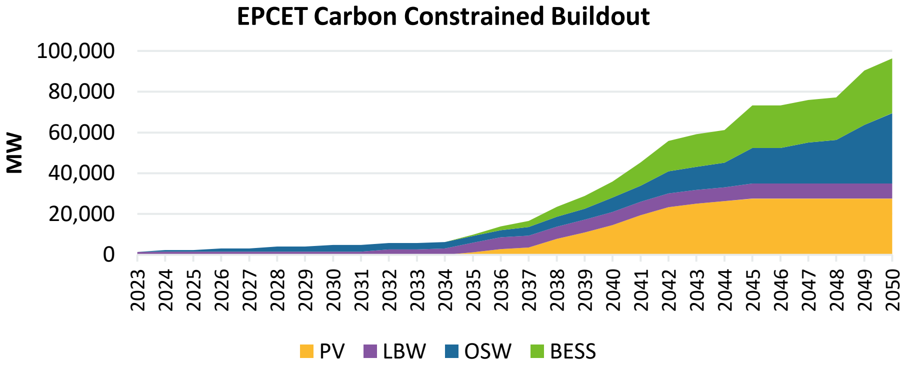
- The total system buildout from 2033-2050 is 58 GW
  - 47 GW generation capacity built
  - 11 GW battery generation capacity built
- Relatively low demand and required emissions reductions in the early 2030s lead to high PV and LBW buildouts as these resources are available at the lowest costs
  - LBW has limited availability due to siting barriers

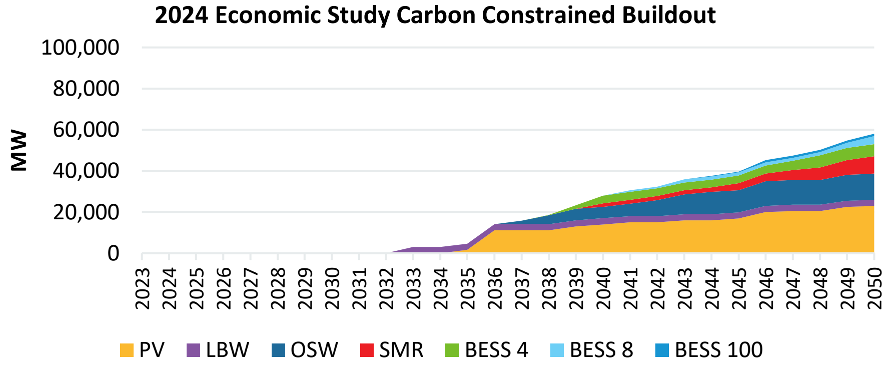
Carbon Constrained Buildout, cont.



- The total annualized system build cost for 2033-2050 is $143 billion
- Final builds:
  - PV: 23,009 MW (avg. 1,278 MW/yr)
  - LBW: 3,000 MW (avg. 167 MW/yr)
  - OSW: 12,637 MW (avg. 702 MW/yr)
  - SMR: 8,465 MW (avg. 470 MW/yr)
  - 4-hr BESS: 5,864 MW (avg. 326 MW/yr)
  - 8-hr BESS: 3,950 MW (avg. 219 MW/yr)
  - 100-hr BESS: 1,136 MW (avg. 63 MW/yr)

EPCET vs. 2024 Economic Study Buildout





- The capacity expansion buildout in the 2024 Economic Study is significantly smaller than the EPCET buildout
  - SMRs reduce the need for vast amounts of energy storage. The greatest impact comes between 2040 and 2050
- See Appendix for additional assumption changes since EPCET

	EPCET		2024 Economic Study	
	2040	2050	2040	2050
PV	14,640	27,538	14,000	23,009
LBW	6,400	7,500	3,000	3,000
OSW	7,067	34,406	5,518	12,637
SMR	-	-	1,667	8,465
Li-ion BESS	7,891	26,904	3,754	9,815
Iron-air BESS	-	-	0	1,136
Total	**35,998**	**96,348**	**27,939**	**58,062**

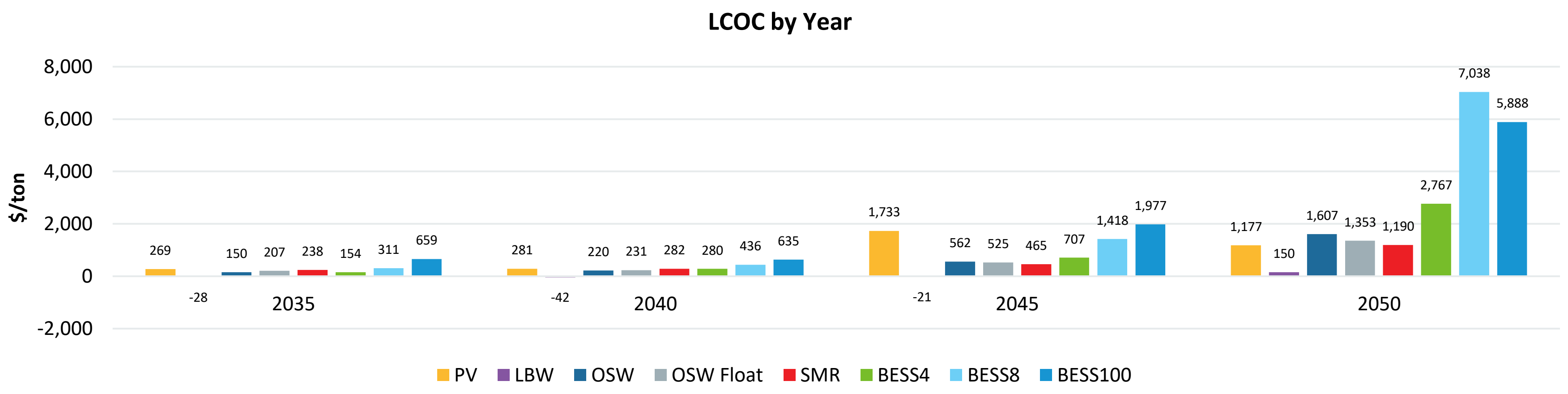
POLICY SCENARIO

Levelized Cost of Carbon Analysis

Levelized Cost Analysis Overview

- A levelized cost analysis was performed manually to verify the decisions made by the capacity expansion model
- The analysis was performed by pausing the expansion build every 5 years and adding 1GW of each resource type. 8,760 production cost models were run to calculate the change in net present value and emissions for each resource addition
- The results of the analysis show which resource types are most economic for reducing carbon emissions and how they vary from 2033-2050

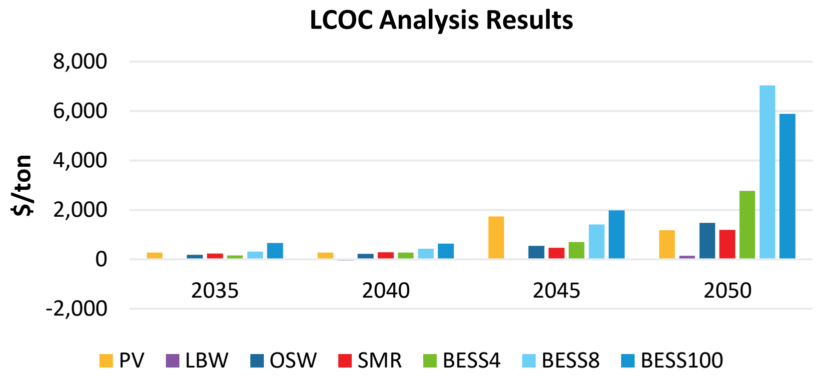
Levelized Cost of Carbon Results

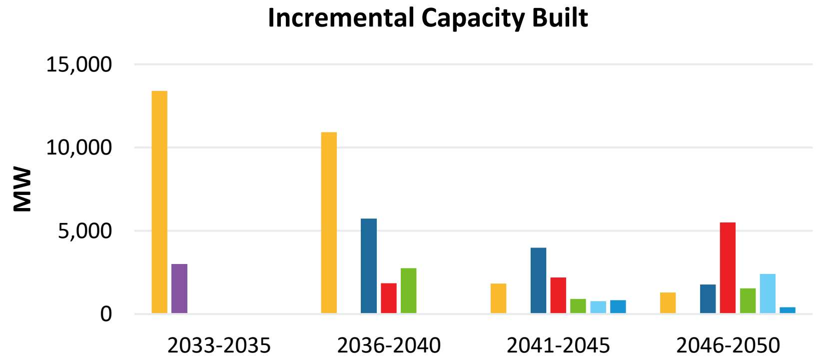


- Over time, all resource types become less cost effective because they are curtailed or unused for larger periods of the year
  - LBW is consistently the most cost-effective resource, but the capacity expansion model is limited to 3,000 MW due to space availability. In 2035, 2040, and 2045, the production cost savings of an additional 1GW of LBW are higher than the additional capital costs
    - Transmission adders are not factored into these calculations, so the real capital costs will be higher
  - 8-hour batteries are almost twice as expensive as 4-hour batteries, but they provide about the same emission reductions

Levelized Cost Analysis Takeaways

- The levelized cost analysis results are consistent with the decisions of the capacity expansion model
  - PV and LBW are built in the early 2030s
  - 4-hour batteries are more economical and should be built in higher capacities than 8- and 100-hour batteries
- As more resources are built and used for smaller fractions of the year, new resource builds are not economical but are necessary for meeting clean energy requirements





POLICY SCENARIO

Production Cost Results

Production Cost Overview

- Hourly production cost models were run for the 2035, 2040, 2045, and 2050 buildouts using the 2019 weather year to investigate detailed energy, emission, and curtailment results
  - The final results of the Policy Scenario will include a multiple weather year analysis

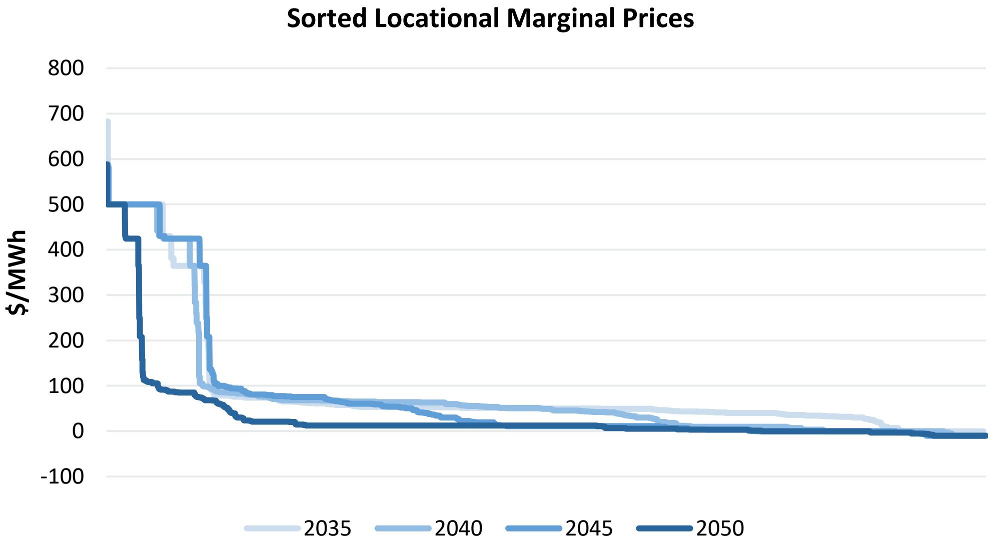
Policy Base Model Production Cost Results

	2035	2040	2045	2050
Annualized Build Cost (Million $)	587	6,419	11,413	18,709
Fixed Cost (Million $)	1,370	2,263	2,889	3,875
Production Cost (Million $)	3,003	2,564	1,958	1,373
Zero Carbon Energy (GWh)	104,181	150,246	178,844	205,424
Carbon Emissions (tons)	18,024,694	11,161,752	6,207,006	2,389,639
Marginal Carbon Price (ΔNPV/ΔCarbon Emissions)	237	250	401	1,702
Curtailed Energy (GWh)	1,133	4,854	8,939	9,684

- Over time, the system sees increased build and fixed costs due to large resource buildouts. Production costs become minimal
- Production cost metrics will be used to evaluate the economic and environmental impacts of Policy scenario sensitivities

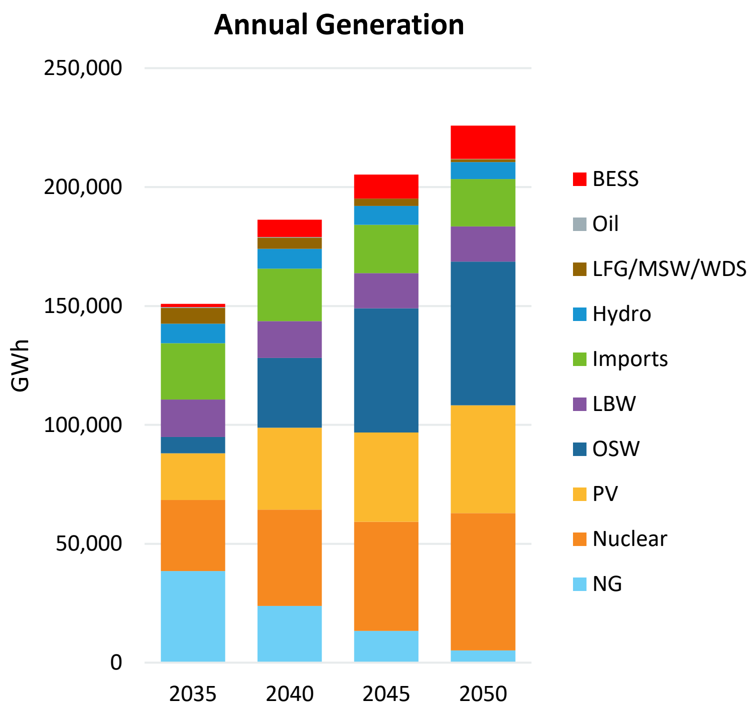
Locational Marginal Prices

	2035	2040	2045	2050
Avg LMP ($/MWh)	90.20	80.86	74.78	32.39



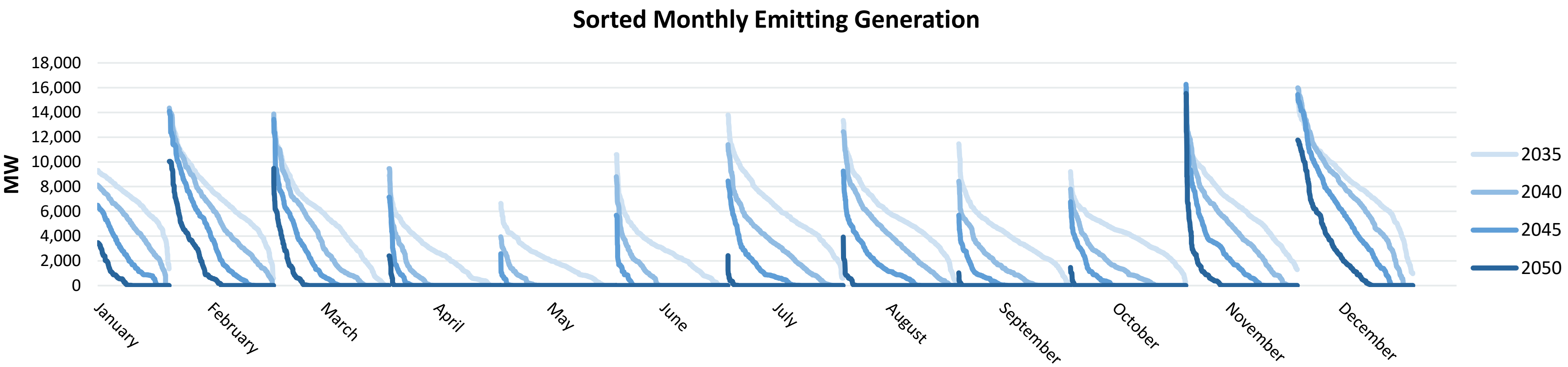
- Price spikes occur during periods of oil and gas generation. As the system is decarbonized, there are less hours of emitting generation and reduced LMPs
- Negative LMPs occur primarily in spring and fall months during high renewable hours

Generation by Fuel Type



- Total annual generation:
  - 2035: 151 TWh
    - 1.8 TWh total storage charging
  - 2040: 186 TWh
    - 8.7 TWh total storage charging
  - 2045: 205 TWh
    - 11.9 TWh total storage charging
  - 2050: 226 TWh
    - 16.4 TWh total storage charging
- In 2050, 97% of energy comes from non-emitting resources
  - Emitting dispatchable generation is still needed for 1,573 hours in the winter months

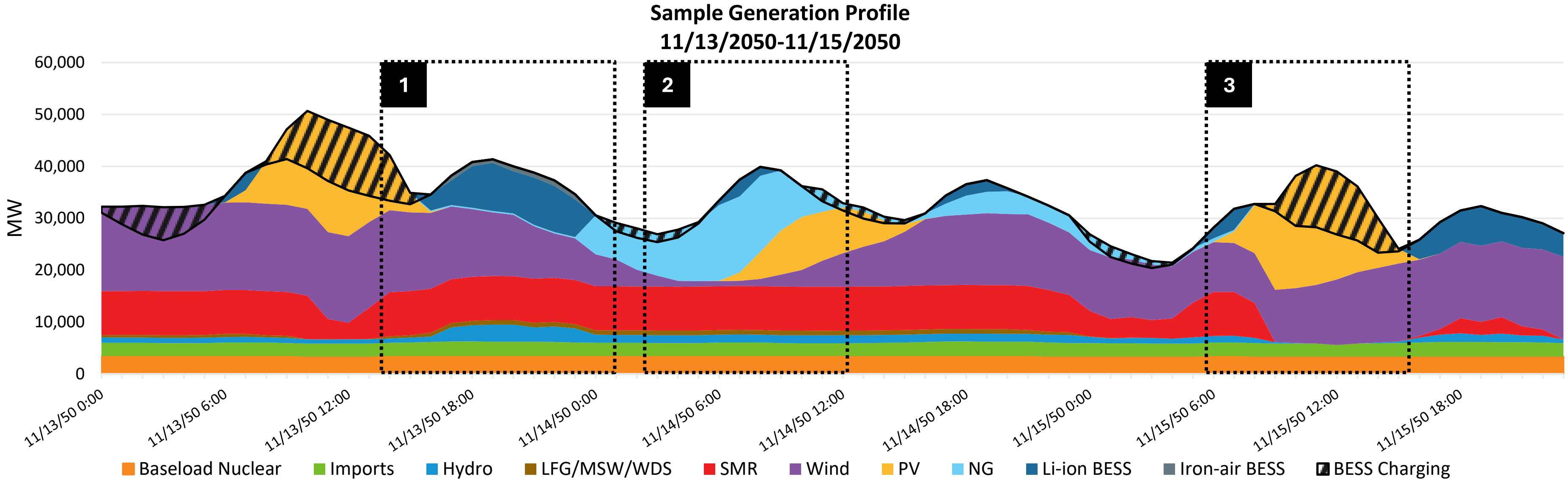
Dispatchable Emitting Resource Operation



- Dispatchable emitting generation is needed to meet demand during peak winter hours and offset rapid demand fluctuations due to midday solar operation
  - Peak hourly emitting generation occurs on a low wind and solar day in November. SMRs built after 2045 reduce emitting generation slightly. Additional wind and solar capacity would not be beneficial in reducing emissions under these weather conditions

- In 2050, dispatchable emitting generation runs one-fifth as often as in 2035. The total load served by emitting generation is reduced from 45 TWh in 2035 to 5.2 TWh in 2050
  - 2050 Gas: 1,562 hours online (17.8% of year), maximum hourly generation of 14,648 MW
  - 2050 Oil: 267 hours online (3% of year), maximum hourly generation of 573 MW

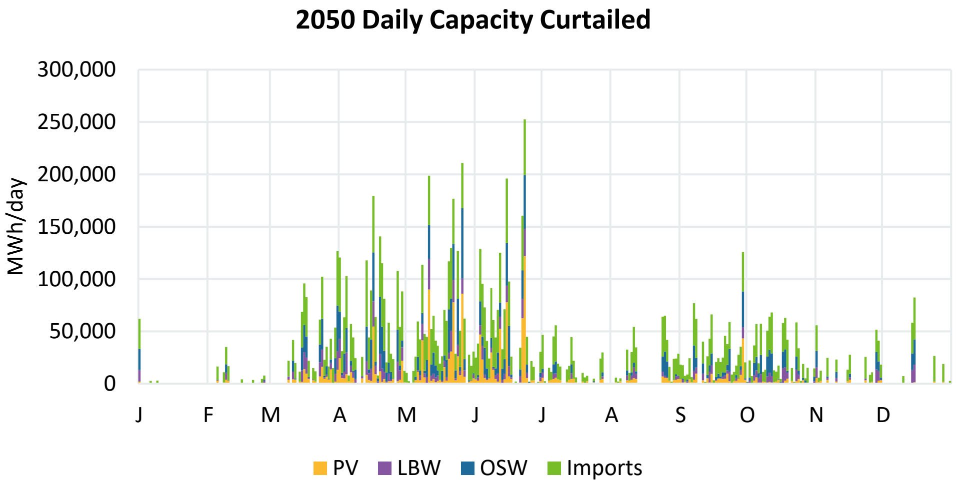
Dispatchable Resources: Sample Generation Profile



- Under certain system conditions, batteries and SMRs act as dispatchable generation in place of gas or oil generation
  1. 11/13: Short duration batteries are dispatched to meet demand in the evening. Some natural gas is still needed. At 12am, all short duration batteries are fully discharged and natural gas generation increases
  2. 11/14: Demand peaks in morning, minimal solar and wind online, all SMRs already online. The system must rely on natural gas until solar and wind can start generating again
  3. 11/15: SMRs ramp to balance high solar penetration midday. No emitting generation is needed

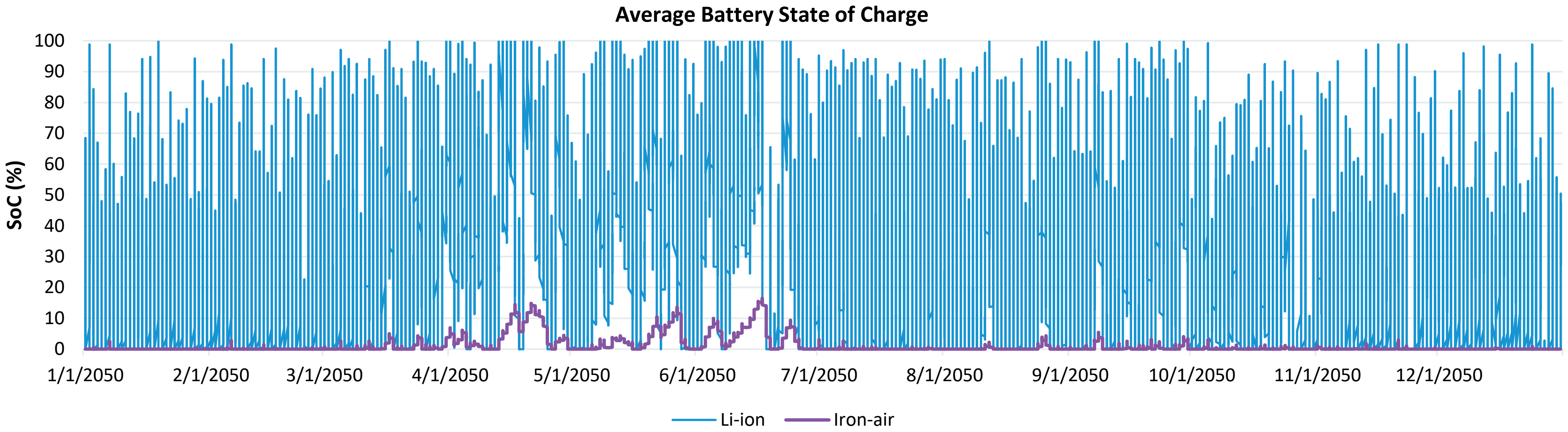
Curtailment by Resource Type

Resource Type	2035 (GWh)	2040 (GWh)	2045 (GWh)	2050 (GWh)
PV	227	1,251	1,823	1,929
OSW	178	839	2,111	2,175
LBW	173	523	1,072	1,157
Imports	555	2,240	3,932	4,422



- Resources are curtailed in large quantities as the system is built out. Energy storage is not economical in shifting large amounts of curtailment from spring, summer, and fall to the winter months
  - Curtailment may be reduced through exports to other areas
- Peak hourly curtailment:
  - 2035: 8,456 MW
  - 2040: 15,569 MW
  - 2045: 24,912 MW
  - 2050: 28,664 MW
- In 2050, 46 TWh of potential SMR generation are unused. SMRs are more expensive to run than wind and solar, but this additional capacity could be used to charge batteries and displace emitting generation later in the year. The ISO will explore how production cost modeling chronology settings impact SMR and battery dispatch

Energy Storage Operation



- 100-hour batteries do not charge above 20% over the course of the year. The model prioritizes the charging of Li-ion batteries over long duration iron-air batteries because of the lower efficiencies associated with the iron air batteries (86% vs 42.5%). Both operate at a VO&M charge of $3/MWh
  - Li-ion annual generation: 13,895 GWh (total generation capacity of 10.8 GW)
  - Iron-air annual generation: 615 GWh (total generation capacity of 1.1 GW)

Policy Scenario Takeaways

- The capacity expansion build favors solar and wind in the early 2030s. Although they are more expensive, SMRs provide more value to the system as demand and emission reduction requirements increase in the 2040s.
- In the 2050 production cost model, the vast majority of energy comes from zero carbon resources. Demand variability leads to an expensive system with extreme hours of emitting resource generation and curtailment
  - Dispatchable emitting resources are still needed for peak load hours with low renewable output and lack of charged storage
  - Large quantities of non-emitting resources are curtailed primarily in the spring, summer, and fall months

STAKEHOLDER REQUESTED SCENARIO

Assumptions

Stakeholder-Requested Scenario and Sensitivities

- Stakeholders have the option to submit a Stakeholder-Requested Scenario proposal or request that a sensitivity of the Reference Scenarios be conducted within the framework of the Economic Studies
  - Sensitivities of the Reference Scenarios may be requested at the time each scenario's final results are presented
- Results of the Stakeholder-Requested Scenario or sensitivities of the Reference Scenarios are considered for informational purposes only
  - The Stakeholder-Requested Scenario/sensitivities **will not be** evaluated as System Efficiency Needs against the factors and metrics outlined in [Attachment N of the OATT]

Stakeholder-Requested Scenario

The ISO received one Stakeholder-Requested Scenario proposal [1]

- Evaluate the operation of peaker generation plants under ISO forecasted heating and EV charging loads combined with expected growth in clean generation
  - Evaluate scenarios of high/low variations in both load and generation

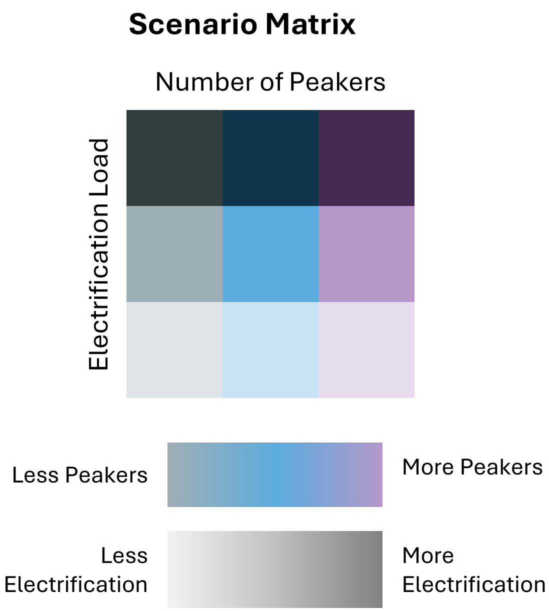
The outcome of the proposal would result in directional guidance to see:

- What combinations of relative growth of grid load vs. clean generation capacity could result in increased or decreased operation of peaker plants
- What level of accelerated clean supply growth or decreased grid load might serve to resolve local peaker plant emissions

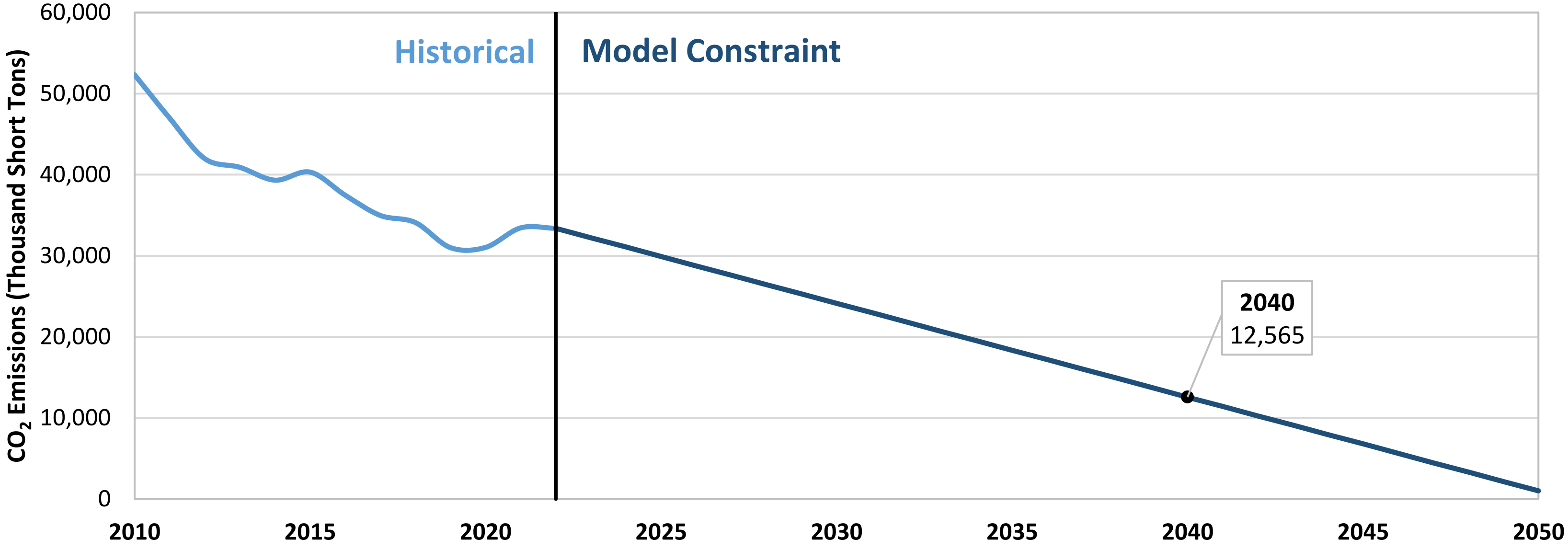
[1] *Submitted by Ray Albrecht via email on April 19, 2024*

Overview of Assumptions

- A capacity expansion model will be run to buildout resources from 2033 to 2040
  - Production cost models will be run in 2040 with the buildout resource mix from capacity expansion
- Input assumptions will mirror the Policy Scenario with modifications to the electrification load and the amount of peaker generators



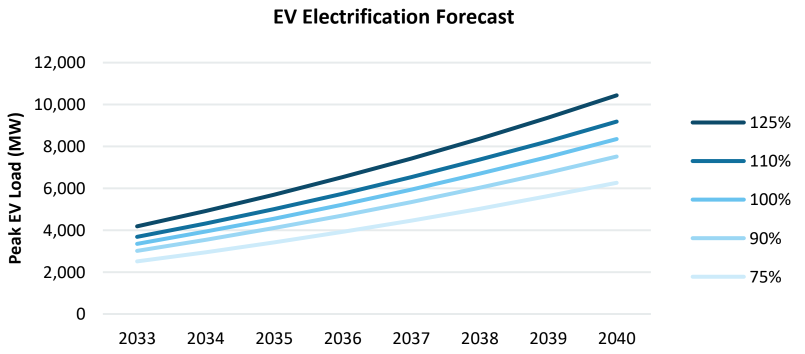
System CO_2 Emissions Constraint Assumption

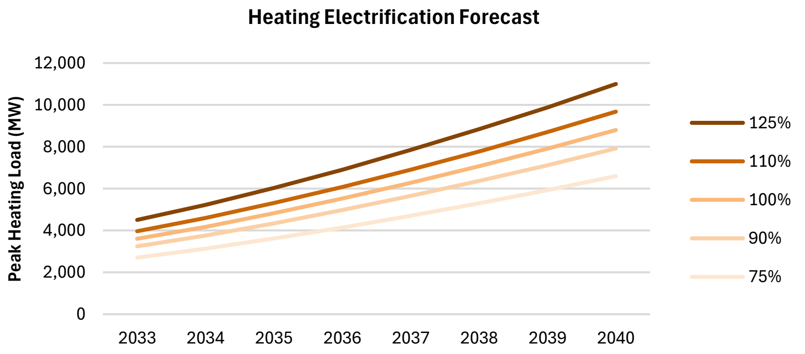


- CO_2 emissions will follow a glide path, decreasing to 1 million short tons annually by 2050
  - Emissions from municipal solid waste, landfill gas, and wood units will not be affected by this constraint; they will be tracked and reported separately

Changes to Electrification Assumptions

- Electrification forecasts for 2033 to 2040 will be adjusted by ±10% and ±25% of peak load
  - Modification values may change based on the outcome of the analysis
- This analysis is not intended to reflect the ISO Load Forecast but serves as a directional analysis of under- or over-paced electrification





Changes to Resource Assumptions

For Increased Peaker Generation

- 100 MW combustion turbines will be available for expansion
- Fuel consumption and emissions for these will be tracked separately

For Decreased Peaker Generation

- Existing peaker generation will be retired based on age

NEXT STEPS

Next Steps

- Final Policy Scenario Results will be presented to the PAC during the January PAC, after which the ISO will begin accepting sensitivities of the Policy Scenario
- The ISO welcomes any comments on the Preliminary Policy Scenario Results from the PAC
  - Please send comments to PACMatters@iso-ne.com by **Tuesday, December 3**
- Preliminary Stakeholder-Requested Scenario results will be presented at the January PAC

Questions

Previous Presentations

Date	Presentation (with Link)
Jan 18 2024	Initiation of the 2024 Economic Study
Mar 20 2024	Stakeholder-Requested Scenario Timeline & Benchmark Scenario Assumptions
Jun 20 2024	Preliminary Benchmark Scenario Results & Review of Stakeholder Requested Scenario Proposals
Aug 21 2024	Final Benchmark Scenario Results, Publishing of the Public Benchmark Scenario, & Policy Scenario Assumptions
Oct 23 2024	Interregional Model Assumptions / High Level Results

APPENDIX

EPCET vs. 2024 Economic Study Policy Scenario Assumptions

Updated Policy Scenario Assumptions from EPCET

- The 2024 Economic Study (2024 ES) Policy Scenario uses updated cost, performance, and resource availability assumptions from the EPCET pilot study
  - Newly included candidate technologies are added to represent the expected technological diversity of the future system
  - Updated cost and performance parameters are based on newly available data from the 2024 NREL ATB, 2050 Transmission Study, and the Pathways Study
- The EPCET capacity expansion model was run using 2023 as the base year. The 2024 Economic Study capacity expansion model starts with a 2033 system restricted to new resources included in the ISO-NE Interconnection Queue

EPCET vs. 2024 ES: Capacity Assumptions

- Maximum capacity built for land-based wind is reduced due to limited siting availability
  - EPCET: 7,200 MW available in NH, VT, WMA, and NE
  - 2024 ES: 3,000 MW available in ME consistent with NESCOE's LTTP RFP
- Offshore wind candidates are based on POI substations rather than BOEM lease areas. Additional one-time costs are added for substations that require transmission upgrades
  - EPCET: 16,000 MW fixed turbines in Southern New England and 20,400 MW floating turbines in the Gulf of Maine
  - 2024 ES: 22,800 MW fixed turbines and 22,800 MW floating turbines
- The EPCET study used cost modifiers to represent increasing capital and interconnection costs. The 2024 ES uses a cost escalation rate from the Pathways Study
  - Within each year, PV has a 10% and BESS a 5% cost to overnight capital cost increase per 1,000 MW to reflect tightness in supply chains/labor and increases in interconnection cost as development grows

EPCET vs. 2024 ES: Cost Assumptions

EPCET vs. 2024 Economic Study Build Costs ($/kW)																	
Year	EPCET PV	2024 ES PV	EPCET LBW	2024 ES LBW	EPCET OSW	2024 ES Fixed OSW	2024 ES Floating OSW	EPCET SMR	EPCET 2x SMR	2024 ES SMR	EPCET BESS 4	2024 ES BESS 4	EPCET BESS 8	2024 ES BESS 8	EPCET BESS 100	2024 ES BESS 100
2033	959	1,015	1,298	1,364	3,373	3,784	6,499	6,688	13,376	12,304	682	1,389	1,363	2,352	2,150	2,150
2034	947	955	1,289	1,349	3,326	3,731	6,261	6,622	13,244	12,179	670	1,368	1,341	2,313	2,150	2,150
2035	935	895	1,281	1,335	3,278	3,684	6,072	6,554	13,107	12,053	659	1,347	1,318	2,274	2,150	2,150
2036	923	881	1,271	1,320	3,228	3,652	5,653	6,481	12,963	11,677	647	1,327	1,294	2,234	2,150	2,150
2037	911	867	1,262	1,305	3,164	3,622	5,373	6,412	12,824	11,300	635	1,306	1,271	2,195	2,150	2,150
2038	899	853	1,254	1,291	3,117	3,595	5,166	6,344	12,688	10,923	624	1,285	1,248	2,156	2,150	2,150
2039	887	839	1,244	1,276	3,069	3,569	5,003	6,274	12,549	10,547	613	1,264	1,225	2,117	2,150	2,150
2040	875	825	1,236	1,261	3,024	3,545	4,869	6,210	12,420	10,170	602	1,243	1,203	2,078	2,150	2,150
2041	864	810	1,228	1,247	2,978	3,522	4,755	6,144	12,288	9,919	591	1,223	1,181	2,038	2,150	2,150
2042	851	796	1,218	1,232	2,929	3,500	4,658	6,073	12,145	9,668	579	1,202	1,158	1,999	2,150	2,150
2043	839	782	1,209	1,217	2,881	3,479	4,572	6,002	12,005	9,417	568	1,181	1,135	1,960	2,150	2,150
2044	826	768	1,199	1,203	2,831	3,459	4,496	5,928	11,856	9,166	556	1,160	1,112	1,921	2,150	2,150
2045	814	754	1,188	1,188	2,782	3,441	4,427	5,853	11,707	8,914	544	1,140	1,088	1,882	2,150	2,150
2046	801	740	1,178	1,174	2,733	3,423	4,365	5,780	11,561	8,726	533	1,119	1,065	1,843	2,150	2,150
2047	789	725	1,168	1,159	2,685	3,406	4,309	5,709	11,417	8,538	521	1,098	1,042	1,804	2,150	2,150
2048	776	711	1,158	1,144	2,636	3,389	4,257	5,636	11,272	8,349	510	1,077	1,020	1,765	2,150	2,150
2049	764	697	1,148	1,130	2,588	3,373	4,209	5,563	11,126	8,161	498	1,057	997	1,727	2,150	2,150
2050	752	683	1,139	1,115	2,541	3,358	4,164	5,494	10,988	7,973	487	1,036	975	1,688	2,150	2,150