



2018 Economic and Draft Annual Energy Forecast

NEPOOL Load Forecast Committee

Load Forecast Group



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Introduction

- ISO has developed draft 2018 energy forecasts for discussion with the Load Forecast Committee
- ISO uses reconstituted loads to estimate both gross annual energy and gross peak demand forecast models
 - Reconstitution is done for load reductions from passive demand resources (PDR), price responsive demand resources (PRD), behind-the-meter PV (BTM PV), and any OP4/Audit events
 - The term “gross” load implies reconstitution
 - The term “net” load implies net of PDR, PRD and BTM PV and is representative of demand observed in real-time
- All forecasts described herein are draft and subject to change



2018 Load Forecast Development Timeline

- Activities completed to date:
 - October 2017 – Received Moody’s Macroeconomic Forecast
 - November 2017 – Published Moody’s forecast to LFC website:
https://www.iso-ne.com/static-assets/documents/2017/11/econ_variable_comp_2017fcst_vs_2016fcst.xlsx
 - November 16, 2017 – Moody’s presentation at PAC:
https://www.iso-ne.com/static-assets/documents/2017/11/a3_moody's_2017_economic_update.pdf
 - December 2017 – ISO published Summer 2017 Weather Normal Peak Load report:
<https://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/summer-and-winter-normalized-peaks>
- LFC meetings:
 - December 13, 2017 – Moody’s forecast, draft energy forecast, 2017 summer peak review
 - February 7, 2018 – Final draft energy forecast and draft summer peak forecast
 - March 28, 2018 – Final draft seasonal peak forecasts
 - July 2018 – Summer LFC meeting (date TBD)
- Other stakeholder meetings:
 - March 14, 2018 – PAC
 - April 26, 2018 – PAC
- May 1, 2018 – Final forecast published in 2018 CELT report

2018 Preliminary Energy Forecast

- Energy models were estimated using reconstituted annual energy from 1990-2017 (28 years)
- Energy models use the updated Moody's macroeconomic forecast published in October 2017
 - Bureau of Economic Analysis revised some historical values
- ISO assumes normal weather for the energy forecast
 - Normal weather is defined as the 20 year average from 1996-2015
- Some data was estimated to develop preliminary forecasts
 - Monthly energy (November-December 2017)
 - BTM PV reconstitution data (September-December 2017)
 - PDR reconstitution data (November-December 2017)
- Preliminary net energy forecast values are based on the 2017 EE and BTM PV forecasts
- The energy forecast is an input into the peak demand forecast
- Regional energy forecast model details and statistics are included in Appendix

Observations on Preliminary 2018 Forecast

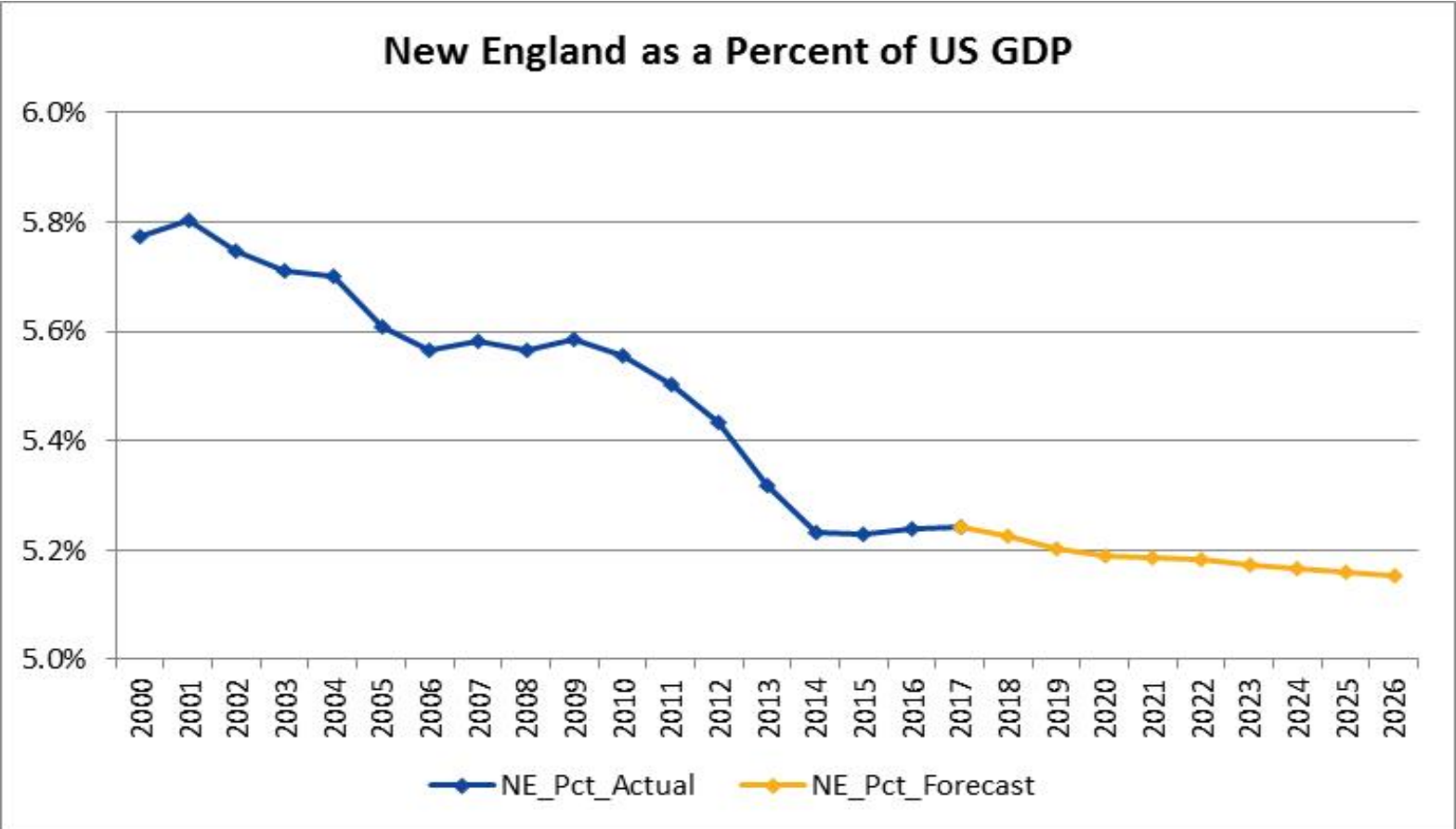
- Moody's forecasts roughly the same economic growth in the region (2017-2026 CAGR of 1.95%) relative to their previous forecast (2017-2026 CAGR of 1.89%)
 - Feds will increase interest rates, with values reaching 4% by end of decade
 - Assume tax cuts pass Congress, and will in turn increase deficit
 - Oil prices increase slowly to \$55-\$60/barrel; natural gas prices remain low
- The preliminary regional gross energy forecast is approximately 0.3% higher in 2026 than the 2017 CELT forecast
 - Percent differences vary over the forecast horizon and across states
- Net energy forecasts presented herein are illustrative and will change when the 2018 EE and BTM PV forecasts are developed
 - These forecasts are developed annually as part of the EE Forecast Working Group (EEFWG) and Distributed Generation Forecast Working Group (DGFWG) stakeholder processes

MOODY'S MACROECONOMIC FORECAST (PUBLISHED OCTOBER 2017)

Gross State Product (GSP) – New England and States

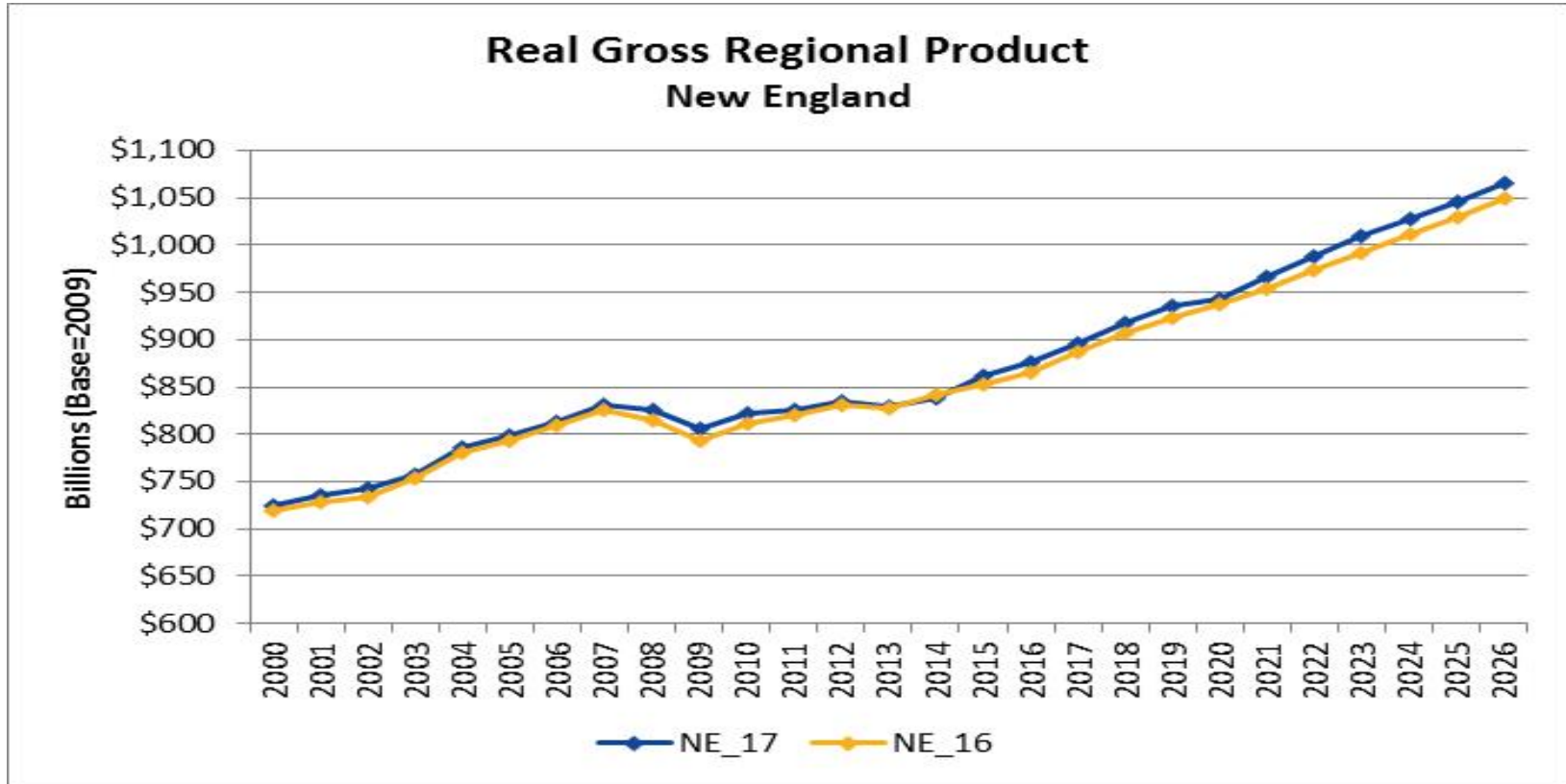
Moody's Economic Forecast

New England Percent of US Gross Domestic Product



Moody's Economic Forecast

New England Gross Regional Product

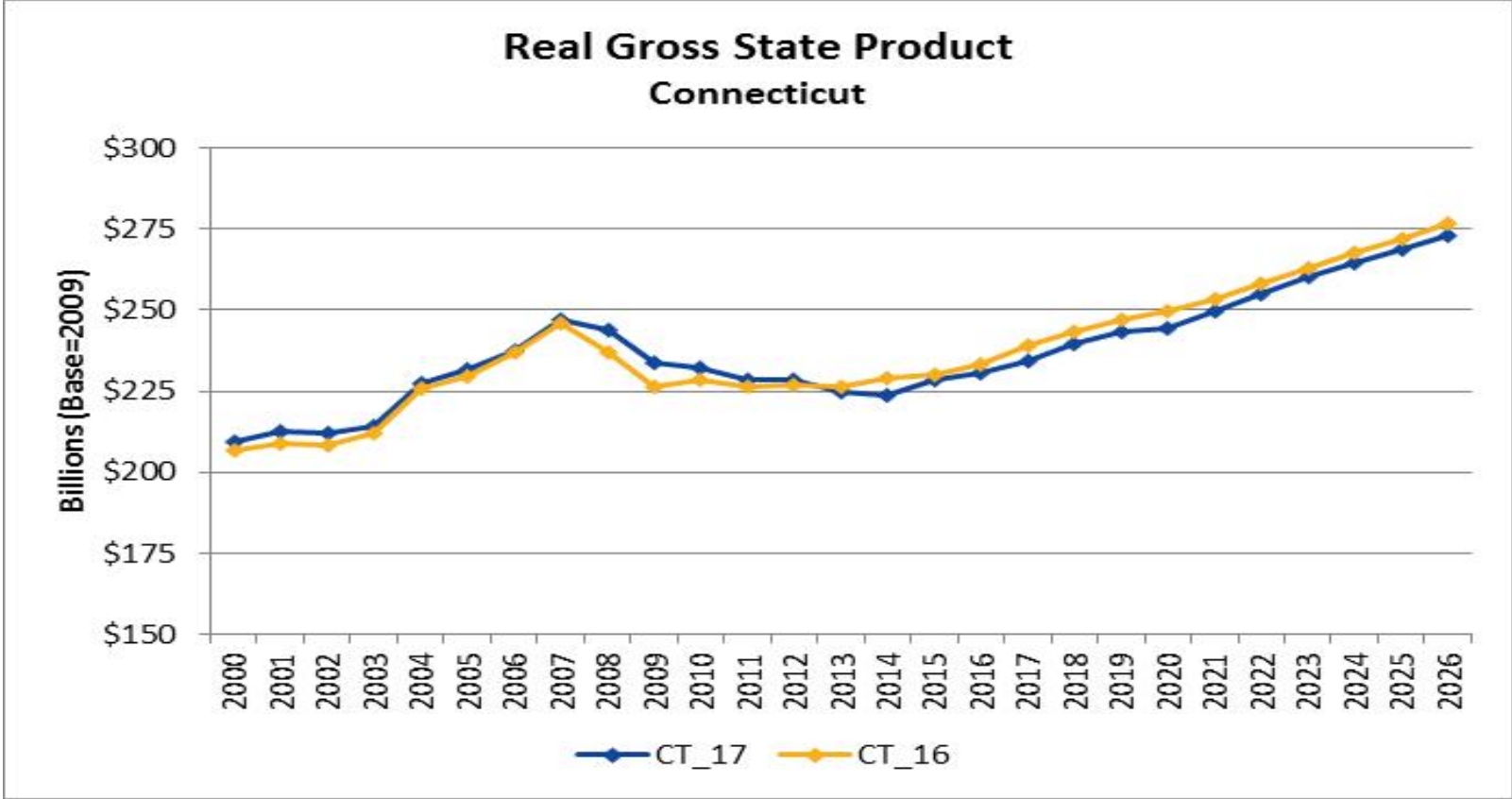


Compound Annual Growth Rate (CAGR) forecast from 2017 thru 2026 of 1.95% approximately the same as last year's forecast of 1.89%. Historical revisions of GRP increased slightly

National CAGR, for the same forecast period, is 2.14%, similar to that from last year's forecast of 2.11%.

Moody's Economic Forecast

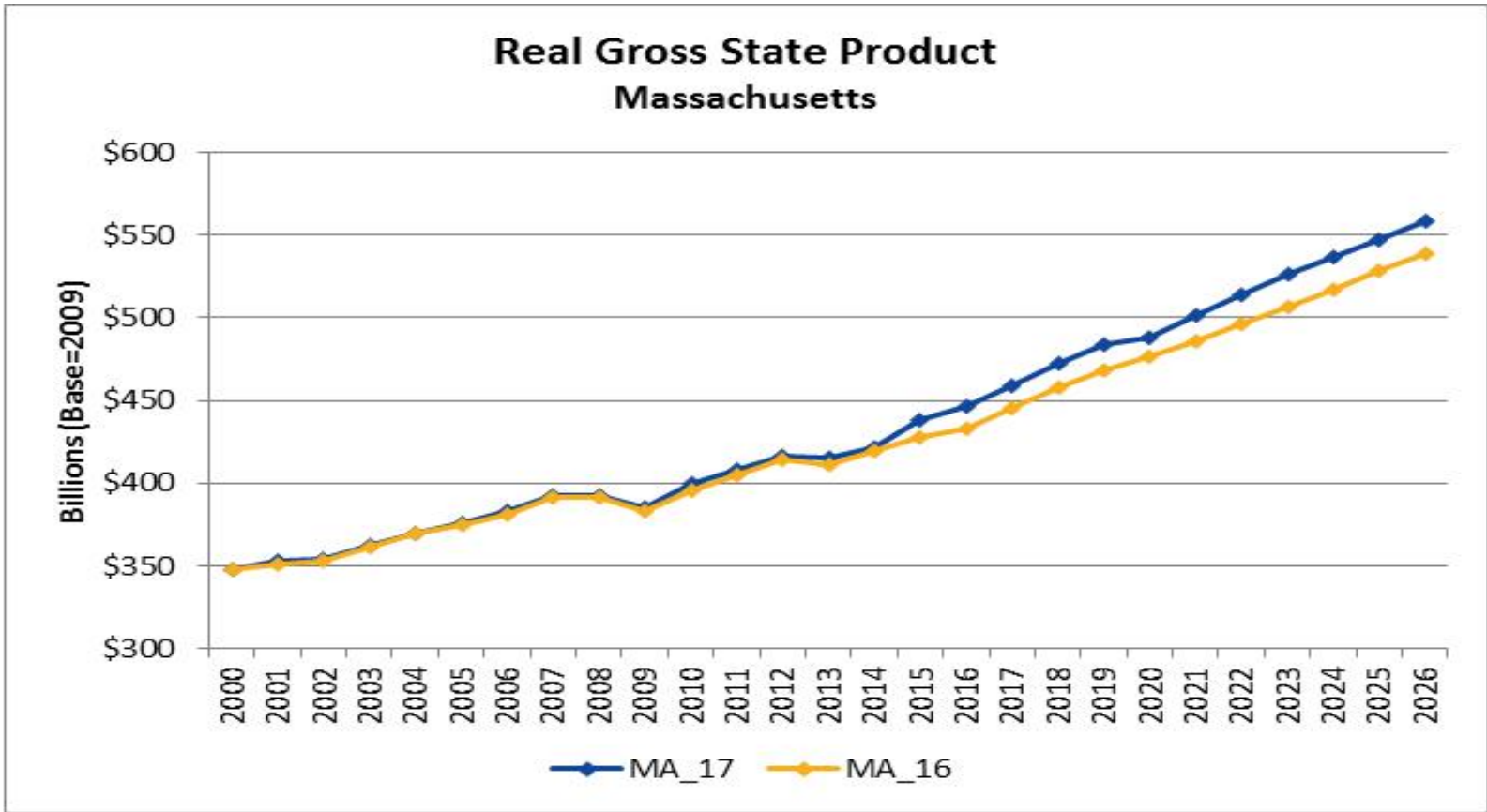
Connecticut Gross State Product



The forecast CAGR from 2017 thru 2026 increased slightly to 1.70% from last year's forecast of 1.65%, however, due to historical revisions, absolute output is lower.

Moody's Economic Forecast

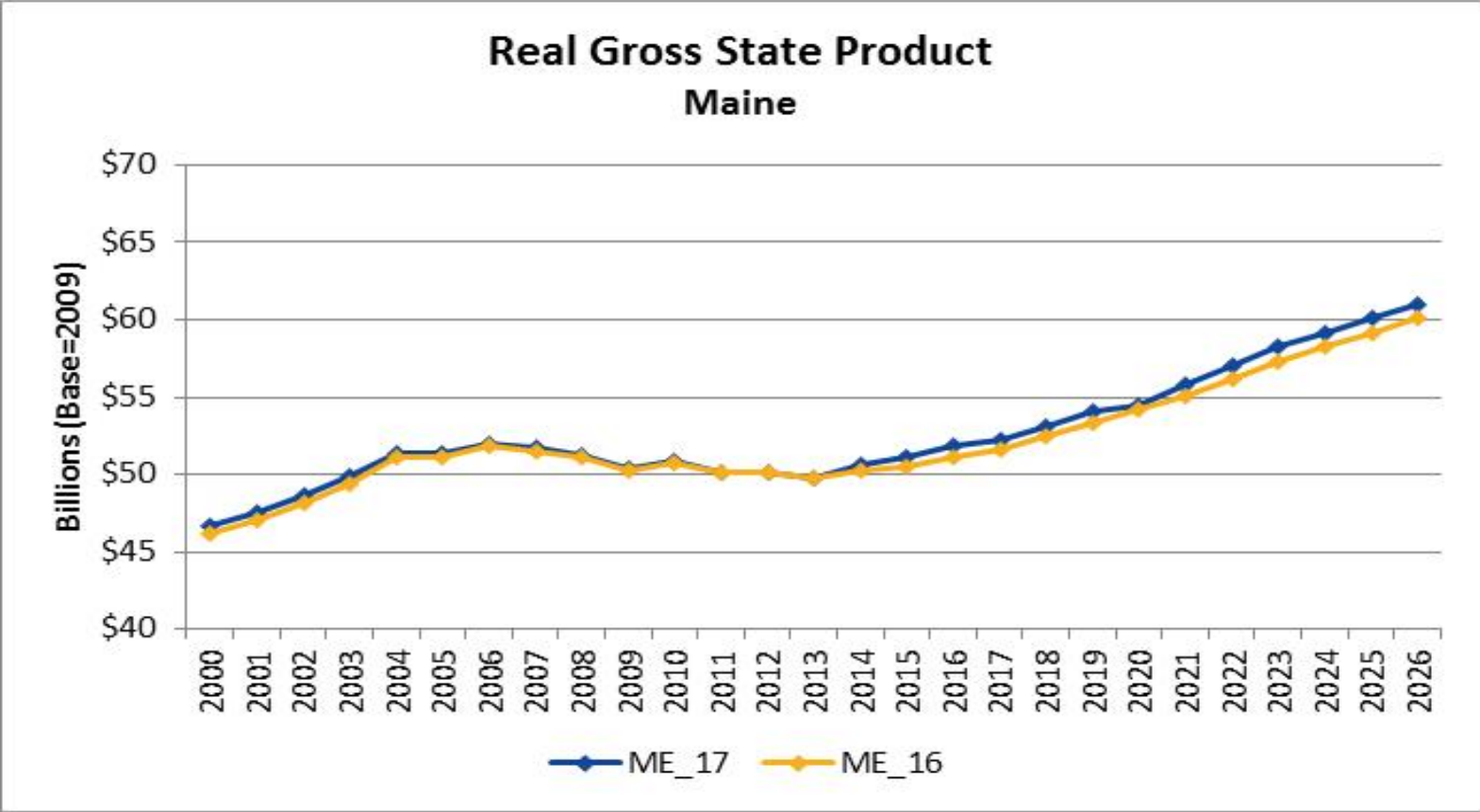
Massachusetts Gross State Product



CAGR forecast from 2017 thru 2026 increased slightly to 2.20% from last year's forecast of 2.14%.
Historical revisions increased GSP level.

Moody's Economic Forecast

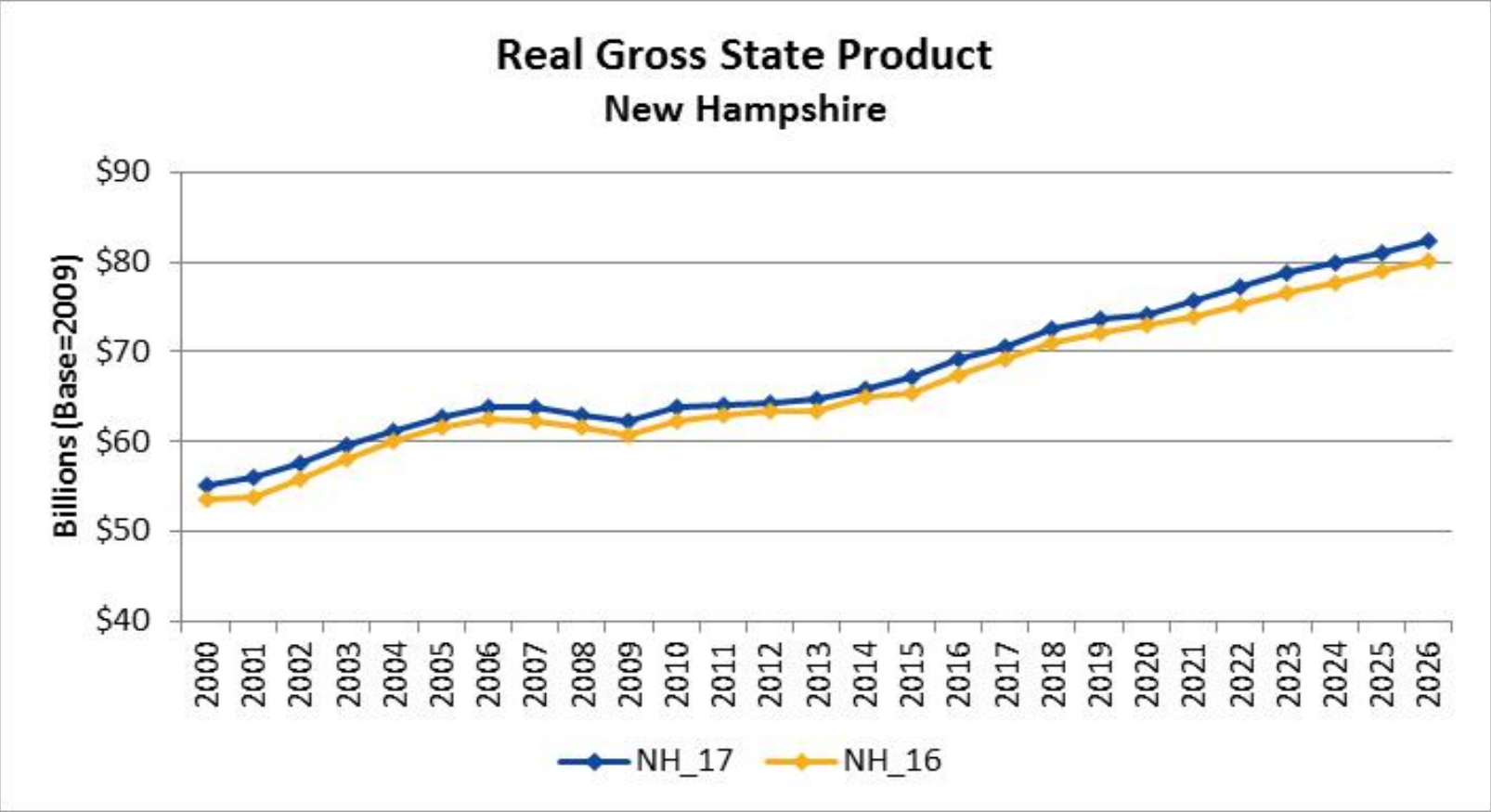
Maine Gross State Product



CAGR from 2017 thru 2026 increased slightly to 1.74% from last year's forecast of 1.69%. Historical revisions increased GSP level.

Moody's Economic Forecast

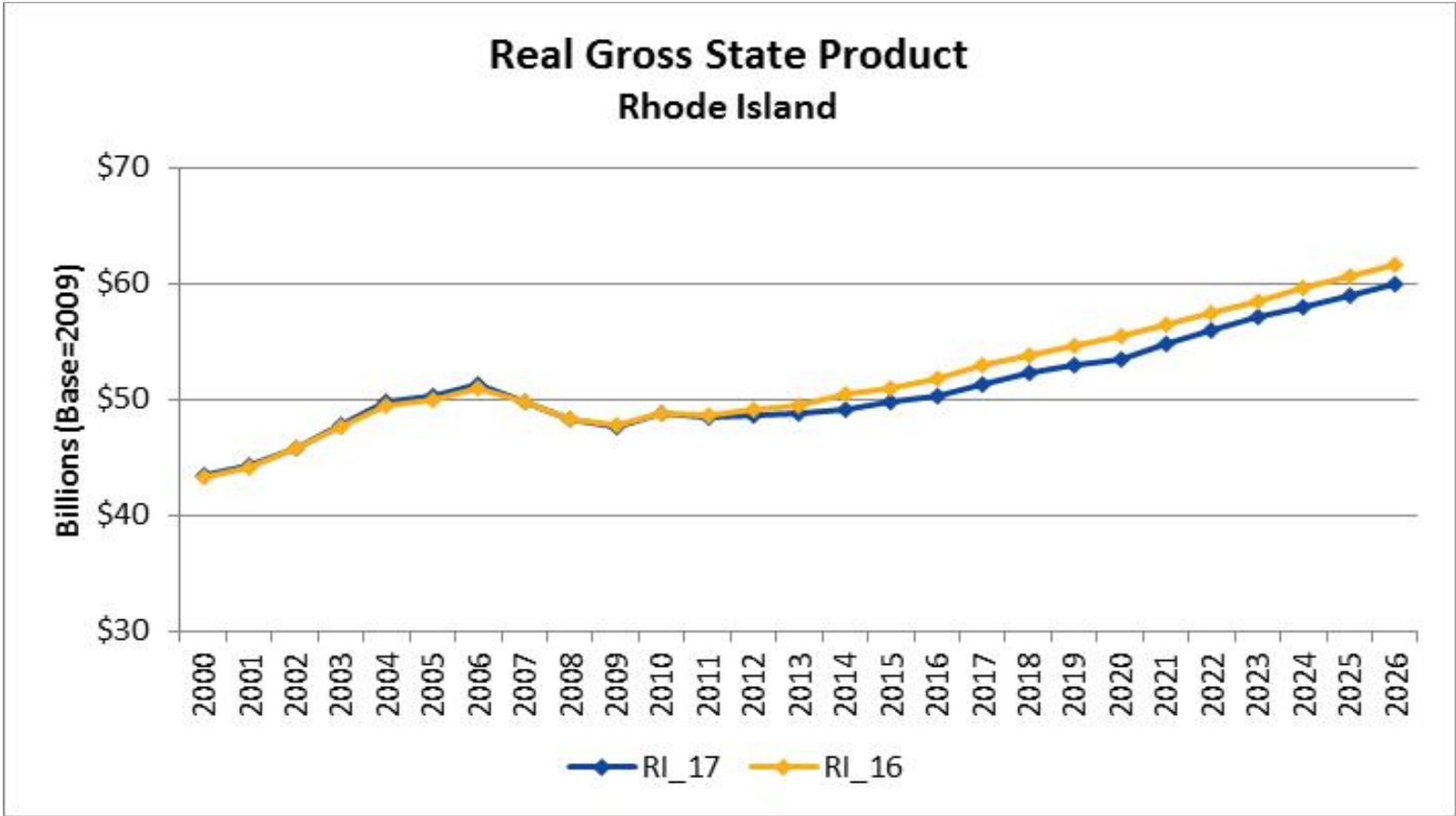
New Hampshire Gross State Product



CAGR from 2017 thru 2026 increased to 1.73% from last year's forecast of 1.66%. Historical GSP was also increased.

Moody's Economic Forecast

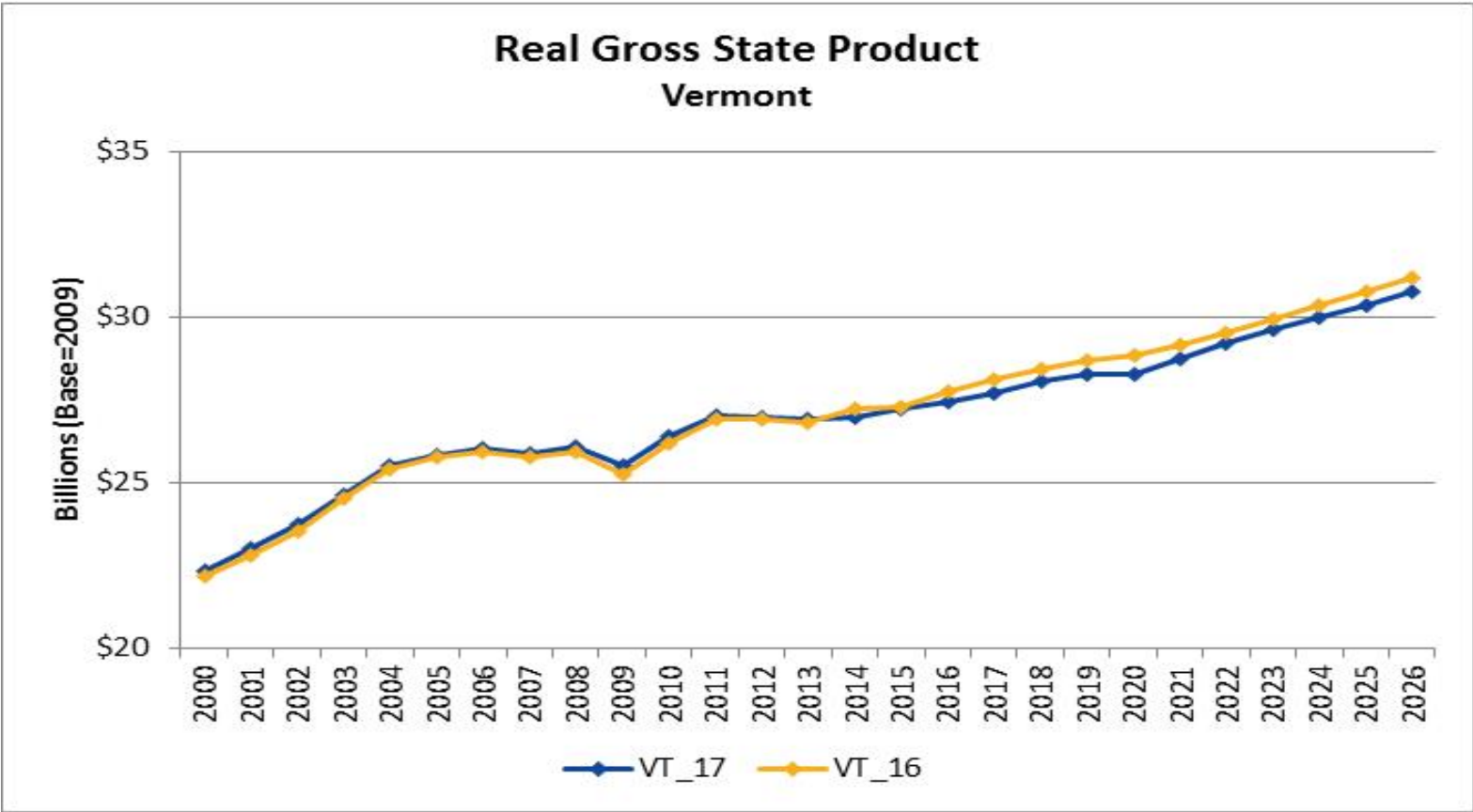
Rhode Island Gross State Product



CAGR from 2017 thru 2026 rose to 1.74% from last year's forecast of 1.68%, however, due to historical revisions, absolute output is lower..

Moody's Economic Forecast

Vermont Gross State Product



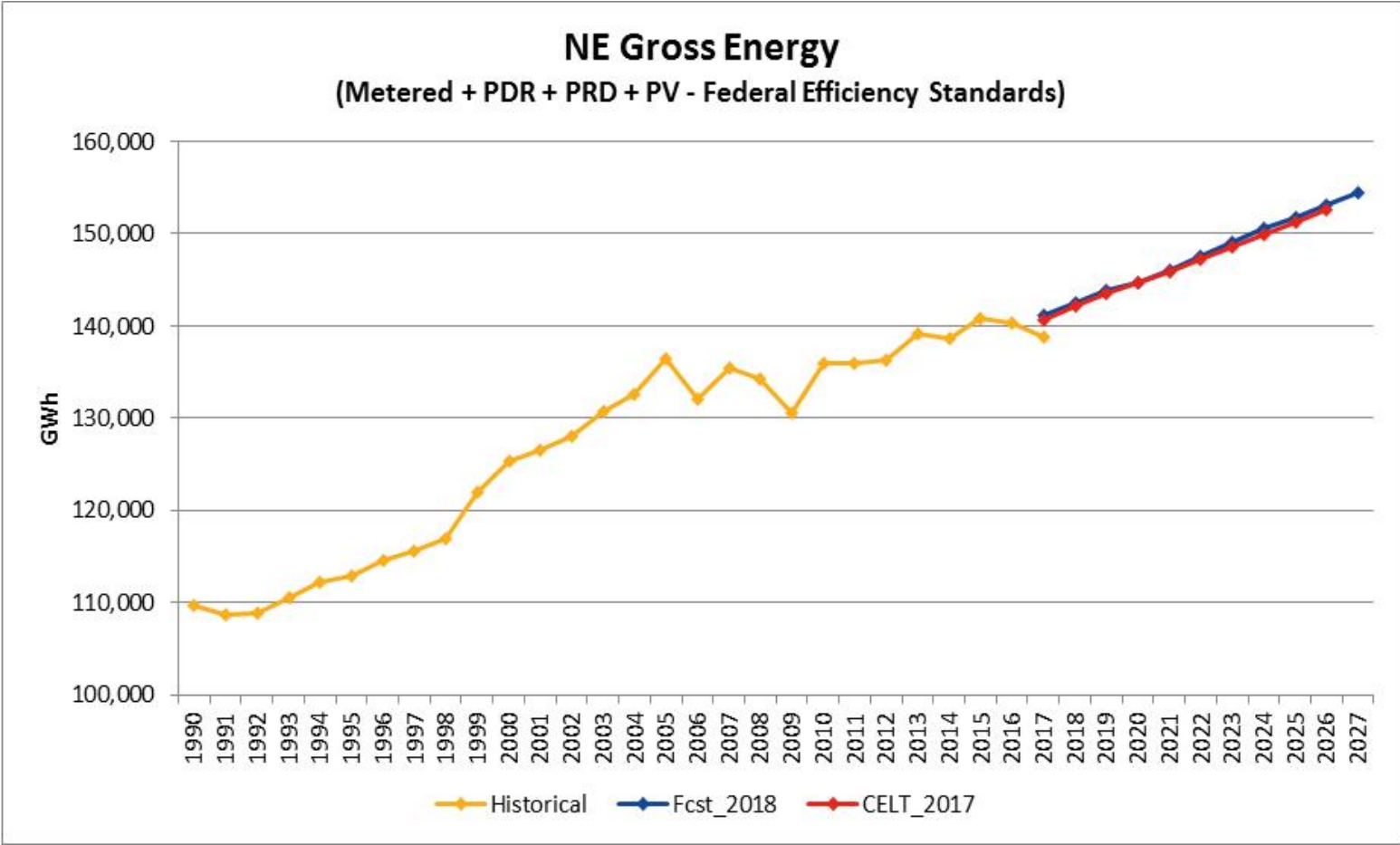
CAGR from 2017 thru 2026 remained approximately the same as last year's forecast of 1.15, however, due to historical revisions, absolute output is lower.

PRELIMINARY 2018 GROSS ENERGY FORECAST

New England and States

Gross Energy Forecast

New England



2018 (+0.3% ,+418 GWh)

2022 (+0.3% ,+420 GWh)

2026 (+0.3% ,+489 GWh)

Gross Energy Forecast

New England

ISO-NE subtracts impacts of Federal Efficiency Standards (EISA07) from the modeled gross energy forecast

Year	2018 Draft Forecast			2017 CELT	Change (GWh)	% Change
	Gross Forecast w/o Standards (GWh)	Incremental Standards (GWh)	Gross Forecast with Standards (GWh)	Gross Forecast with Standards (GWh)		
	2018	142,530	34	142,496		
2019	143,896	68	143,828	143,447	381	0.27%
2020	144,742	99	144,643	144,611	32	0.02%
2021	146,159	141	146,018	145,799	219	0.15%
2022	147,743	196	147,547	147,127	420	0.29%
2023	149,362	252	149,110	148,507	603	0.41%
2024	150,790	296	150,494	149,884	610	0.41%
2025	152,122	346	151,776	151,233	543	0.36%
2026	153,476	394	153,082	152,593	489	0.32%
2027	154,814	440	154,374			

Energy Forecast

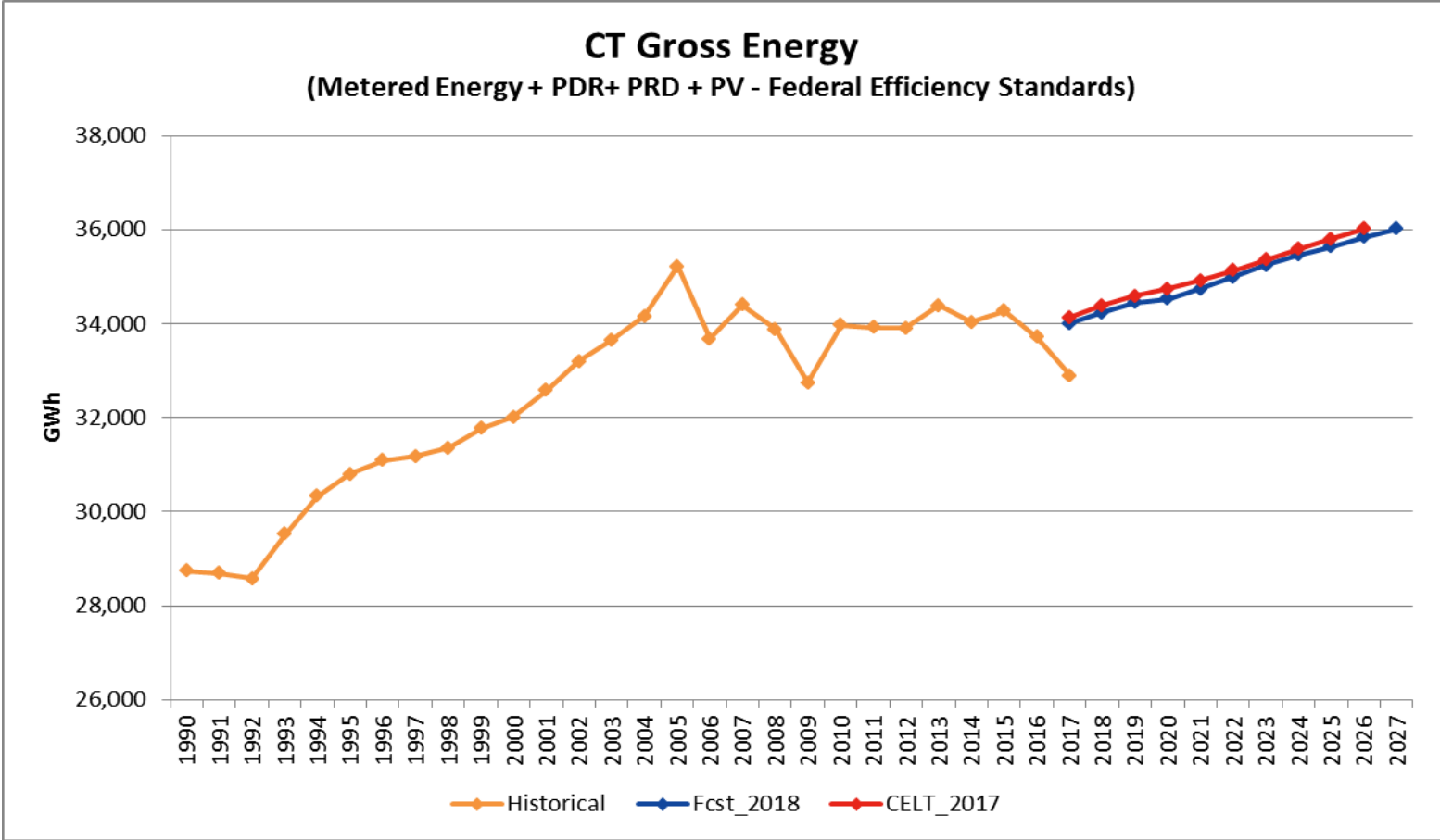
New England Gross and Net

Annual Energy (GWh)				
	Gross Forecast with Standards	PV:BTM *	PDR *	Net Forecast with Standards
2018	142,496	2,373	13,279	126,844
2019	143,828	2,800	14,911	126,117
2020	144,643	3,133	17,038	124,472
2021	146,018	3,381	19,441	123,196
2022	147,547	3,609	21,659	122,279
2023	149,110	3,830	23,683	121,597
2024	150,494	4,027	25,508	120,959
2025	151,776	4,185	27,137	120,454
2026	153,082	4,338	28,575	120,169
2027	154,374			

* Note: 2017 EE and BTM PV forecast values used for reference only; 2018 EE and BTM PV forecasts are under development

Gross Energy Forecast

Connecticut



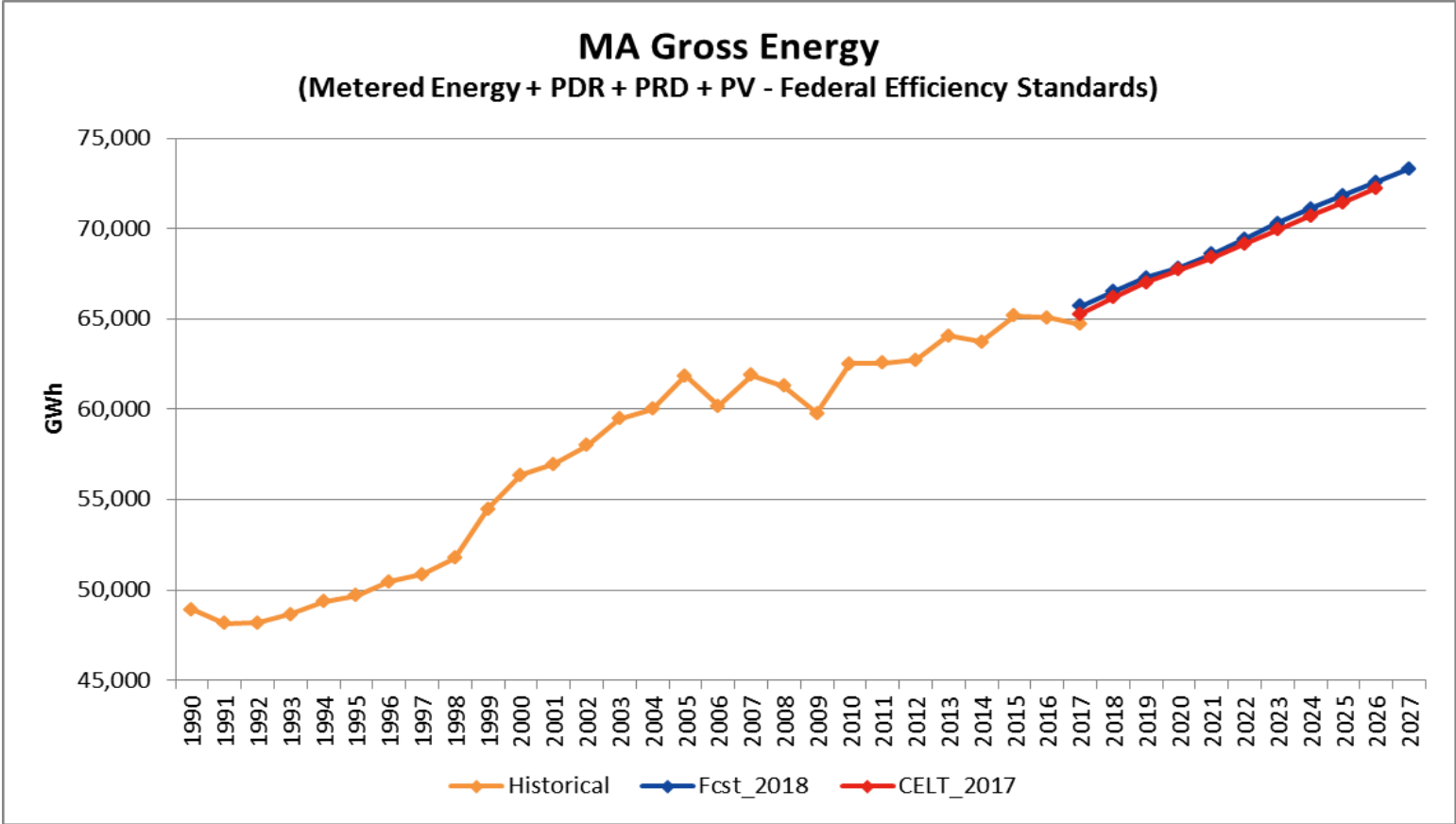
2018 (-0.4%, -148 GWh)

2022 (-0.4%, -134 GWh)

2026 (-0.5%, -178 GWh)

Gross Energy Forecast

Massachusetts



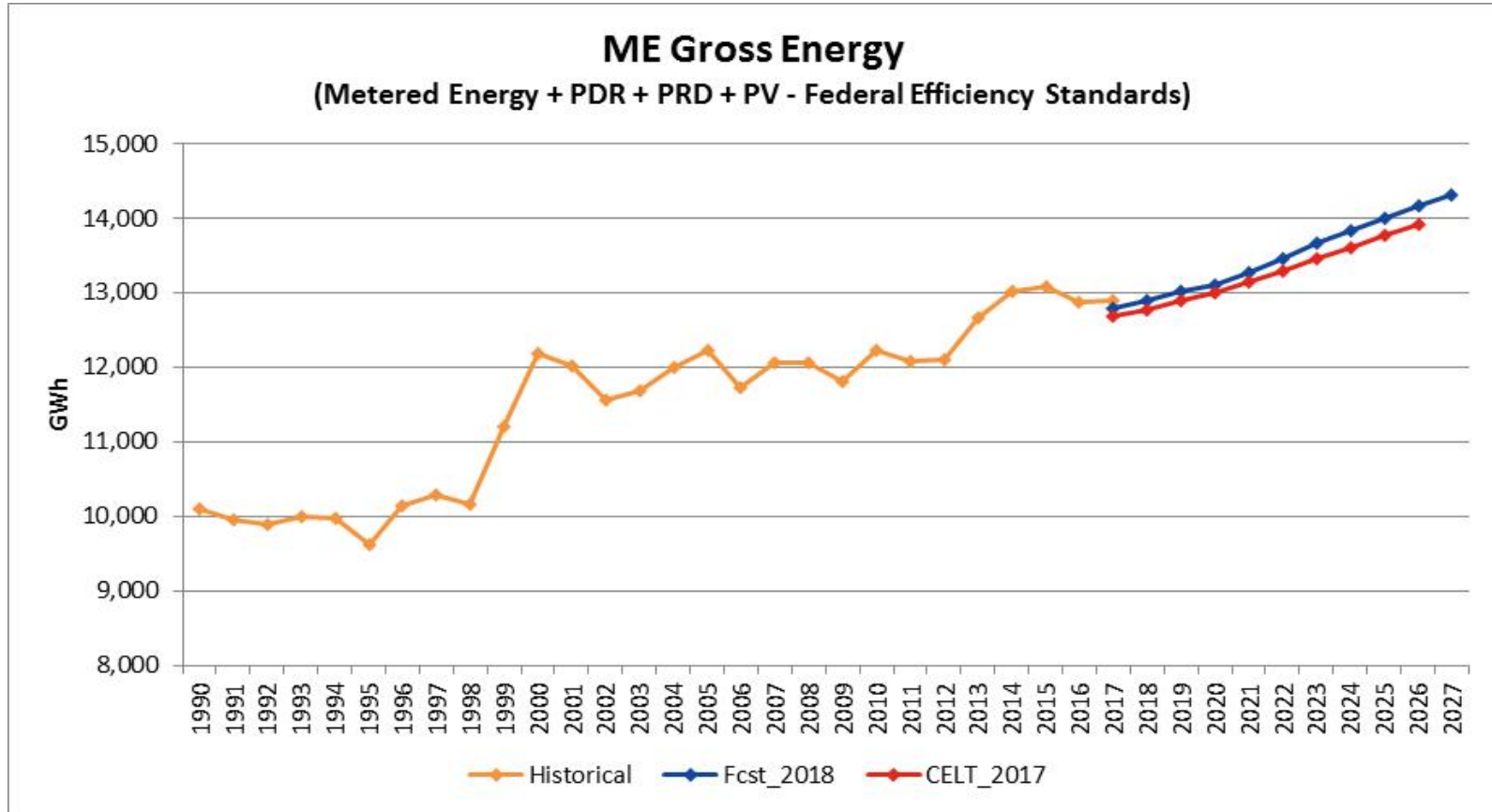
2018 (+0.5%, +351 GWh)

2022 (+0.4%, +301 GWh)

2026 (+0.5%, +365 GWh)

Gross Energy Forecast

Maine



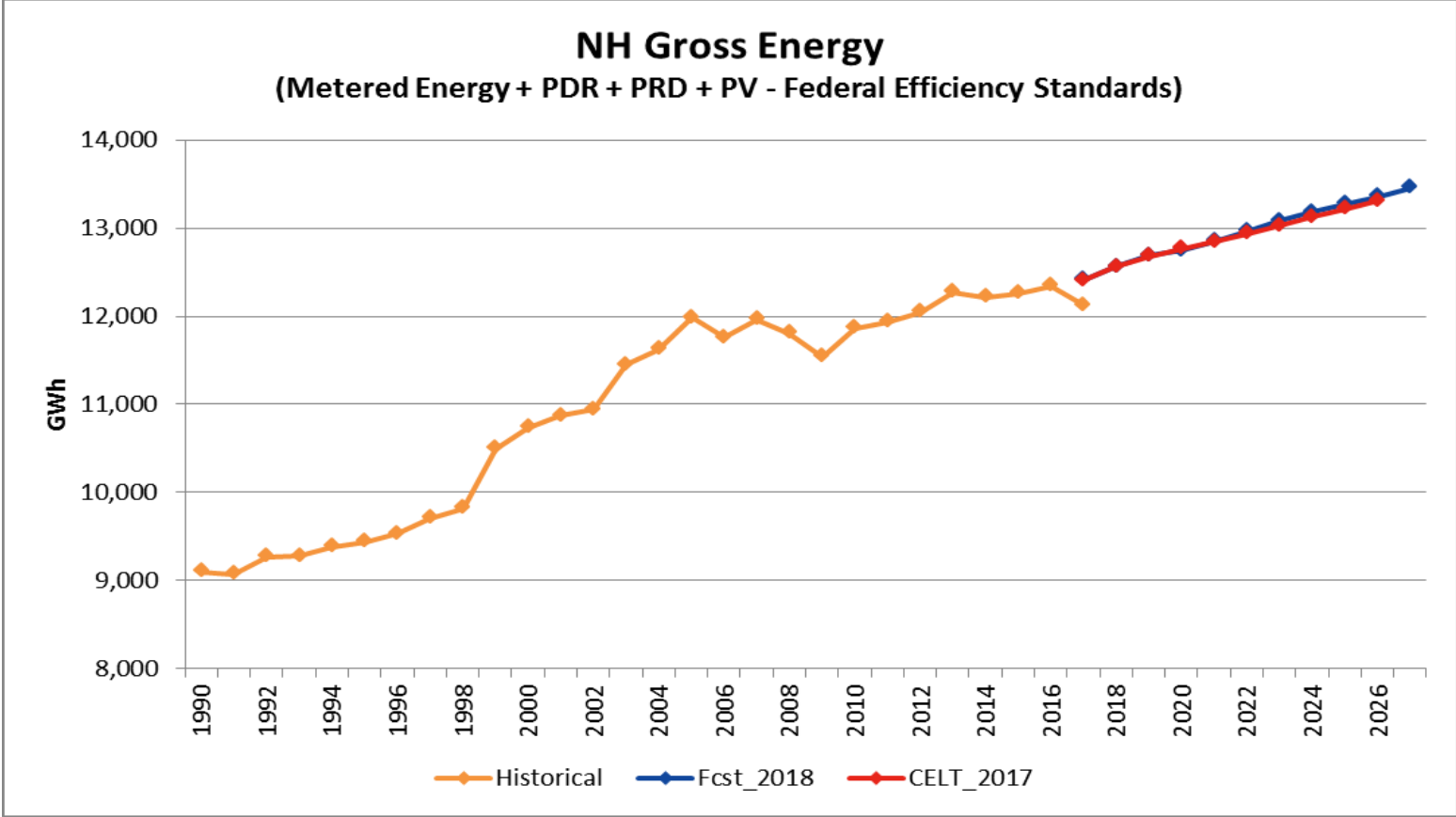
2018 (+1.0%, +122 GWh)

2022 (+1.3%, +171 GWh)

2026 (+1.8%, +252 GWh)

Gross Energy Forecast

New Hampshire



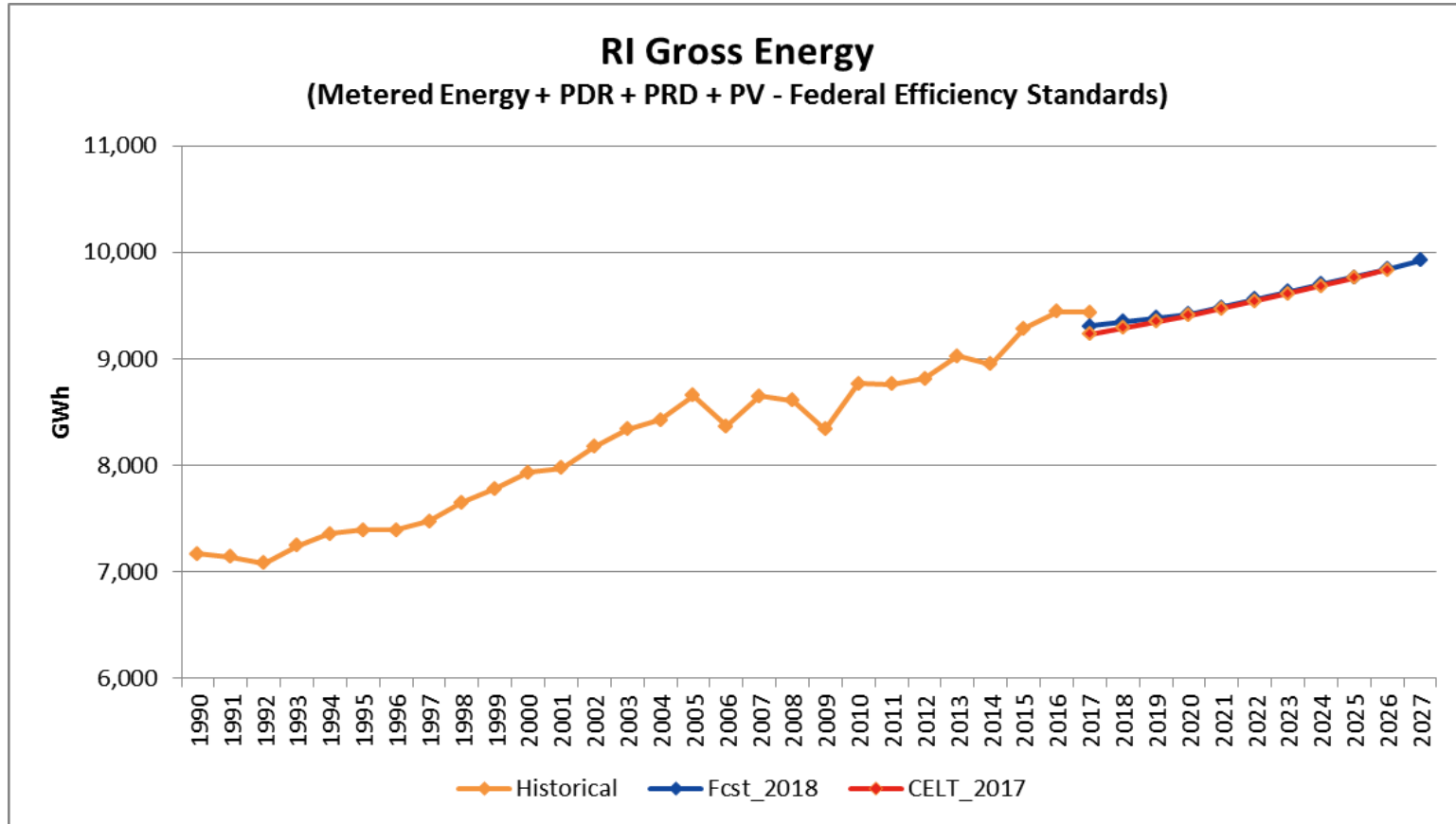
2018 (0.0% , +4 GWh)

2022 (+0.3% , +33 GWh)

2026 (+0.4% , +52 GWh)

Gross Energy Forecast

Rhode Island



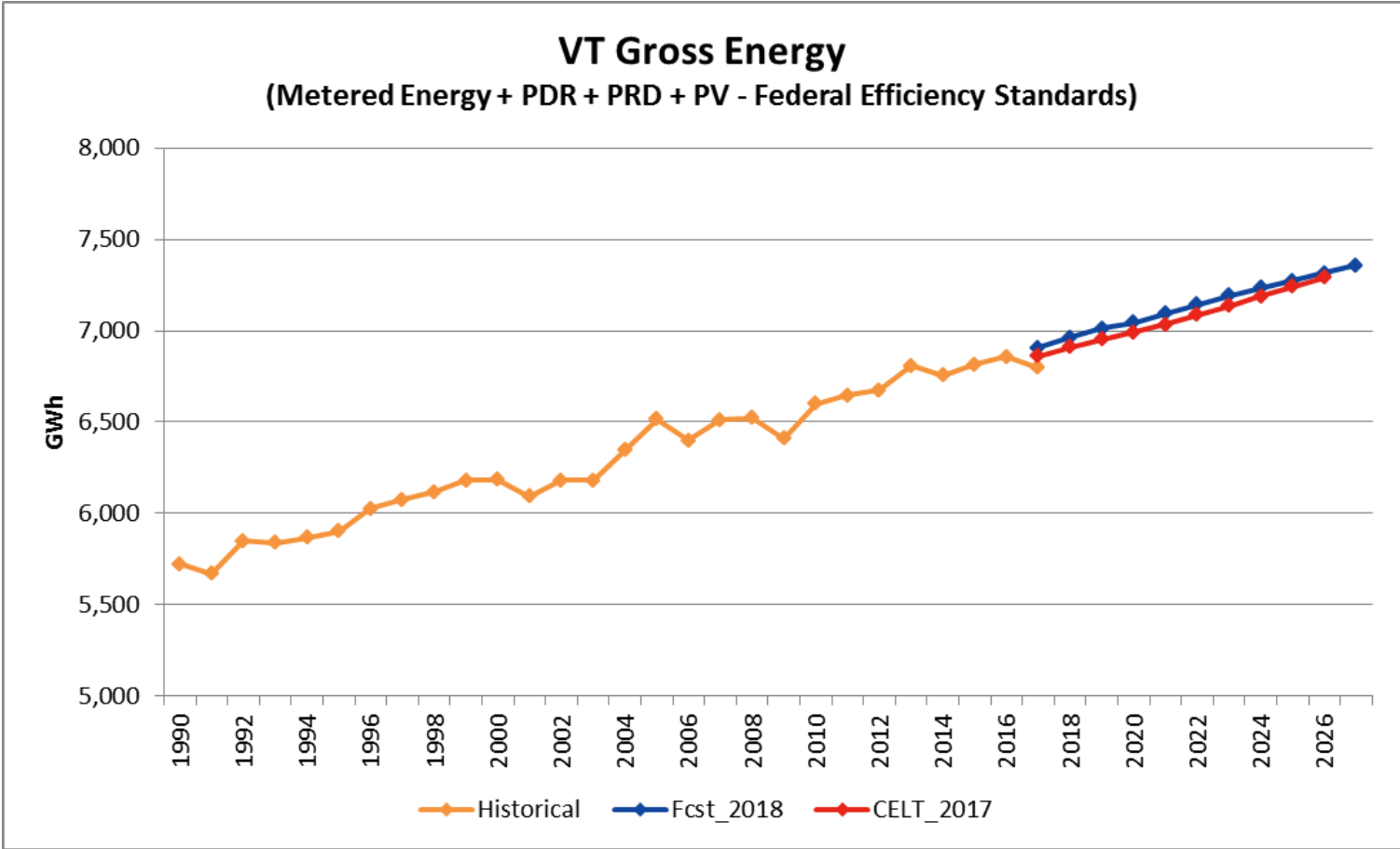
2018 (+0.4%, +33 GWh)

2022 (-0.1%, -11 GWh)

2026 (-0.3%, -29 GWh)

Gross Energy Forecast

Vermont



2018 (+0.8% , +56 GWh)

2022 (+0.8% , +60 GWh)

2026 (+0.4% , +27 GWh)

SUMMARY OF 2017 SUMMER PEAK DEMAND

Summary of 2017 Summer Peak Demand

Net Demand

- ISO's long-term summer load forecast uses a 3-day, eight-city weighted temperature-humidity index (WTHI)
- The table below lists the five highest net peak demand days for summer 2017 along with the summer peak demand forecasts published in 2017 CELT
 - The BTM PV values are the MW reduction of the daily peak load determined through reconstitution, as depicted on next slide

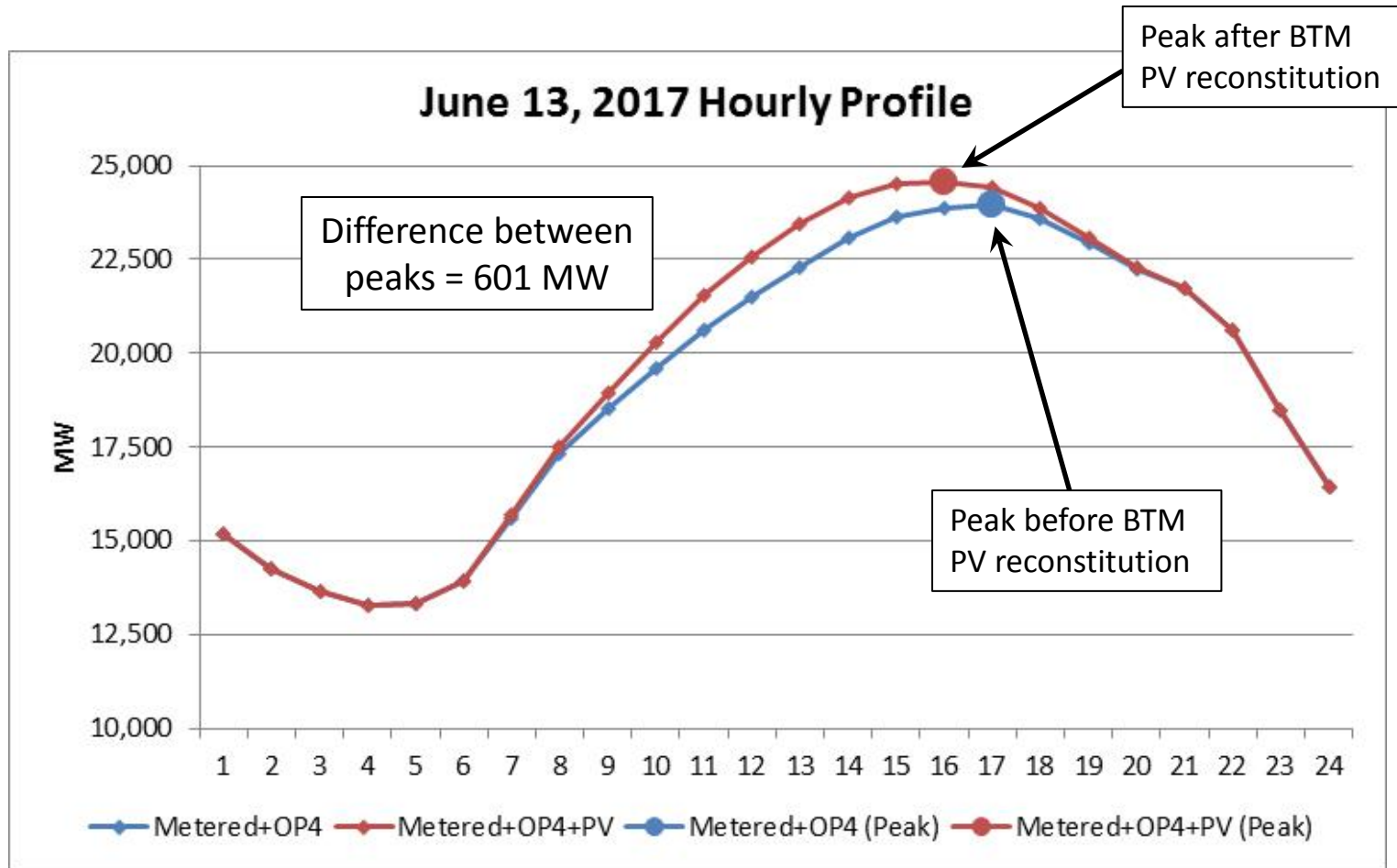
Peak Day	Day of Week	Peak Load *	Peak Hour	WTHI	BTM PV
90/10 Forecast	-	28,865	-	82.0	575
50/50 Forecast	-	26,482	-	79.9	575
6/13/2017	Tue	23,968	17	79.3	601
7/19/2017	Wed	23,593	18	77.2	538
7/20/2017	Thr	23,556	17	78.2	720
6/12/2017	Mon	23,346	18	77.4	491
7/21/2017	Fri	22,942	17	77.8	650

* Forecast loads are net of forecasted impacts of Passive and Active Demand Resources and behind-the-meter PV; actual peak loads are those measured in real-time, but are reconstituted for Real Time Demand Resources dispatched during Audit



Determining BTM PV Peak Load Reduction

2017 New England Summer Peak Day



2017 Summer Peak – Tuesday, June 13, 2017

Observed Load vs. Forecast

- The observed system peak load on June 13th was 2,514 MW lower than the 2017 CELT net 50/50 forecast
 - Observed weather at ISO's eight weather stations was less severe (WTHI=79.3) than the weather assumed for the 50/50 long-term load forecast (WTHI=79.9)
- Using CELT 2017 forecast model coefficients, the difference between forecast and actual can be attributed to two factors:
 1. Peak occurred in June – if the same June peak WTHI value (79.3) were to occur in either July or August, the peak would have been 2,050 MW higher
 2. Peak hour WTHI value less than 50/50 WTHI value - an increase of 0.6 degrees in the WTHI, the difference between the June peak WTHI value and the 50/50 value, would lead to an increase of demand by about 630 MW
- Adding back the adjustments described above to the June 13th peak value results in a adjusted peak of 26,648 MW which is 166 MW (0.6%) higher than the 2017 CELT net 50/50 forecast of 26,482 MW



Next Steps

- Next LFC meeting is February 7, 2018
 - Final draft energy forecast and draft summer peak forecast will be discussed
- The final forecast will be published as part of the 2017 CELT by May 1st



Questions



APPENDIX

Regional Energy Forecast Model Details/Statistics

Energy Model Variables

Energy Models	
Variable	Definition
Intercept	Constant Term
_Log	Natural Logarithm
NEL	Net Energy for Load net of Passive Demand Resources and PV, GWh
NEL_LAG	NEL lagged 1 period
RGSP	Real Gross State/Regional Product
RPI	Annual Average Real Personal Income
RP	Real Price of Electricity
CDD	Total Annual Cooling Degree Days, Base 55°
HDD	Total Annual Heating Degree Days, Base 65°
Trend	Annual index
YRXXXX	Dummy Variable; YRXXXX=1 if Year=XXXX; 0 otherwise

Energy Model Statistics (preliminary)

2018 CELT New England Energy Model				
Dependent Variable:		log (Nel+PDR+PRD+BTMPV)		
Sample:		1990:2017		
Observations		28		

Parameter Estimates				
Variable	Estimate	Standard Error	t Value	Pr > t
Intercept	2.0018	0.6603	3.03	0.006
Nel_log_lag	0.3656	0.1088	3.36	0.003
RGSP_LOG	0.3138	0.0530	5.92	<.0001
RP_log	-0.0210	0.0245	-0.85	0.402
CDD_LOG	0.0384	0.0096	4.00	0.001
HDD_LOG	0.1217	0.0337	3.61	0.002

Analysis of Variance				
Source	DF	Sum of Squares	Mean Square	F Value
Model	5	0.2194	0.04388	484.24
Error	22	0.0020	0.00009	
Corrected Total	27	0.2214		

Other Statistics				
Root MSE	0.00952	R-Square	0.991	