

DRAFT 2017 PV Forecast



Distributed Generation Forecast Working Group

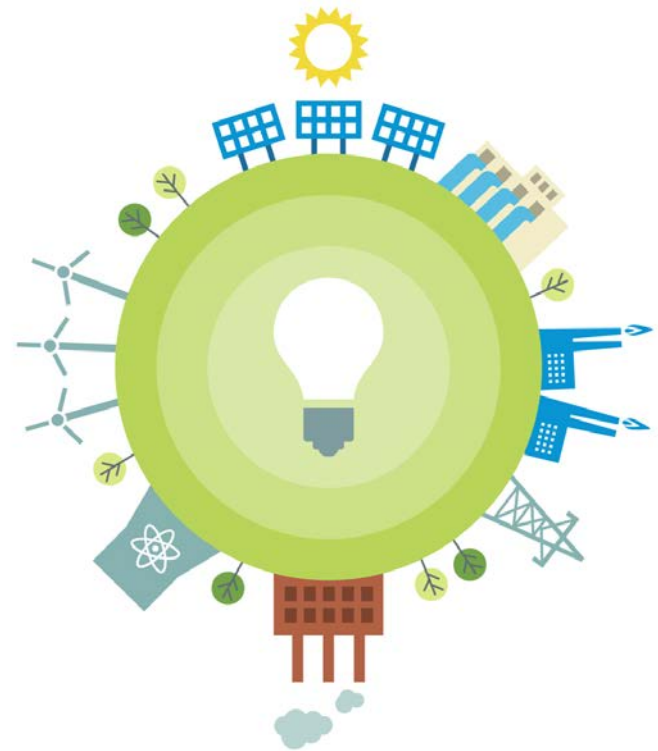
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Presentation Outline

- Introduction and Background
- 2016 PV Growth: Forecast vs. Reported
- Forecast Assumptions and Inputs
- Draft 2017 PV Forecast - Nameplate
- Next Steps for CELT 2017



INTRODUCTION AND BACKGROUND



Introduction

- The majority of state-sponsored distributed PV does not participate in wholesale markets, but reduces the system load observed by ISO
- The long-term PV forecast helps the ISO to determine future system load characteristics that are important for the reliable planning and operation of the system
- To properly account for PV in long-term planning, the finalized PV forecast will be categorized as follows:
 1. PV as a capacity resource in the Forward Capacity Market (FCM)
 2. Non-FCM Energy Only Resources (EOR) and Generators
 3. Behind-the-meter PV

Similar to energy efficiency (EE), behind-the-meter PV is reconstituted into historical loads*

The 2017 gross load forecast reflects loads without PV load reductions

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



Background: PV Forecast Focuses on DG

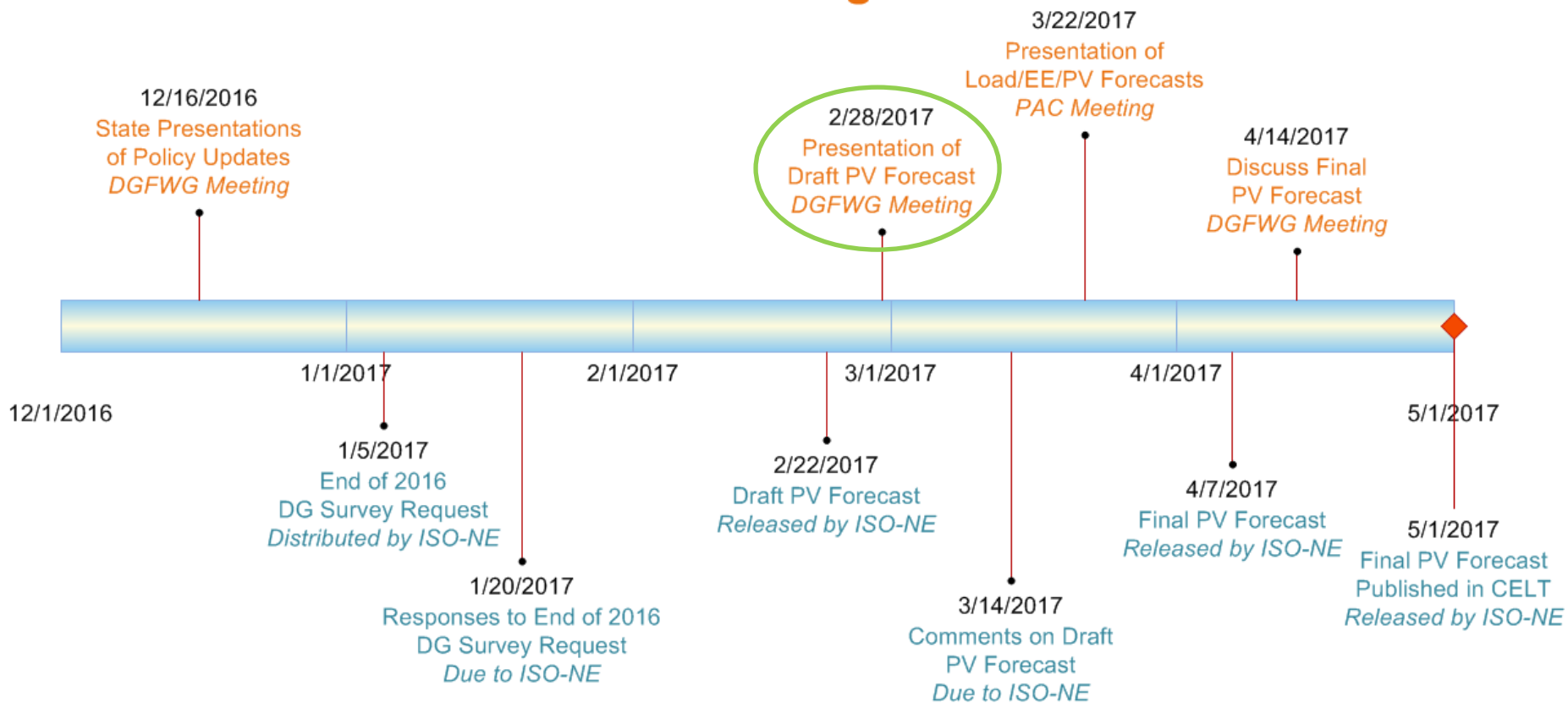
- The focus of the DGFWG is distributed generation projects:
 - “...defined as those that are typically 5 MW or less in nameplate capacity and are interconnected to the distribution system (typically 69 kV or below) according to state-jurisdictional interconnection standards.”¹
- Therefore, the forecast does not consider policy drivers supporting larger-scale projects (i.e., those >5 MW)
 - E.g., projects planned as part of the three-state Clean Energy RFP
- Large projects are generally accounted for as part of ISO’s interconnection process and participate in wholesale markets

¹ Distributed Generation Forecast Working Group (DGFWG) Proposed Scope of Work, available at: https://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/othr/distributed_generation_frctst/2013mtrls/sep302013/draft_dgfwg_scope_of_work.pdf



2017 PV Forecast Schedule

Meetings



Milestones



The PV Forecast Incorporates State Policies and Is Based on Historical Data

- The forecast reflects and incorporates existing state policies
- The expansion of existing state policies or the development of future state policy programs is not explicitly considered
- The PV forecast process is informed by ISO analysis and by input from state regulators and other stakeholders through the DGFWG
- The PV forecast methodology is straightforward, intuitive, and rational
- The forecast is meant to be a reasonable projection of the anticipated growth of out-of-market, distributed PV resources to be used in ISO's System Planning studies, consistent with our role to ensure prudent planning assumptions for the bulk power system



Forecast Focuses on State Policies in All Six New England States



- A policy-based forecasting approach has been chosen to reflect the observation that trends in distributed PV development are in large part the result of policy programs developed and implemented by the New England states
- The ISO makes no judgment regarding state policies, but rather utilizes the state goals as a means of informing the forecast
- In an attempt to control related ratepayer costs, states often factor anticipated changes in market conditions directly into policy design, which are therefore implicit to ISO's policy considerations in the development of the forecast



Many Factors Influence the Future Commercialization Potential of PV

- Policy Drivers:
 - Feed-in-tariffs (FITs)/Long-term procurement
 - State Renewable Portfolio Standards (RPS) programs
 - Net energy metering (NEM)
 - Investment Tax Credit (ITC)
- Other Drivers:
 - Role of private investment in PV development
 - Future equipment and installation costs
 - Future wholesale and retail electricity costs
- Background information concerning the economic drivers of PV can be found in ICF International's February 2015 report, Economic Drivers of PV Report for ISO New England, available at: http://www.iso-ne.com/static-assets/documents/2015/02/icf_economic_drivers_of_pv_report_for_iso_ne_2_27_15.pdf



Summary: Draft CELT 2017 PV Forecast

- The 2017 forecast reflects PV development trends in the region
- The 2017 forecast also reflects discussions with stakeholders and data exchange with the New England states and Distribution Owners
- Approximately 593 MW of PV development occurred in 2016
- Approximately 2,444 MW of PV development is projected from 2017 through 2026 for a total of 4,362 MW in 2026



2016 PV GROWTH: FORECAST VS. REPORTED



2016 PV Nameplate Growth

- Reported growth in region was 143.4 MW higher than forecast
- Table below compares the forecasted (2016 PV forecast) annual PV growth (MW_{AC}) and the reported growth for 2016

State	2016 Forecasted Growth	2016 Reported Growth	Difference
CT	85.5	93.5	8.0
MA	294.4	377.7	83.3
ME	4.7	6.8	2.1
NH	13.3	27.9	14.6
RI	21.6	13.2	-8.4
VT	30.2	73.8	43.6
Region	449.6	593.0	143.4

FORECAST ASSUMPTIONS AND INPUTS



Federal Investment Tax Credit

- The federal residential and business Investment Tax Credit (ITC) is a key driver of PV development in New England
- There are no changes to the ITC since the 2016 forecast

Residential ITC

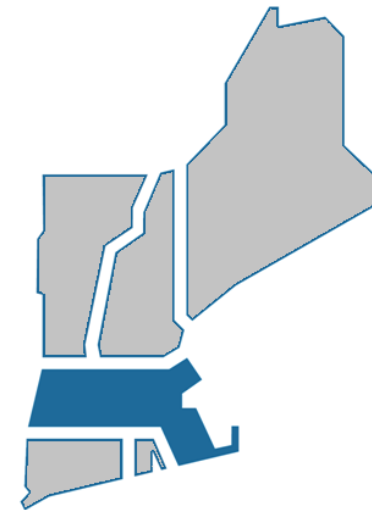
Maximum Allowable Residential ITC	
Year	Credit
2016	30%
2017	30%
2018	30%
2019	30%
2020	26%
2021	22%
Future Years	0%

Business ITC

ITC by Date of Construction Start	
Year construction starts	Credit
2016	30%
2017	30%
2018	30%
2019	30%
2020	26%
2021	22%
2022	10%
Future Years	10%

Sources: <http://programs.dsireusa.org/system/program/detail/658> and <http://programs.dsireusa.org/system/program/detail/1235>

Massachusetts Forecast Methodology and Assumptions



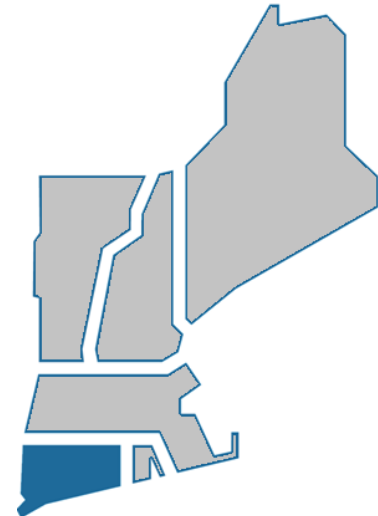
- [MA DPU's 12/16/16 DGFVG presentation](#) serves as primary source for MA policy information
- MA SREC I/II program goals met and Emergency Regulations result in expansion of SREC II
 - 83% AC-to-DC ratio assumed
 - Converted original 2020 goals: $1,600 \text{ MW}_{\text{DC}} = \mathbf{1,328 \text{ MW}_{\text{AC}}}$
 - Emergency Regulations result in additional $400 \text{ MW}_{\text{DC}} = \mathbf{332 \text{ MW}_{\text{AC}}}$
 - **Total of $1,660 \text{ MW}_{\text{AC}}$**
- MA Distribution Owners report a total of $1,324.77 \text{ MW}_{\text{AC}}$ installed by 12/31/16
 - Assume $30 \text{ MW}_{\text{AC}}$ is non-SREC capacity (i.e., “legacy”)
 - This results in $1,294.77 \text{ MW}_{\text{AC}}$ of SREC projects installed by 12/31/16
 - This leaves $365.23 \text{ MW}_{\text{AC}}$ of SREC projects remaining
- SREC I/II programs assumed to end in 2018; remaining capacity applied:
 - 2017 – 273.9 MW (75%)
 - 2018 – 91.3 MW (25%)

Massachusetts Forecast Methodology and Assumptions *continued*



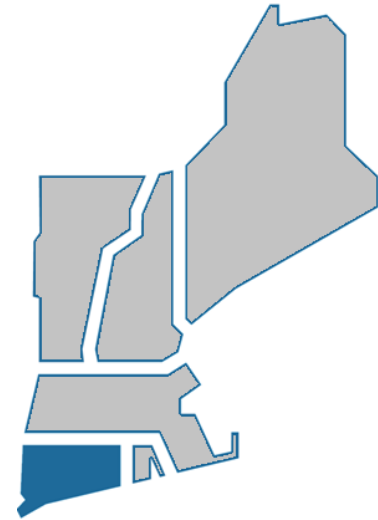
- MA DOER finalized design of Solar MA Renewable Target (SMART) program:
<http://www.mass.gov/eea/docs/doer/rps-aps/final-program-design-1-31-17.pdf>
 - Sets forth a 1,600 MW_{AC} SMART program goal
 - Program capacity goal is divided evenly over 2018-2022 (5 years) and post-policy discount factor is applied
 - ISO is seeking updated information concerning the regulatory process and implementation of the new SMART program

Connecticut Forecast Methodology and Assumptions



- [CT DEEP's 12/16/16 DGFWDG presentation](#) serves as primary source for CT policy information
- LREC/ZREC program assumptions
 - Solicitations for years 1-5 yielded 330 MW, of which 259 MW is PV
 - As proxy for year 6 solicitation planned for 2017, ISO used year 5 solicitation results, which included:
 - Medium/Large ZREC & LREC totals 72.7 MW (57 MW Eversource, 15.7 MW UI), of which 56.7 MW is PV
 - Small ZREC projects – assumed 20 MW PV total
 - 76.7 MW total PV assumed to be procured in Year 6
 - This yields a total of 335.7 MW PV from LREC/ZREC solicitations
 - This is a slight decrease from 360 MW assumed in 2016 PV forecast
 - Based on Distribution Owner data, approximately 113 MW of ZREC projects in service by 12/31/16
 - Remaining 222.7 MW were divided and applied to 2017-2020 as follows:
 - 2017-2019: 66.8 MW/year
 - 2020: 22.3 MW
 - Post-ZREC (after 2020) forecast values are kept at 2020 growth level, but are more significantly discounted

Connecticut Forecast Methodology and Assumptions *continued*



- CEFIA/Green Bank Residential Solar Incentive Program (RSIP) and Solar Home Renewable Energy Credit (SHREC) program
 - Total 300 MW goal by 2022, but CT DEEP anticipate goal met by 2019
 - Based on Distribution Owner data, approximately 154 MW installed as of 12/31/16 ; with 146 MW remaining
 - 48.67 MW/year from 2017-2019
 - Post-2019: Forecast inputs kept at 48.67 MW/year and post-policy discount factor applied
- Small Scale Procurement (< 5MW) associated with Public Act 15-107
 - Total of 5 MW expected to go into service in 2020
- A 20 MW project in Sprague/Lisbon removed from forecast since it is larger than 5MW

Vermont Forecast Methodology and Assumptions



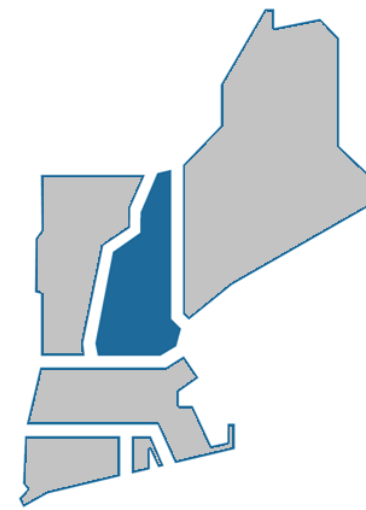
- [VT DPS' 12/16/16 DGFWDG presentation](#) serves as primary source for VT policy information
- DG carve-out of the Renewable Energy Standard (RES)
 - Assume 85% of eligible resources will be PV and a total of 25 MW/year will develop
- Standard Offer Program
 - Will promote a total of 110 MW of PV (of the 127.5 MW total goal)
 - All renewable energy certificates (RECs) from Standard Offer projects will be sold to utilities and count towards RES DG carve-out
- Net metering
 - All renewable energy certificates (RECs) from net metered projects will be sold to utilities and count towards RES DG carve-out

Vermont Forecast Methodology and Assumptions *continued*



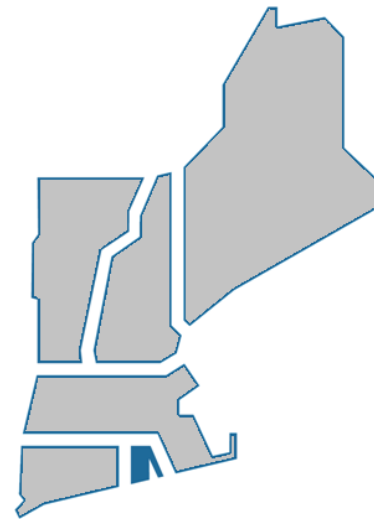
- Distribution Owners reported a total of 73.79 MW of PV growth in 2016
 - ISO assumed 48.79 MW (i.e., all but 25 MW) of 2016 growth will be used for future RES DG carve-out compliance
 - ISO implemented this assumption by lowering future RES-driven forecast over years 2017-2020 from 25 MW/year to 12.8 MW/year, reflecting a reduction of 12.2 MW/year
 - ISO is seeking feedback about draft assumptions concerning the anticipated fate of environmental attributes associated with this recent PV development

New Hampshire Forecast Methodology and Assumptions



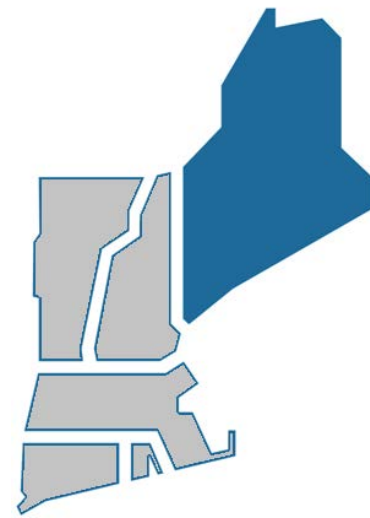
- [NH PUC's 12/16/16 DGFWDG presentation](#) serves primary source for NH policy information
- Based on distribution owner survey results, net metering and other state rebate/grants resulted in 27.9 MW of PV growth in 2016
- Net metering
 - The new 100 MW cap is reflected in draft forecast
 - Assume all of the remaining 30.1 MW will be PV, and 100 MW net metering cap reached by 2018

Rhode Island Forecast Methodology and Assumptions



- [RI OER's 12/16/16 DGFWDG presentation](#) serves as primary source for RI policy information
- DG Standards Contracts program
 - A total of 30 MW of 40 MW program goal will be PV
 - Estimated 18 MW installed by 12/31/16, and 12 MW remaining assumed to be installed at 6 MW/year from 2017-2018
- Renewable Energy Growth Program (REGP)
 - Total of 144 MW of 160 MW of program goal will be PV
 - Estimated 4.8 MW installed by 12/31/16, and remaining 139.2 MW installed over years 2017-2021
- Renewable Energy Fund & Net Metering (joint policy drivers)
 - Historically has supported a total of ~14 MW of PV through 12/31/16
 - Form EIA-826 data indicates 13.741 MW through 11/30/16
 - Includes a new 30 MW virtual net metering program created in 2016
 - Assumed to yield 4 MW/year over the forecast horizon (total of 40 MW)

Maine Forecast Methodology and Assumptions



- [ME PUC's 12/16/16 DGFWDG presentation](#) serves as primary source for ME policy information
- Based on Distribution Owner survey results, net metering and other state grants/incentives resulted in 6.84 MW of PV growth in 2016
- This annual growth is carried forward at constant rate throughout forecast period



Discount Factors

- Discount factors were developed and incorporated into the forecast, and reflect a degree of uncertainty in future PV commercialization
- Discount factors were developed for two types of future PV inputs to the forecast (and all discount factors are applied equally in all states)

<u>Policy-Based</u> <i>PV that results from state policy</i>	<u>Post-Policy</u> <i>PV that may be installed after existing state policies end</i>
Discounted by values that increase annually up to a maximum value of 20%	Discounted by 50% due to the high degree of uncertainty associated with possible future expansion of state policies and/or future market conditions required to support PV commercialization in the absence of policy expansion

Discount Factors, *continued*

- Annual discount factors for policy-based solar PV are tabulated on the right
 - Draft 2017 vs. final 2016 shown
- Trajectory of draft 2017 policy-based discount factors is similar to that of 2016 forecast, and reflects timing of federal ITC phase-out
- All post-policy MWs are discounted at 50%, consistent with last year's forecast approach

Forecast	Final 2016	Draft 2017
Thru 2016	5%	0%
2017	5%	5%
2018	10%	5%
2019	10%	10%
2020	10%	10%
2021	15%	15%
2022	20%	20%
2023	20%	20%
2024	20%	20%
2025	20%	20%
2026	--	20%

Summary of State-by-State 2017 Forecast Inputs

Pre-Discounted Nameplate Values

States	Pre-Discount Annual Total MW (AC nameplate rating)											Totals
	Thru 2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
CT	281.5	115.5	115.5	115.5	75.9	70.9	70.9	70.9	70.9	70.9	70.9	1,129.5
MA	1324.8	273.9	358.0	266.7	266.7	266.7	266.7	266.7	133.3	133.3	133.3	3,690.0
ME	22.1	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	90.5
NH	54.3	18.1	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	180.7
RI	36.8	41.3	41.3	35.3	35.3	17.9	17.9	17.9	17.9	17.9	17.9	297.6
VT	198.4	12.8	12.8	12.8	12.8	25.0	25.0	25.0	25.0	25.0	25.0	399.6
Pre-Discount Annual Policy-Based MWs	1918.0	468.4	279.8	170.4	82.2	49.8	35.8	35.8	35.8	35.8	35.8	3,147.8
Pre-Discount Annual Post-Policy MWs	0.0	0.0	266.7	278.7	327.4	349.6	363.6	363.6	230.2	230.2	230.2	2,640.2
Pre-Discount Annual Total (MW)	1918.0	468.4	546.5	449.1	409.6	399.4	399.4	399.4	266.1	266.1	266.1	5,788.0
Pre-Discount Cumulative Total (MW)	1918.0	2,386.4	2,932.8	3,382.0	3,791.6	4,191.0	4,590.4	4,989.8	5,255.9	5,521.9	5,788.0	5,788.0

Notes:

- (1) The above values **are not the forecast**, but rather pre-discounted inputs to the forecast (see slides 13-25 for details)
- (2) Yellow highlighted cells indicate that values contain post-policy MWs
- (3) All values include FCM Resources, non-FCM Settlement Only Generators and Generators (per OP-14), and load reducing PV resources
- (4) All values represent end-of-year installed capacities

DRAFT 2017 SOLAR PV FORECAST

Nameplate MW

Final 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	294.4	122.7	69.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	1,705.0
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	23.8	22.5	22.5	22.5	21.3	20.0	20.0	20.0	20.0	347.3
Regional - Annual (MW)	1325.0	449.6	301.9	217.7	186.7	176.5	133.2	127.5	118.2	118.2	118.2	3,272.8
Regional - Cumulative (MW)	1325.0	1774.7	2076.5	2294.2	2480.9	2657.4	2790.6	2918.1	3036.3	3154.6	3272.8	3,272.8

Notes:

- (1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
- (2) The forecast reflects discount factors described on slides 24-25
- (3) All values represent end-of-year installed capacities

Draft 2017 PV Forecast

Nameplate Capacity, MW_{ac}

States	Annual Total MW (AC nameplate rating)											Totals
	Thru 2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
CT	281.5	109.7	109.7	103.9	48.9	35.5	35.5	35.5	35.5	35.5	35.5	866.6
MA	1324.8	260.2	220.1	133.3	133.3	133.3	133.3	133.3	66.7	66.7	66.7	2,671.7
ME	22.1	6.5	6.5	6.2	6.2	5.8	5.5	5.5	5.5	5.5	5.5	80.6
NH	54.3	17.2	11.4	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	131.1
RI	36.8	39.3	39.3	31.8	31.8	15.2	10.2	10.2	10.2	10.2	10.2	244.9
VT	198.4	12.2	12.2	11.5	11.5	21.3	20.0	20.0	20.0	20.0	20.0	367.0
Regional - Annual (MW)	1918.0	445.0	399.1	292.7	237.7	217.1	210.5	210.5	143.8	143.8	143.8	4,361.9
Regional - Cumulative (MW)	1918.0	2363.0	2762.1	3054.8	3292.5	3509.7	3720.1	3930.6	4074.4	4218.1	4361.9	4,361.9

Notes:

- (1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
- (2) The forecast reflects discount factors described on slides 24-25
- (3) All values represent end-of-year installed capacities



NEXT STEPS FOR FINAL CELT 2017

Next Steps for CELT 2017

- Once the 2017 nameplate PV forecast is finalized, ISO will:
 - Break down the forecast by market participation category
 - At the end of 2016, approximately 65% of PV was behind-the-meter
 - Create the PV energy forecast
- ISO will reconstitute PV into the historical loads used to develop the long-term gross load forecast
 - Overall accounting in the net load forecast will be the same
 - Three PV categories will be used for CELT 2017:
 1. PV as a capacity resource in the FCM
 2. Non-FCM Energy Only Resources (EOR) and Generators (per Operating Procedure 14)
 3. Behind-the-meter (BTM) PV
- ISO will use the same approach as last year for the geographic distribution of PV forecast
 - Assumes future development is in existing areas of PV development

We Want Your Feedback ...

- Please share your comments today
- ISO requests written comments on draft 2017 PV forecast by 3/14/17
- Please submit comments to DGFWGMatters@iso-ne.com



Questions

