

# Final 2020 Energy Efficiency Forecast

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# INTRODUCTION

# Acronyms

- ARA 3 Third Annual Reconfiguration Auction (FCM)
- BCR Benefit-Cost Ratio
- CSO Capacity Supply Obligation (FCM)
- C&I Commercial and Industrial
- CELT 10-year forecast of Capacity, Energy, Loads and Transmission
- EE Energy Efficiency
- EEFWG Energy Efficiency Forecast Working Group
- FCA Forward Capacity Auction (FCM)
- FCM Forward Capacity Market
- ICR Installed Capacity Requirement
- PA Program Administrator
- R&L Residential and Low Income
- RGGI Regional Greenhouse Gas Initiative
- SBC System Benefit Charge

# Introduction

- This presentation contains the final EE forecast for the period 2021 through 2029
- The forecast estimates reductions in energy and demand from state-sponsored EE programs in the New England control area by state (CT, MA, ME, NH, RI, VT)
- The data used to create the forecast originates from state-sponsored EE program administrators (PAs) and state regulatory agencies
- The EE forecast is updated annually and is incorporated into the CELT report

# Introduction

## *Impacts*

- The EE forecast is used in ISO studies including:
  - Long-term transmission planning studies
  - Economic planning studies
- EE forecast will not impact:
  - ICR/Local Sourcing Requirement/Maximum Capacity Limit/Demand Curves
  - FCM auctions
  - FCM related reliability studies (qualification, de-list bid reliability reviews)



# MODEL METHODOLOGY



# Previous Model Methodology

## *Issues Identified in Prior EE Forecast Cycles*

- During the 2017, 2018, and 2019 EE forecast cycles, the ISO has highlighted a number of growing concerns with the prior EE forecast methodology
- Prior methodology does not incorporate any forward looking information about the evolving composition of measures used to achieve savings
  - Production costs were grown over the forecast horizon by a single, one-size fits all, escalator
  - Peak-to-energy ratios were based on history and remained static over the forecast horizon
- Prior methodology did not separately model winter peak savings
  - Winter peak savings were simply a proration of summer peak savings based on FCM values
- Prior methodology was very sensitive to changes in initial starting production costs
  - Resulted in the need for ISO adjustments in recent forecast(s)

# Updated EE Forecast Methodology

## Overview

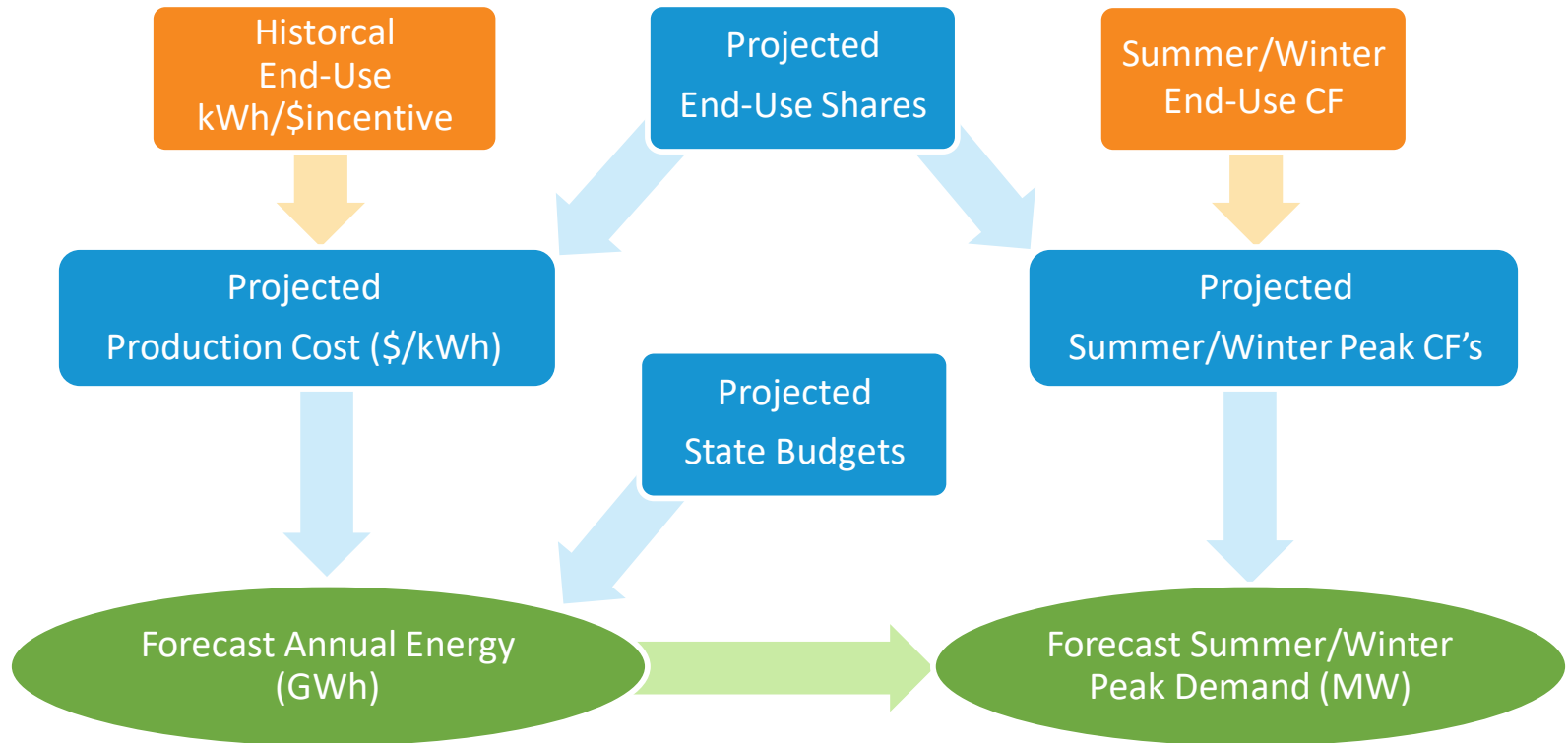
- At the September 13<sup>th</sup> and October 18<sup>th</sup> EEFWG meetings the ISO discussed proposed updates to the EE forecast model methodology
  - Savings will be modeled separately for two sectors
    - Residential & Low Income (R&L)
    - Commercial & Industrial (C&I)
  - Future program activity will be assumed to target end-uses in proportions that evolve over time (based on PA provided data)
  - Sector production costs will be a function of end-use shares
  - Sector energy savings will stem from weighted production costs applied to state budgets
  - Sector summer and winter peak savings will be derived separately based on weighted coincidence factors
- The updated model methodology continues to focus on traditional EE savings (i.e. not active demand reduction activities)
- Work to develop a separate mechanism for calculating savings from active demand reduction activities is ongoing, but had not been incorporated into the 2020 EE forecast



# Updated EE Forecast Methodology

## Process Diagram

- The process below is followed separately for each sector (R&L and C&I) using sector specific inputs in each of the orange blocks
- Summer and winter peak savings are computed separately using season-specific coincidence factors



# Updated EE Forecast Methodology

## *Features*

- The EE forecast continues to utilize a production cost model
- Updated methodology offers improvements to the way production costs are calculated
  - Reduces reliance on a production cost escalator
  - Incorporates forward looking projections of the measures/end-uses anticipated to be targeted by programs
  - Takes a sector specific approach, resulting in separate forecasts for each sector:
    - Commercial & Industrial (C&I)
    - Residential & Low Income (R&L)
- Updated methodology also offers enhancements in the method by which energy savings are converted into demand savings
  - Aggregates coincidence factors based on projected end-use shares
  - Summer and winter peak savings are derived based on seasonal coincidence factors

# INPUT DATA AND ASSUMPTIONS

*State End-Use Shares, Regional Coincidence Factors, and State Budgets*



# EE Forecast Input Data

- Historical end-use kWh/\$incentive
  - source: PA provided data (2013-2018)
- Historical incentives as a % of total program costs
  - source: PA provided data (2013-2018)
- Projected end-use shares
  - Source: PA provided data (new data request for EEF 2020)
- Summer and winter end-use coincidence factors
  - Source: PA provided BCR models (new data request for EEF 2020)
- Annual inflation adjustment of 2%
  - Source: Moody's Economics
- Annual graduated escalation of costs of 1.25%
  - Source: Original graduated rate introduced during the 2017 EE forecast

# ISO Request for Information

- On October 2, 2019 the ISO sent out a request for information to representatives from program administrators and the states
- Two components of this request formed key inputs into the 2020 EE forecast
  - Projected shares of planned savings (energy and peak) by sector and end-use through 2029
    - Used to develop sector-level end-use shares by state
  - BCR models
    - Used to extract regional end-use coincidence factors by sector
- Program administrators and states were very responsive to the initial request as well as to all follow-up communication

# End-Use Share Projections

- End-use shares by state and sector were compiled based on data provided by the PAs within each state
  - All PA's provided some form of shares
  - End-use shares shown on the following slides are based on energy
- Reporting of shares and end-uses varied widely within and across states
  - Some PAs were able to provide 10 year projections, others only were able to provide 1-2 year projections
  - Some PAs mapped measures to end-uses, some did not
  - Some PAs within a given state had very different shares for the same end-uses
- The ISO aimed to directly use the shares as provided by the PAs within each state as much as possible
  - Where shares differed, shares from PAs within a state were roughly averaged
  - When only one PA provided a 10 year projection, that projection guided the shares
  - No cutoff was imposed on the end of lighting in the R&L or C&I sectors
- In order to standardize end-uses across all states and PA's, the following aggregations were applied
  - Residential "process" includes: process, custom, food service, motors/drives, pool pumps, and appliances
  - Residential "HVAC" includes: HVAC and building envelope
  - C&I "process" includes: process and food service

# Residential & Low Income End-Use Shares

*MA, CT, and RI*

Massachusetts										
End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
HVAC	7%	6%	9%	13%	16%	21%	21%	21%	21%	21%
Process	9%	15%	23%	32%	40%	51%	51%	51%	51%	51%
Hot Water	2%	3%	4%	6%	7%	9%	9%	9%	9%	9%
Lighting	79%	71%	55%	38%	23%	0%	0%	0%	0%	0%
Refrigeration	3%	5%	8%	12%	14%	19%	19%	19%	19%	19%
Connecticut										
End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
HVAC	16%	16%	16%	20%	28%	33%	38%	46%	46%	46%
Process	20%	20%	20%	25%	26%	32%	37%	40%	40%	40%
Hot Water	4%	4%	4%	4%	4%	4%	4%	8%	8%	8%
Lighting	60%	60%	60%	49%	40%	29%	19%	0%	0%	0%
Refrigeration	1%	1%	1%	2%	2%	2%	2%	6%	6%	6%
Rhode Island										
End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Hot Water	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%
HVAC	4%	8%	12%	16%	20%	26%	26%	26%	26%	26%
Lighting	83%	71%	55%	38%	23%	0%	0%	0%	0%	0%
Process	9%	16%	25%	34%	42%	55%	55%	55%	55%	55%
Refrigeration	3%	5%	8%	12%	14%	19%	19%	19%	19%	19%

# Residential & Low Income End-Use Shares

*VT, NH, and ME*

Vermont										
End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
HVAC	12%	15%	17%	18%	20%	22%	24%	26%	27%	30%
Hot Water	10%	12%	7%	8%	8%	8%	8%	7%	7%	7%
Lighting	40%	33%	31%	21%	21%	19%	18%	17%	15%	15%
Refrigeration	3%	3%	2%	2%	2%	2%	2%	2%	2%	1%
Process	35%	38%	43%	50%	49%	50%	49%	47%	49%	47%

New Hampshire										
End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Process	2%	3%	3%	3%	4%	4%	4%	5%	5%	5%
Hot Water	14%	17%	19%	21%	25%	27%	28%	29%	29%	29%
HVAC	25%	30%	35%	38%	44%	48%	50%	53%	53%	53%
Lighting	53%	42%	34%	27%	16%	8%	4%	0%	0%	0%
Refrigeration	6%	8%	9%	10%	11%	12%	13%	14%	14%	14%

Maine										
End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Process	2%	2%	2%	4%	7%	9%	11%	11%	11%	11%
Hot Water	16%	16%	16%	33%	51%	69%	86%	86%	86%	86%
HVAC	1%	1%	1%	1%	2%	2%	3%	3%	3%	3%
Lighting	82%	82%	82%	62%	41%	21%	0%	0%	0%	0%



# Commercial & Industrial End-Use Shares

*MA, CT, and RI*

## Massachusetts

End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Compressed Air	1%	2%	2%	3%	3%	3%	3%	3%	3%	3%
Custom Measures	26%	27%	36%	44%	49%	53%	53%	53%	53%	53%
HVAC	9%	11%	15%	18%	20%	20%	20%	20%	20%	20%
Lighting	58%	51%	35%	21%	12%	6%	6%	6%	6%	6%
Motors/Drives	3%	5%	6%	7%	8%	9%	9%	9%	9%	9%
Refrigeration	1%	2%	2%	3%	3%	3%	3%	3%	3%	3%
Process	2%	3%	4%	5%	6%	6%	6%	6%	6%	6%

## Connecticut

End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
HVAC	18%	18%	18%	23%	28%	32%	37%	40%	44%	46%
Process	14%	14%	14%	19%	24%	29%	34%	36%	38%	38%
Motors/Drives	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Lighting	63%	63%	63%	52%	42%	33%	23%	18%	12%	10%
Refrigeration	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%

## Rhode Island

End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Compressed Air	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%
Custom Measures	26%	39%	52%	63%	70%	79%	79%	79%	79%	79%
HVAC	3%	5%	7%	8%	9%	10%	10%	10%	10%	10%
Lighting	67%	50%	34%	20%	11%	0%	0%	0%	0%	0%
Motors/Drives	3%	4%	5%	6%	7%	8%	8%	8%	8%	8%
Refrigeration	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%

# Commercial & Industrial End-Use Shares

*VT, NH, and ME*

## Vermont

End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
HVAC	15%	16%	17%	18%	20%	21%	20%	21%	21%	20%
Hot Water	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Process	12%	13%	13%	13%	13%	13%	14%	15%	15%	15%
Lighting	53%	48%	45%	41%	36%	33%	30%	28%	27%	27%
Motors/Drives	11%	13%	13%	15%	16%	16%	16%	17%	17%	17%
Refrigeration	8%	9%	10%	12%	14%	16%	17%	17%	18%	18%

## New Hampshire

End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Custom Measures	1%	1%	2%	2%	2%	2%	2%	2%	2%	2%
Hot Water	0.2%	0.3%	0.3%	0.4%	0.4%	0.4%	0.5%	0.5%	0.5%	0.5%
HVAC	11%	18%	23%	27%	29%	31%	34%	34%	34%	34%
Lighting	70%	53%	39%	30%	24%	19%	11%	11%	11%	11%
Motors/Drives	0.2%	0.4%	0.5%	1%	1%	1%	1%	1%	1%	1%
Process	17%	27%	35%	40%	44%	46%	51%	51%	51%	51%
Refrigeration	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%

## Maine

End-Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Lighting	70%	70%	70%	58%	47%	35%	24%	12%	12%	12%
Compressed Air	5%	5%	5%	8%	12%	16%	20%	24%	24%	24%
HVAC	24%	24%	24%	30%	37%	43%	49%	56%	56%	56%
Custom	2%	2%	2%	3%	4%	6%	7%	9%	9%	9%

# End-Use Starting kWh/\$Incentive

Source: PA Supplied Data (2013-2018)

Residential & Low Income	
End-Use	kWh/\$Incentive
HVAC	0.49
Water Heating	2.15
Lighting	3.52
Refrigeration	2.47
Process	2.23

Commercial & Industrial	
End-Use	kWh/\$Incentive
HVAC	3.21
Water Heating	3.68
Lighting	3.69
Refrigeration	3.79
Process	3.67
Compressed Air	3.58
Motors/Drives	4.66
Custom	2.94

# End-Use Coincidence Factors

Source: PA Supplied BCR Models (Current State Plans)

Residential & Low Income		
End-Use	Summer Coincidence Factor (MW/GWh)	Winter Coincidence Factor (MW/GWh)
HVAC	0.559	0.464
Water Heating	0.102	0.163
Lighting	0.102	0.177
Refrigeration	0.158	0.101
Process	0.245	0.280

Commercial & Industrial		
End-Use	Summer Coincidence Factor (MW/GWh)	Winter Coincidence Factor (MW/GWh)
HVAC	0.504	0.338
Water Heating	0.078	0.168
Lighting	0.116	0.109
Refrigeration	0.117	0.114
Process	0.094	0.077
Compressed Air	0.162	0.113
Motors/Drives	0.133	0.125
Custom	0.094	0.079

# State EE Budgets

Source: State EE Budget Administrators

Total R&L Budget Dollars (\$1000's)							
	NE	MA	CT	ME	RI	VT	NH
<b>2021</b>	576,072	345,925	85,422	16,623	68,221	25,923	33,958
<b>2022</b>	576,914	345,925	85,503	17,059	68,221	26,248	33,958
<b>2023</b>	577,351	345,925	85,587	17,059	68,221	26,601	33,958
<b>2024</b>	577,685	345,925	85,511	17,059	68,221	27,011	33,958
<b>2025</b>	578,432	345,925	85,141	17,059	68,221	28,128	33,958
<b>2026</b>	577,891	345,925	84,228	17,059	68,221	28,500	33,958
<b>2027</b>	576,622	345,925	82,843	17,059	68,221	28,616	33,958
<b>2028</b>	577,560	345,925	82,629	17,059	68,221	29,768	33,958
<b>2029</b>	576,639	345,925	81,313	17,059	68,221	30,163	33,958

Total C&I Budget Dollars (\$1000's)							
	NE	MA	CT	ME	RI	VT	NH
<b>2021</b>	607,982	355,456	117,848	28,508	41,593	29,233	35,344
<b>2022</b>	609,087	355,456	118,046	29,049	41,593	29,599	35,344
<b>2023</b>	610,560	355,456	118,250	29,049	41,593	30,868	35,344
<b>2024</b>	610,482	355,456	118,581	29,049	41,593	30,459	35,344
<b>2025</b>	611,842	355,456	118,681	29,049	41,593	31,719	35,344
<b>2026</b>	612,333	355,456	118,752	29,049	41,593	32,139	35,344
<b>2027</b>	612,721	355,456	119,010	29,049	41,593	32,269	35,344
<b>2028</b>	612,448	355,456	117,438	29,049	41,593	33,568	35,344
<b>2029</b>	603,243	355,456	107,787	29,049	41,593	34,014	35,344

Total Budget Dollars (\$1000's)							
	NE	MA	CT	ME	RI	VT	NH
<b>2021</b>	1,184,056	701,382	203,270	45,131	109,814	55,156	69,303
<b>2022</b>	1,186,003	701,382	203,550	46,108	109,814	55,847	69,303
<b>2023</b>	1,187,912	701,382	203,836	46,108	109,814	57,470	69,303
<b>2024</b>	1,188,167	701,382	204,092	46,108	109,814	57,470	69,303
<b>2025</b>	1,190,274	701,382	203,821	46,108	109,814	59,847	69,303
<b>2026</b>	1,190,225	701,382	202,980	46,108	109,814	60,639	69,303
<b>2027</b>	1,189,344	701,382	201,854	46,108	109,814	60,885	69,303
<b>2028</b>	1,190,009	701,382	200,067	46,108	109,814	63,336	69,303
<b>2029</b>	1,179,883	701,382	189,100	46,108	109,814	64,177	69,303

# State EE Production Costs

*Source: End-use shares applied to end-use production costs*

R&L Production Costs (\$/MWh)						
	MA	CT	ME	RI	VT	NH
2021	672	942	510	708	1,005	1,356
2022	841	996	539	900	1,106	1,575
2023	1,048	1,221	656	1,135	1,259	1,806
2024	1,270	1,595	796	1,386	1,412	2,175
2025	1,627	1,953	966	1,794	1,607	2,532
2026	1,802	2,387	1,174	1,987	1,874	2,899
2027	2,018	3,086	1,315	2,226	2,195	3,363
2028	2,286	3,494	1,489	2,521	2,549	3,809
2029	2,617	4,001	1,705	2,886	3,058	4,361

C&I Production Costs (\$/MWh)						
	MA	CT	ME	RI	VT	NH
2021	459	436	444	468	426	439
2022	496	461	469	510	449	468
2023	542	497	509	559	480	504
2024	594	542	558	614	520	547
2025	656	597	620	685	568	601
2026	726	666	695	759	627	670
2027	813	749	789	850	700	750
2028	921	853	893	962	797	849
2029	1,055	980	1,023	1,102	908	972

Weighted Production Costs (\$/MWh)						
	MA	CT	ME	RI	VT	NH
2021	544	563	466	593	584	657
2022	622	596	493	698	623	714
2023	711	661	555	816	673	779
2024	805	749	628	940	739	864
2025	929	841	714	1,112	816	960
2026	1,029	950	819	1,232	912	1,047
2027	1,153	1,087	926	1,380	1,030	1,211
2028	1,305	1,240	1,049	1,563	1,177	1,371
2029	1,495	1,451	1,201	1,789	1,359	1,570

# FINAL 2020 EE FORECAST

*Annual Energy, Summer Peak, and Winter Peak Savings*

# Final 2020 EE Forecast

## *Annual Energy, Summer Peak, and Winter Peak Savings*

Annual Energy Savings (GWh)							
	NE	CT	MA	ME	NH	RI	VT
<b>2021</b>	2,133	361	1,290	97	106	185	94
<b>2022</b>	1,908	342	1,128	94	97	157	90
<b>2023</b>	1,686	308	986	83	89	135	85
<b>2024</b>	1,492	273	871	73	80	117	78
<b>2025</b>	1,306	242	755	65	72	99	73
<b>2026</b>	1,171	214	681	56	65	89	66
<b>2027</b>	1,040	186	608	50	57	80	59
<b>2028</b>	917	161	537	44	51	70	54
<b>2029</b>	789	130	469	38	44	61	47
<b>Total (2021-2029)</b>	12,443	2,217	7,326	600	660	993	647
<b>Average (2021-2029)</b>	1,382	246	814	67	73	110	72

Summer Peak Demand Savings (MW)							
	NE	CT	MA	ME	NH	RI	VT
<b>2021</b>	341	63	198	17	18	27	18
<b>2022</b>	330	59	194	16	17	26	18
<b>2023</b>	316	58	186	16	15	24	17
<b>2024</b>	299	56	175	16	14	22	16
<b>2025</b>	278	53	160	16	13	20	16
<b>2026</b>	251	49	144	15	11	18	14
<b>2027</b>	227	45	129	14	10	16	13
<b>2028</b>	202	40	114	13	9	14	12
<b>2029</b>	174	33	99	11	8	13	10
<b>Total (2021-2029)</b>	2,420	457	1,400	135	114	180	134
<b>Average (2021-2029)</b>	269	51	156	15	13	20	15

Winter Peak Demand Savings (MW)							
	NE	CT	MA	ME	NH	RI	VT
<b>2021</b>	339	59	203	16	14	30	17
<b>2022</b>	312	56	185	16	13	26	16
<b>2023</b>	287	53	168	15	12	23	16
<b>2024</b>	262	49	152	14	11	21	15
<b>2025</b>	234	45	134	13	10	18	14
<b>2026</b>	212	42	121	12	9	16	12
<b>2027</b>	189	37	108	11	8	14	11
<b>2028</b>	168	33	95	10	7	13	10
<b>2029</b>	144	27	83	8	6	11	9
<b>Total (2021-2029)</b>	2,148	403	1,249	115	90	172	119
<b>Average (2021-2029)</b>	239	45	139	13	10	19	13



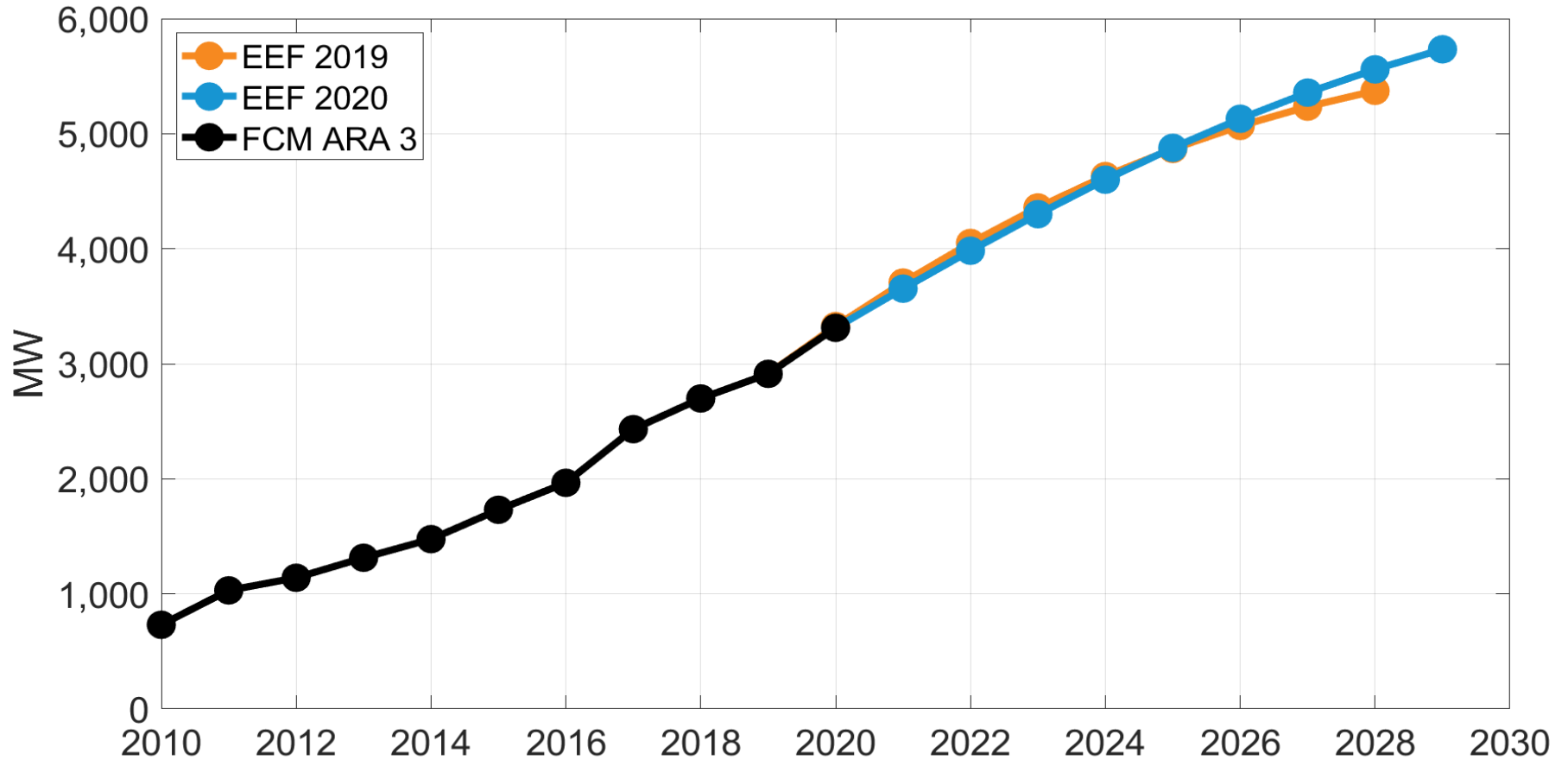
# EE Forecast Comparison

## Final 2019 EE Forecast Vs. Final 2020 EE Forecast

Total EE Dollars (1000s)	NE	MA	CT	ME	RI	VT	NH
<b>2019 EE Forecast</b>							
Total (2020-2028)	10,608,350	6,381,474	1,832,704	415,565	979,362	524,007	475,238
Average (2020-2028)	1,178,706	709,053	203,634	46,174	108,818	58,223	52,804
<b>2020 EE Forecast</b>							
Total (2021-2029)	10,685,873	6,312,434	1,812,570	413,995	988,326	534,827	623,723
Average (2021-2029)	1,187,319	701,382	201,397	45,999	109,814	59,425	69,303
Energy Savings (GWh)	NE	MA	CT	ME	RI	VT	NH
<b>2019 EE Forecast</b>							
Total (2020-2028)	17,457	10,547	2,658	891	1,597	914	850
Average (2020-2028)	1,940	1,172	295	99	177	102	94
<b>2020 EE Forecast</b>							
Total (2021-2029)	12,443	7,326	2,217	600	993	647	660
Average (2021-2029)	1,383	814	246	67	110	72	73
Summer Peak Savings (MW)	NE	MA	CT	ME	RI	VT	NH
<b>2019 EE Forecast</b>							
Total (2020-2028)	2,460	1,500	383	146	210	101	120
Average (2020-2028)	273	167	43	16	23	11	13
<b>2020 EE Forecast</b>							
Total (2021-2029)	2,420	1,400	457	135	180	134	114
Average (2021-2029)	269	156	51	15	20	15	13
Winter Peak Savings (MW)	NE	MA	CT	ME	RI	VT	NH
<b>2019 EE Forecast</b>							
Total (2020-2028)	2,340	1,426	370	137	207	98	101
Average (2020-2028)	260	158	41	15	23	11	11
<b>2020 EE Forecast</b>							
Total (2021-2029)	2,146	1,249	403	115	172	119	88
Average (2021-2029)	238	139	45	13	19	13	10

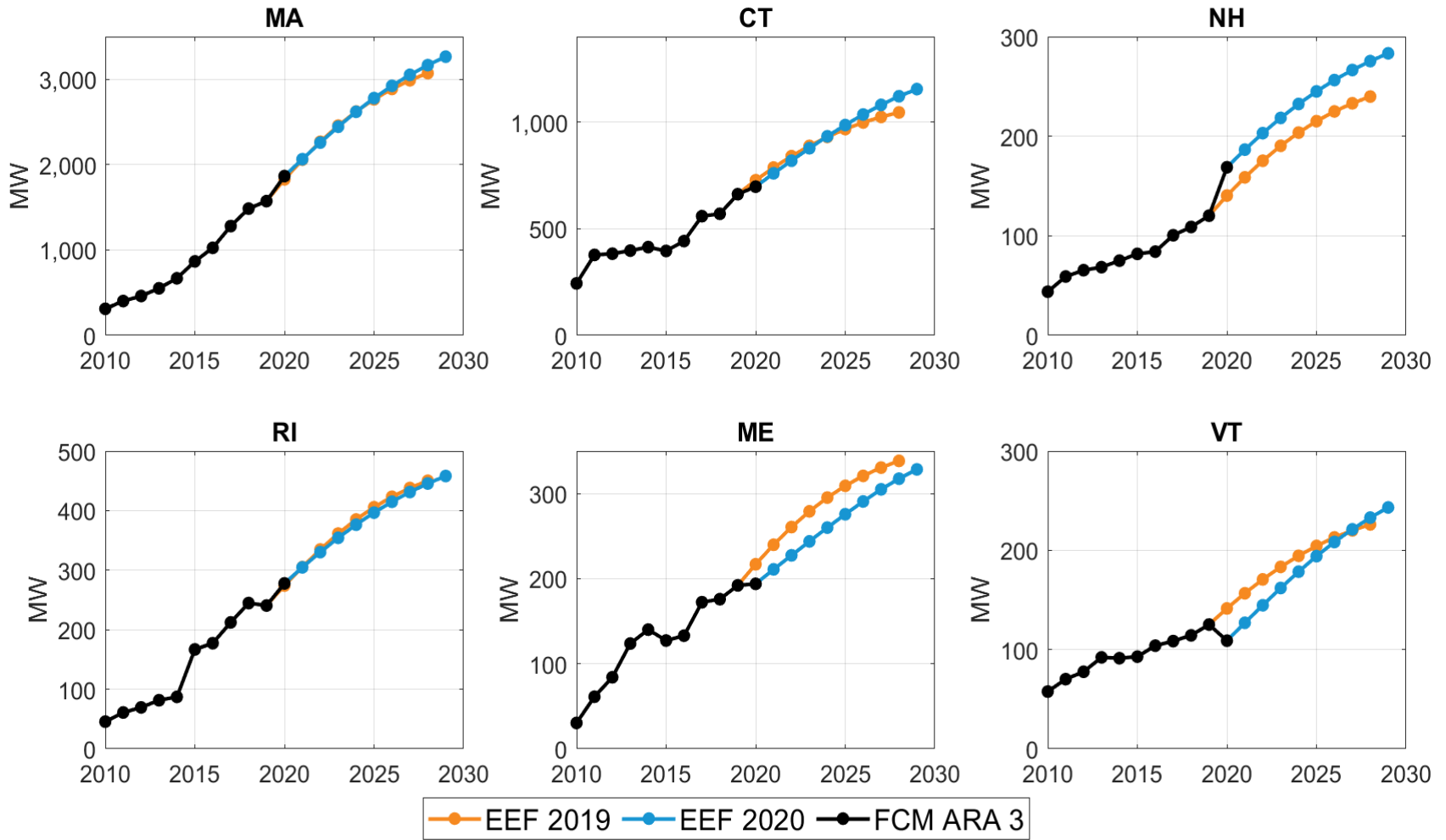
# Energy Efficiency on Summer Peak

*New England*



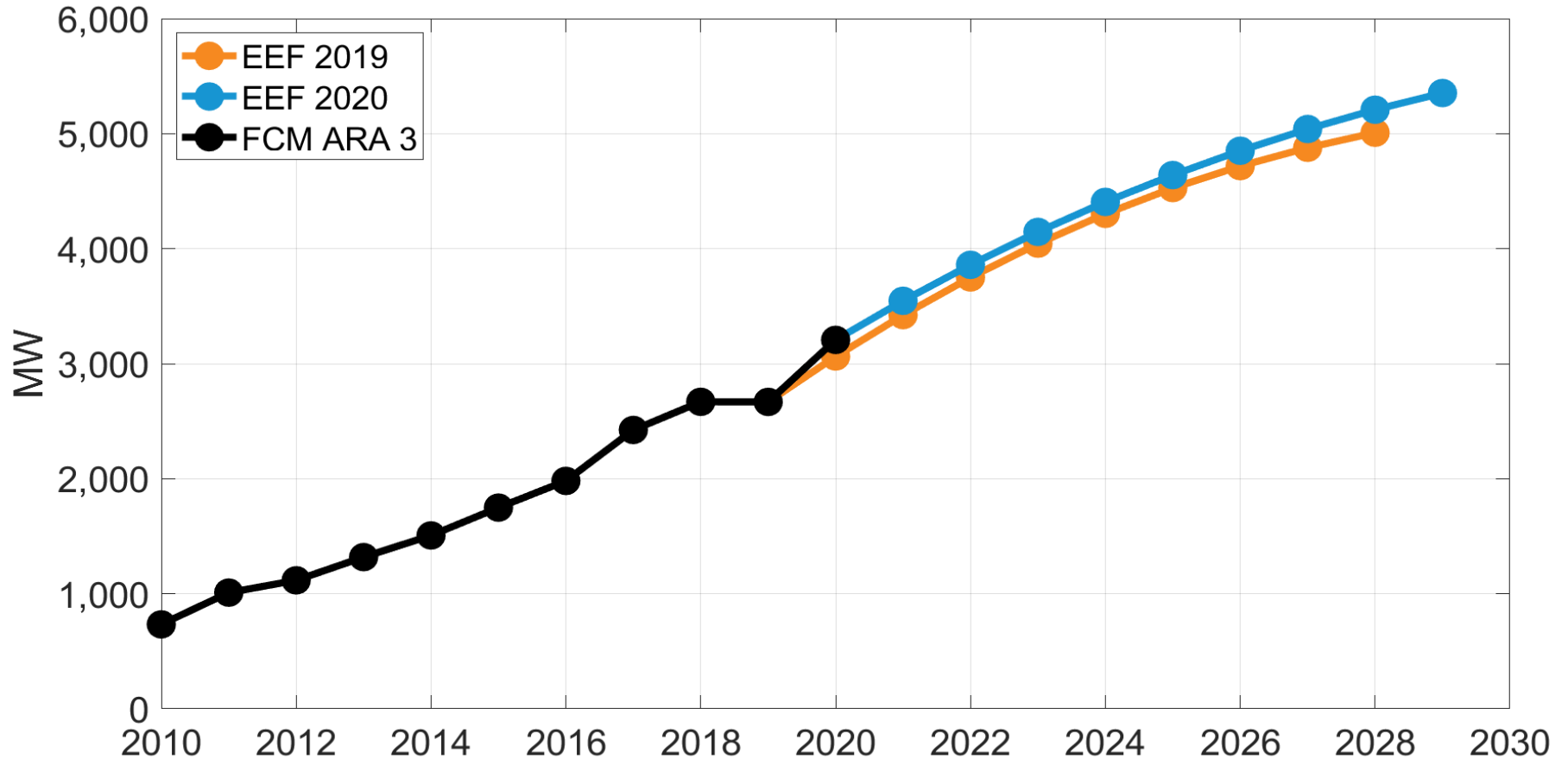
# Energy Efficiency on Summer Peak

## *New England*



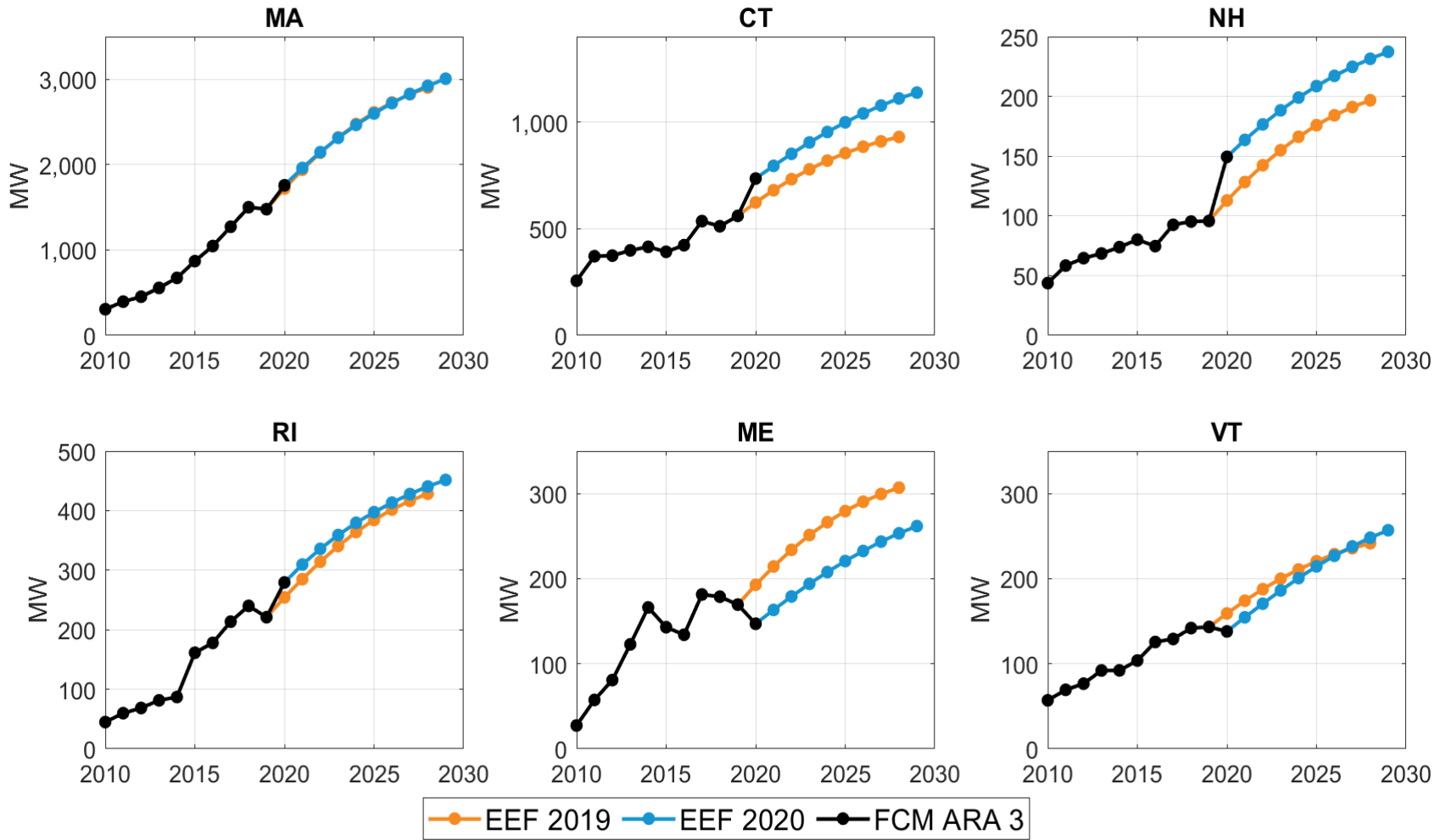
# Energy Efficiency on Winter Peak

*New England*



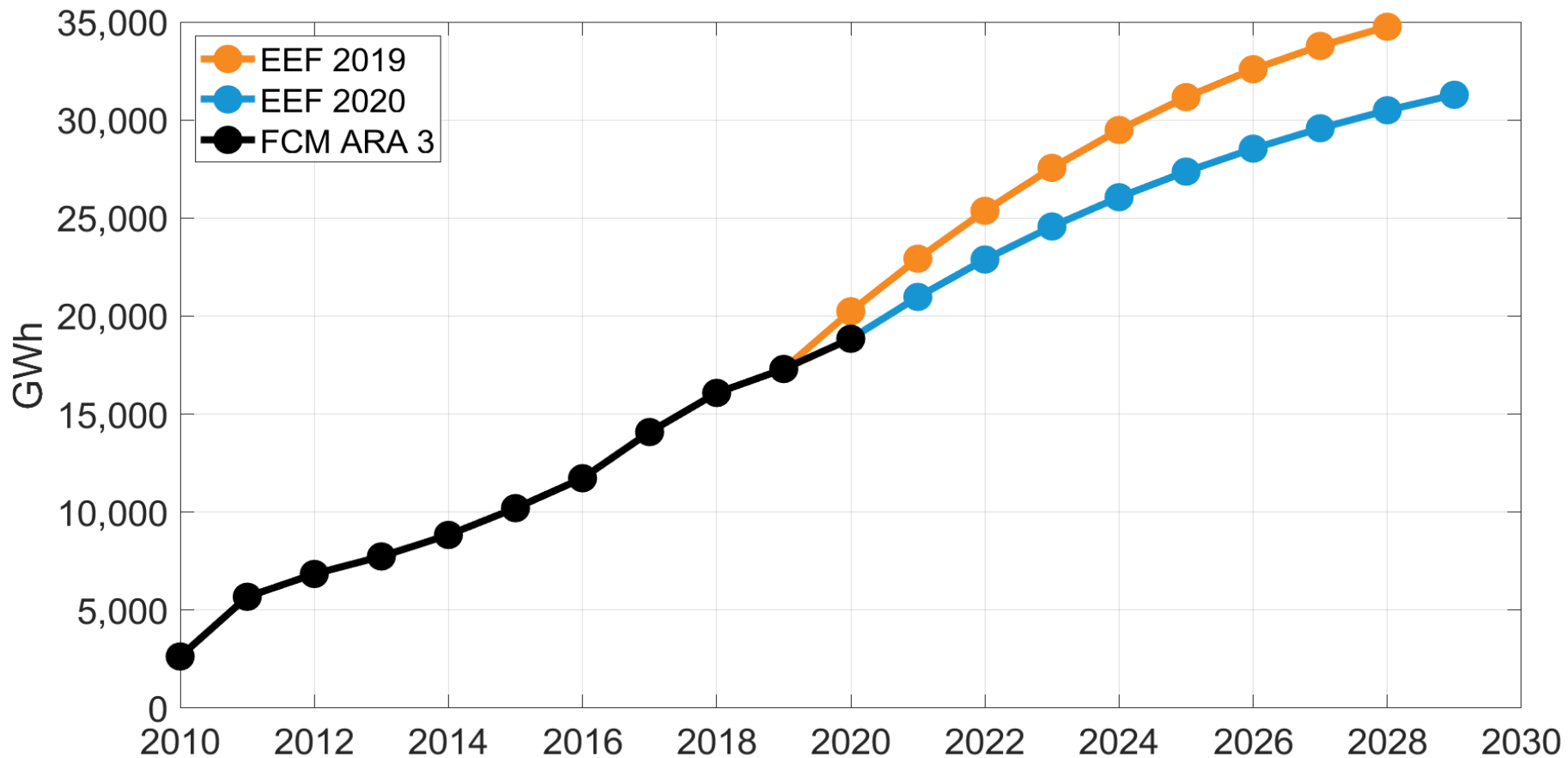
# Energy Efficiency on Winter Peak

## States



# Energy Efficiency on Annual Energy

*New England*



# Energy Efficiency on Annual Energy

## States

