# 2024 Draft Energy and Seasonal Peak Forecasts

*Load Forecast Committee*

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LOAD FORECASTING, SYSTEM PLANNING

# Acronyms

- ASHP — Air-Source Heat Pump
- BEV — Battery Electric Vehicle
- BTM PV — Behind-the-Meter Photovoltaic
- CAGR — Compound Annual Growth Rate
- CDD — Cooling Degree Days
- CELT — Capacity, Energy, Loads, and Transmission Forecast
- CSO — Capacity Supply Obligation
- DGFWG — Distributed Generation Forecast Working Group
- EE — Energy Efficiency
- EEFWG — Energy Efficiency Forecast Working Group
- EV — Electric Vehicle
- HP — Heat Pump
- LFC — Load Forecast Committee
- LDV — Light-Duty Vehicle
- MAPE — Mean Absolute Percent Error
- PAC — Planning Advisory Committee
- PDR — Passive Demand Resource
- PRD — Price Responsive Demand
- WTHI — 3-day Weighted Temperature-Humidity Index

# Introduction

- The ISO annually develops 10-year forecasts of energy and demand that are published as part of the Capacity, Energy, Loads, and Transmission (CELT) report
- An overview of the ISO's methodology for developing the 10-year load forecast was given at the September 22, 2023 Load Forecast Committee (LFC) meeting
- Final forecasts will be published in the 2024 CELT Report

# CELT 2024 Load Forecast Timeline

*Working Group and Committee Meetings*

- Load Forecast Committee (LFC)
  - September 22, 2023 – Forecast methodology review, summer peak review
  - December 8, 2023 – Moody's November economic forecast, update on heating electrification forecast, update on transportation electrification forecast
  - January 12, 2024 – draft heating electrification forecast, draft transportation electrification forecast, update on EV managed charging
  - **February 23, 2024 – Draft annual energy and seasonal peak demand forecasts**
  - March 28, 2024 – Final draft annual energy and seasonal peak forecasts
- Distributed Generation Forecast Working Group (DGFWG)
  - October 27, 2023 – Overview of the Distributed Generation Market Model
  - December 4, 2023 – State DG policy updates from MA, CT, RI, VT, NH, and ME, PV Forecast Preliminary Policy Modeling,
  - February 16, 2024 – Draft 2024 PV forecast, December 2023 distributed generation survey results
  - March 25, 2024 – Final 2024 PV forecast
- Energy Efficiency Forecast Working Group Meetings (EEFWG)
  - December 4, 2022 – EE program data review, EE measure data review
  - February 16, 2024 – Draft 2024 EE forecast
  - March 25, 2024 – Final 2024 EE forecast

# Updates Included in the Draft 2024 Forecast

- Model estimation period through the end of 2023
  - Peak demand models: 2009 – 2023 (updated from 2008-2022 period used in CELT 2023)
  - Energy models: 1997 – 2023 (updated from 1996-2022 period used in CELT 2023)
- Moody's November 2023 economic forecast
- Estimated FCA 18 CSO's (Capacity Supply Obligations) for passive demand resources (PDRs)
  - For the draft forecast, estimated values are based on FCA 18 Qualified Capacity (FCA QC)
- Inclusion of draft 2024 heating and transportation electrification forecasts

# REVIEW OF ENERGY AND PEAK DEMAND FORECASTING ASSUMPTIONS

# Overview of Gross and Net Load Forecasts

- The ISO annually develops 10-year forecasts of energy and demand that are published as part of the Capacity, Energy, Loads, and Transmission (CELT) report
- The *gross load forecast* reflects a forecast of load:
  - Before reductions from Demand Capacity Resources
    - Includes energy efficiency (EE), passive distributed generation (DG) resources, and price-responsive demand (PRD)
  - Before reductions from BTM PV
  - After load additions associated with forecasts of transportation and heating electrification
- The *net load forecast* reflects the gross load forecast minus forecasts of EE and BTM PV
  - The annual BTM PV forecast is developed through the Distributed Generation Forecast Working Group (DGFWG)
  - The annual EE forecast is developed though the Energy Efficiency Forecast Working Group (EEFWG)

| Gross Load | Net Load |
|---|---|
| $Load_{Gross}$ = NEL + PRD + EE + BTMPV + *Electrification* | $Load_{Net}$ = NEL + PRD + *Electrification* |

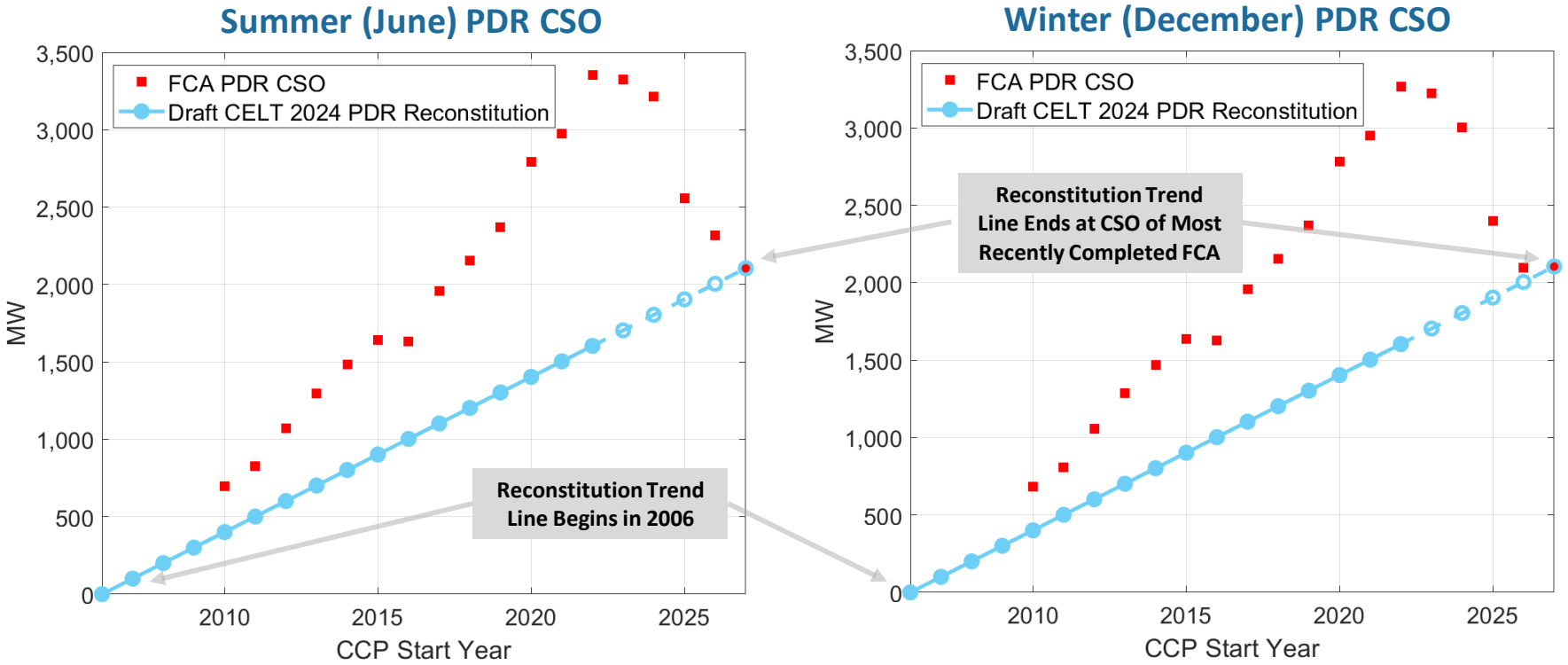
Electrification forecasts were first developed as part of the 2020 forecast cycle.
Electrification = Transportation Electrification + Heating Electrification

# PDR Reconstitution in the Gross Load Forecast

- Reconstitution for passive demand resources (PDRs) is based on total CSOs (Capacity Supply Obligations) acquired by PDRs in the most recent Forward Capacity Auction (FCA)
  - Draft forecasts utilize FCA Qualified Capacity (FCA QC)
- By calibrating to the PDR CSOs from the most recently completed FCA, the new reconstitution methodology results in improved accounting for:
  - The amount of EE that participates in the FCA, and not EE installations in excess of EE resources' CSOs
  - EE expiring measures that are no longer participating as supply in the FCA
- Working in tandem with the gross load forecast, the accounting for PDR in the EE forecast also reflects this methodology
- Further details regarding how load is reconstituted for the purposes of producing the gross load forecast can be found in the September 22, 2023 Long-Term Load Forecast Methodology Overview presentation

# Draft CELT 2024 Summer and Winter PDR Reconstitution

*New England*




**FCA 18 CSO values shown are estimates based on FCA Qualified Capacity (FCA QC) values for FCA 18*

# Economic Indicators Used in Energy Modeling

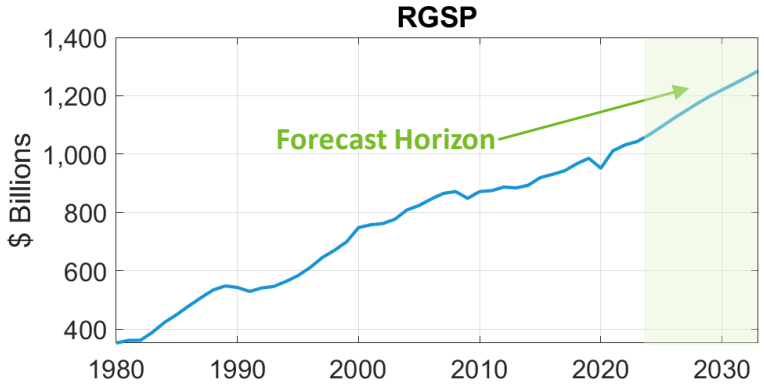
- The 10-year economic outlook is an input into the ISO's gross energy forecast
- Real Gross State Product (RGSP) is the primary indicator used in most of the ISO's energy models
  - Forecast RGSP tends to almost always reflect growth across all New England states
  - This has resulted in annual energy forecasts that are typically higher than observed energy

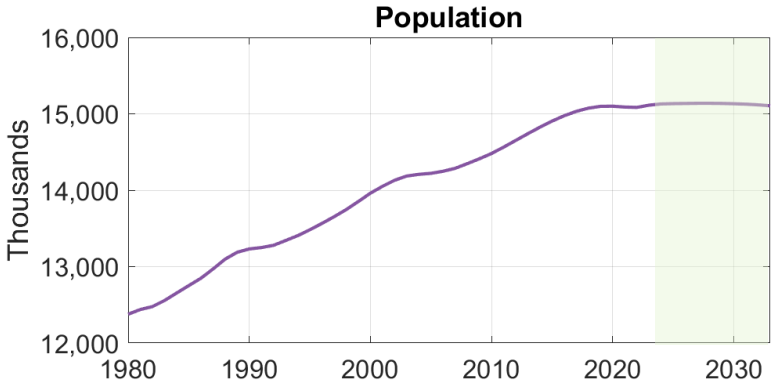
**Annual Net Energy for New England**

| Year | CELT 2021 | Observed | % Difference |
|---|---|---|---|
| 2021 | 121,692 | 118,927 | + 2.3% |
| 2022 | 123,847 | 118,758 | + 4.3% |

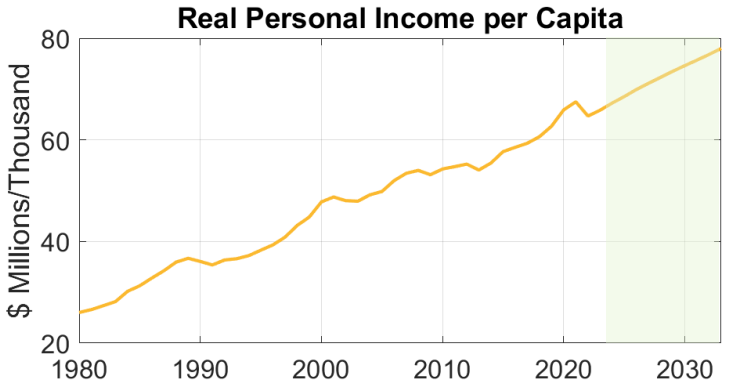
- While state economic growth is typically the prevailing forecast trend in the region, population and employment trends do not move similarly across all the states
  - Using RGSP alone yields an overly optimistic economic input into the energy forecast
  - Common industry indicators include: population, employment, RGSP
  - Countervailing trends among economic indicators are not captured using a single indicator
- As was discussed at on slides 13-19 of a December 8, 2023 LFC presentation, ISO has re-evaluated the economic indicators used in state and regional energy modeling with the purpose of creating better alignment between forecast and observed energy in the CELT 2024 forecast
  - Demand forecasts have not demonstrated the same inaccuracies exhibited by the energy forecasts, therefore the objective is lower the energy forecast while minimizing impact on peak demand

# Examples of Common Economic Indicators



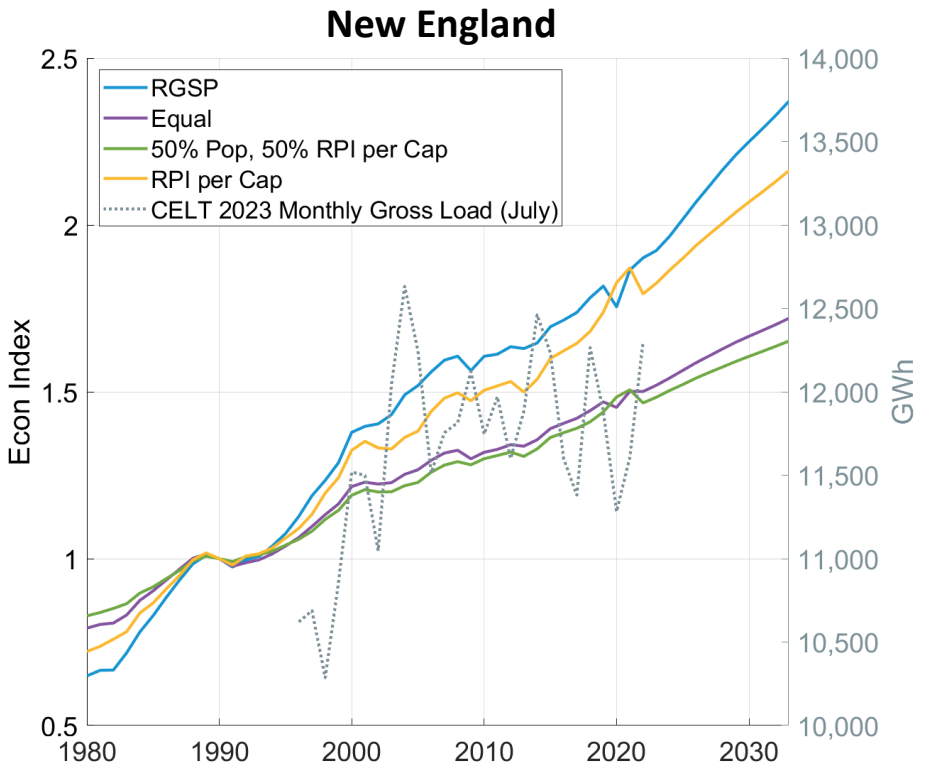







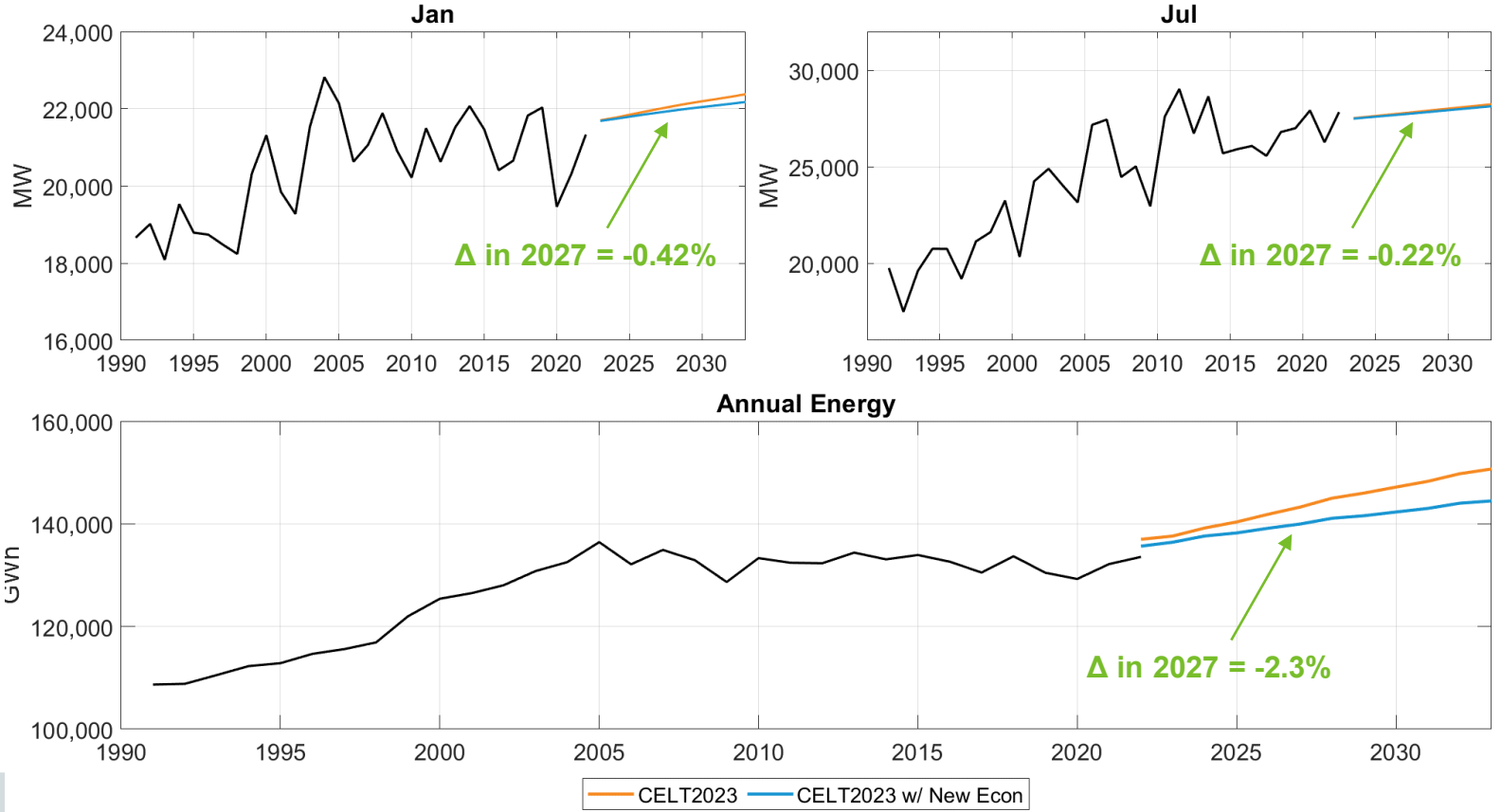
# Resulting Economic Constructs

- Indexing economic indicators to a common base year allows for the isolation of relative growth trends
  - Values shown to the right reflect indexing to 1990
  - Weighting multiple concepts together results in indictors that are reflective of the larger economic picture
- Blends of economic indicators were chosen based simulations of the CELT 2023 forecast
  - Primary consideration was given to annual energy forecast accuracy and trajectory, while minimizing impact to seasonal peak demand
  - Model statistics such as in-sample MAPE's and adjusted $R^2$ were considered, but were not the only metrics used in selecting the economic variable construction
- Three variable constructions were found to be most appropriate
  - **"Equal"** – Equal weighting of RGSP, Employment, Population, Real Personal Income per Capita
  - **"50% Pop, %50 RPI per Cap"** – Equal weighting of Population and Real Personal Income per Capita
  - **"RPI per Cap"** – Real Personal Income per Capita
- Differing indices were used across the months and states, optimizing a reduction in the energy forecast, while maintaining minimal peak impact
  - Regional monthly energy decreases 1-4% in 2027
  - Regional peak demand forecast decreases no more than 0.5% in 2027
  - 50/50 and 90/10 peak demand impacts are similar across the region and states



# Annual Energy and 50/50 Peak Demand Impacts

*New England CELT 2023 Forecast*



# DRAFT 2024 ANNUAL ENERGY FORECAST

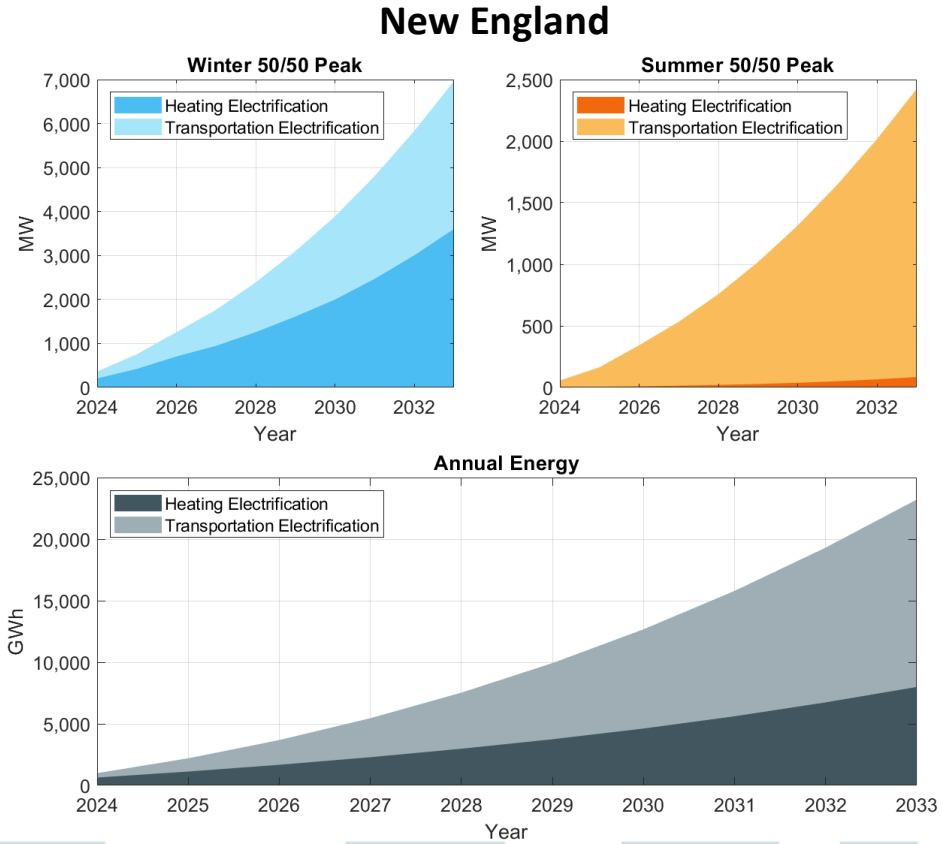
# Draft CELT 2024 Forecast

*Summer Peak, Winter Peak, and Annual Energy*

- The following slides summarize the draft CELT 2024 annual energy and seasonal peak demand forecasts
  - The charts and figures presented are draft and are subject to change
- No changes were made to the gross load forecast methodology since CELT 2022
  - Updates to the economic indicators used in the gross energy forecast have been updated to reflect composite economic indices described in the previous section
- The following inputs are not yet finalized and may affect the final forecast:
  - FCA 18 PDR summer/winter CSO values
  - Moody's 2024 macroeconomic outlook
  - Final 2024 heating and transportation electrification forecasts
  - Final 2024 EE and BTM PV forecasts (impacts net forecast only)
- Net energy forecasts presented are illustrative, and will change when the 2024 EE and BTM PV forecasts are finalized
  - The EE and BTM PV forecasts are currently under development
  - Net forecasts shown utilize the draft 2024 EE forecast and the 2023 PV forecast
  - The BTM PV forecast does not impact winter peak demand forecast

# Draft 2024 Electrification Forecasts

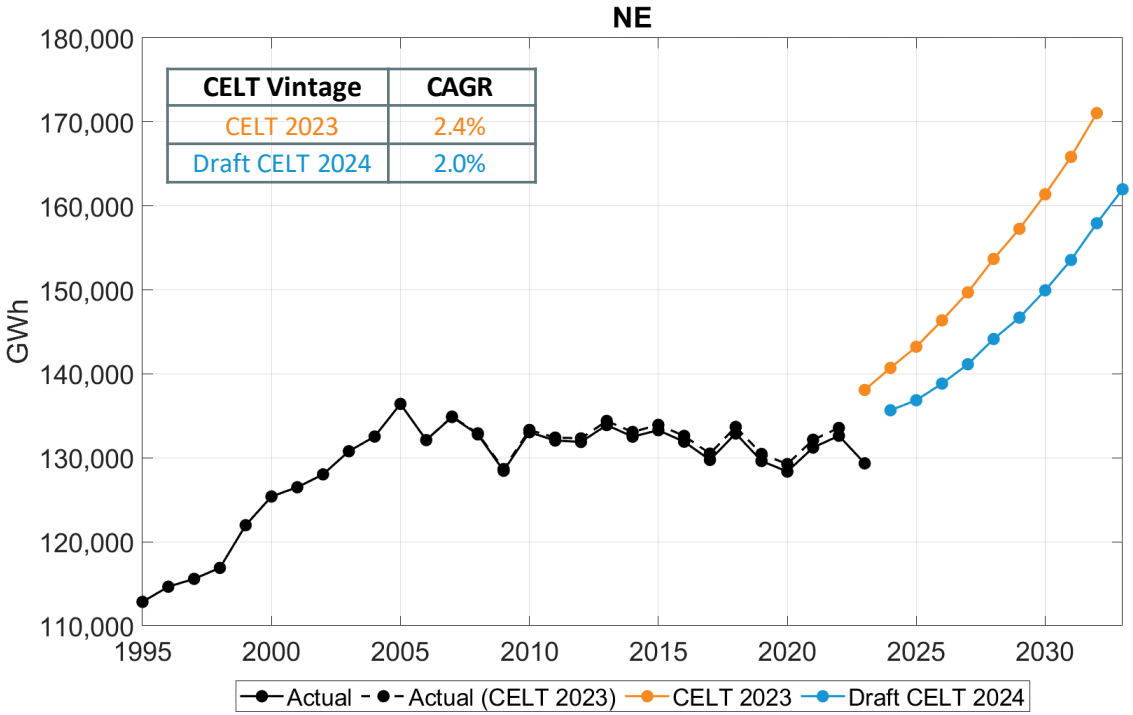
- The draft 2024 heating and transportation electrification forecasts were presented at the January 12, 2024 LFC meeting
  - Updates for 2024 include:
    - Enhanced modeling of partial heating applications
    - Inclusion of EV managed charging for personal light-duty vehicles
  - Final forecasts are expected to be unchanged from the draft forecasts
- Gross and net forecasts include the impacts of electrification



# Annual Gross Energy Forecast

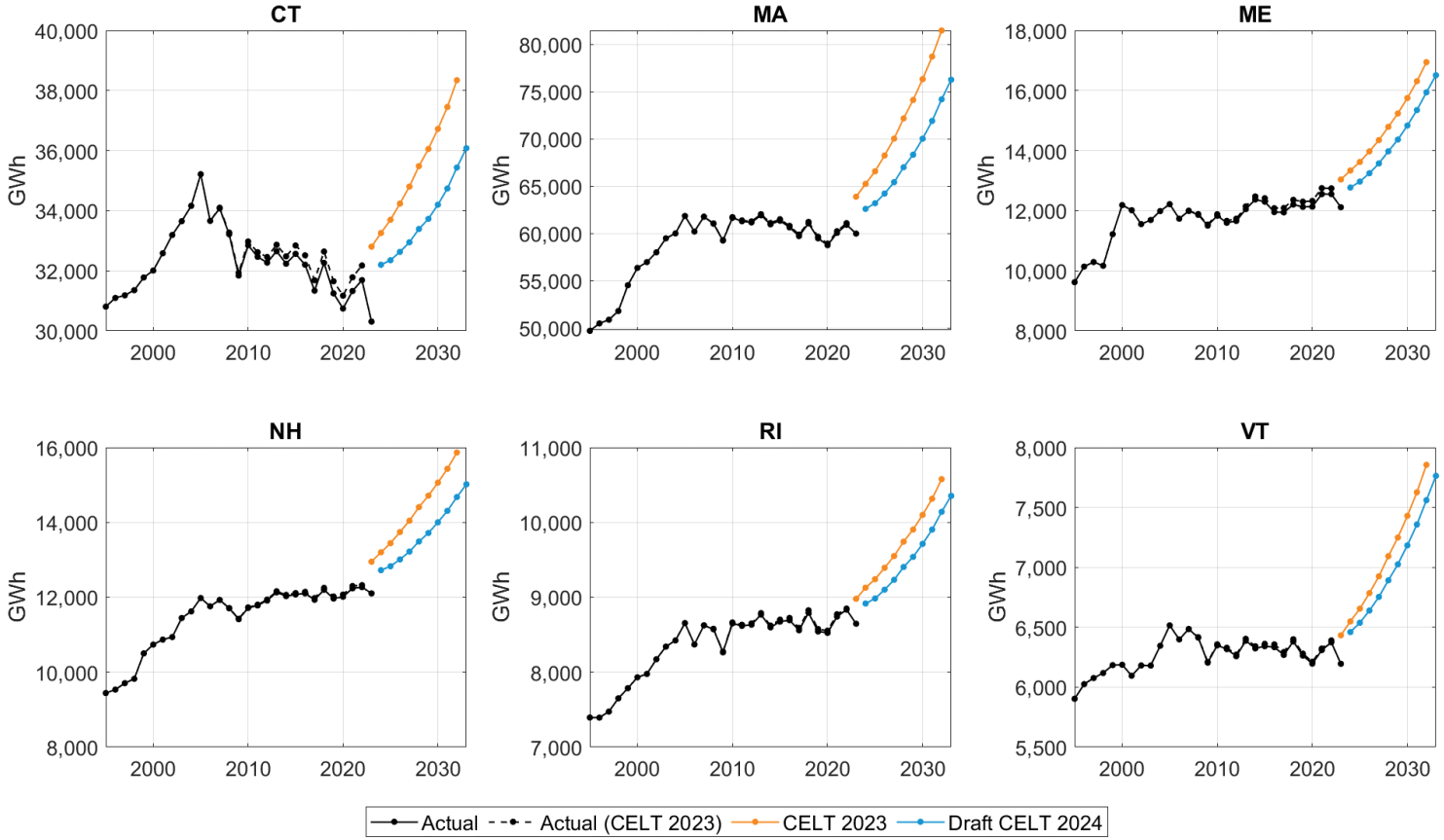
*New England – Draft CELT 2024 Vs. CELT 2023*

| Year | Gross CELT 2023 (GWh) | Draft Gross CELT 2024 (GWh) | Change (GWh) | Change (%) |
|---|---|---|---|---|
| 2024 | 140,711 | 135,663 | -5,048 | -3.6% |
| 2025 | 143,230 | 136,859 | -6,371 | -4.4% |
| 2026 | 146,370 | 138,840 | -7,529 | -5.1% |
| 2027 | 149,703 | 141,145 | -8,558 | -5.7% |
| 2028 | 153,690 | 144,150 | -9,540 | -6.2% |
| 2029 | 157,274 | 146,701 | -10,573 | -6.7% |
| 2030 | 161,384 | 149,952 | -11,431 | -7.1% |
| 2031 | 165,838 | 153,556 | -12,282 | -7.4% |
| 2032 | 171,050 | 157,941 | -13,110 | -7.7% |
| 2033 | | 161,982 | | |



# Annual Gross Energy Forecast

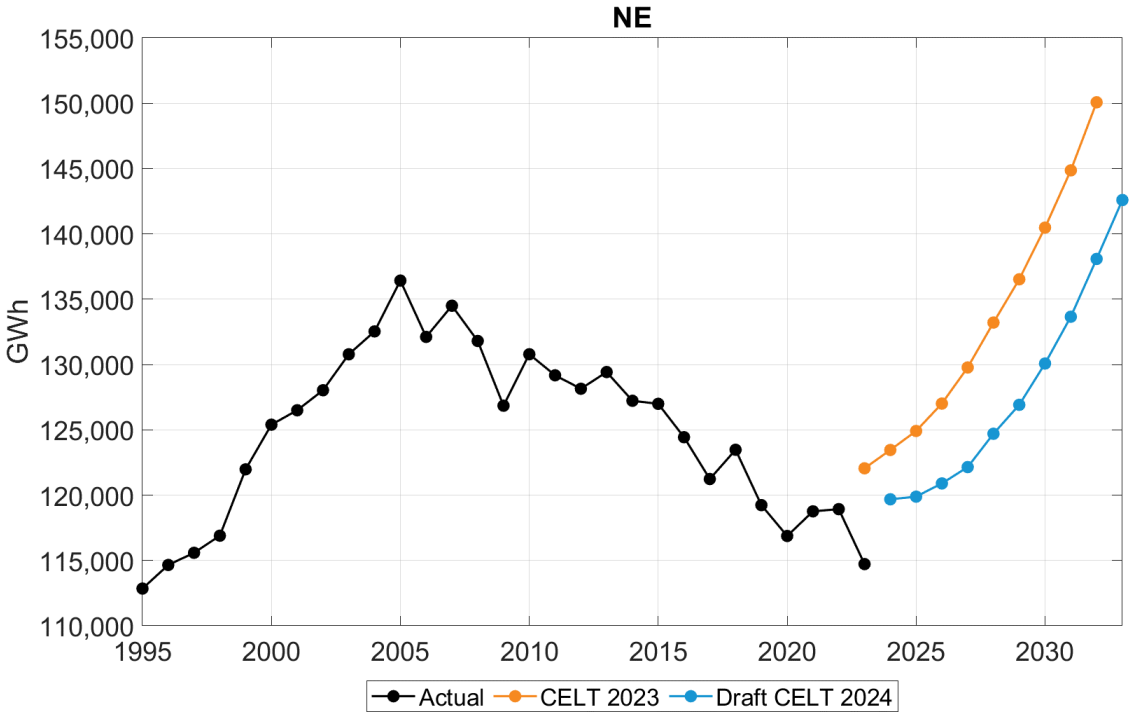
*States – Draft CELT 2024 Vs. CELT 2023*



# Annual Net Energy Forecast

*New England – Draft CELT 2024 Vs. CELT 2023*

| Year | Net CELT 2023 (GWh) | Draft Net CELT 2024 (GWh) | Change (GWh) | Change (%) |
|---|---|---|---|---|
| 2024 | 123,460 | 119,684 | -3,776 | -3.1% |
| 2025 | 124,914 | 119,887 | -5,027 | -4.0% |
| 2026 | 127,013 | 120,899 | -6,113 | -4.8% |
| 2027 | 129,776 | 122,149 | -7,627 | -5.9% |
| 2028 | 133,214 | 124,701 | -8,513 | -6.4% |
| 2029 | 136,526 | 126,917 | -9,609 | -7.0% |
| 2030 | 140,481 | 130,077 | -10,404 | -7.4% |
| 2031 | 144,865 | 133,661 | -11,204 | -7.7% |
| 2032 | 150,073 | 138,085 | -11,988 | -8.0% |
| 2033 | | | | |



# Draft 2024 Gross and Net Annual Energy Forecasts

*New England - Summary*

| Year | Transportation Electrification* (GWh) | Heating Electrification* (GWh) | Gross (GWh) | EE** (GWh) | BTM PV** (GWh) | Net** (GWh) |
|---|---|---|---|---|---|---|
| 2024 | 325 | 640 | 135,663 | 11,009 | 4,970 | 119,684 |
| 2025 | 1,045 | 1,127 | 136,859 | 11,636 | 5,336 | 119,887 |
| 2026 | 1,978 | 1,676 | 138,840 | 12,262 | 5,679 | 120,899 |
| 2027 | 3,134 | 2,292 | 141,145 | 12,889 | 6,107 | 122,149 |
| 2028 | 4,522 | 2,979 | 144,150 | 12,853 | 6,596 | 124,701 |
| 2029 | 6,151 | 3,749 | 146,701 | 12,758 | 7,027 | 126,917 |
| 2030 | 8,024 | 4,618 | 149,952 | 12,460 | 7,415 | 130,077 |
| 2031 | 10,148 | 5,614 | 153,556 | 12,103 | 7,792 | 133,661 |
| 2032 | 12,532 | 6,742 | 157,941 | 11,688 | 8,168 | 138,085 |
| 2033 | 15,182 | 7,996 | 161,982 | 11,009 | | |

** Electrification forecasts are included in both gross and net peak forecasts.*

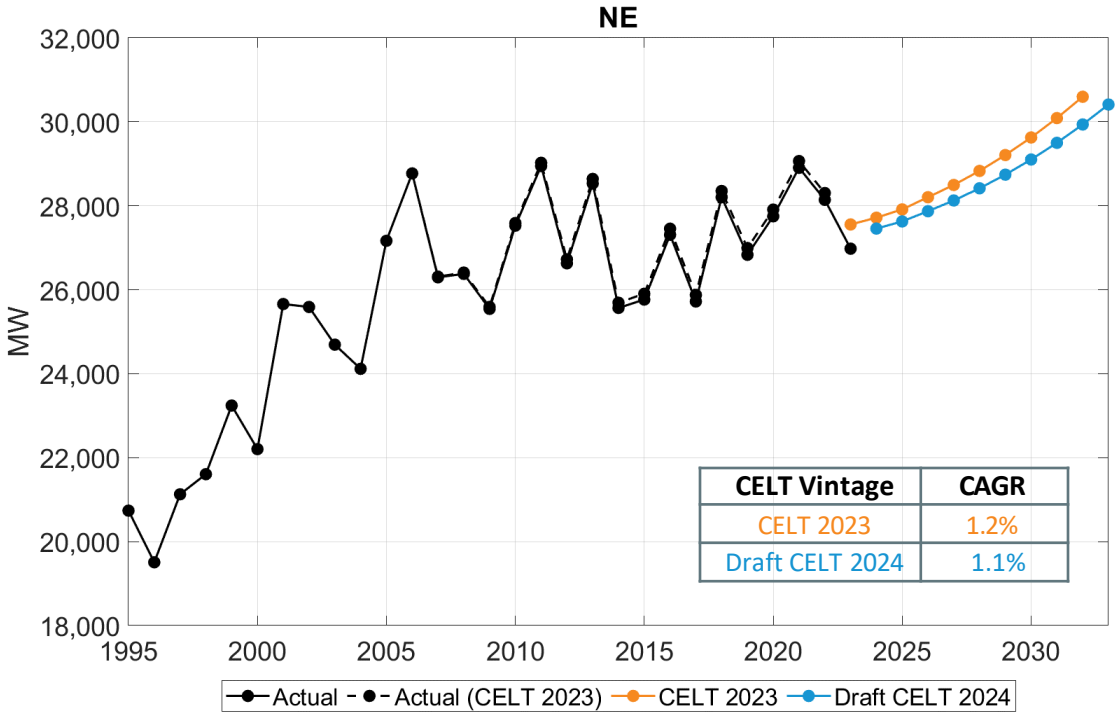
*** Net figures utilize the draft 2024 EE forecast and the final 2023 PV forecast*

# DRAFT 2024 SUMMER PEAK DEMAND FORECAST

# Summer Gross 50/50 Peak Forecast

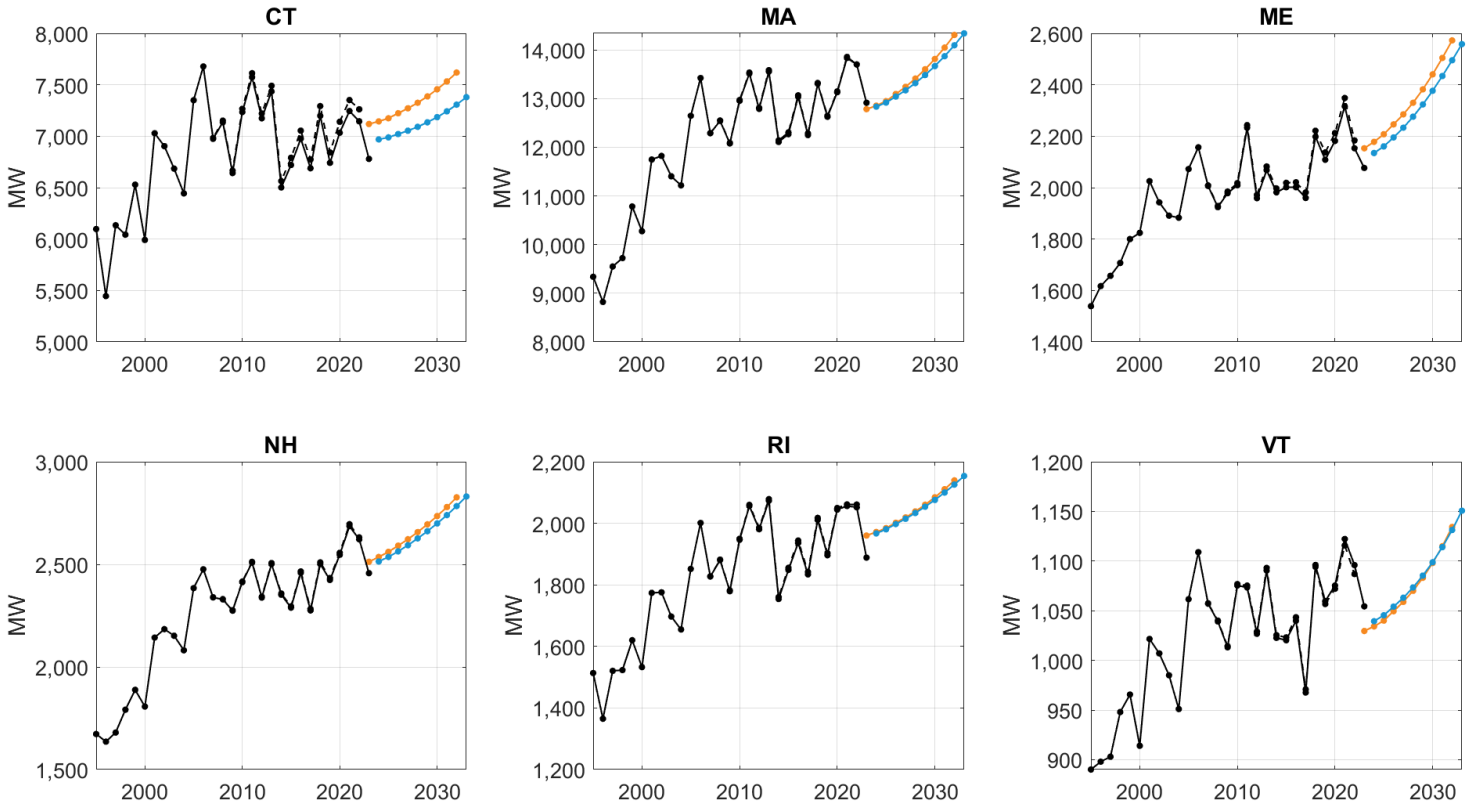
*New England – Draft CELT 2024 Vs. CELT 2023*

| Year | Gross CELT 2023 (MW) | Draft Gross CELT 2024 (MW) | Change (MW) | Change (%) |
|---|---|---|---|---|
| 2024 | 27,717 | 27,458 | -260 | -0.9% |
| 2025 | 27,914 | 27,628 | -286 | -1.0% |
| 2026 | 28,205 | 27,872 | -333 | -1.2% |
| 2027 | 28,497 | 28,127 | -370 | -1.3% |
| 2028 | 28,832 | 28,417 | -414 | -1.4% |
| 2029 | 29,209 | 28,743 | -467 | -1.6% |
| 2030 | 29,628 | 29,103 | -525 | -1.8% |
| 2031 | 30,090 | 29,500 | -590 | -2.0% |
| 2032 | 30,599 | 29,938 | -661 | -2.2% |
| 2033 | | 30,413 | | |



# Summer Gross 50/50 Peak Forecast

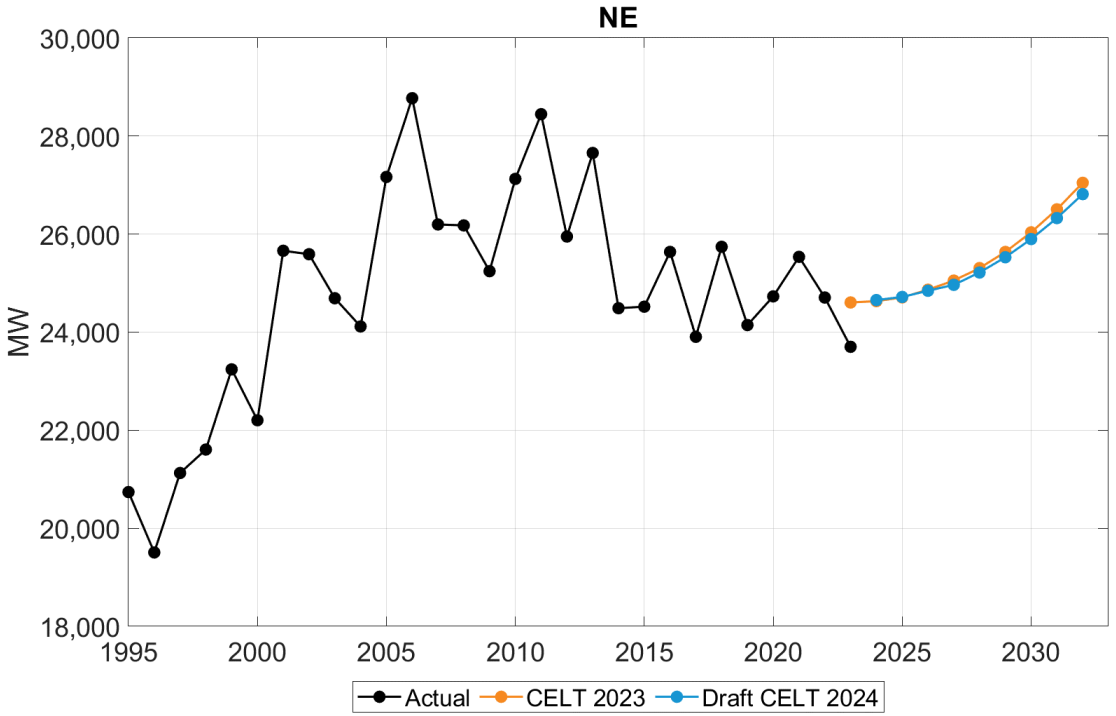
*States – Draft CELT 2024 Vs. CELT 2023*



# Summer Net 50/50 Peak Forecast

*New England – Draft CELT 2024 Vs. CELT 2023*

| Year | Net CELT 2023 (MW) | Draft Net CELT 2024 (MW) | Change (MW) | Change (%) |
|---|---|---|---|---|
| 2024 | 24,633 | 24,654 | 21 | 0.1% |
| 2025 | 24,708 | 24,718 | 10 | 0.0% |
| 2026 | 24,866 | 24,844 | -21 | -0.1% |
| 2027 | 25,052 | 24,965 | -87 | -0.3% |
| 2028 | 25,307 | 25,216 | -90 | -0.4% |
| 2029 | 25,636 | 25,528 | -108 | -0.4% |
| 2030 | 26,036 | 25,899 | -137 | -0.5% |
| 2031 | 26,505 | 26,326 | -179 | -0.7% |
| 2032 | 27,046 | 26,816 | -230 | -0.9% |
| 2033 | | | | |



# Draft 2024 Gross and Net Summer Peak Forecasts

*New England 50/50 - Summary*

| Year | Transportation Electrification* (MW) | Heating Electrification* (MW) | Gross (MW) | EE** (MW) | BTM PV** (MW) | Net** (MW) |
|---|---|---|---|---|---|---|
| 2024 | 51 | 2 | 27,458 | 1,805 | 999 | 24,654 |
| 2025 | 155 | 5 | 27,628 | 1,905 | 1,005 | 24,718 |
| 2026 | 330 | 9 | 27,872 | 2,005 | 1,023 | 24,844 |
| 2027 | 515 | 14 | 28,127 | 2,105 | 1,057 | 24,965 |
| 2028 | 734 | 21 | 28,417 | 2,117 | 1,084 | 25,216 |
| 2029 | 986 | 28 | 28,743 | 2,112 | 1,102 | 25,528 |
| 2030 | 1,273 | 38 | 29,103 | 2,092 | 1,112 | 25,899 |
| 2031 | 1,592 | 50 | 29,500 | 2,056 | 1,118 | 26,326 |
| 2032 | 1,946 | 66 | 29,938 | 2,005 | 1,117 | 26,816 |
| 2033 | 2,334 | 85 | 30,413 | 1,939 | | |

** Electrification forecasts are included in both gross and net peak forecasts.*

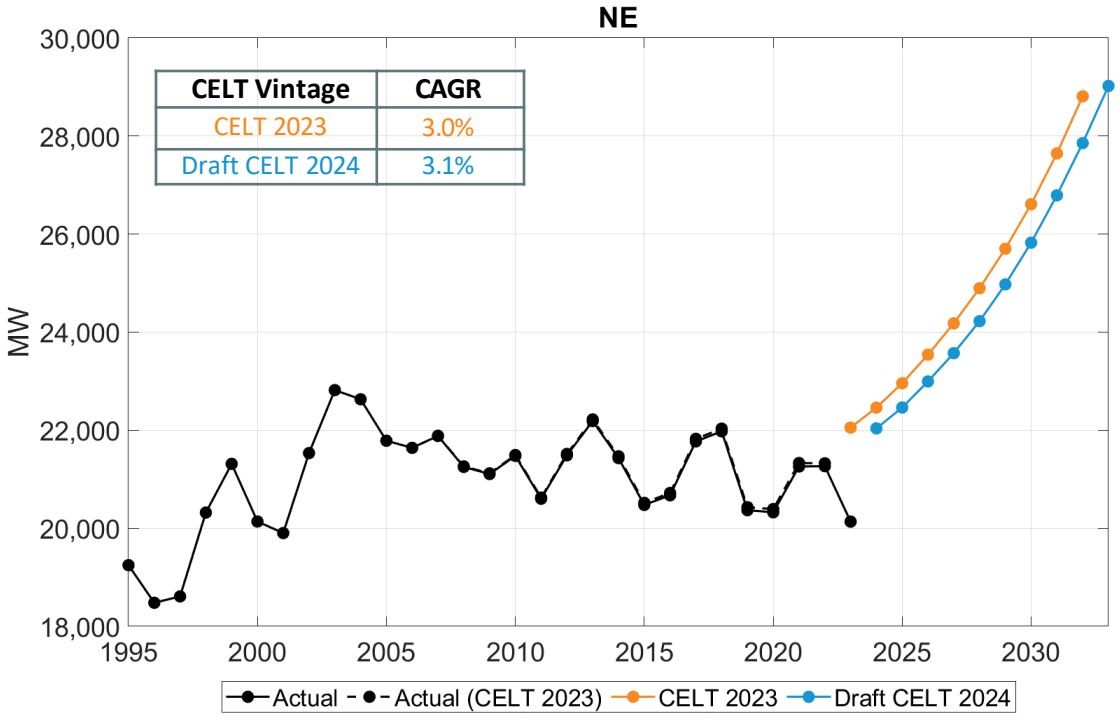
*** Net figures utilize the draft 2024 EE forecast and the final 2023 PV forecast*

# DRAFT 2024 WINTER PEAK DEMAND FORECAST

# Winter Gross 50/50 Peak Forecast

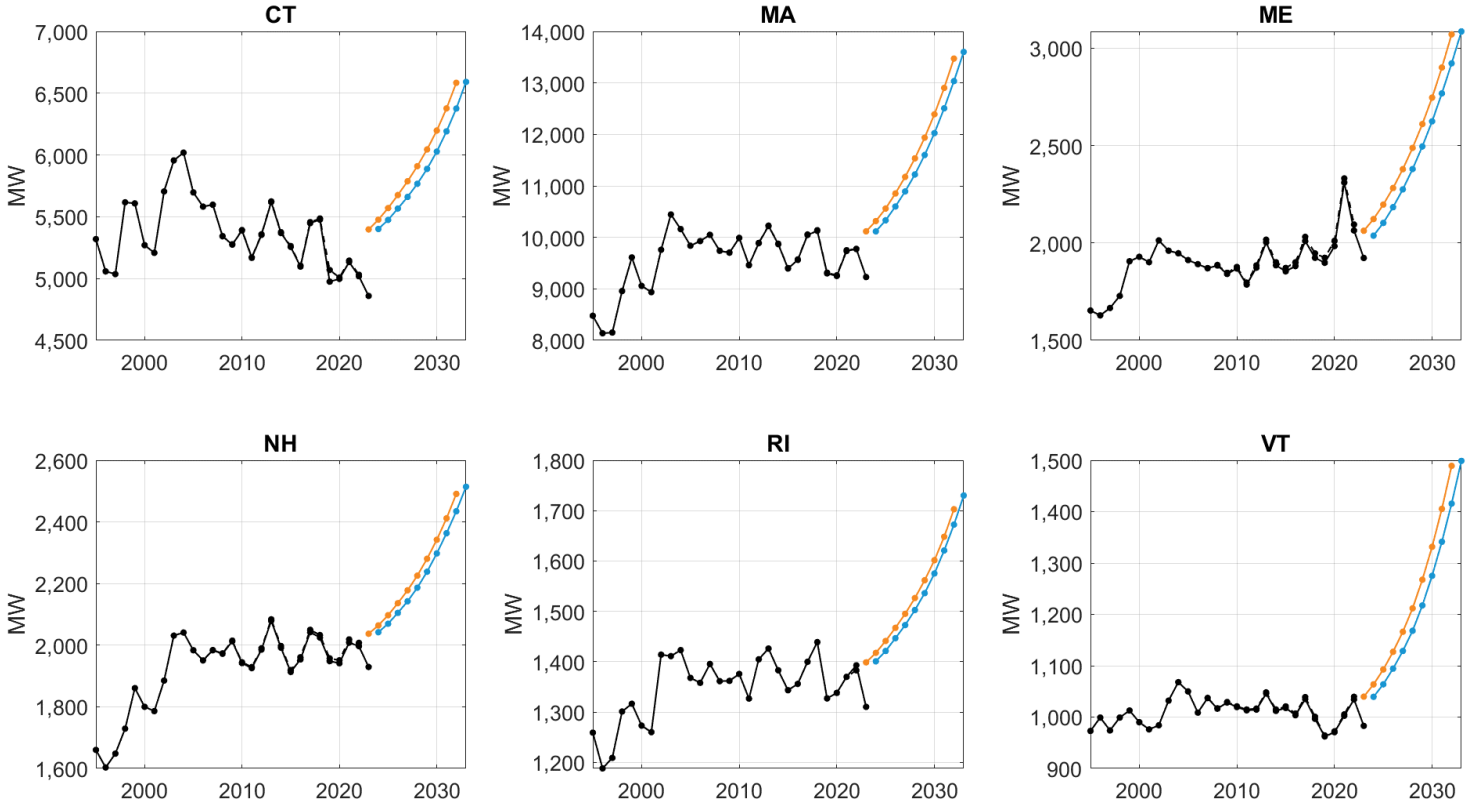
*New England – Draft CELT 2024 Vs. CELT 2023*

| Year | Gross CELT 2023 (MW) | Draft Gross CELT 2024 (MW) | Change (MW) | Change (%) |
|---|---|---|---|---|
| 2024 | 22,461 | 22,037 | -424 | -1.9% |
| 2025 | 22,958 | 22,463 | -495 | -2.2% |
| 2026 | 23,541 | 22,995 | -546 | -2.3% |
| 2027 | 24,180 | 23,572 | -608 | -2.5% |
| 2028 | 24,896 | 24,224 | -672 | -2.7% |
| 2029 | 25,701 | 24,974 | -727 | -2.8% |
| 2030 | 26,610 | 25,825 | -785 | -3.0% |
| 2031 | 27,646 | 26,791 | -854 | -3.1% |
| 2032 | 28,810 | 27,856 | -954 | -3.3% |
| 2033 | | 29,022 | | |



# Winter Gross 50/50 Peak Forecast

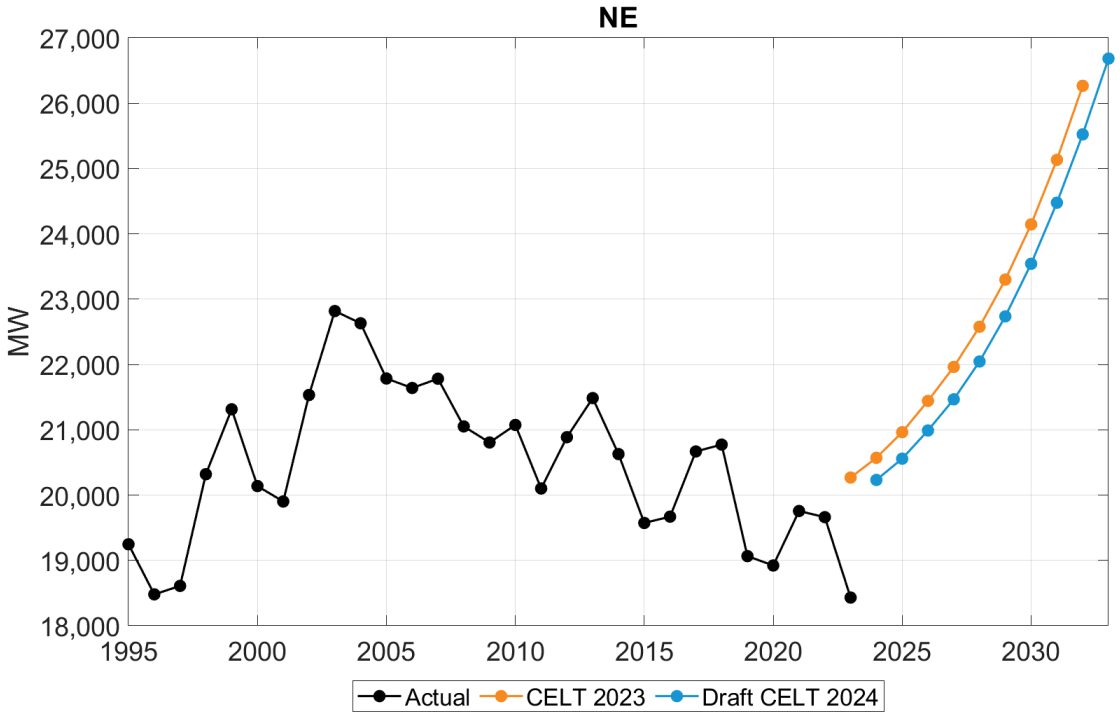
*States – Draft CELT 2024 Vs. CELT 2023*



# Winter Net 50/50 Peak Forecast

*New England – Draft CELT 2024 Vs. CELT 2023*

| Year | Net CELT 2023 (MW) | Draft Net CELT 2024 (MW) | Change (MW) | Change (%) |
|---|---|---|---|---|
| 2024 | 20,572 | 20,232 | -340 | -1.7% |
| 2025 | 20,964 | 20,558 | -406 | -1.9% |
| 2026 | 21,442 | 20,990 | -453 | -2.1% |
| 2027 | 21,963 | 21,467 | -496 | -2.3% |
| 2028 | 22,578 | 22,046 | -532 | -2.4% |
| 2029 | 23,301 | 22,737 | -564 | -2.4% |
| 2030 | 24,145 | 23,542 | -603 | -2.5% |
| 2031 | 25,133 | 24,477 | -656 | -2.6% |
| 2032 | 26,267 | 25,524 | -743 | -2.8% |
| 2033 | | | | |



# Draft 2024 Gross and Net Winter Peak Forecasts

*New England 50/50 - Summary*

| Year | Transportation Electrification* (MW) | Heating Electrification* (MW) | Gross (MW) | EE** (MW) | BTM PV** (MW) | Net** (MW) |
|---|---|---|---|---|---|---|
| 2024 | 147 | 206 | 22,037 | 1,805 | 0 | 20,232 |
| 2025 | 325 | 421 | 22,463 | 1,905 | 0 | 20,558 |
| 2026 | 543 | 705 | 22,995 | 2,005 | 0 | 20,990 |
| 2027 | 811 | 946 | 23,572 | 2,105 | 0 | 21,467 |
| 2028 | 1,121 | 1,258 | 24,224 | 2,178 | 0 | 22,046 |
| 2029 | 1,476 | 1,612 | 24,974 | 2,237 | 0 | 22,737 |
| 2030 | 1,880 | 1,998 | 25,825 | 2,283 | 0 | 23,542 |
| 2031 | 2,325 | 2,469 | 26,791 | 2,314 | 0 | 24,477 |
| 2032 | 2,814 | 3,005 | 27,856 | 2,333 | 0 | 25,524 |
| 2033 | 3,348 | 3,604 | 29,022 | 2,338 | | |

** Electrification forecasts are included in both gross and net peak forecasts.*

*** Net figures utilize the draft 2024 EE forecast. The PV forecast does not impact winter peak.*

# Next Steps

- Next LFC meeting will be on March 28, 2024 LFC meeting
  - Final draft energy and seasonal peak forecasts (gross and net)
  - Inclusive of final heating and transportation electrification forecasts
- May 1, 2024–Publish final forecasts as a part of the 2024 CELT

# Questions