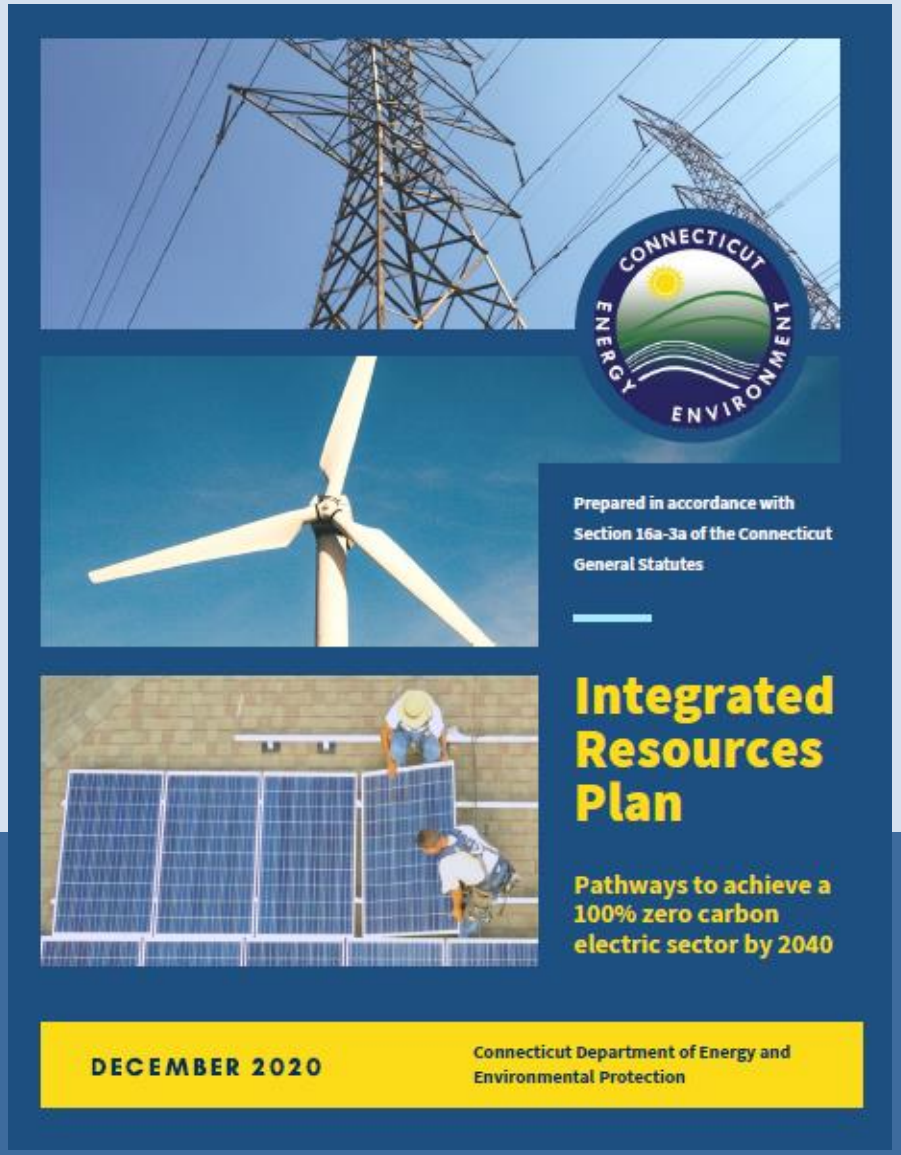
2020 Integrated Resources Plan

Technical Meeting- Modeling
January 28, 2021



Connecticut Department of Energy and Environmental Protection

Questions Addressed in Objective 1

Decarbonizing the Electricity Sector

1. What generation/capacity mixes, emissions, reliability, and energy costs can we expect from different pairings of electrification policy, and electric-sector decarbonization policy?
2. How does emphasizing different zero carbon technologies (e.g nuclear, BTM PV) affect the outcomes of those different scenarios?
3. How do we plan for a future without base-load zero carbon generation from Millstone?

Modeling Resources Used

- Aurora
  - Simulation tool used for capacity expansion and production cost modeling
  - Utilized in zonal transmission configuration
  - Incorporates resource adequacy (RA), transmission, operational, and policy constraints for entry / exit, dispatch, wholesale prices, emissions
- Statistical modeling and ISO-NE's GE-MARS
  - Reliability metrics thru MARS (ISO model for RA)
  - Extended probabilistic procedures to electrification loads, VER output, and battery availability

	Business-as-usual Load	Electrification of Transportation and Building-Heating Load
Electrification Level	• **What is "known and knowable"** • Based on ISO-NE's CELT forecast and Transportation Electrification Forecast • S-shaped growth curve applied to VEIC 2019 ASHP installations (primarily electrict-to-electric)	• Based on ISO-NE's CELT forecast + increased Wx energy efficiency • GC3-projected EV demand and meets ZEV MOU • Expected ASHP installation triples with increased conversion from NG to electric
Decarbonization Policy	• **What is "known and knowable"** • Includes all clean energy projects with approved contracts, or have been selected for long-term contract under state-mandated procurement, FCA14 retirement bids, and any other policy announced prior to Jan 30th, 2020.	• Meets aspirational goal of 100% zero-carbon for the electric sector by 2040, as specified by Governor Lamont's Executive Order No. 3

Initial Model Run Scenarios

	Electrification Level		Decarbonization Policy	
Model Run	Business-as-usual load	Electrification of transportation and building-heating load	Business-as-usual energy policy	Aspirational State Electric Sector Decarbonization Goals
Base Load Reference Case	X		X	
Electrification Load Reference Case		X	X	
Base Load Balanced Blend Case	X			X
Electrification Load Balanced Blend Case		X		X

Sensitivity Scenarios

Millstone Extension

- Assumes Millstone continues operating beyond 2029 (the end of Connecticut's current contract) and then deploys least cost resources to meet the 100% Zero Carbon Target

BTM Solar PV Emphasis

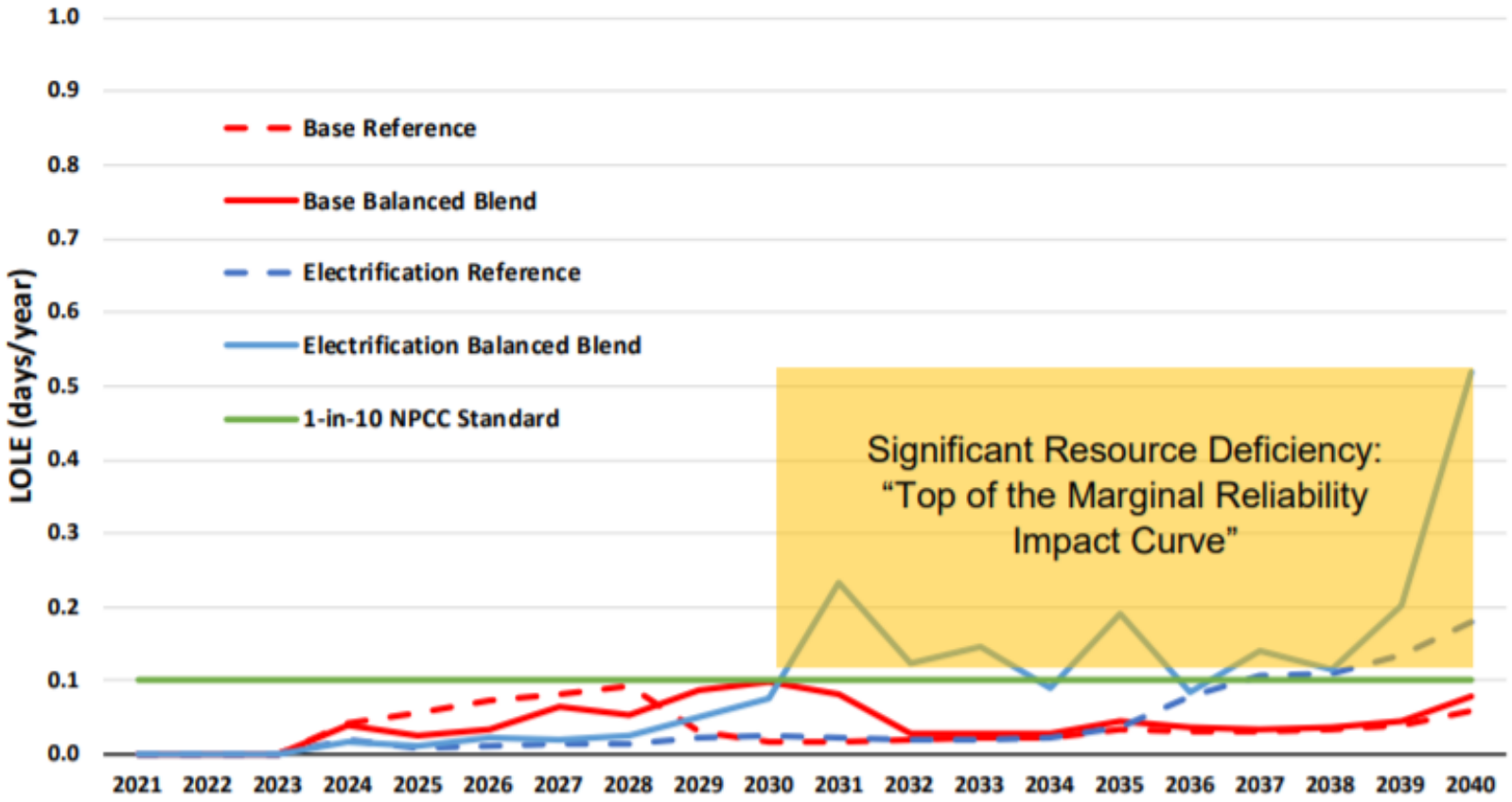
- Assumes an increased amount of behind the meter (BTM) solar is deployed, then deploys least cost resources to meet the 100% Zero Carbon Target

No Transmission Constraints

- Eliminates transmission constraints, then deploys least cost resources to meet the 100% Zero Carbon Target
- Applied to Balanced Blend scenarios

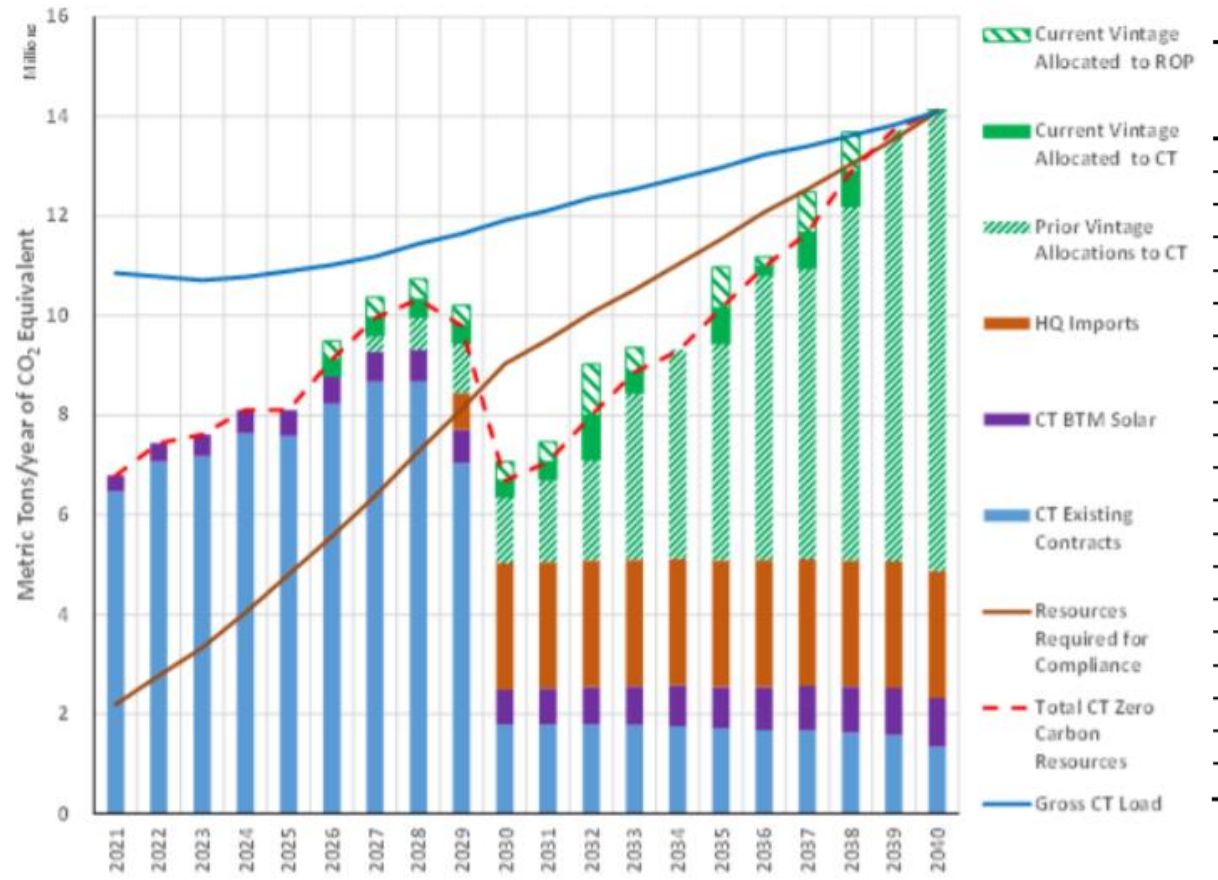
MARS Modeling

Figure 4. ISO-NE System Annual LOLE by Scenario



Scenario Data

Figure 1.12: Connecticut Incremental Resource Allocations, Electrification Load Balanced Blend Scenario



Calendar Year	Cumulative Incremental Resource Allocation			
	CT Storage (MW)	CT Solar (MW)	CT LBW (MW)	CT OSW (MW)
2021	0	0	0	0
2022	0	0	0	0
2023	0	0	0	0
2024	0	0	0	0
2025	0	0	0	0
2026	0	425	0	0
2027	0	887	0	0
2028	0	1,347	0	0
2029	0	1,805	0	0
2030	232	2,260	0	0
2031	232	2,713	0	0
2032	464	2,900	325	358
2033	464	3,146	325	892
2034	929	3,131	325	1,245
2035	929	3,115	325	1,962
2036	929	3,100	557	2,503
2037	1,139	3,084	557	3,077
2038	1,603	3,069	557	4,208
2039	1,603	3,054	557	5,152
2040	1,603	3,045	557	5,710

Detailed Modeling Results Organization

A1- Inputs & Assumptions

- Citations to data sources
- Input from other NE states
- Assumed projections for EE, BTM Solar PV, ASHP installations, and EV deployments
- Projected resource capital costs
- Operating reserve modeling methods and inputs

A2- MARS Modeling Results

- Modeling using ISO-NE's GE Multi-Area Reliability Simulation model
- Reports loss-of-load-expectation (LOLE) results for the Base and Electrification load Reference and Balanced Blend scenario
  - Measures resource adequacy for these scenarios

A3- Energy Modeling Results

- Capacity expansion results
  - Regional resource additions and retirements
  - CT incremental resource additions
  - Present value cost and benefit analysis
- Operating reserves
- Annual regional generation
- Curtailment analysis
- Emissions trajectories
- Hourly generation estimates by resource type
- Transmission interface flows

Detailed Modeling Results Organization

A4- Financial Modeling Results

- Detailed breakdown of costs and benefits
- Allocation of incremental resources calculations
- Differential annual and PV costs for each scneario
- Annual ratepayer cost comparison

A7- Carbon Tax Modeling Results

- Tests an in-state generation carbon tax
- CT tax revenue and cost impacts by tax-level
- Wholesale energy cost comparison
- Emissions comparison

Other

- A5- Solar Siting Fact Sheet
- A6- Past Procurement Selections and Pricing

Pre-filed Questions

Topic 1: Assumptions

- **" What is the definition of an “ASHP installation”?**
  - **Is an “ASHP installation” a whole home conversion?**
  - **Would a single-family residence need more than one “ASHP installation” to supply 100% of the residences annual heat load from the ASHP system?**
  - **Would a supplementary heat source be necessary for a residence that completes an “ASHP installation”?"**

Topic 1: Assumptions

- **"Why did you use the simple average of “mini-split installations” and “ASHP installations”?"**

Topic 1: Assumptions

- "Why did you use the simple average of “mini-split installations” and “ASHP installations”?"
- **"Did you consider the “ISO-NE 2020 CELT Report” or “ISO-NE Final 2020 Heating Electrification Forecast” report in your grid load projections and winter peak load projections?**
  - **Specifically, on slide 14 of the ISO-NE “Final 2020 Heating Electrification Forecast” Do you agree with the equations for energy and winter demand before and after heat pump adoption, which were based off their study of 18 residences?**
  - **Do you agree with ISO-NE’s grid load and winter peak load projections from ASHP adoption on slides 18 and 23 for Connecticut?"**

Topic 1: Assumptions

- "Why did you use the simple average of “mini-split installations” and “ASHP installations”?"
- "Did you consider the “ISO-NE 2020 CELT Report” or “ISO-NE Final 2020 Heating Electrification Forecast” report in your grid load projections and winter peak load projections?
  - Specifically, on slide 14 of the ISO-NE “Final 2020 Heating Electrification Forecast” Do you agree with the equations for energy and winter demand before and after heat pump adoption, which were based off their study of 18 residences?
  - Do you agree with ISO-NE’s grid load and winter peak load projections from ASHP adoption on slides 18 and 23 for Connecticut?"
- **"When projecting the ratepayer cost of electricity through 2040, what was the added grid load and winter peak load kW unit used per ASHP installation?"**

Topic 2: Modeling Approach

- **""“First, the emissions profile from any zero carbon resources that have already been, or would have to be, procured by Connecticut under long-term contracts funded by Connecticut ratepayers to meet the 100% Zero Carbon Target are assigned to the State. This assignment is made even though any RECs associated with those contracts may be either retained or sold by that state’s EDCs.” Please explain how that arrangement is not double-counting and potentially misleading ratepayers in one jurisdiction about the environmental attributes of their energy."**

Topic 3: Results

- **"What analysis has DEEP done that quantifies for ratepayers how their bills would increase for the IRP's preferred pathways?"**

Topic 3: Results

- "What analysis has DEEP done that quantifies for ratepayers how their bills would increase for the IRP's preferred pathways?"
- **"What analysis has DEEP done that quantifies for ratepayers the cost of additional transmission projects that the IRP's pathways assume would happen?"**

Topic 3: Results

- **"IRP page 146 states: “Competitive procurements have been an effective tool to deploy the zero carbon resources needed to meet the State’s climate goals at the least cost for all ratepayers.” (a) Please explain how you measure “costs” for purposes of that statement.**

Topic 3: Results

- "IRP page 146 states: “Competitive procurements have been an effective tool to deploy the zero carbon resources needed to meet the State’s climate goals at the least cost for all ratepayers.” (a) Please explain how you measure “costs” for purposes of that statement.
- **"(b) Please explain what analysis was done to compare the costs and benefits of in-State solar facilities that are “load reducers” in ISO-NE as compared to the out-of-state grid-scale projects discussed in the IRP?"**

Topic 3: Results

- **"c) Please explain how that statement is reconciled with the large increase in ratepayer rates that was experienced last July and reviewed in PURA docket 20-01-01?"**

Topic 3: Results

- **"What amount of natural gas generation in ISO-NE does the IRP assume is still operating at 2040?"**

Topic 4: Other States

- **"Do the IRP's pathways depend upon all the other ISO-NE States and New York NOT decarbonizing their electric grid by 2040?"**

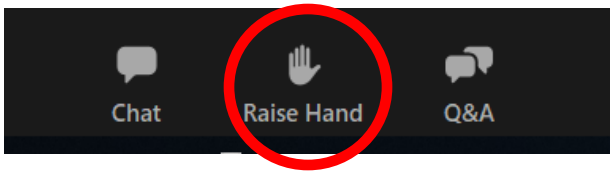
Topic 4: Other States

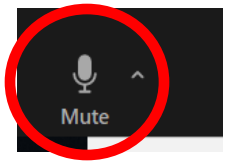
- **"What analysis has DEEP done to prepare for the possibility that other New England States decide to decarbonize their grids prior to 2040, such as Rhode Island which has recently issued its report to do so by 2030, and how would that affect the IRP's pathways and ratepayer costs, particularly the Reference Case's continued reliance on natural gas past 2040?"**

Procedure for Participation

To indicate interest in speaking please:

1. Raise your hand by pressing the raise hand button at the bottom of your screen
2. We will call your name as it is displayed on Zoom and you will get a notice to unmute yourself
3. Unmute yourself in Zoom, and on your phone if you have called in for audio.
4. Please state and spell your name and affiliation
5. If you would like to submit your question in writing, please enter it into the Q&A box, the chat has been disabled for this event.





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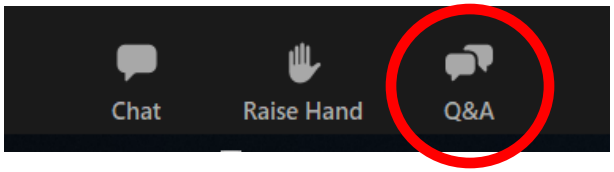

Break

This technical meeting is paused for a break until 2:45pm.

Adjourn

- You may also submit written comments to DEEP.EnergyBureau@ct.gov until 2/15/2021
- Thank you for your participation!