

# 2023 Final Seasonal Peak Forecasts

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*Power Supply Planning Committee*



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# Acronyms

- ARA Annual Reconfiguration Auction
- ASHP Air-Source Heat Pump
- BTM PV Behind-the-Meter Photovoltaic
- CAGR Compound Annual Growth Rate
- CCP Capacity Commitment Period
- CDD Cooling Degree Days
- CELT Capacity, Energy, Loads, and Transmission Forecast
- CSO Capacity Supply Obligation
- DGFVG Distributed Generation Forecast Working Group
- EE Energy Efficiency
- EEFVG Energy Efficiency Forecast Working Group
- EV Electric Vehicle
- FCA Forward Capacity Auction
- HP Heat Pump
- ICR Installed Capacity Requirement
- 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 23, 2022 Load Forecast Committee (LFC) meeting
- Final forecasts were published in the 2023 CELT Report on May 1, 2023

# CELT 2023 Load Forecast Timeline

## *Working Group and Committee Meetings*

- Load Forecast Committee (LFC)
  - September 23, 2022 – [Forecast methodology review](#), [discussion of electrification forecasts](#), [summer peak review](#)
  - November 7, 2022 – [Update on heating electrification forecast](#), [update on transportation electrification forecast](#)
  - December 9, 2022 – [Moody's November economic forecast](#), [draft heating electrification adoption forecast](#), [draft transportation electrification forecast](#)
  - February 24, 2023 – [Draft annual energy and seasonal peak demand forecasts](#), [draft heating electrification forecast](#), [draft transportation electrification forecast](#)
  - April 14, 2023 – [Final draft annual energy and seasonal peak forecasts](#)
- Distributed Generation Forecast Working Group (DGFWG)
  - December 5, 2022 – State DG policy updates from [MA](#), [CT](#), [RI](#), [VT](#), [NH](#), and [ME](#), [August 2022 distributed generation survey results](#)
  - February 17, 2023 – [Draft 2023 PV forecast](#), [December 2022 distributed generation survey results](#)
  - April 10, 2023 – [Final 2023 PV forecast](#)
- Energy Efficiency Forecast Working Group Meetings (EEFWG)
  - December 5, 2022 – [EE program data review](#), [EE measure data review](#)
  - February 17, 2023 – [Draft 2023 EE forecast](#)
  - April 10, 2023 – [Final 2023 EE forecast](#)

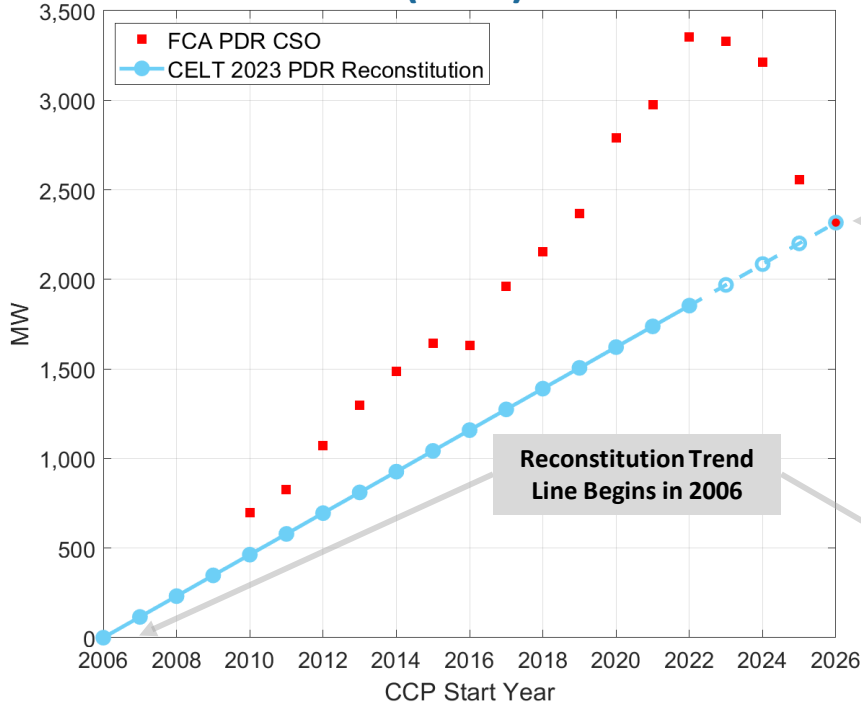
# Updates Since the CELT 2022 Forecast

- Model estimation period through the end of 2022
  - Peak demand models: 2008 – 2022 (updated from 2007-2021 period used in CELT 2022)
  - Energy models: 1996 – 2022 (updated from 1995-2021 period used in CELT 2022)
- No major changes to the specification of the summer/winter demand forecast models have been made since CELT 2020
- Incorporated Moody's February 2023 macroeconomic outlook
- Incorporated FCA 17 CSO values for PDR reconstitution
- Incorporated finalized 2023 heating and transportation electrification forecasts
  - Methodologies for both the heating and transportation electrification forecasts have been updated since CELT 2022
- Net forecast values incorporate the final 2023 EE and BTM PV forecasts

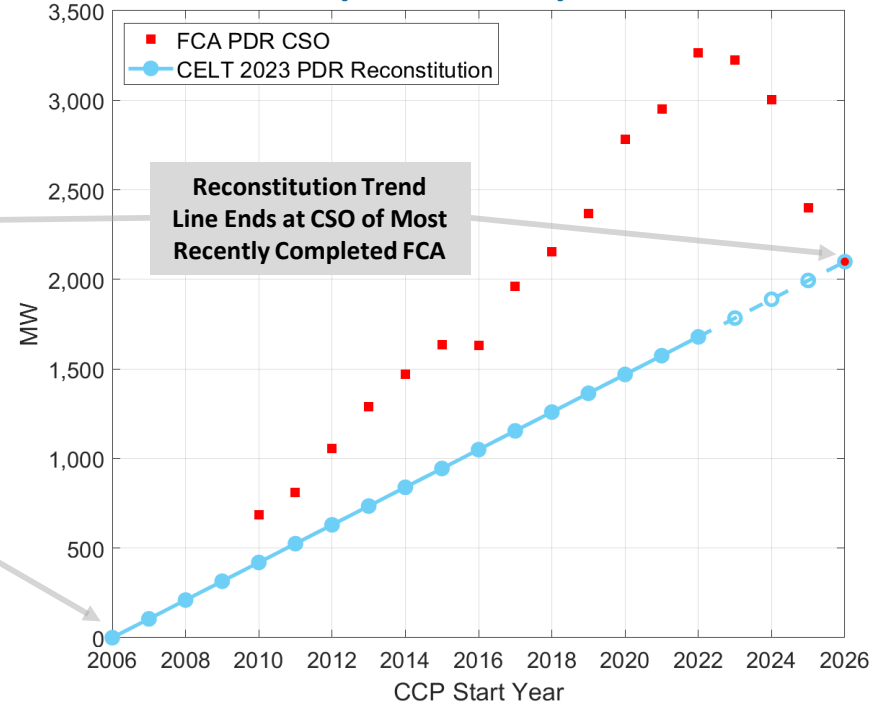
# CELT 2023 Summer and Winter PDR Reconstitution

*New England*

## Summer (June) PDR CSO

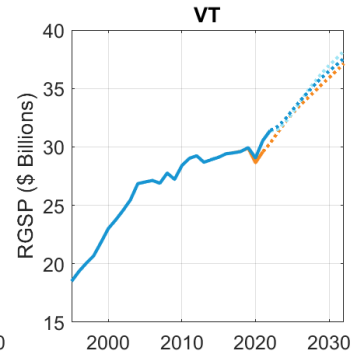
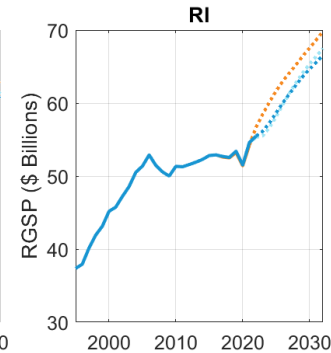
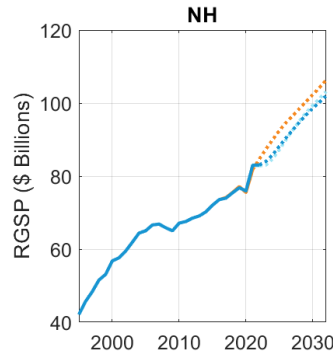
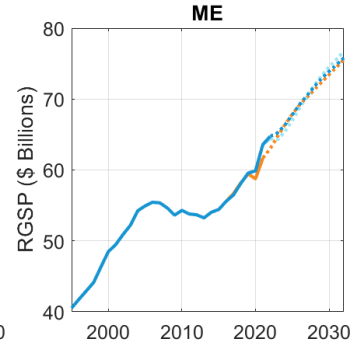
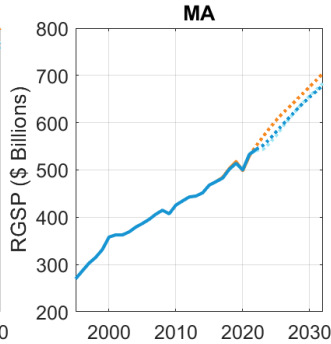
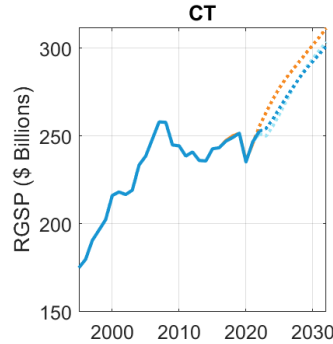
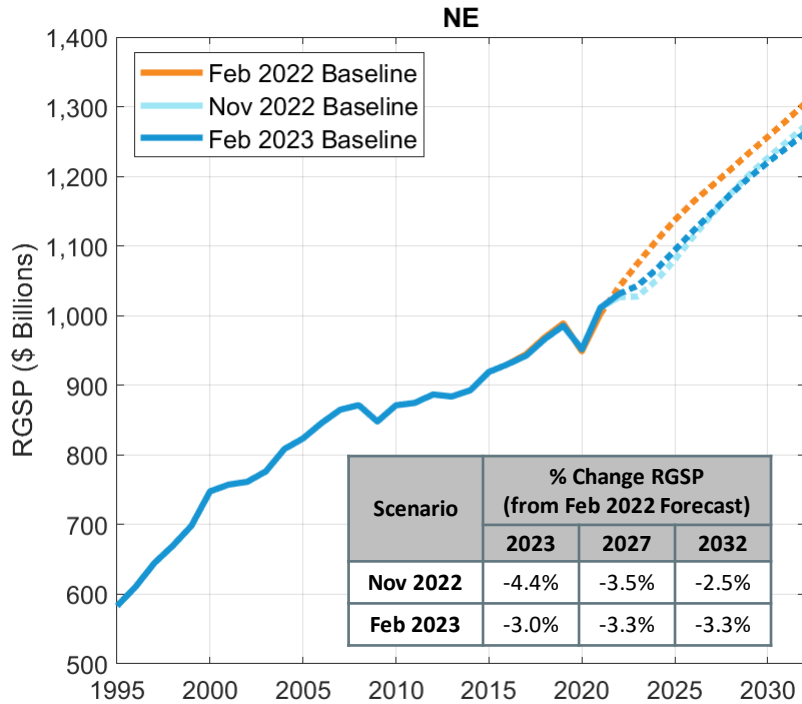


## Winter (December) PDR CSO



# Updated Economic Outlook

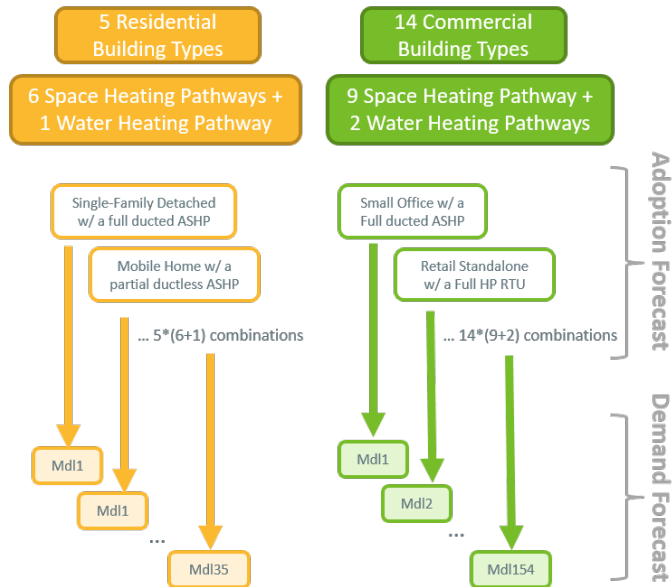
## Real Gross State Product



# Heating Electrification Forecast

New methodology leverages the National Renewable Energy Laboratory's [ResStock](#) and [ComStock](#) datasets, and is based on four sequential tasks:

1. New England building stock characterization
2. Development of "heating pathways"
3. Forecast of adoption along each "heating pathway"
4. Hourly demand modeling



# Transportation Electrification Forecast

Updated adoption forecast methodology

- Reflects all federal, state, and local programs, goals, and mandates, resulting in two adoption scenarios
- **"Full Electrification" adoption scenario** Intended to represent an upper bound on the pace and extent of EV adoption and is informational only
- **"CELT 2023" adoption scenario** Intended to reflect the likely pace and level of EV adoption over the next 10 years

Refined weather-responsiveness for personal light-duty vehicles

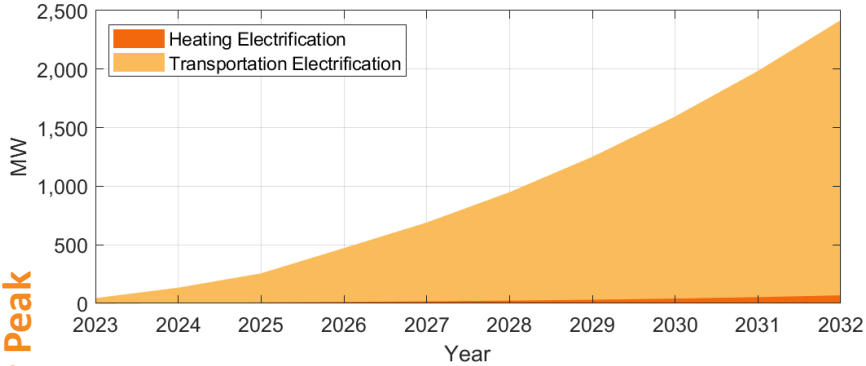
- Energy and demand impacts of personal LDVs was revised to more dynamically incorporate the impacts of weather as well as the increased utilization of BEVs
- Weather sensitive vehicle efficiency curves (based on average daily dry-bulb temperature)



# Electrification Forecast

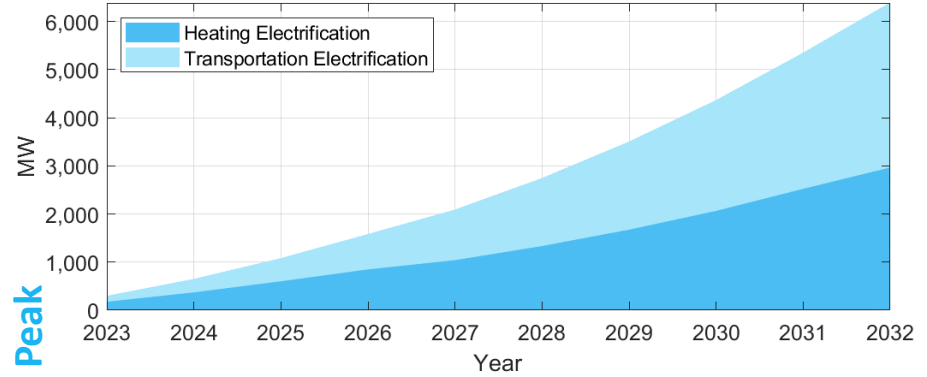
## 2023 Final Draft 50/50 Peak Demand

Summer Peak



Year	Transportation Electrification			Heating Electrification		
	CELT 2022 (MW)	CELT 2023 (MW)	Change (MW)	CELT 2022 (MW)	CELT 2023 (MW)	Change (MW)
2023	29	39	11	0	2	2
2024	75	126	51	0	5	5
2025	142	245	103	0	8	8
2026	264	456	192	0	12	12
2027	385	669	284	0	17	17
2028	527	922	396	0	23	23
2029	690	1,216	526	0	31	31
2030	877	1,551	674	0	41	41
2031	1,082	1,927	845	0	53	53
2032		2,346			69	

Winter Peak

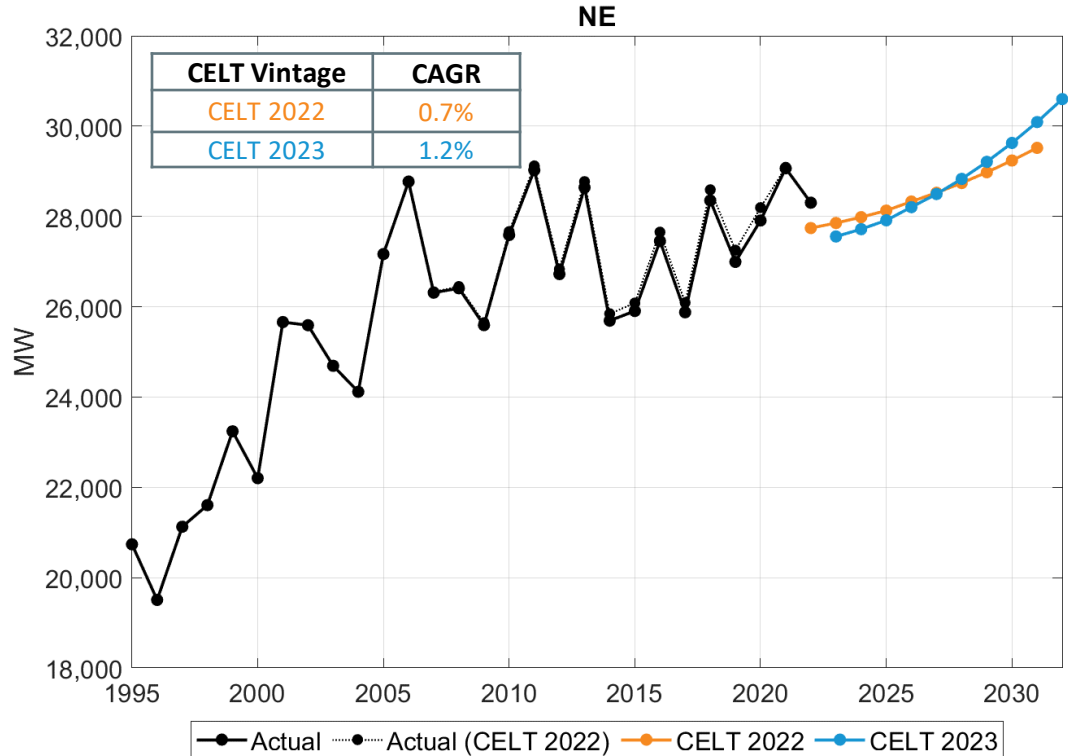


Year	Transportation Electrification			Heating Electrification		
	CELT 2022 (MW)	CELT 2023 (MW)	Change (MW)	CELT 2022 (MW)	CELT 2023 (MW)	Change (MW)
2023	50	116	66	75	175	100
2024	133	271	138	179	370	192
2025	244	473	229	311	601	290
2026	382	726	344	473	848	374
2027	549	1,042	493	668	1,040	372
2028	743	1,404	661	895	1,333	438
2029	967	1,822	855	1,158	1,673	515
2030	1,221	2,293	1,072	1,476	2,063	588
2031	1,497	2,820	1,323	1,831	2,521	691
2032		3,420			2,965	

# Summer Gross 50/50 Peak Forecast

*New England - CELT 2023 vs. CELT 2022*

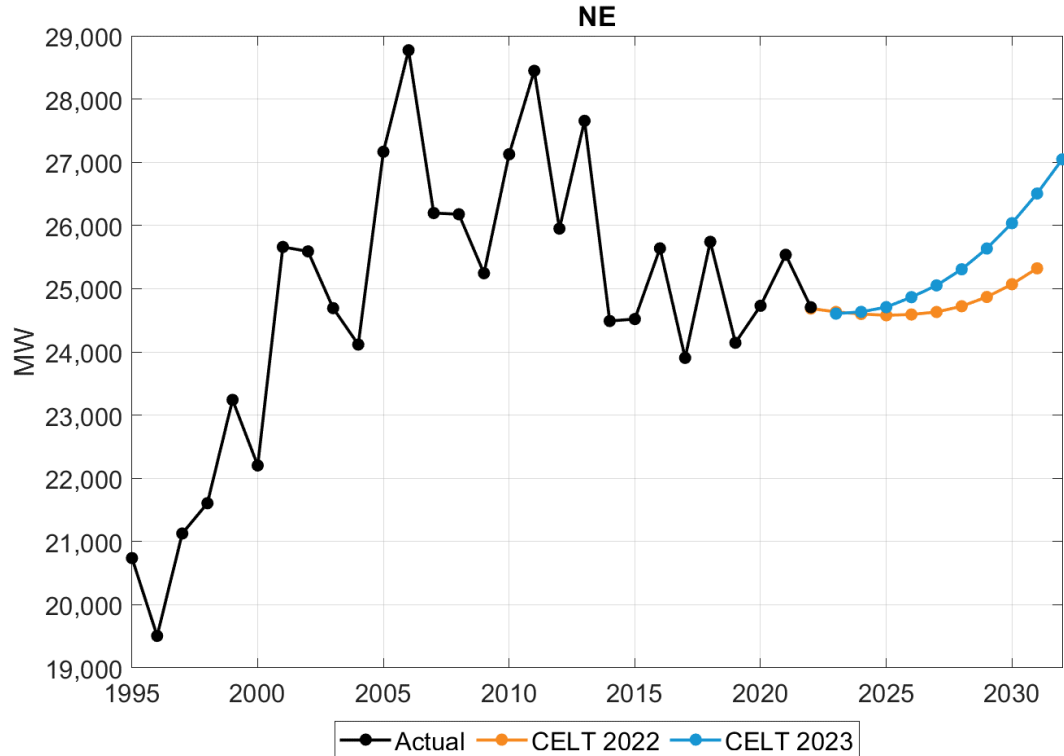
Year	Gross CELT 2022 (MW)	Gross CELT 2023 (MW)	Change (MW)	Change (%)
2023	27,855	27,556	-299	-1.1%
2024	27,983	27,717	-266	-1.0%
2025	28,130	27,914	-216	-0.8%
2026	28,330	28,205	-124	-0.4%
2027	28,524	28,497	-27	-0.1%
2028	28,740	28,832	91	0.3%
2029	28,979	29,209	231	0.8%
2030	29,239	29,628	389	1.3%
2031	29,519	30,090	571	1.9%
2032		30,599	782	2.6%



# Summer Net 50/50 Peak Forecast

*New England - CELT 2023 vs. CELT 2022*

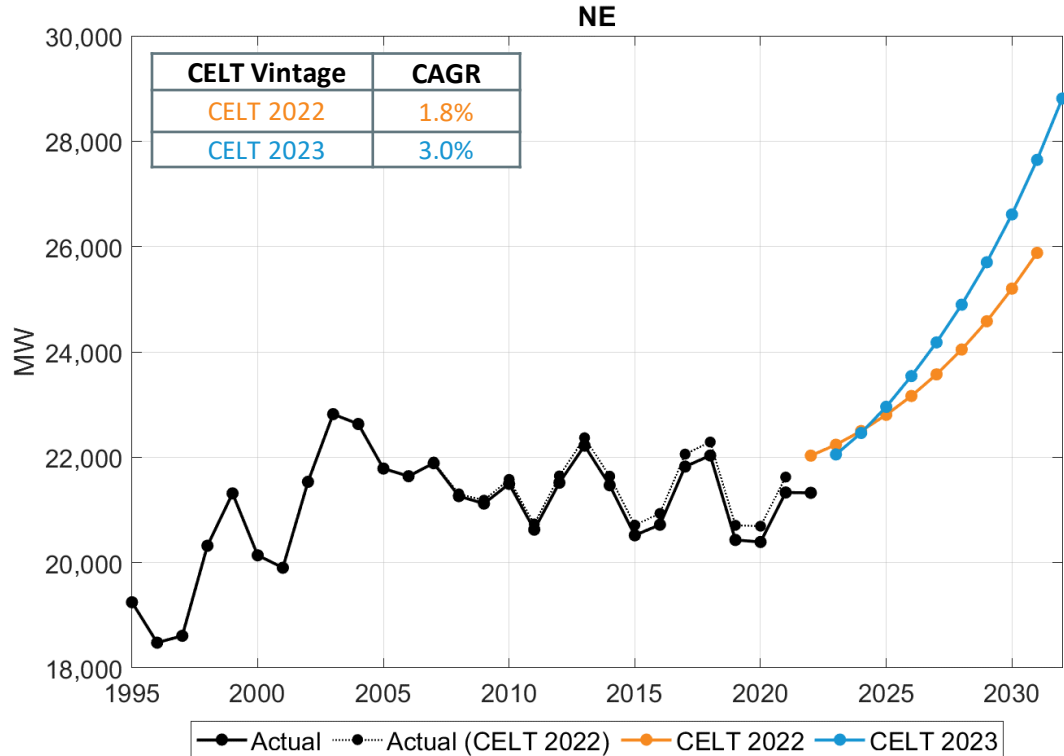
Year	Net CELT 2022 (MW)	Net CELT 2023 (MW)	Change (MW)	Change (%)
2023	24,633	24,605	-27	-0.1%
2024	24,600	24,633	33	0.1%
2025	24,579	24,708	129	0.5%
2026	24,592	24,866	274	1.1%
2027	24,631	25,052	421	1.7%
2028	24,722	25,307	585	2.4%
2029	24,869	25,636	767	3.1%
2030	25,071	26,036	965	3.9%
2031	25,322	26,505	1,183	4.7%
2032		27,046		



# Winter Gross 50/50 Peak Forecast

*New England - CELT 2023 vs. CELT 2022*

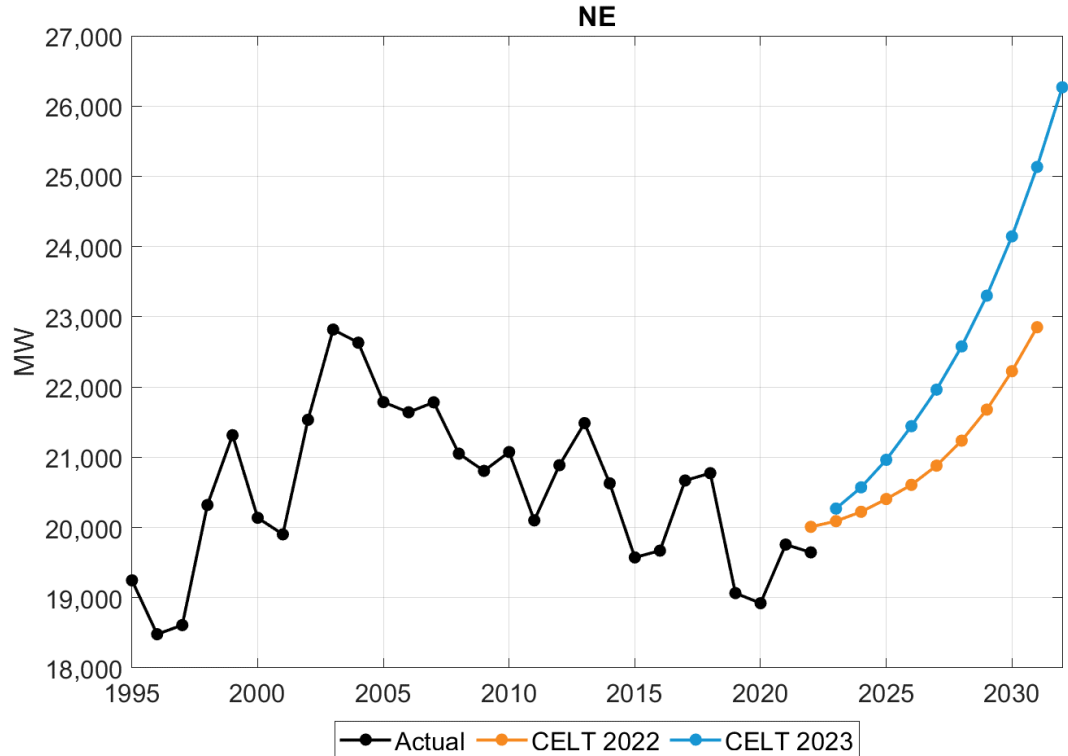
Year	Gross CELT 2022 (MW)	Gross CELT 2023 (MW)	Change (MW)	Change (%)
2023	22,238	22,053	-185	-0.8%
2024	22,498	22,461	-37	-0.2%
2025	22,806	22,958	152	0.7%
2026	23,164	23,541	378	1.6%
2027	23,573	24,180	607	2.6%
2028	24,045	24,896	851	3.5%
2029	24,581	25,701	1,120	4.6%
2030	25,201	26,610	1,409	5.6%
2031	25,880	27,646	1,765	6.8%
2032		28,810		



# Winter Net 50/50 Peak Forecast

*New England - CELT 2023 vs. CELT 2022*

Year	Net CELT 2022 (MW)	Net CELT 2023 (MW)	Change (MW)	Change (%)
2023	20,090	20,269	179	0.9%
2024	20,223	20,572	348	1.7%
2025	20,405	20,964	559	2.7%
2026	20,607	21,442	835	4.1%
2027	20,881	21,963	1,082	5.2%
2028	21,236	22,578	1,342	6.3%
2029	21,678	23,301	1,622	7.5%
2030	22,226	24,145	1,919	8.6%
2031	22,852	25,133	2,282	10.0%
2032		26,267		



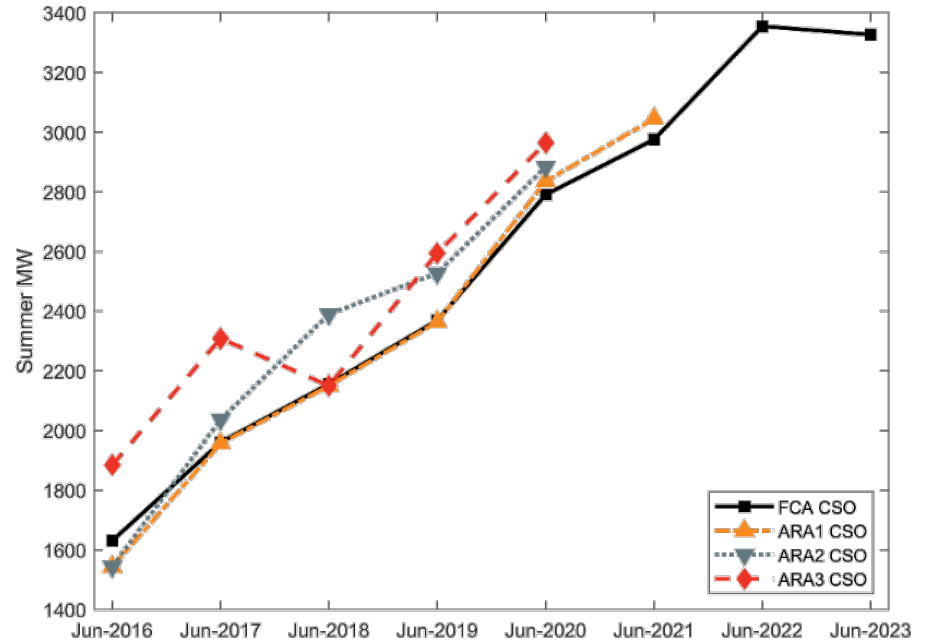
# GROSS LOAD FORECAST ADJUSTMENTS

*Used in ICR Calculations for the ARAs*

# Why Gross Forecast Adjustments Are Necessary

## Reason #1

- Different amounts of PDR often clear in each of the ARAs than in the FCA for the corresponding CCP\*



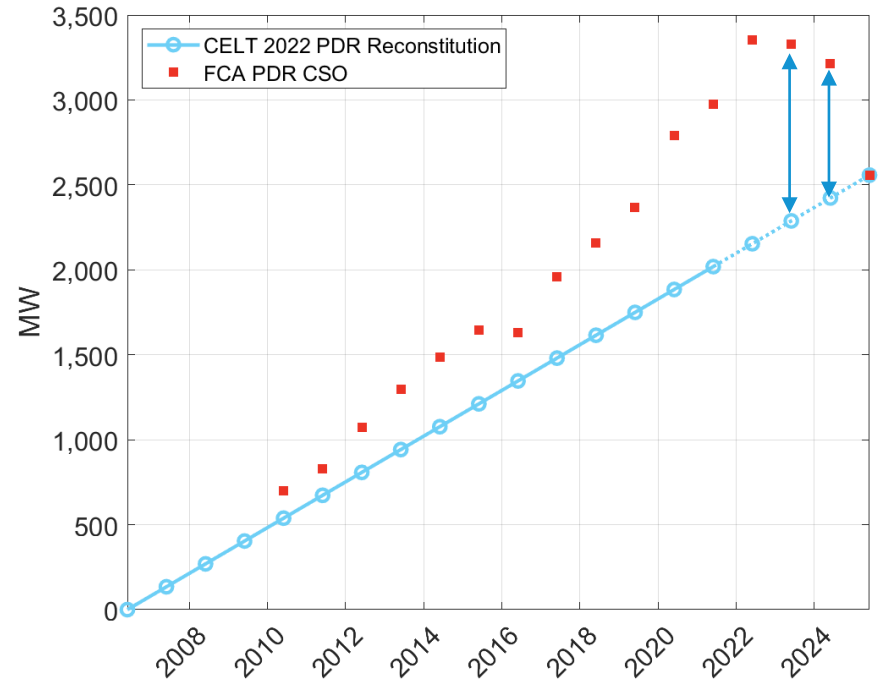
\*Example data through CCP 14 shown for illustration purposes only and is not inclusive of more recent FCAs

# Why Gross Forecast Adjustments Are Necessary

## Reason #2

- Amount of PDR that participates in ARAs can deviate **significantly** from amount of PDR that is embedded in the gross load forecast
  - Needs to be calibrated to reconstitution trendline

Summer – CELT 2022 Example

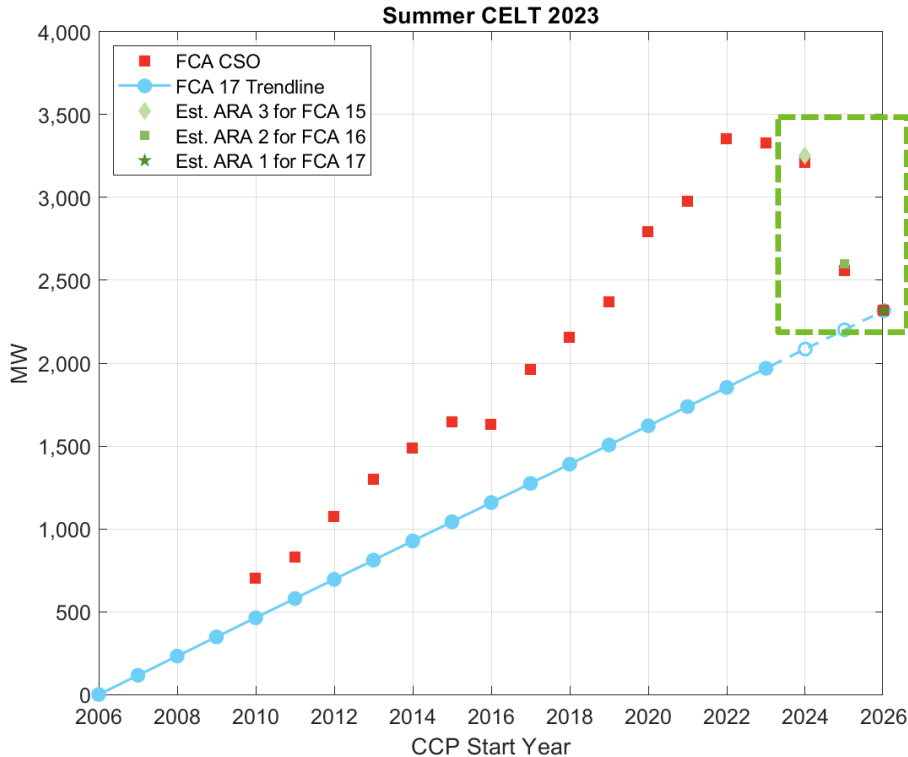




# ARA Gross Load Forecast Adjustment Methodology

- Adjustments to the gross load forecast for the ARAs are calculated using the following two steps (corresponding equations in Appendix):
  1. Estimate the ARAx CSOs for the upcoming auctions using historical ARA and FCA CSO data
    - Estimation uses the average differences between the two most recent ARAx CSOs and those of the FCAs for the corresponding CCPs
  2. Calculate the adjustments based on the difference between the estimated ARAx CSOs and the PDR “embedded” in the gross load forecast of the appropriate CCP
    - The reconstitution trend line used in developing the gross load forecast represents the amount of PDR “embedded” in the gross load forecast

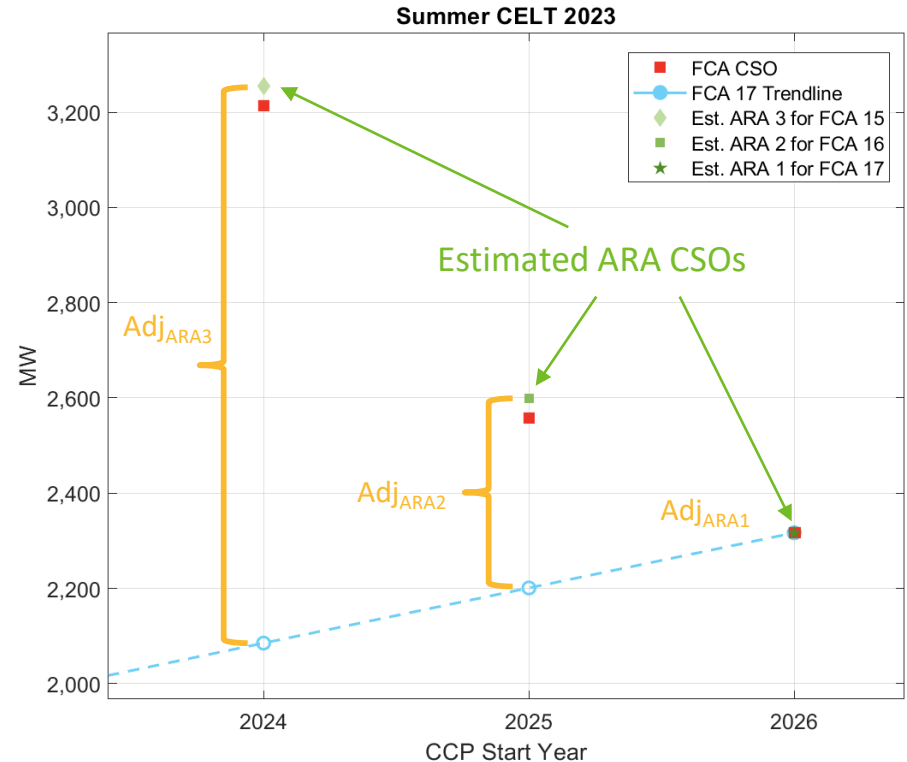
# CELT 2023 Reconstitution Trend Line and Estimated ARA CSO values



- The FCA 17 PDR CSO values were used to calculate the reconstitution trend line used in developing the CELT 2023 gross load forecast
- The estimated ARAx CSO values for the CELT 2023 forecast cycle are shown
- The area within the **green box** is expanded on the following slide

# CELT 2023 ARA Adjustment Calculation

- Calculation captures both reasons for making adjustments
- Note that calibration to the reconstitution trendline (reason 2) can be a much larger factor reflected in adjustments for ARA 2 and ARA 3



# Application of Forecast Adjustments for ARAs

- The forecast adjustments are developed uniquely for both summer and winter
- Forecast adjustments are applied to the gross load forecast by adjusting (*i.e.*, upward or downward) all points within the weekly probabilistic load forecast distribution by the appropriate seasonal MW adjustment values
- Adjustments are only relevant for the CCP associated with the ARA
  - Three adjusted gross load forecasts for each season (*i.e.*, one for each CCP/ARA pair) are documented as follows
    - CELT Report (6.3 - Forecasts for ARAs)
    - Forecast Data (Tab 18 - Adjusted Gross for ARAs)

# CELT 2023 ARA Gross Load Forecast Adjustments

		Summer Peak (MW)			Winter Peak (MW)		
CCP	Reconfiguration Auction	Adjusted 50/50 Gross	Adjusted 90/10 Gross	Adjustment	Adjusted 50/50 Gross	Adjusted 90/10 Gross	Adjustment
2024–2025	FCA 15 - ARA 3	28,887	30,712	1,170	23,617	24,446	1,157
2025–2026	FCA 16 - ARA 2	28,313	30,148	398	23,406	24,293	448
2026–2027	FCA 17 - ARA 1	28,205	30,053	0	23,540	24,483	-1

# Further Information on the CELT 2023 Load Forecast

- A summary of the CELT 2023 load forecast can be found in the final draft 2023 forecast presentation given to the LFC on [April 14, 2023](#)
- More detailed information on the forecast is available on the [Load Forecast webpage](#)
  - [2023 Forecast Data Workbook](#) (see Appendix I for a description of data within each tab)
  - [2023 Forecast Itemization Workbook](#)
  - [2023 Transportation Electrification Forecast](#)
  - [2023 Heating Electrification Forecast](#)
- Materials detailing all of the work incorporated into the CELT 2023 forecast, including the electrification forecasts and other work can be found on the ISO's [LFC webpage](#)

# APPENDIX I

## *Forecast Data Workbook Description*

# Forecast Data Workbook (1 of 3)

## Description of Contents

Worksheet	Description of Contents
1	ISONE Control Area & New England States Net Energy for Load (NEL) and Seasonal Peak Load History
2A	Summer Peak Load Forecast: ISONE Control Area, States, Regional System Plan (RSP) Sub-areas, and SMD Load Zone Forecasts <ul style="list-style-type: none"><li>Expected weather case (50th percentile), extreme weather case (90th percentile) and compound annual growth rates</li></ul>
2B	Winter Peak Load Forecast (Same details as 2A)
2C	Annual Energy Forecast: ISONE Control Area, States, RSP Sub-areas, and SMD Load Zones Forecasts
3	Confidence Intervals: Energy and Seasonal Peak Load Forecast and 90% confidence Intervals for ISONE Control Area, States, and RSP Sub-areas
4	ISONE Control Area and New England States Monthly Peak Load Forecast
5	Weather Normalized History & Forecast (ISONE Control Area only)



# Forecast Data Workbook (2 of 3)

## *Description of Contents*

Worksheet	Description of Contents
6	Monthly Net Energy for Load Forecast: ISONE Control Area and States
7	Seasonal Peak Load Forecast Distributions: ISONE Control Area and States
8	Energy Model Economic/Demographic Variables: ISONE Control Area and States
9	Adjusting the State Energy Forecasts to the ISONE Energy Forecast
10G	Current CELT Gross forecast differences from prior year: ISONE and the New England States
10N	Current CELT Net forecast differences from prior year: ISONE and the New England States
11	Percentage of ISONE Control Area, operating companies, and load zones portioned out to the RSP sub-areas (Summer 2022 and Summer 2031)
12	Annual Energy and Seasonal Peak Forecast (Transpose of Tab 2 data)

# Forecast Data Workbook (3 of 3)

## Description of Contents

Worksheet	Description of Contents
13	Westinghouse Capacity Model Program Load Inputs (Power Years)
14	Summary Tables: ISONE Control Area, States, Regional System Plan Sub-areas, and SMD Load Zones Energy and Seasonal Peak Load Forecast
15	Current CELT forecast differences from prior year: BTM PV and EE for ISONE and states
16	Heating and Transportation Electrification Forecasts
17	Values used to reconstitute historical loads for the impact of Passive Demand Resources (PDRs) participating in the FCM for the purposes of producing the gross load forecast
18	Adjusted gross seasonal peak forecasts for ARA ICR calculations

# Questions

