

# 2023 Final Draft Energy and Seasonal Peak Forecasts

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*Planning Advisory Committee*

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# Today's Presentation

- Provide the Planning Advisory Committee (PAC) with a summary of the long-term energy and demand forecasts that will be published in the 2023 Capacity, Energy, Loads, and Transmission (CELT) report

# Acronyms

- ASHP Air-Source Heat Pump
- 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 23, 2022 Load Forecast Committee (LFC) meeting
- Final forecasts will be published in the 2023 CELT Report

# 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](#)

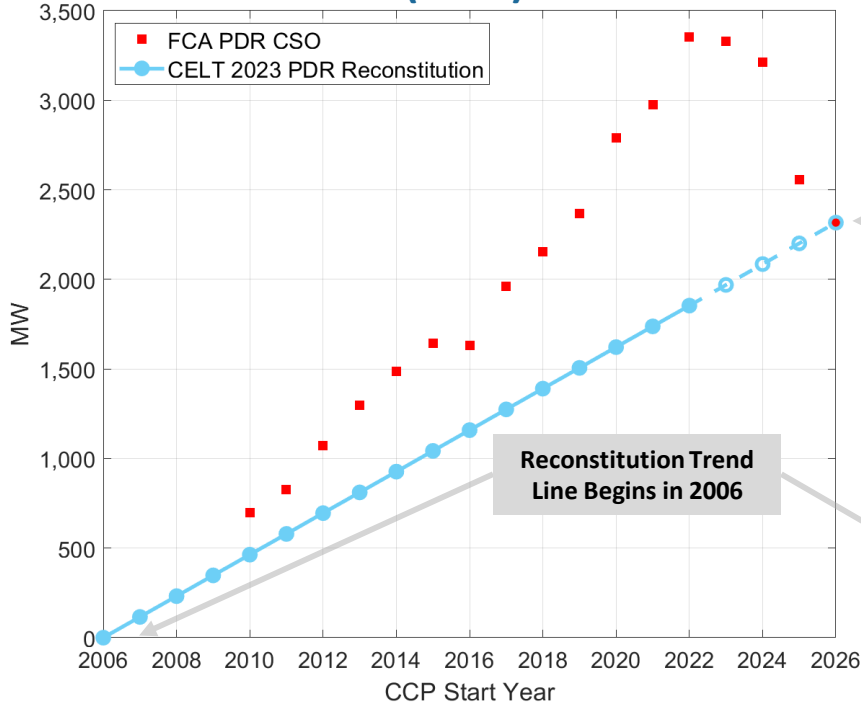
# Updates Since the CELT 2022 Forecast

- 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 capacity supply obligation (CSO) values for passive demand resources (PDRs)
- 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 energy efficiency (EE) and behind-the-meter photovoltaic (BTM PV) forecasts

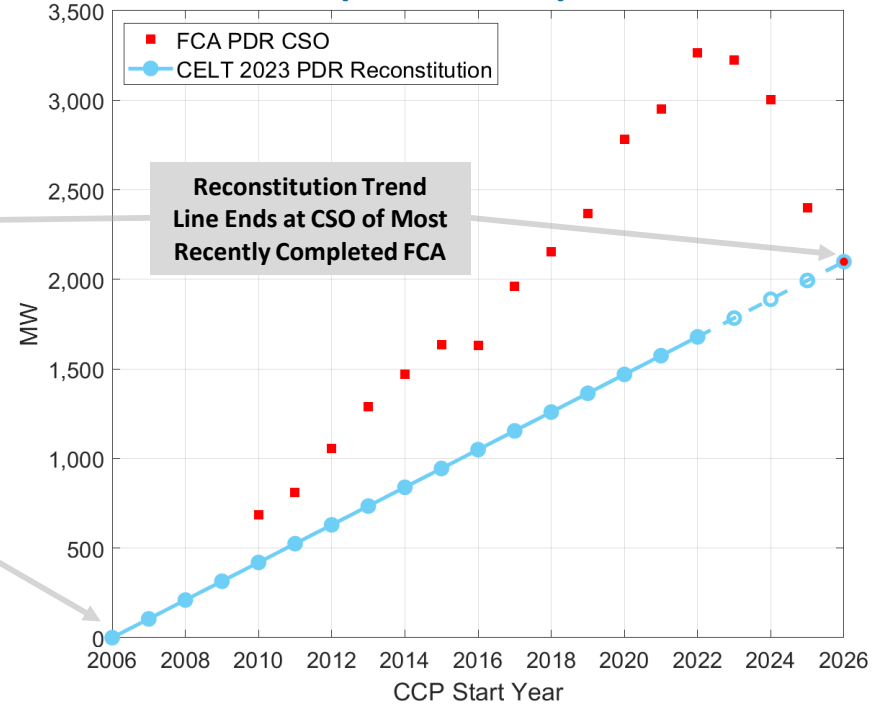
# CELT 2023 Summer and Winter PDR Reconstitution

*New England*

## Summer (June) PDR CSO

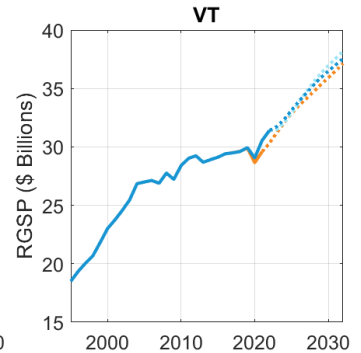
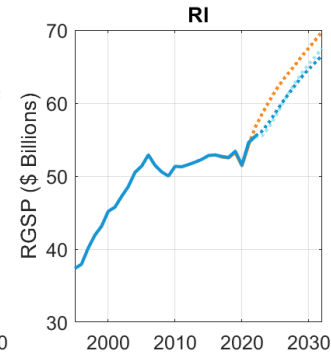
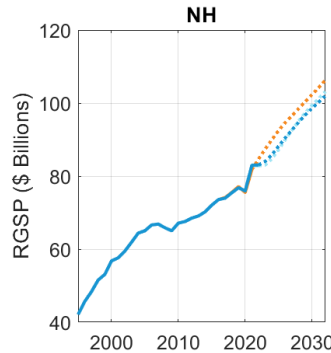
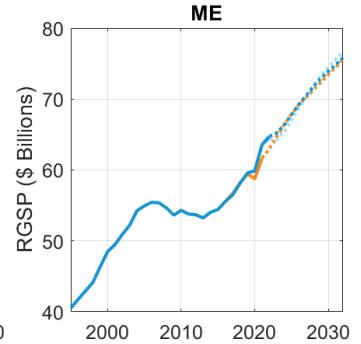
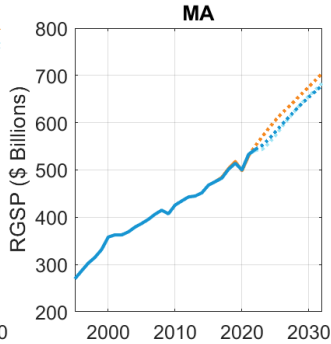
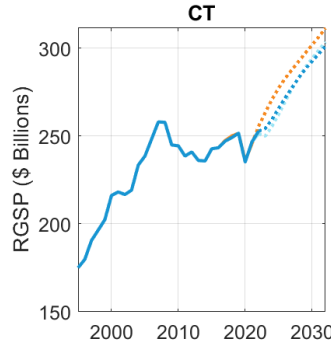
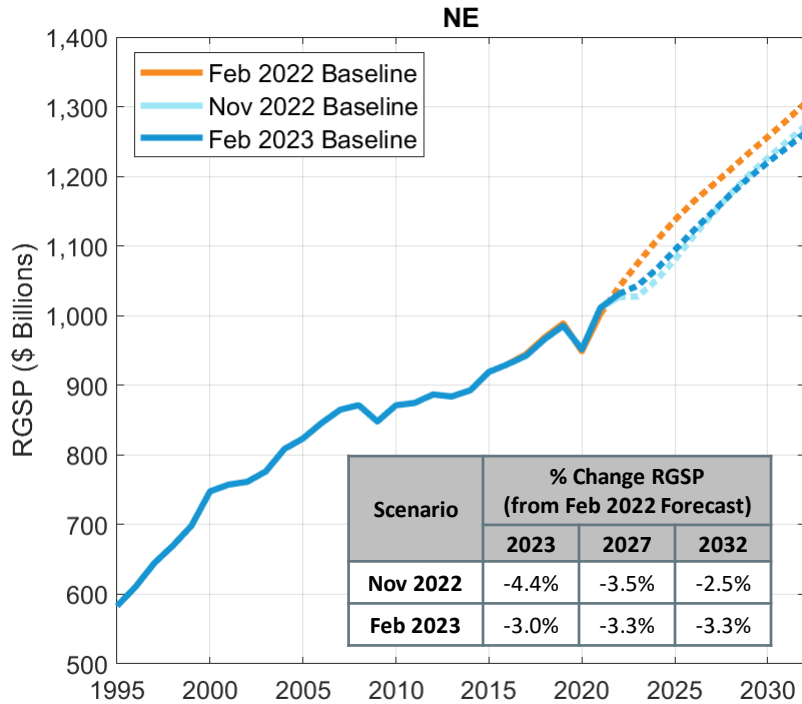


## Winter (December) PDR CSO



# Updated Economic Outlook

## Real Gross State Product



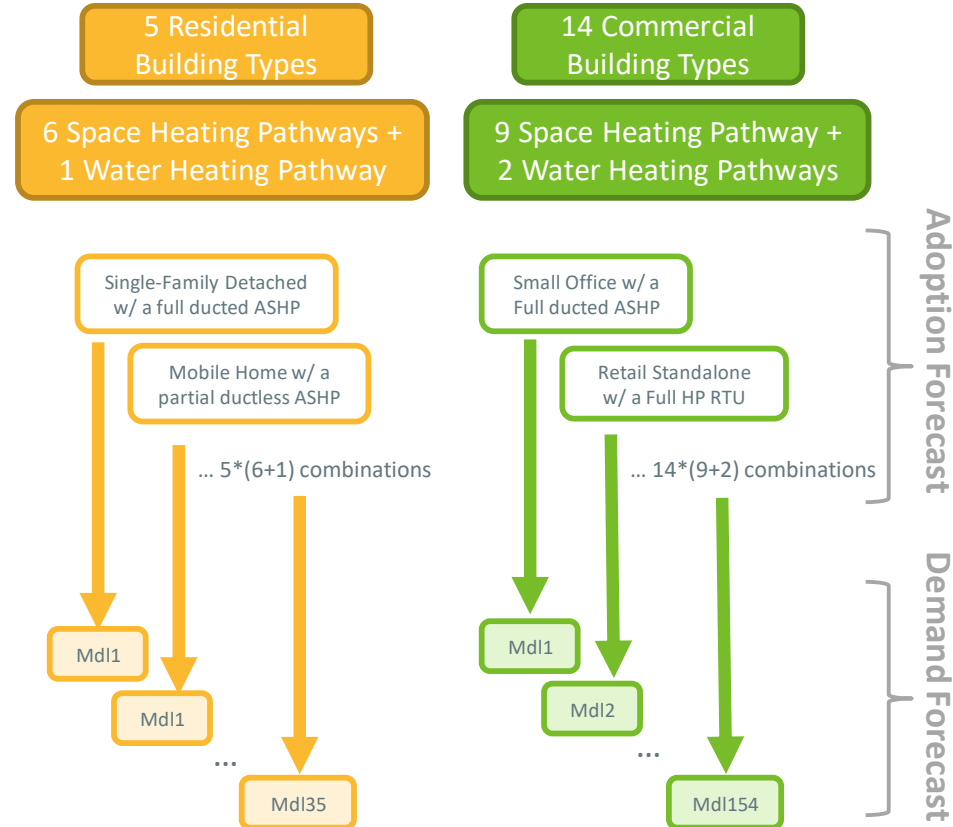


# Heating Electrification Forecast

## New Methodology for CELT 2023

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

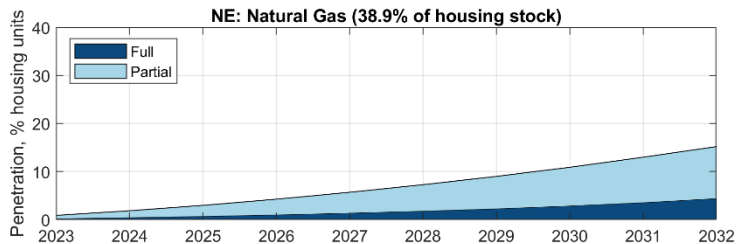
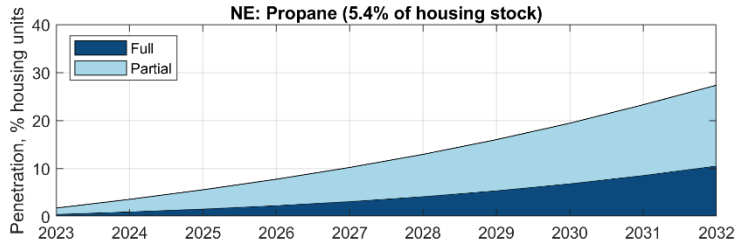
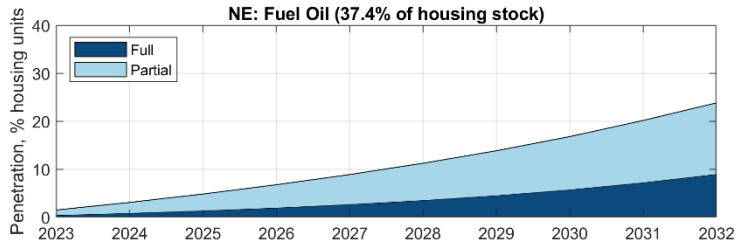
1. New England building stock characterization  
(refer to [November 7, 2022 slides](#))
  - Comprehensive characterization of the existing New England building stock
2. Development of “heating pathways”  
(refer to [November 7, 2022 slides](#))
  - Heating pathways specify a technology that could be used to either partially or fully electrify a given building’s space or water heating needs
3. Forecast of adoption along each “heating pathway”  
(refer to [December 9, 2022 slides](#))
  - Level of adoption of technologies along specified pathways for a variety of building types in the residential and commercial sectors
4. Hourly demand modeling  
(refer to [February 24, 2023 slides](#))
  - Captures the electric impacts of each adoption pathway for each building type in the residential and commercial sectors



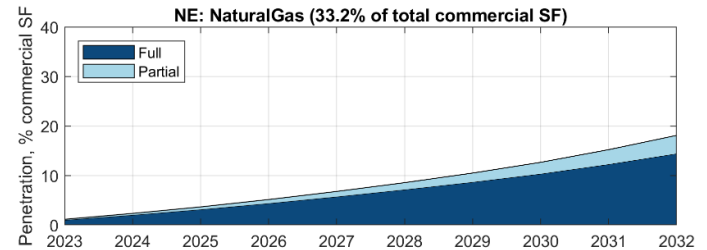
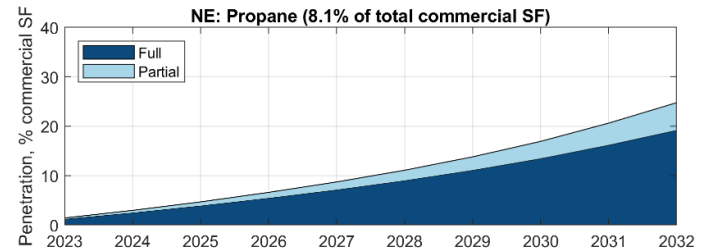
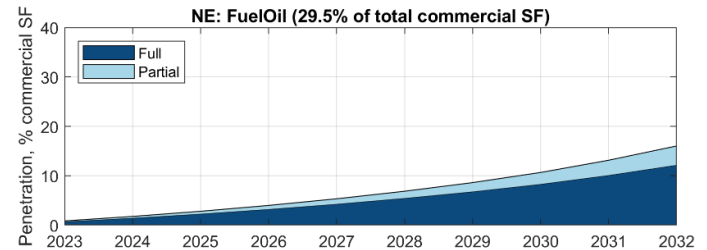
# Heating Electrification Forecast

## 2023 Final Draft Adoption Forecast: Space Heating by Existing Fuel

Residential



Commercial



# Transportation Electrification Forecast

## Updates to Methodology for CELT 2023

### Updated Adoption Forecast Methodology

Reflects all federal, state, and local programs, goals, and mandates, resulting in two adoption scenarios (refer to [December 9, 2022](#) slides):

#### “Full Electrification” adoption scenario

- This scenario is informational only (not directly used in the forecast)
- Intended to represent an upper bound on the pace and extent of EV adoption
- Assumes state ZEV (Zero Emissions Vehicle) goals are met entirely by electric vehicles
- Assumes all vehicles in each vehicle class are electrified by 2050

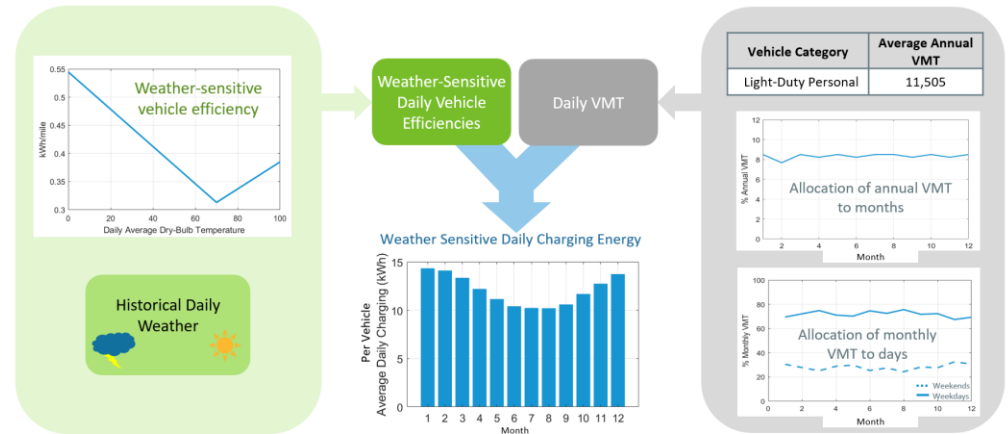
#### “CELT 2023” adoption scenario

- This scenario was used to generate the energy and demand impacts for the CELT 2023 forecast
- Intended to reflect the likely pace and level of EV adoption over the next 10 years
- Reflects uncertainty in the timing of goal achievement and extent to which electric vehicles will be utilized to accomplish goals

### Refined Weather-Responsiveness for Personal Light-Duty Vehicles

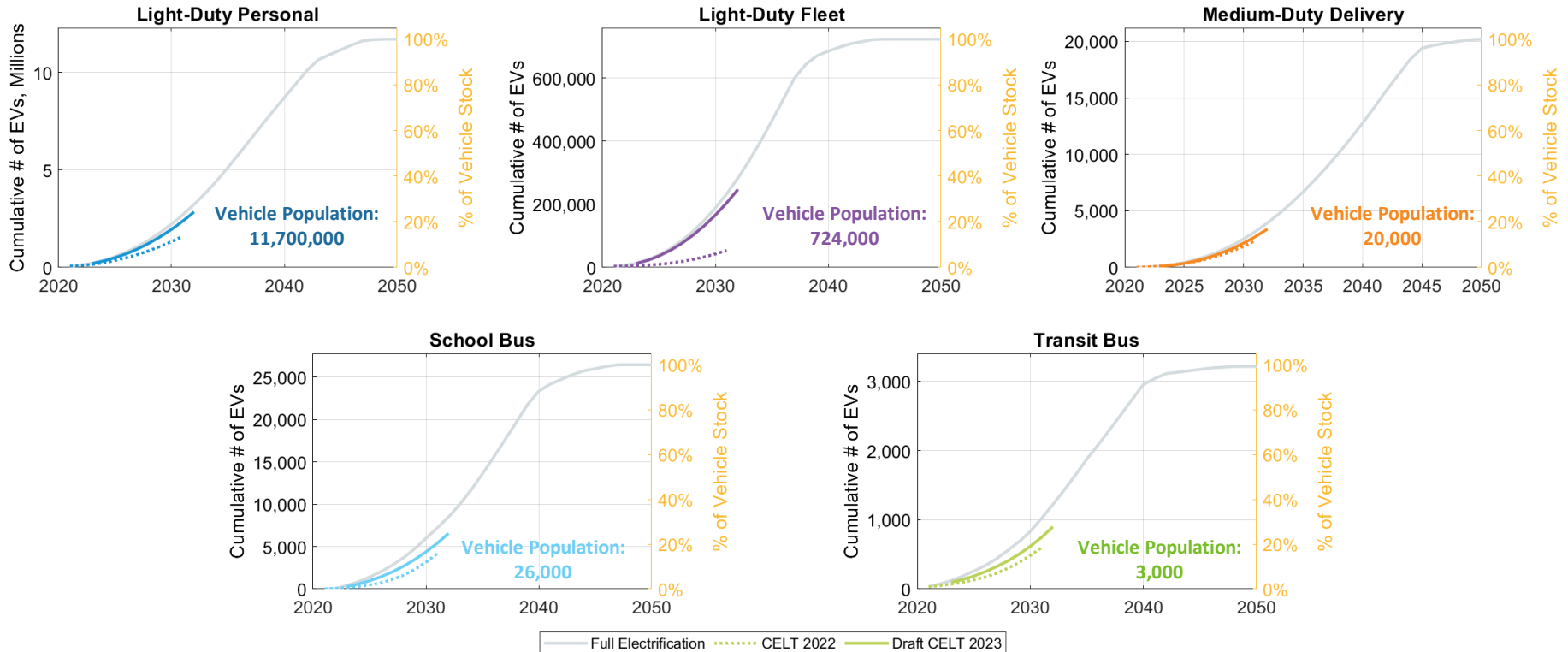
Energy and demand impacts of personal LDVs was revised to more dynamically incorporate the impacts of weather as well as the increased utilization of BEVs (refer to [November 7, 2022](#) slides)

- Weather sensitive vehicle efficiency curves (based on average daily dry-bulb temperature)
- Vehicle miles traveled (VMT)
- Hourly charging shapes indicating relative allocation of daily charging energy



# Transportation Electrification Forecast

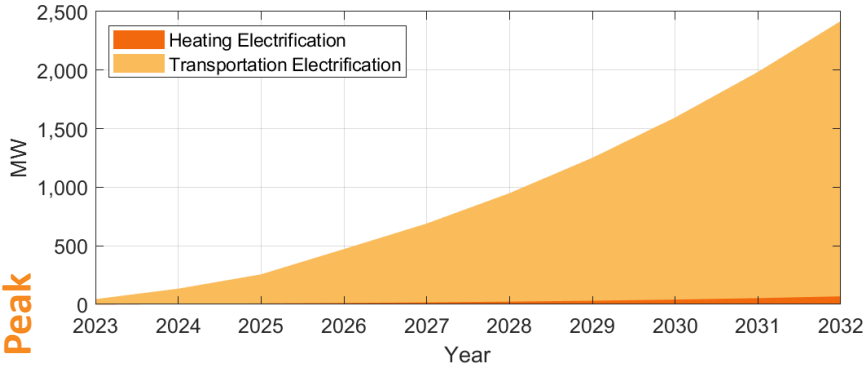
## 2023 Final Draft Adoption Forecast



# Electrification Forecast

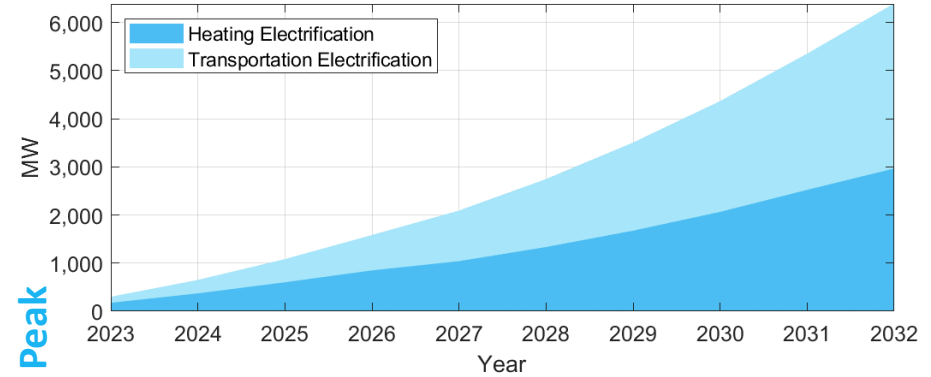
## 2023 Final Draft 50/50 Peak Demand

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

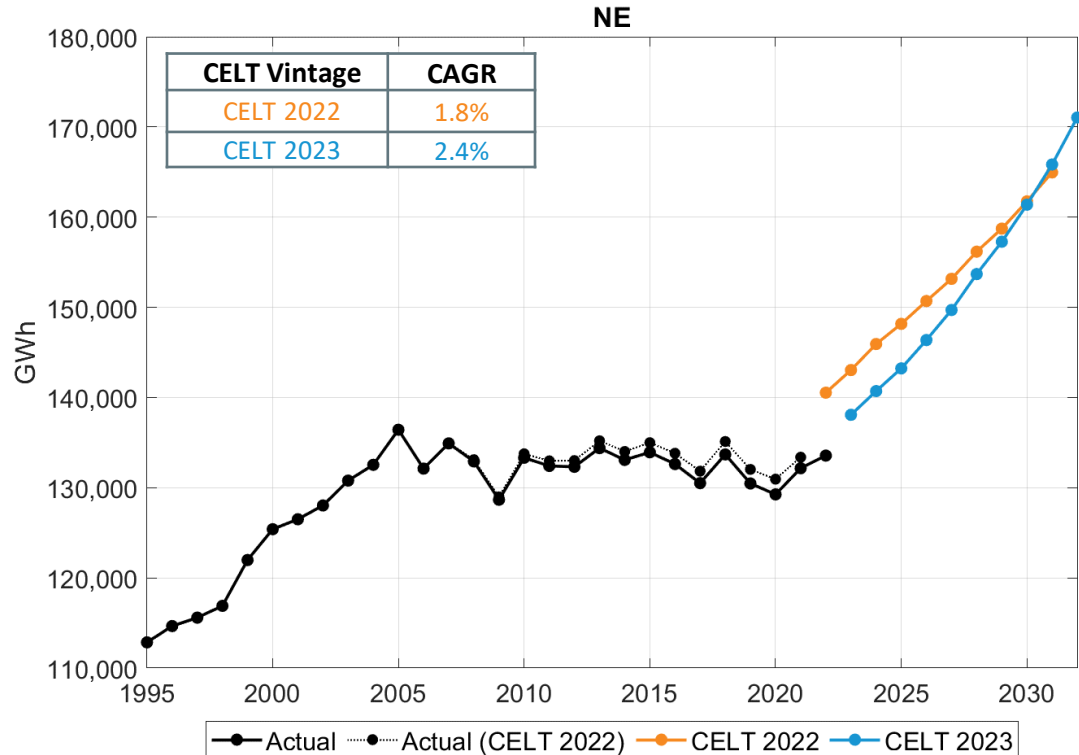


Year	Transportation Electrification			Heating Electrification		
	CELT 2022 (MW)	CELT 2023 (MW)	Change (MW)	CELT 2022 (MW)	CELT 2023 (MW)	Change (MW)
2023	50	116	66	75	175	100
2024	133	271	138	179	370	192
2025	244	473	229	311	601	290
2026	382	726	344	473	848	374
2027	549	1,042	493	668	1,040	372
2028	743	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	

# Annual Gross Energy Forecast

## New England - CELT 2023 Vs. CELT 2022

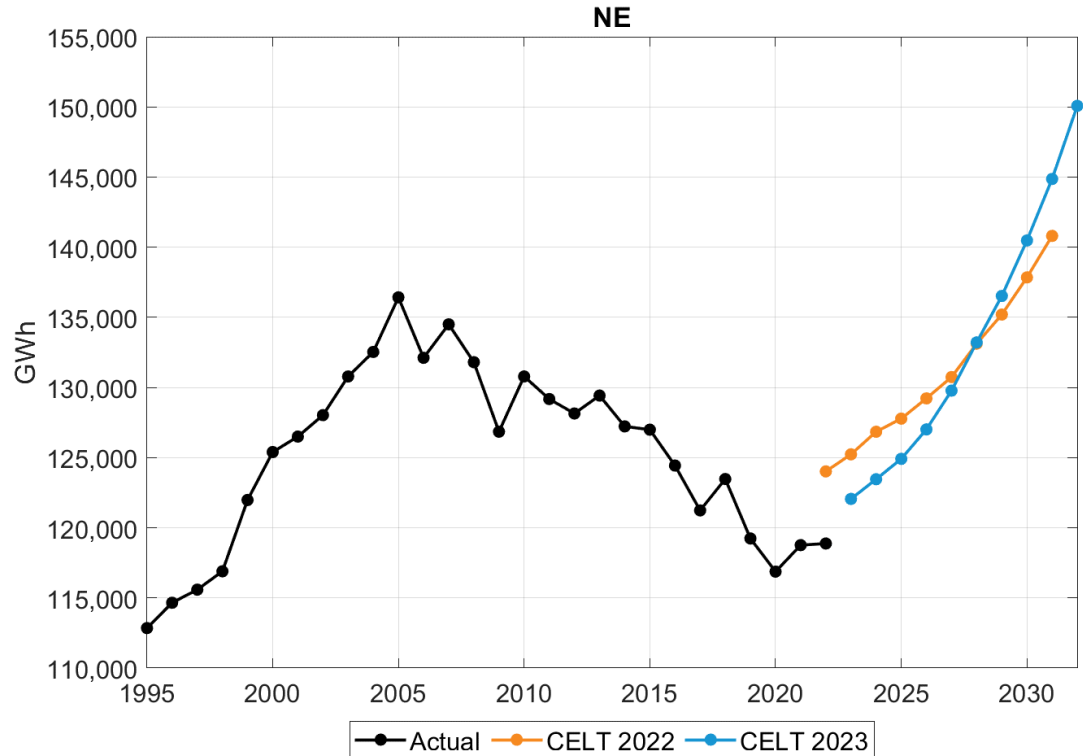
Year	Gross CELT 2022 (GWh)	Gross CELT 2023 (GWh)	Change (GWh)	Change (%)
2023	143,042	138,081	-4,961	-3.5%
2024	145,929	140,711	-5,218	-3.6%
2025	148,167	143,230	-4,937	-3.3%
2026	150,695	146,370	-4,326	-2.9%
2027	153,159	149,703	-3,456	-2.3%
2028	156,172	153,690	-2,483	-1.6%
2029	158,727	157,274	-1,453	-0.9%
2030	161,748	161,384	-364	-0.2%
2031	164,965	165,838	872	0.5%
2032		171,050		



# Annual Net Energy Forecast

*New England - CELT 2023 Vs. CELT 2022*

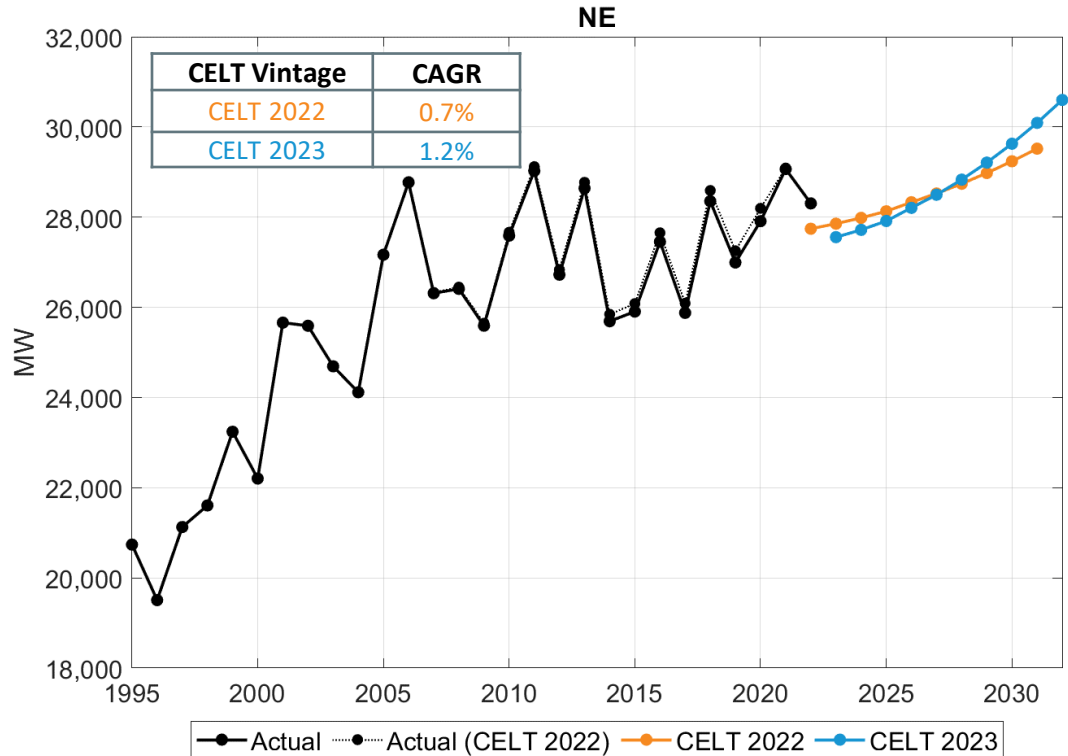
Year	Net CELT 2022 (GWh)	Net CELT 2023 (GWh)	Change (GWh)	Change (%)
2023	125,236	122,057	-3,179	-2.5%
2024	126,847	123,460	-3,387	-2.7%
2025	127,781	124,914	-2,867	-2.2%
2026	129,224	127,013	-2,211	-1.7%
2027	130,742	129,776	-966	-0.7%
2028	133,127	133,214	86	0.1%
2029	135,199	136,526	1,327	1.0%
2030	137,847	140,481	2,634	1.9%
2031	140,805	144,865	4,059	2.9%
2032		150,073		



# 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	

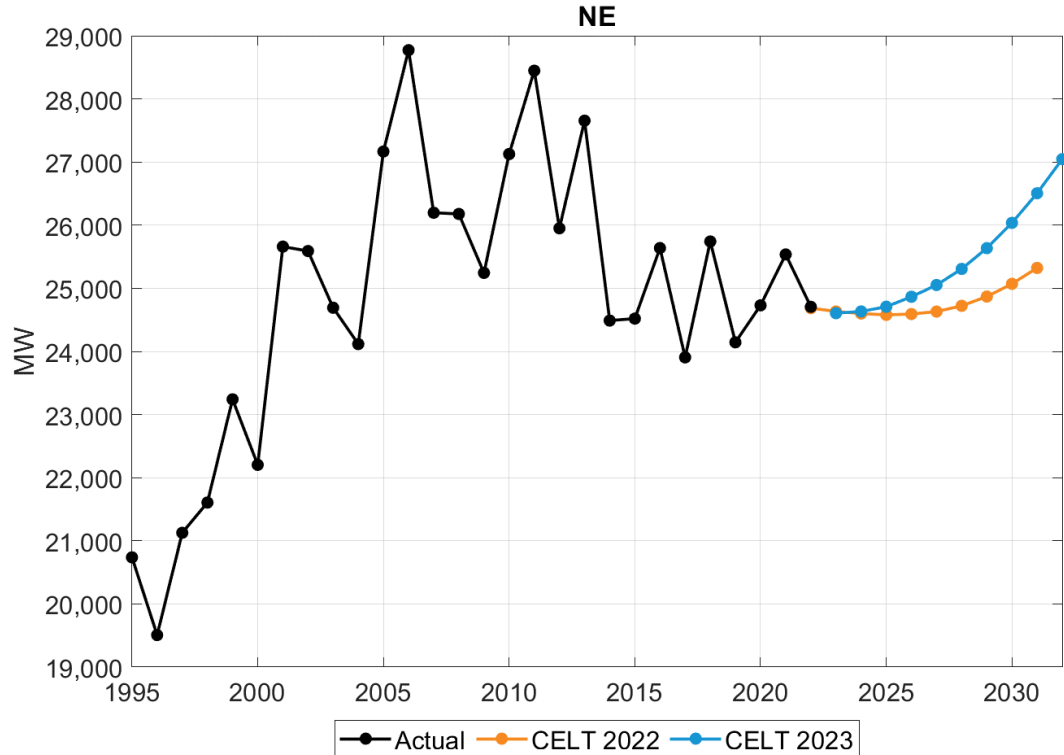




# Summer Net 50/50 Peak Forecast

*New England - CELT 2023 Vs. CELT 2022*

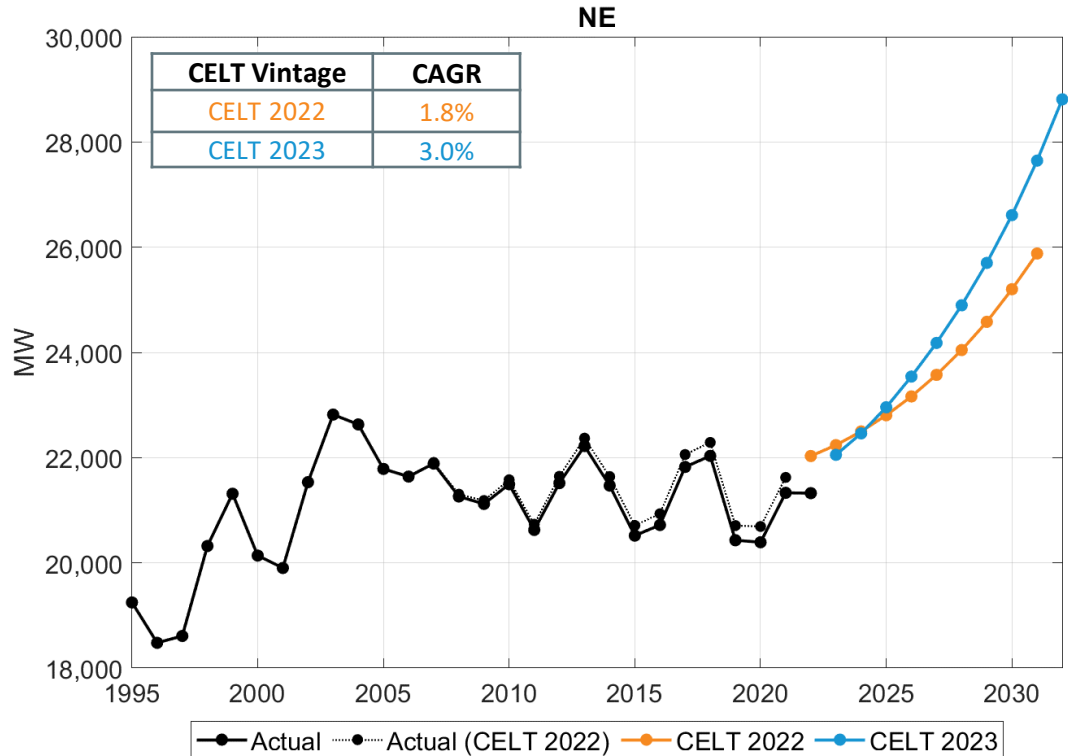
Year	Net CELT 2022 (MW)	Net CELT 2023 (MW)	Change (MW)	Change (%)
2023	24,633	24,605	-27	-0.1%
2024	24,600	24,633	33	0.1%
2025	24,579	24,708	129	0.5%
2026	24,592	24,866	274	1.1%
2027	24,631	25,052	421	1.7%
2028	24,722	25,307	585	2.4%
2029	24,869	25,636	767	3.1%
2030	25,071	26,036	965	3.9%
2031	25,322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



# Winter Gross 50/50 Peak Forecast

*New England - CELT 2023 Vs. CELT 2022*

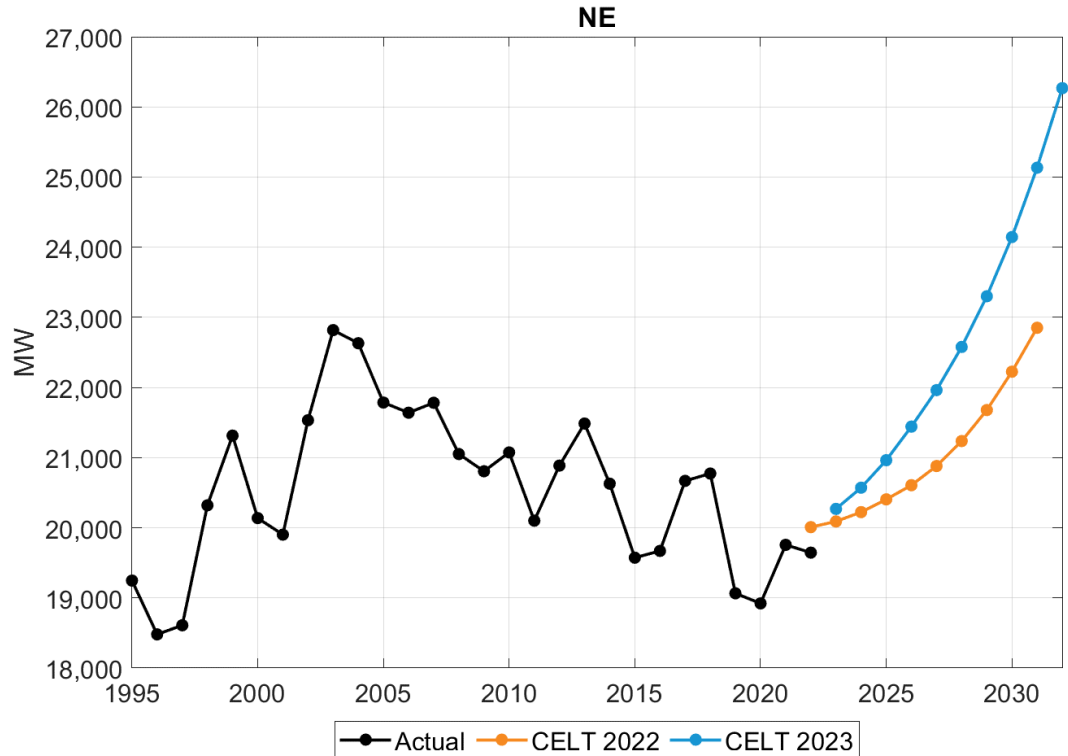
Year	Gross CELT 2022 (MW)	Gross CELT 2023 (MW)	Change (MW)	Change (%)
2023	22,238	22,053	-185	-0.8%
2024	22,498	22,461	-37	-0.2%
2025	22,806	22,958	152	0.7%
2026	23,164	23,541	378	1.6%
2027	23,573	24,180	607	2.6%
2028	24,045	24,896	851	3.5%
2029	24,581	25,701	1,120	4.6%
2030	25,201	26,610	1,409	5.6%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



# 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 will be available on the [Load Forecast webpage](#) by May 1, 2023
  - 2023 Forecast Data Workbook (see Appendix I for a description of data within each tab)
  - 2023 Forecast Itemization Workbook
- 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

