

Draft 2016 CELT ISO-NE Annual Energy and Summer Peak Forecast

Planning Advisory Committee

David Ehrlich

MANAGER, LOAD FORECASTING

Eric Winkler

TECHNICAL MANAGER

Jon Black

MANAGER, LOAD FORECASTING



Outline

- 2015 Weather Normal Energy, 2015 Weather Normal Summer Peak, and the 2015/2016 Winter “Peak”
- Draft 2016 CELT Energy Efficiency Forecast
- Draft 2016 CELT Solar PV Forecast
- Draft 2016 Annual Energy and Summer Peak Forecast
- Next Steps



Weather Normal 2015 Energy and Changes from Weather Normal 2014 Energy (GWh)

- After adjusting for weather and weekday/weekend, energy demand is down by 1.1% compared to the weather normal 2014 energy demand
- After reconstituting for Forward Capacity Market (FCM) Passive Demand Resources (PDR), energy demand is up by 0.5% compared to 2014
- The 2015 weather normal energy reconstituted for PDR is 138,739 GWh, which is virtually the same (6 GWh lower) as the April 2014 forecast of 138,745 GWh

	<u>2014</u>	<u>2015</u>	<u>GWh</u> <u>Change</u>	<u>%</u> <u>Change</u>
Weather Normal Energy	127,114	125,779	-1,335	-1.1
Passive Demand Resources	10,933	12,960	2027	18.5
Weather Normal Energy + PDR	138,047	138,739	692	0.5

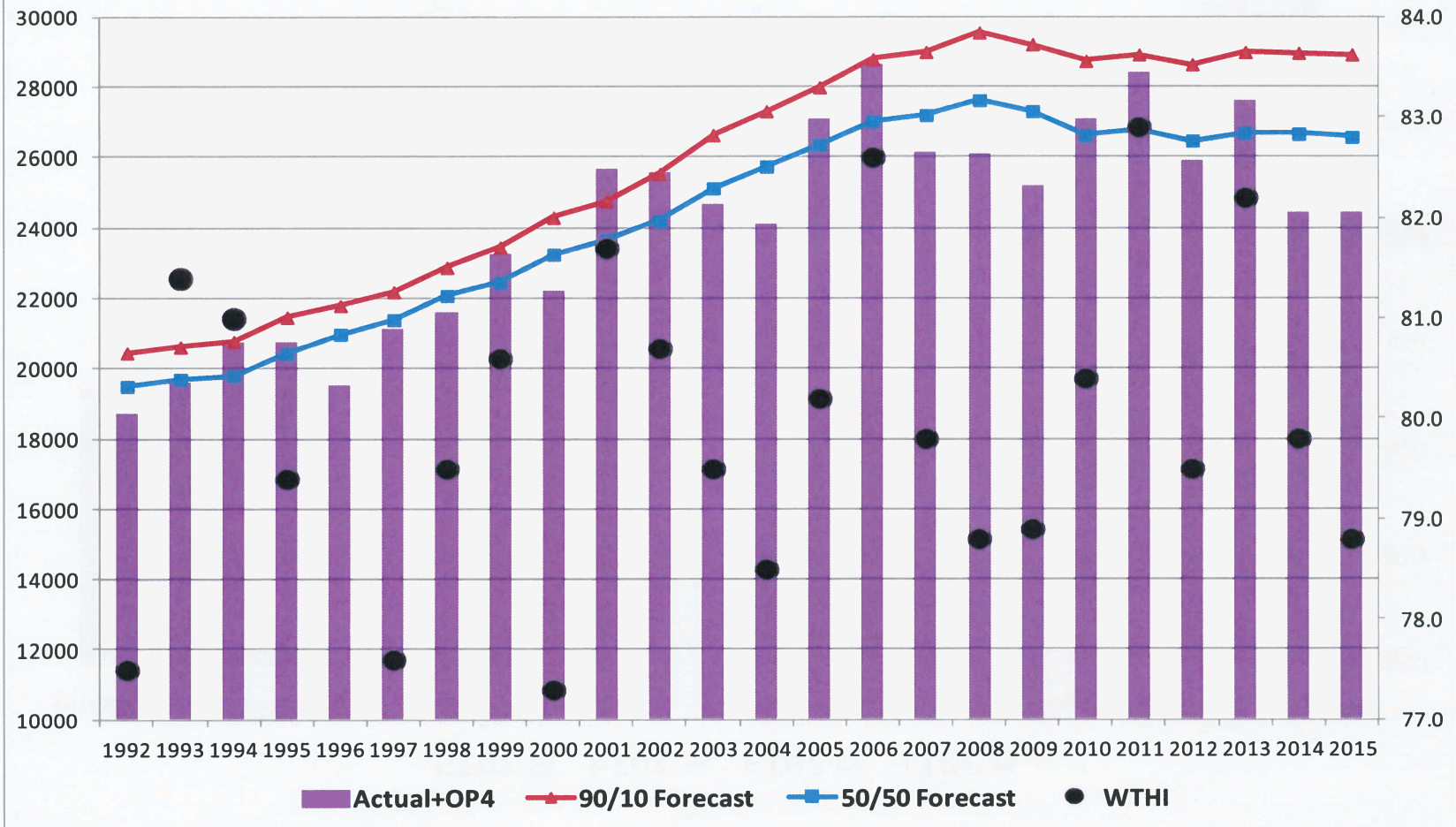


Weather Normal 2015 Summer Peak Load

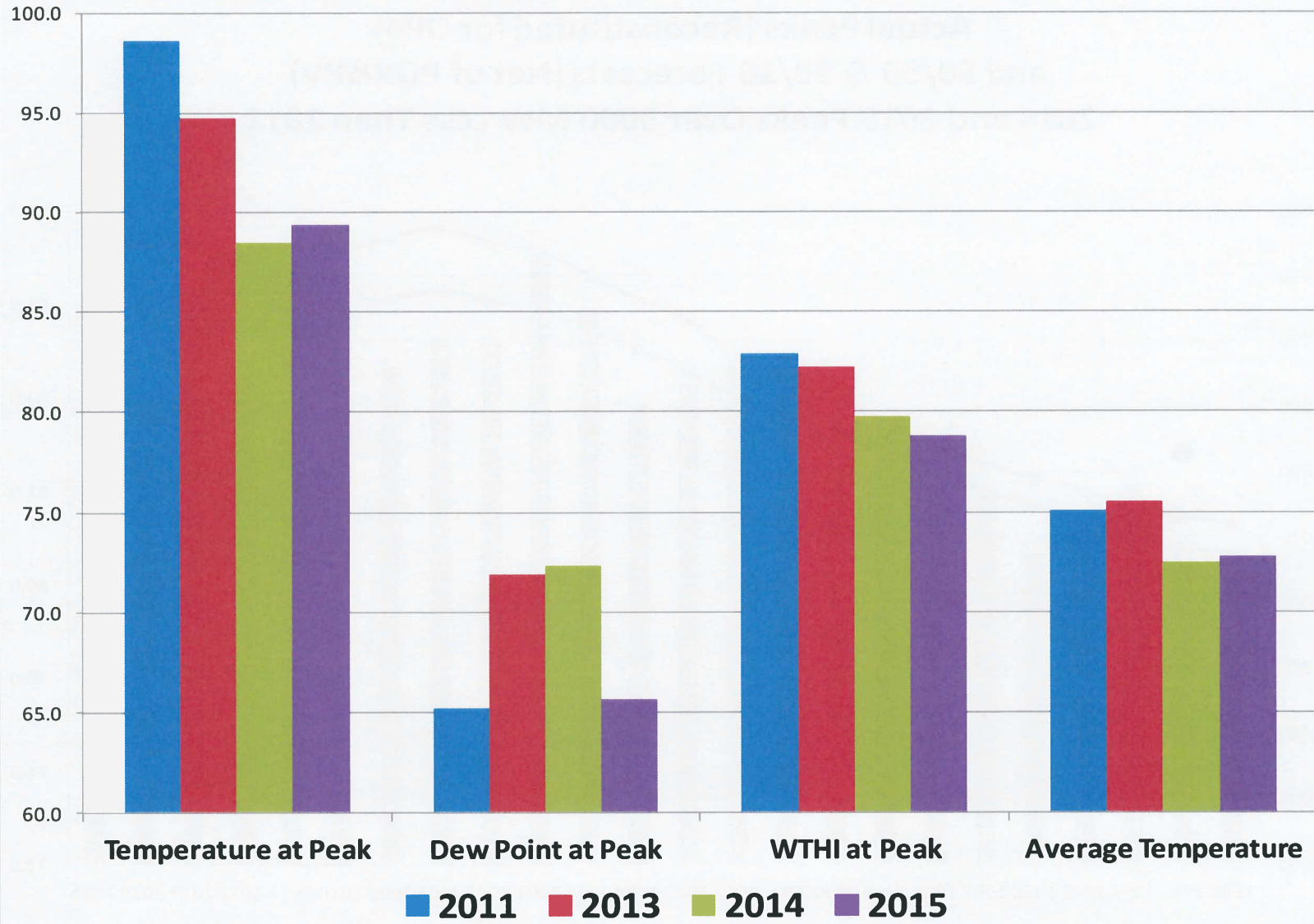
- The 50/50 weather normalized peak load for the summer of 2015 is 28,225 MW
 - 0.6% (170 MW) lower than the 2015 CELT 50/50 summer forecast of 28,395 MW
- The 90/10 weather normalized peak load for the summer of 2015 is 30,485 MW
 - 0.8% (260 MW) lower than the 2015 CELT 90/10 forecast of 30,745 MW
- The ISO New England Control Area actual summer peak load of 24,437 MW, occurred on July 20, 2015 at HE 1700, temperature was 89.4 F, dew point was 65.6 F, and WTHI was 78.8 F (3-day weighted temperature-humidity index)
 - After reconstitution for the OP4 active demand resources, the FCM PDR, behind-the-meter (BTM) PV, and the Energy Market Price Responsive Demand (PRD) the peak was 26,472 MW



ISO-NE Summer Peaks (MW) Actual Peaks (Reconstituted for OP4) and 50/50 & 90/10 Forecasts (Net of PDR&PV) 2014 and 2015 Peaks Over 3000 MW Less Than 2011

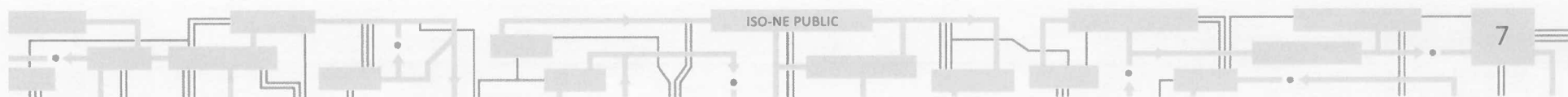


New England July Weather Statistics



2015/2016 Winter

- The 2015/2016 winter weather normal peak load will be calculated within the next few weeks
- The 2015/2016 winter was the second mildest winter since 1960
- The only cold weather was February 13-15, 2016
- The 2015/2016 actual winter peak was 19,524 MW on Presidents Day February 15, 2016 at HE 1800 at a temperature of 18 F, but the average daily temperature was 9.6 F
- The January 19, 2016 peak was 19,421 MW at a temperature of 20 F, but the average daily temperature was 18.7 F
- The January 8, 2015 peak was 20,556 MW at a temperature of 20 F, but the average daily temperature was 8.8 F



DRAFT 2016 ENERGY-EFFICIENCY FORECAST

Summary of Draft 2016 Forecast

- Draft Energy Efficiency (EE) forecast results are largely unchanged from the 2015 forecast results due to offsetting increases and decreases in forecasted EE production
- The detailed power point presentation is posted at
 - <http://www.iso-ne.com/committees/planning/energy-efficiency-forecast>
- Program performance changes from the 2015 forecast include:
 - Production cost increased in all states except RI where it remained about the same, resulting in a decrease in energy reductions from equivalent budget \$
 - Peak-to-Energy Ratios changed in multiple directions, decreasing in ME, NH, RI and VT, nearly unchanged in MA, and increased in CT
 - Average annual budgets over the forecast period were nearly identical to the period in the 2015 forecast, with ME decreasing by 4% and CT increasing by 5%
 - Spend rates improved in RI and MA



EE Forecast Model General Assumptions

- Annual EE budgets provided by the Commissions or representatives on their behalf were used in the model and held constant in years after the latest approved budget
- Realization Rate and Percent Spent variables were combined into a single Budget Spend Rate adjustment
- Production cost baselines were derived from a three-year average of recent performance
- The production cost escalation rate was set at 5% per year
- Inflation rate was set at 2.5% per year
- Peak-to-Energy Ratios were derived from a three-year average of recent performance and held constant through the forecast period
- Current CELT/RSP energy forecast used in conjunction with SBCs to forecast SBC dollars

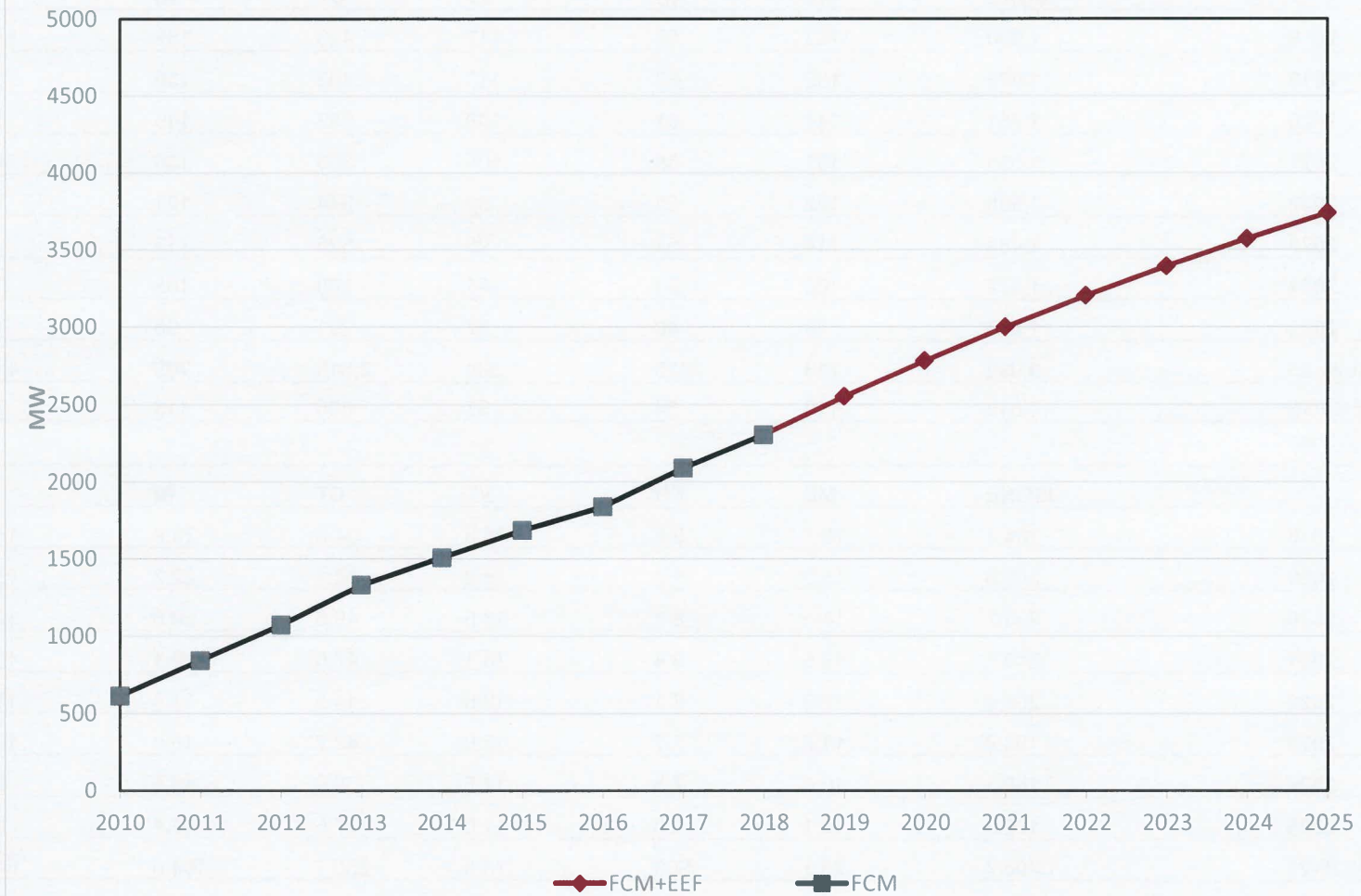


Energy and Summer Peak EE Forecast Data

GWh Savings							
	ISONE	ME	NH	VT	CT	RI	MA
2018	1,990	163	65	117	423	162	1,059
2019	1,873	152	63	113	403	150	992
2020	1,761	141	61	108	383	140	929
2021	1,655	131	58	104	363	130	869
2022	1,555	122	55	99	344	121	813
2023	1,461	114	53	95	326	113	761
2024	1,372	106	50	91	308	105	712
2025	1,287	98	48	87	291	98	666
TOTAL20-25	9,092	713	325	584	2,015	705	4,750
AVERAGE	1,515	119	54	97	336	118	792
MW Savings							
	ISONE	ME	NH	VT	CT	RI	MA
2018	264.1	16.7	9.6	14.8	54.8	23.9	144.5
2019	248.6	15.6	9.2	14.2	52.1	22.2	135.3
2020	233.7	14.5	8.8	13.6	49.6	20.6	126.7
2021	219.7	13.5	8.4	13.1	47.0	19.1	118.6
2022	206.4	12.5	8.1	12.6	44.5	17.8	110.9
2023	193.9	11.7	7.7	12.0	42.2	16.6	103.8
2024	182.1	10.8	7.3	11.5	39.9	15.5	97.1
2025	170.9	10.1	7.0	11.0	37.6	14.4	90.8
TOTAL20-25	1,206.7	73.1	47.3	73.8	260.7	104.0	647.7
AVERAGE	201.1	12.2	7.9	12.3	43.5	17.3	108.0



ISONE Energy Efficiency on Summer Peak (MW)



DRAFT 2016 SOLAR PV FORECAST

Summary: Draft 2016 PV Forecast

- Factors influencing future development of PV resources are complex
- The 2016 PV forecast reflects a qualitative approach, but with better information than was available to the ISO last year
- The 2016 forecast reflects discussions with stakeholders and data exchange with the New England states and Distribution Owners
- More PV development is expected in the region than projected in 2015
 - The 2016 draft forecast is approximately 30% higher than the final 2015 forecast
- The draft PV forecast was discussed at the February 24, 2016 Distributed Generation Forecast Working Group (DGFWG)
 - Stakeholder comments were received by March 9, 2016
- The final PV forecast will be discussed at the April 15, 2016 DGFWG meeting

What's New in the 2016 PV Forecast?

- Longer set of historical data
 - Reflects recent PV growth through the end of 2015 as reported by Distribution Owners
- Consideration of recent federal and state policy changes
- Forecast will be categorized differently this year
 - Discussed more on slide 20
- Forecast will incorporate results of analysis showing expected reductions of future summer peak loads due to PV
 - For more information, refer to slides 33-59 here: http://www.iso-ne.com/static-assets/documents/2016/03/2016_draftpvforecast_20160224revised.pdf

Similar to EE, behind-the-meter PV will be reconstituted into historical loads*

The 2016 gross load forecast will reflect loads without PV load reductions

**Existing PV decreases the historical loads seen by the ISO, which are an input to the load forecast*

Final 2015 PV Forecast

Nameplate Capacity, MW_{ac}

States	Annual Total MW (AC nameplate rating)											Totals
	Thru 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
CT	118.8	70.9	89.9	45.8	43.1	40.4	40.4	26.9	26.9	26.9	26.9	556.8
MA	666.8	197.0	229.8	51.4	48.4	45.4	45.4	30.2	30.2	30.2	30.2	1,405.1
ME	10.4	2.2	2.2	2.0	1.8	1.7	1.7	1.7	1.7	1.7	1.7	28.9
NH	12.7	4.3	4.3	3.8	3.6	3.4	3.4	2.3	2.3	2.3	2.3	44.4
RI	18.2	9.7	20.4	27.2	31.0	29.0	20.6	7.1	5.4	5.4	5.4	179.3
VT	81.9	40.4	40.4	22.3	13.9	6.3	6.3	6.3	6.3	6.3	4.2	234.7
Regional - Annual (MW)	908.8	324.3	386.9	152.4	141.7	126.2	117.8	74.6	72.9	72.9	70.8	2,449.1
Regional - Cumulative (MW)	908.8	1233.1	1620.0	1772.4	1914.1	2040.3	2158.1	2232.6	2305.5	2378.4	2449.1	2,449.1

Notes:

- (1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
- (2) The forecast reflects discount factors to account for uncertainty in meeting state policy goals
- (3) All values represent end-of-year installed capacities

Draft 2016 PV Forecast

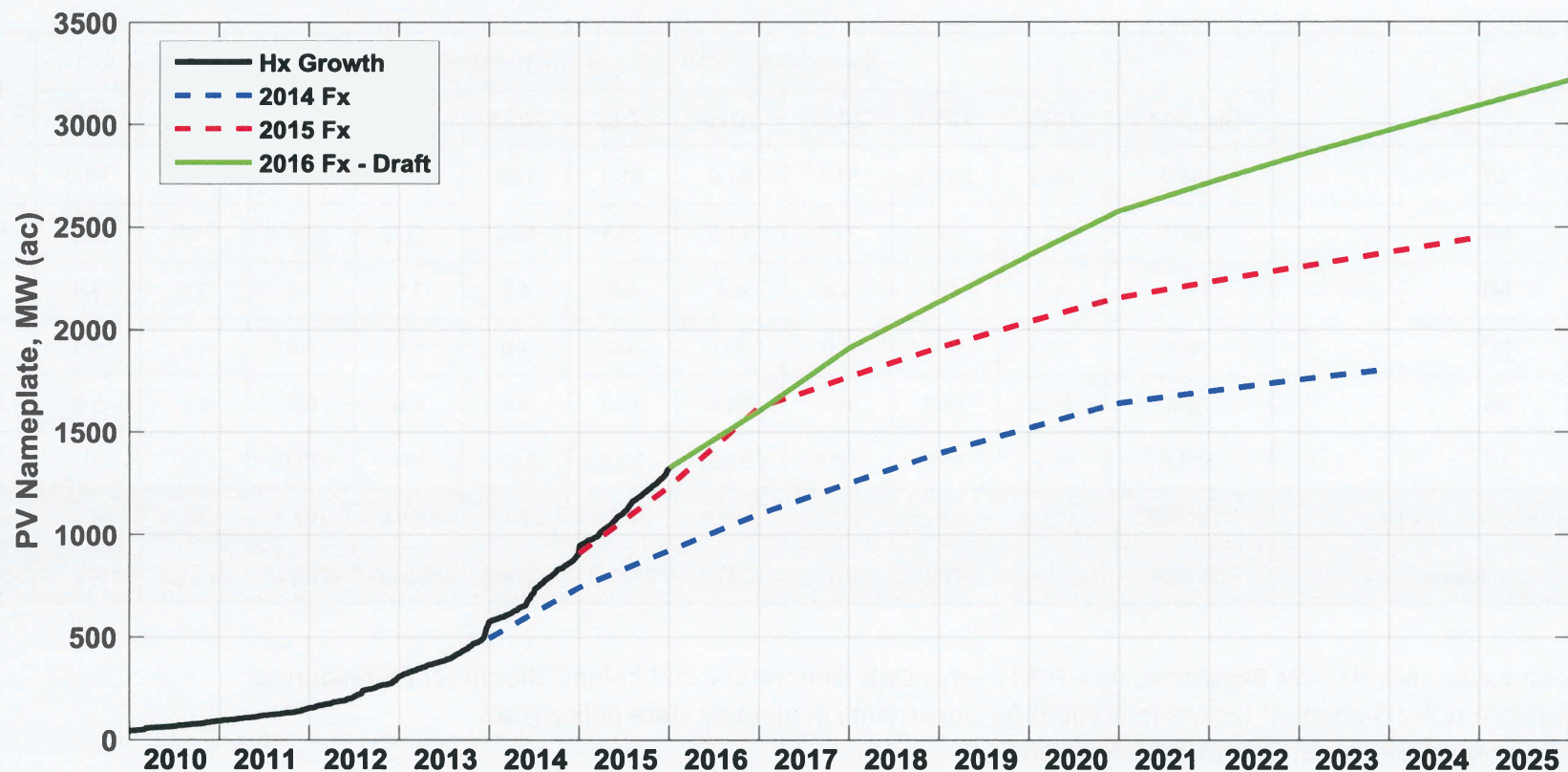
Nameplate Capacity, MW_{ac}

States	Annual Total MW (AC nameplate rating)											Totals
	Thru 2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
CT	188.0	85.5	104.5	81.0	81.0	81.0	55.8	54.3	45.0	45.0	45.0	866.1
MA	947.1	122.7	122.7	77.5	77.5	77.5	43.0	43.0	43.0	43.0	43.0	1,640.0
ME	15.3	4.7	4.7	4.4	4.4	4.4	4.2	3.9	3.9	3.9	3.9	57.9
NH	26.4	13.3	7.6	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	79.3
RI	23.6	21.6	38.7	36.0	36.0	25.9	9.1	6.6	6.6	6.6	6.6	217.2
VT	124.6	30.2	30.2	22.5	22.5	22.5	21.3	20.0	20.0	20.0	20.0	353.7
Regional - Annual (MW)	1325.0	277.9	308.3	225.4	225.4	215.3	137.5	131.8	122.5	122.5	122.5	3,214.3
Regional - Cumulative (MW)	1325.0	1602.9	1911.2	2136.6	2362.0	2577.3	2714.8	2846.6	2969.2	3091.7	3214.3	3,214.3

Notes:

- (1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
- (2) The forecast reflects discount factors to account for uncertainty in meeting state policy goals
- (3) All values represent end-of-year installed capacities

PV Growth: Reported vs. Forecast



DRAFT 2016 ENERGY AND SUMMER PEAK LOAD FORECAST

Energy & Summer Peak Forecast Summary

- Updated Moody's economic forecast from November 2014 to November 2015
- Re-estimated econometric models, with the addition of 2015 data, based on actual energy and daily peaks that have been reconstituted for OP4, PDR, and BTM solar PV
 - The 2015CELT Gross forecast was reconstituted for PDR and OP4 only
- The 2016CELT forecast of energy, summer peak, PDR, and BTM solar PV are all DRAFT
- Reconstituting the historical data with BTM Solar PV eliminated the “BTM embedded in the load” (BTMEL), so all of the BTM solar PV can be subtracted from the Gross forecast
 - The 2015CELT Gross forecast had BTM embedded in the load (BTMEL), so only the “BTM not embedded in the load” (BTMNEL) was subtracted from the Gross forecast
- The 2016CELT energy and summer peak forecasts are lower than the 2015CELT forecasts
- The draft forecast was presented to the NEPOOL Load Forecast Committee (LFC) on March 11, 2016
 - No objections to the forecast were raised



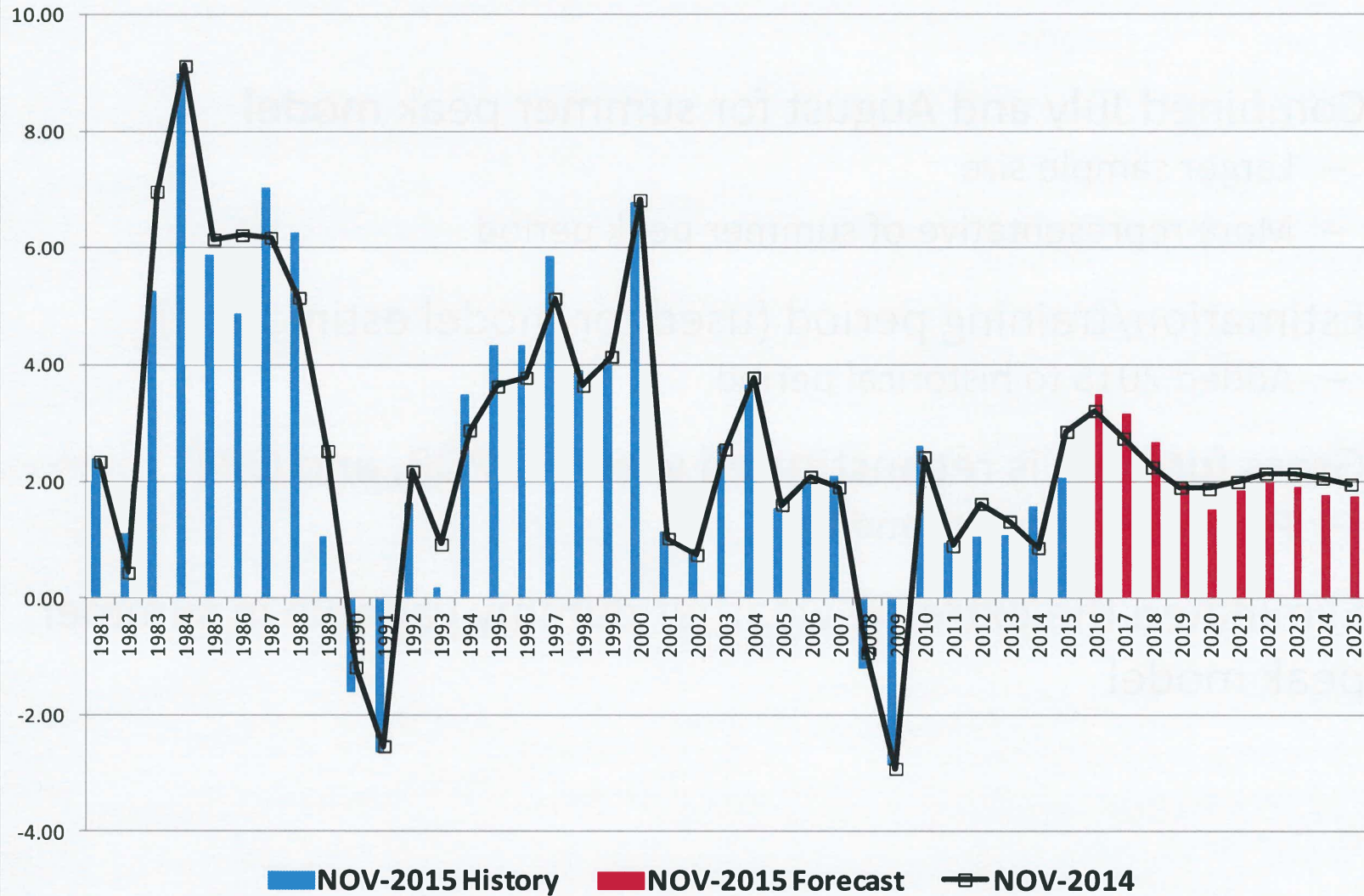
2016 Model Builds Upon 2015 Models

- Combined July and August for summer peak model
 - Larger sample size
 - More representative of summer peak period
- Estimation/training period (used for model estimation)
 - Added 2015 to historical period
- Gross forecast is reconstituted with PV, PDR, and OP4
 - Previously only PDR and OP4
- Eliminated the extreme weather dummy variable in summer peak model

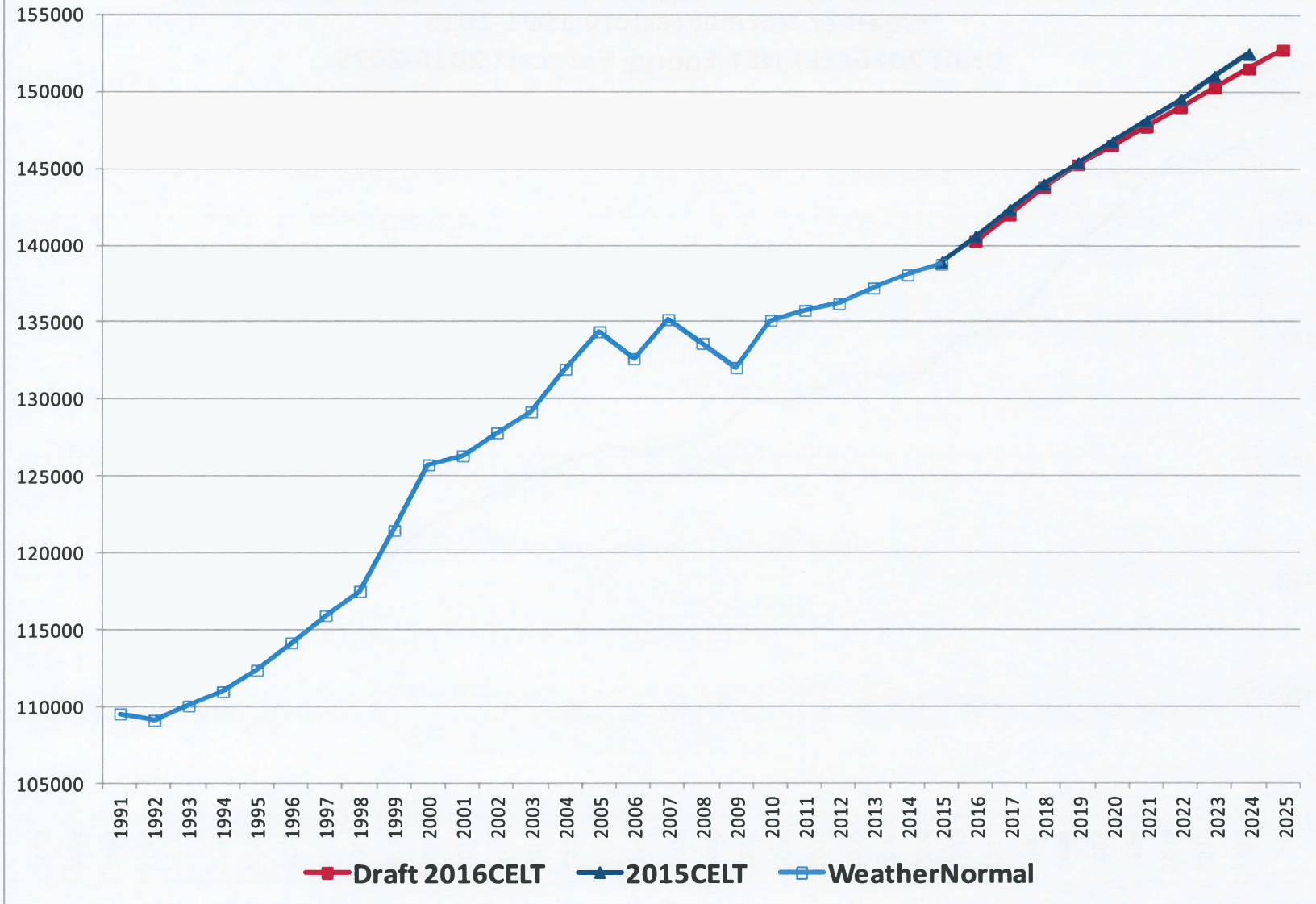
Moody's 2015 and 2014 Forecasts

New England Real Gross Regional Product Annual Percent Changes

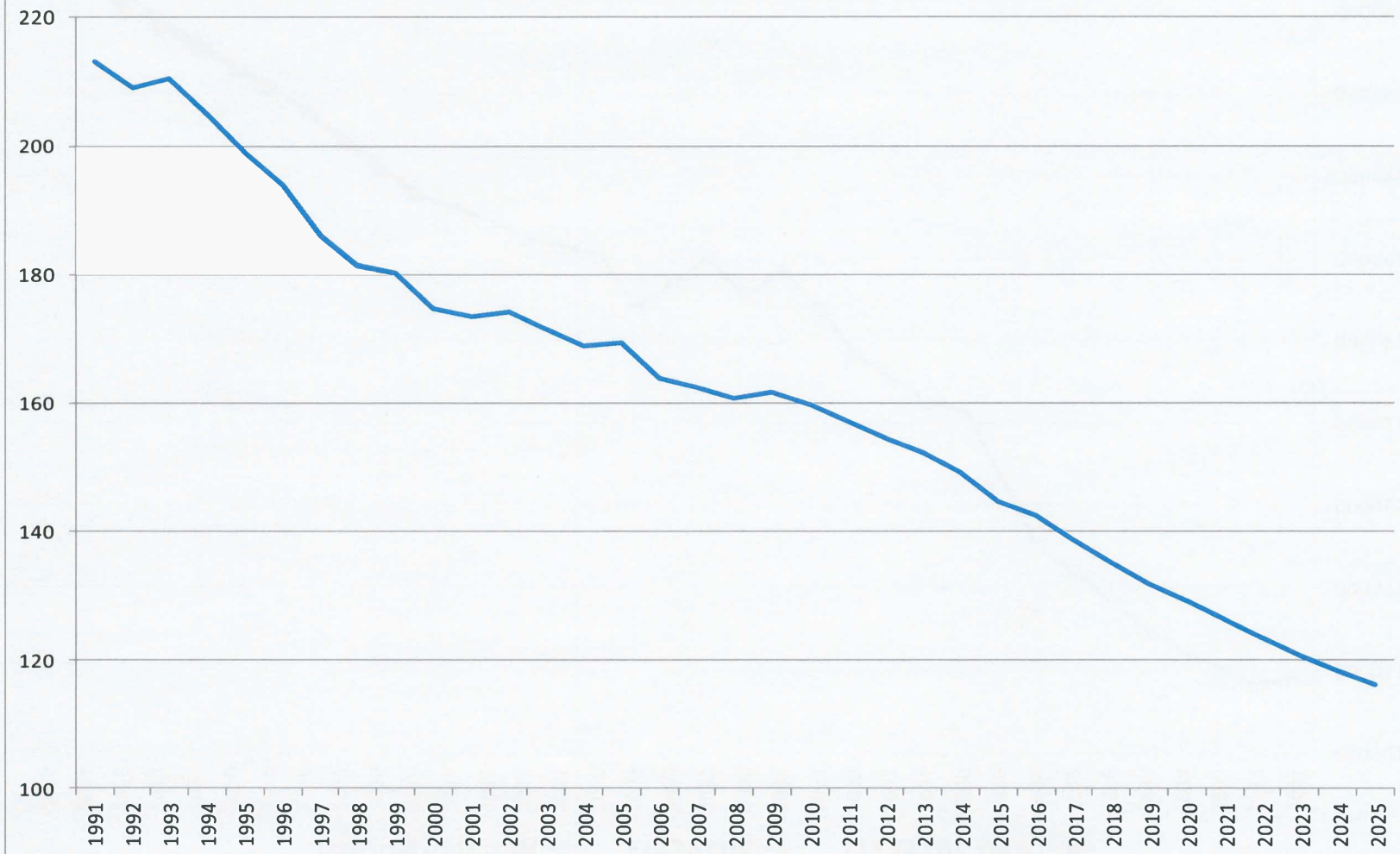
2016-2025 CAGR: Nov2015 2.1% Nov2014 2.1%



ISO-NE Gross Energy Forecast (GWh) Reconstituted for Historical Passive DR and BTM Solar PV



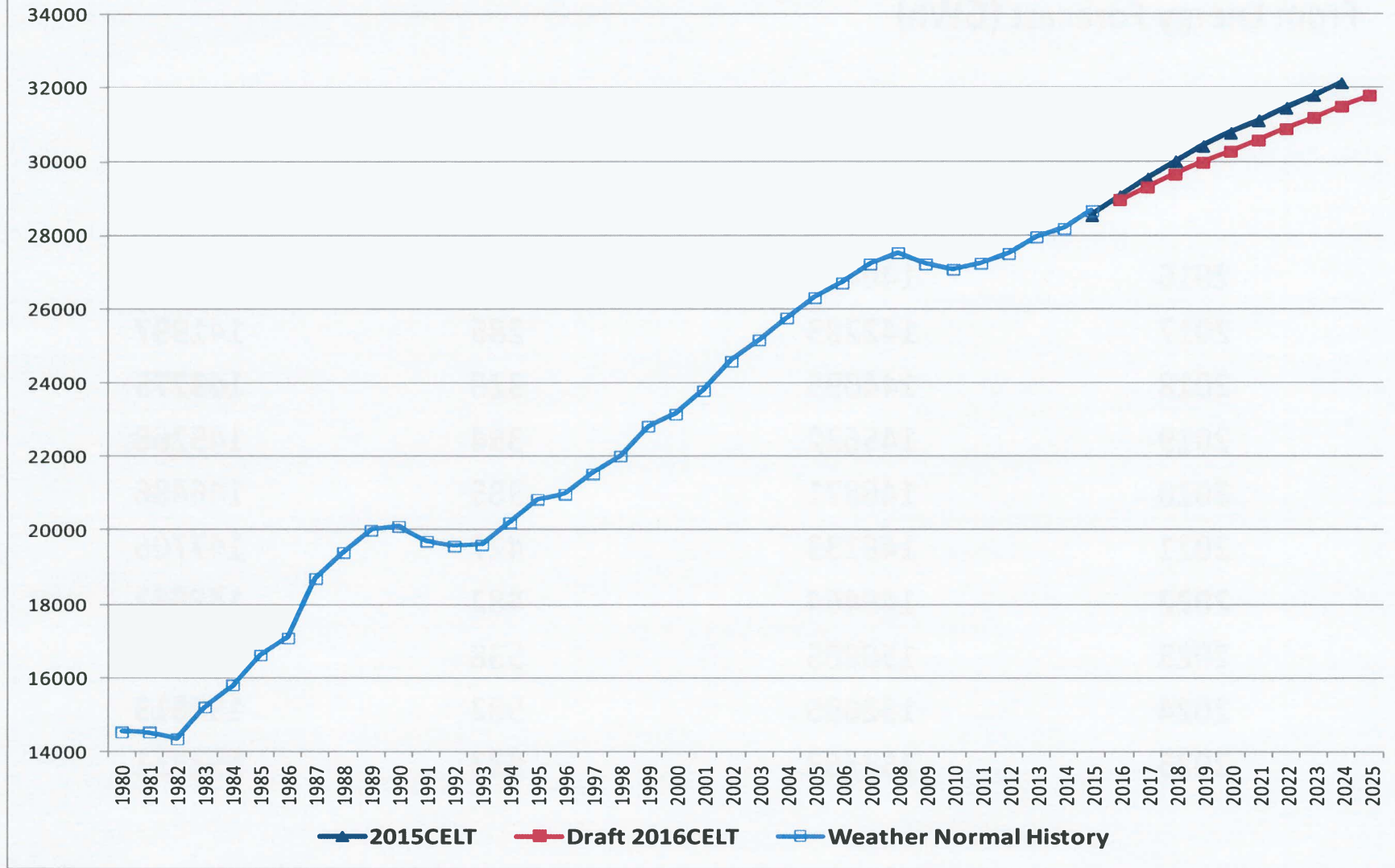
ISO-NE GWh of Annual Energy per Billion Dollars of Real Gross Domestic Product Weather Normal History 1991-2015 Draft 2016CELT NET Energy Forecast 2016-2025



**ISO-NE Subtracts Impacts of Federal Efficiency Standards (EISAS07)
From Energy Forecast (GWh)**

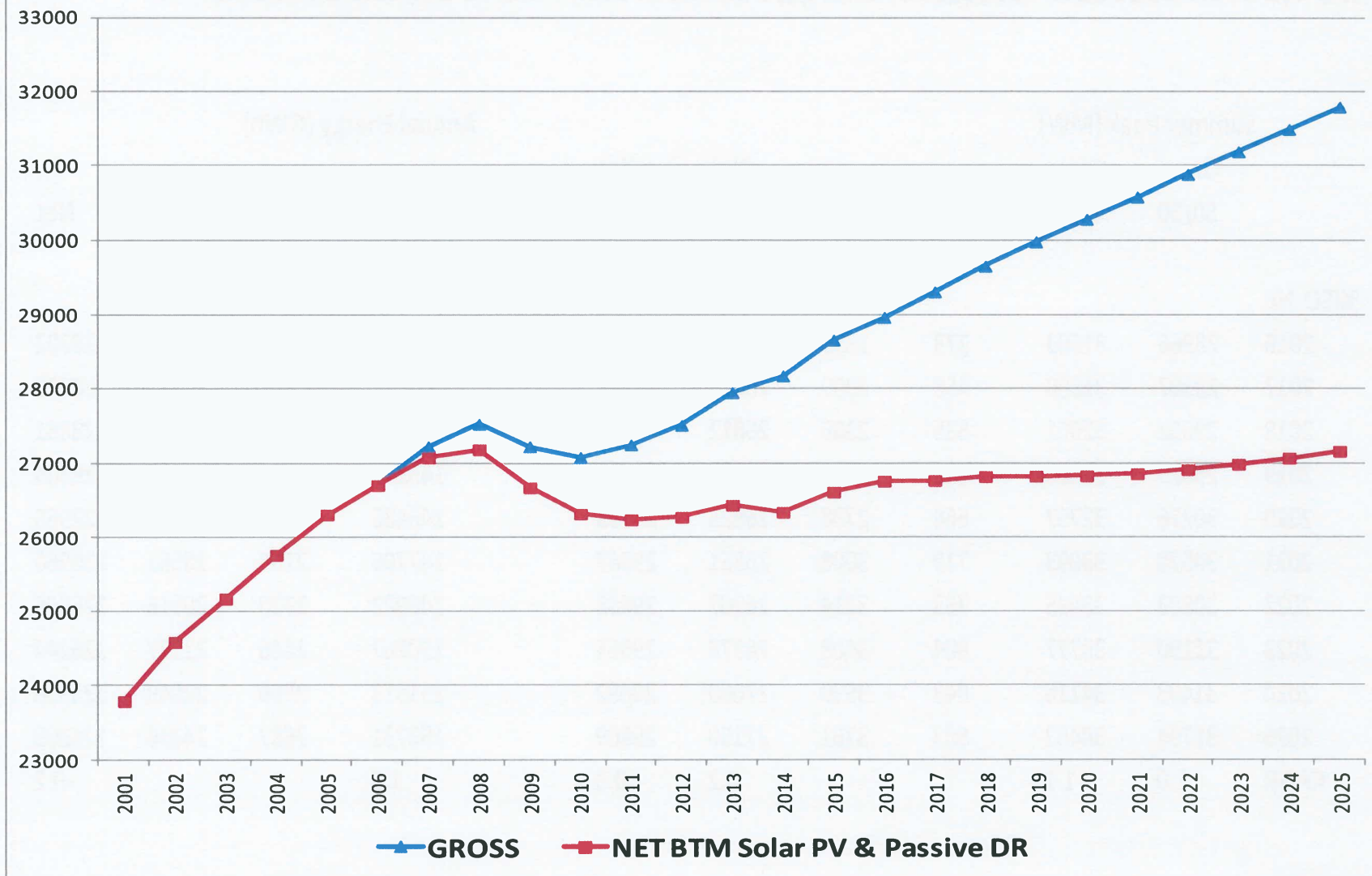
Year	Model Forecast	Incremental Standards	Forecast-Standards
2016	140450	181	140269
2017	142283	286	141997
2018	144095	320	143775
2019	145622	354	145268
2020	146871	385	146486
2021	148133	427	147706
2022	149464	482	148982
2023	150805	538	150267
2024	152095	582	151513
2025	153363	632	152731

ISO-NE Gross 50/50 Summer Peak Forecasts (MW) Reconstituted for Historical Passive DR and BTM Solar PV



The BTMEL has been added into the 2015CELT values

Draft 2016CELT ISO-NE 50/50 Summer Peak Forecast (MW) Weather Normal History 2001-2015 & Forecast 2016-2025



—▲— GROSS —■— NET BTM Solar PV & Passive DR

ISO-NE Draft 2016CELT Forecast of Energy, Summer Peak, Passive DR, and BTM Solar PV

	Summer Peak (MW)					Annual Energy (GWh)				
	Gross	Gross	PV:BTM	PDR	Net	Net	Gross	PV:BTM	PDR	Net
	50/50	90/10			50/50	90/10				
%ISO-NE										
2016	28966	31303	373	1839	26754	29092	140269	1127	10940	128202
2017	29307	31680	458	2089	26760	29133	141997	1384	11893	128720
2018	29652	32061	535	2306	26812	29221	143775	1622	13271	128881
2019	29975	32420	600	2554	26822	29266	145268	1819	15144	128304
2020	30276	32757	664	2788	26825	29305	146486	2016	16905	127565
2021	30578	33093	719	3008	26851	29367	147706	2185	18561	126960
2022	30883	33435	763	3214	26907	29458	148982	2320	20116	126546
2023	31190	33777	804	3408	26978	29565	150267	2446	21577	126244
2024	31493	34116	843	3590	27060	29682	151513	2566	22949	125998
2025	31794	34452	883	3761	27150	29809	152731	2687	24236	125808
CAGR	1.0	1.1			0.2	0.3	1.0			-0.2

Forecast Comparison Table: Draft 2016CELT and 2015CELT

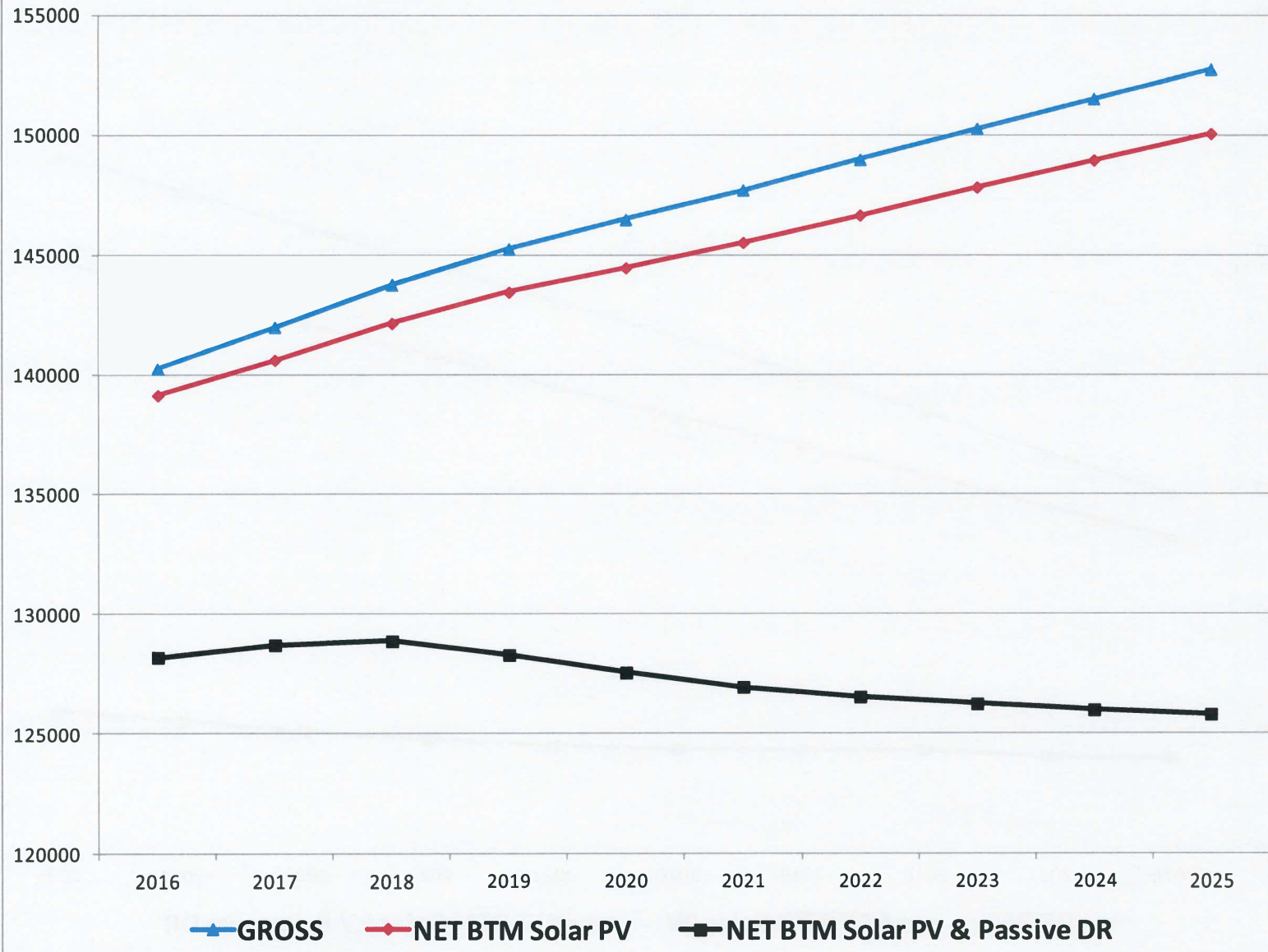
NET of Passive DR and BTM Solar PV										Average	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	Change	CAGR
Annual Energy (GWh)											
2016CELT	128202	128720	128881	128304	127565	126960	126546	126244	125998	-276	-0.2
2015CELT	128644	129208	129345	128786	128283	127910	127720	127668	127698	-118	-0.1
Difference	-442	-488	-464	-482	-718	-950	-1173	-1424	-1701		
50/50 Summer Peak (MW)											
2016CELT	26754	26760	26812	26822	26825	26851	26907	26978	27060	38	0.1
2015CELT	26835	26976	27178	27310	27399	27487	27598	27733	27875	130	0.5
Difference	-81	-216	-366	-488	-575	-635	-692	-755	-815		
90/10 Summer Peak (MW)											
2016CELT	29092	29133	29221	29266	29305	29367	29458	29565	29682	74	0.3
2015CELT	29215	29391	29628	29790	29914	30037	30183	30348	30525	164	0.5
Difference	-123	-258	-407	-523	-610	-669	-725	-783	-843		
GROSS Reconstituted with Passive DR and BTM Solar PV											
	2016	2017	2018	2019	2020	2021	2022	2023	2024		
Annual Energy (GWh)											
2016CELT	140269	141997	143775	145268	146486	147706	148982	150267	151513	1406	1.0
2015CELT	140578	142333	143966	145382	146733	148101	149534	151014	152490	1489	1.0
Difference	-309	-336	-191	-114	-247	-395	-552	-747	-977		
50/50 Summer Peak (MW)											
2016CELT	28966	29307	29652	29975	30276	30578	30883	31190	31493	316	1.1
2015CELT	29054	29529	29991	30407	30763	31099	31439	31789	32136	385	1.3
Difference	-88	-222	-339	-432	-487	-521	-555	-600	-643		
90/10 Summer Peak (MW)											
2016CELT	31303	31680	32061	32420	32757	33093	33435	33777	34116	352	1.1
2015CELT	31434	31944	32441	32887	33278	33649	34024	34404	34786	419	1.3
Difference	-131	-264	-380	-467	-521	-555	-589	-628	-670		

The BTMEL has been added into the 2015CELT values

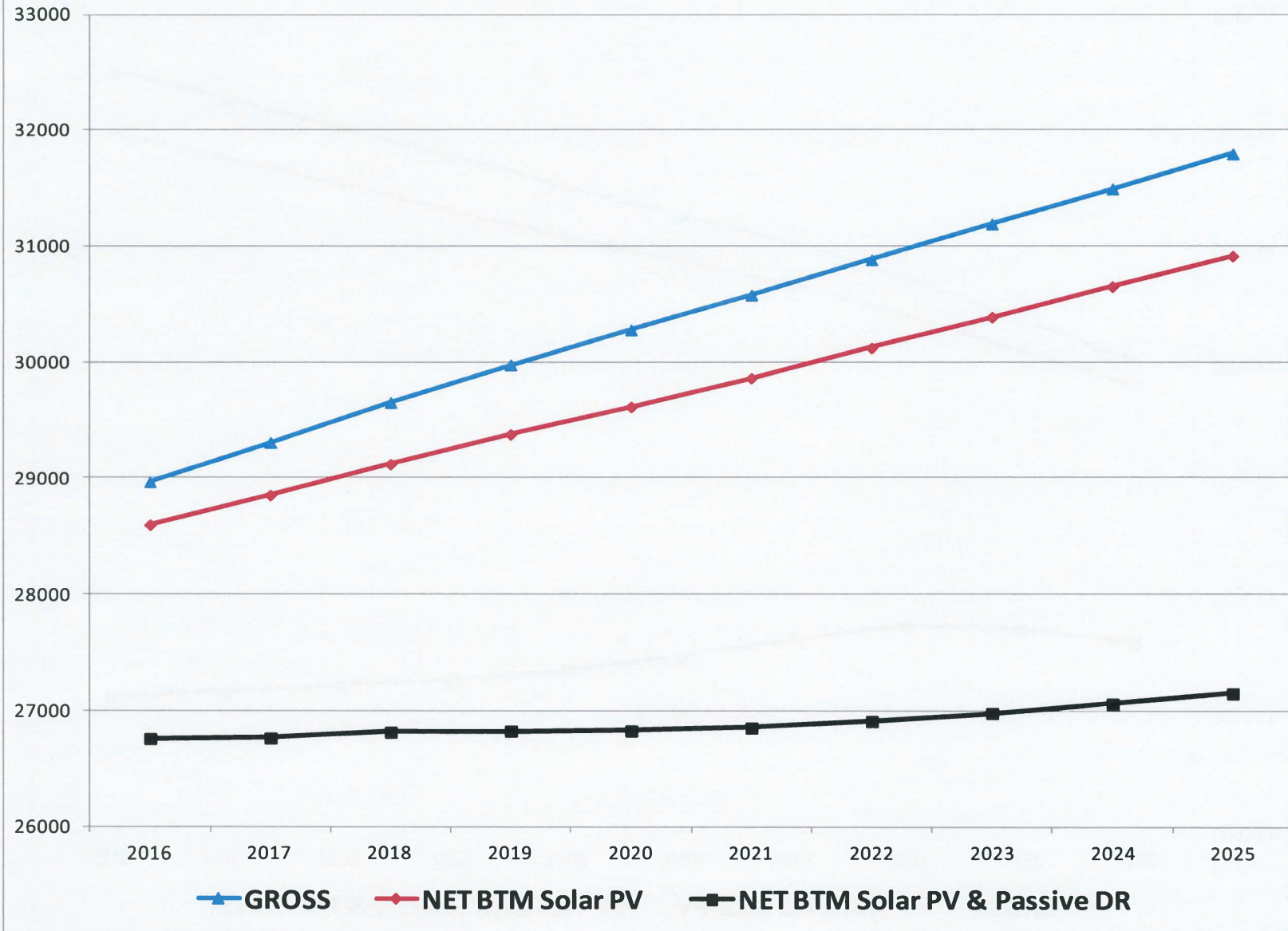
Forecast Comparison Table: Draft 2016CELT and 2015CELT

	2016	2017	2018	2019	2020	2021	2022	2023	2024
BTM Solar PV on Summer Peak (MW)									
2016CELT	373	458	535	600	664	719	763	804	843
2015CELT	382	466	510	548	583	614	637	660	683
Difference	-9	-8	25	51	81	105	125	143	160
Passive Demand Resources on Summer Peak (MW)									
2016CELT	1839	2089	2306	2554	2788	3008	3214	3408	3590
2015CELT	1839	2089	2306	2551	2782	3000	3205	3398	3579
Difference	0	0	0	3	6	8	9	10	11
Total Difference									
	-9	-8	25	54	87	113	134	153	171

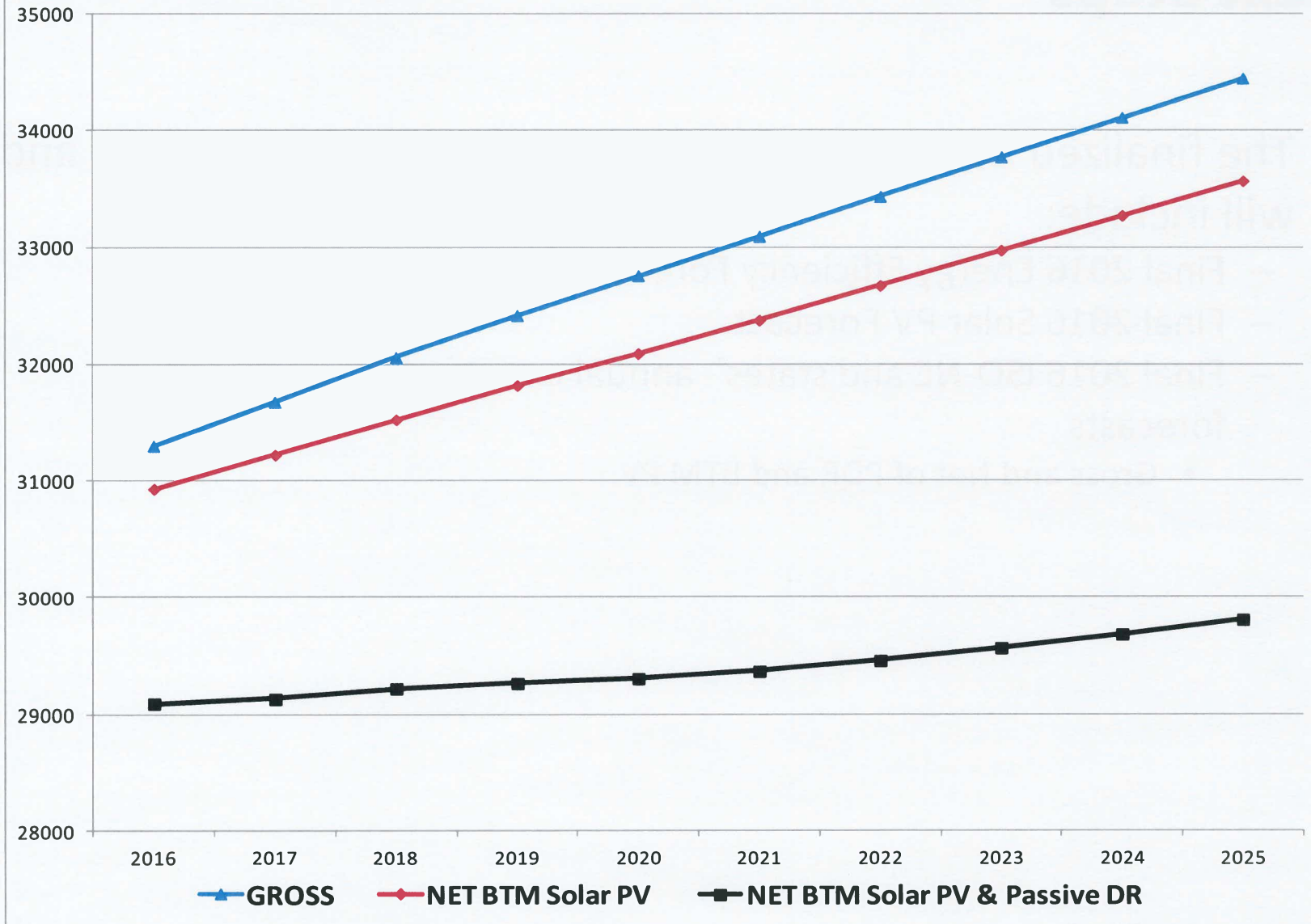
Draft 2016CELT ISONE Annual Energy Forecast (GWh)



Draft 2016CELT ISONE 50/50 Summer Peak Forecast (MW)



Draft 2016CELT ISONE 90/10 Summer Peak Forecast (MW)



Next Steps

- The finalized 2016 CELT will be published by May 1, 2016, and will include:
 - Final 2016 Energy Efficiency Forecast
 - Final 2016 Solar PV Forecast
 - Final 2016 ISO-NE and states' annual energy and seasonal peak forecasts
 - Gross and Net of PDR and BTM PV

Questions

