



Draft 2022 Photovoltaic (PV) Forecast

*Distributed Generation Forecast Working
Group*

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Outline

- Introduction and Background
- 2021 PV Growth: Forecast vs. Reported
- Forecast Assumptions and Inputs
- Draft 2022 PV Forecast - Nameplate
- Next Steps for the 2022 Capacity, Energy, Loads, and Transmission (CELT) Forecast



INTRODUCTION & 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 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 (BTM PV)

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

The 2022 gross load forecast reflects loads without PV load reductions

**Existing BTM PV decreases the historical metered loads, which are an input to the gross load forecast*



PV Forecast Focuses on Distributed Generation

- The focus of the DGFWG is distributed generation (DG) 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.”
- Therefore, the forecast does not consider policy drivers supporting larger-scale projects (i.e., those >5 MW)
- Large projects are generally accounted for as part of ISO’s interconnection process and participate in wholesale markets



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

- The PV forecast process is informed by ISO analysis and input from state regulators and other stakeholders through the Distributed Generation Forecast Working Group (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 its role to ensure prudent planning assumptions for the bulk power system
- The forecast reflects and incorporates state policies and the ISO does not explicitly forecast the expansion of existing state policies or the development of future state policy programs



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) and retail rate structure
- Federal investment tax credit (ITC) and federal depreciation
- Federal trade policy

Other Drivers

- Role of private investment in PV development
- Future equipment and installation costs
- Future wholesale and retail electricity costs
- Interconnection costs and issues



Draft CELT 2022 PV Forecast

Summary

- The 2022 forecast reflects:
 - PV development trends in the region
 - Discussions with stakeholders and data exchange with the New England states and Distribution Owners
- According to data provided by Distribution Owners, approximately 771 MW of PV development occurred in 2021, totaling 4,767 MW installed across the region
 - Values include FCM, EOR, and BTM PV projects
- Approximately 6,531 MW of PV development is projected from 2022 through the end of 2031 for a total of 11,298 MW
 - Values include FCM, EOR, and BTM PV projects
- By the end of 2030, the draft 2022 PV nameplate forecast is 835 MW higher than the 2021 PV forecast

2021 PV GROWTH: FORECAST VS. REPORTED

2021 PV Growth

Total Nameplate Capacity

- Comparison of the state-by-state 2021 forecast PV growth and the growth for 2021 reported by utilities is tabulated below
 - Values include FCM, EOR, and BTM PV projects
- Regionally, 2021 growth reported by utilities totaled 771.1 MW, which is 23 MW lower than the forecast growth
 - Results vary by state

State	2021 Reported Growth	2021 Forecast Growth	Difference
CT	126.8	108.1	18.8
MA	451.1	454.3	-3.2
ME	56.2	138.8	-82.6
NH	31.6	19.1	12.4
RI	64.6	49.1	15.5
VT	40.8	24.7	16.1
Region	771.1	794.1	-23.0

Larger-Scale PV

Projects >5 MW_{ac}

- Tabulated below is a summary of in-service, larger-scale (i.e., non-DG) PV projects included as part of Distribution Owner survey data responses
- These projects are not included in the PV forecast, and are excluded from installed PV totals reported herein

State	# Projects Listed	Total Nameplate (MW _{ac})
CT	3	66.4
MA	-	-
ME	1	9.9
NH	-	-
RI	13	102.5
VT	-	-
Total	17	178.8

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
 - Congress extended the ITC for two years in December 2020
- Department of Energy guidance is available for both the [Residential ITC](#) and [Business ITC](#)

Residential ITC

Maximum Allowable Residential ITC	
Year	Credit
2020	30%
2021-2022	26%
2023	22%
Future Years	0%

Business ITC

ITC by Date of Construction Start	
Year construction starts	Credit
2020-2022	26%
2023	22%
Future Years	10%

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

Massachusetts Forecast Assumptions

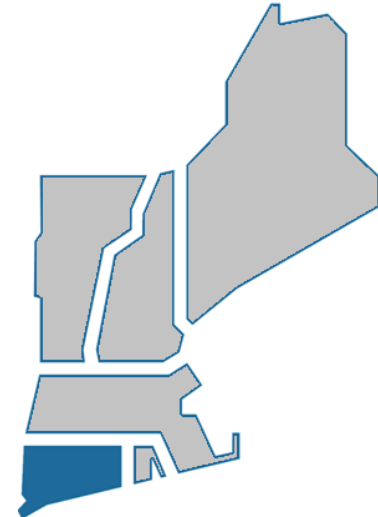


- [MA DPU's 12/6/21 DGFVG presentation](#) serves as primary source for MA policy information
- MA Distribution Owners survey results:
 - 2,953.4 MW_{AC} installed by 12/31/21
- Solar Massachusetts Renewable Target (SMART) Program
 - Program goal of 3,200 MW_{AC} goal achieved over the period 2021-2027 (7 years)
 - 713.6 MW_{AC} installed by end of 2021; 2,813.3 MW_{AC} remaining
 - Assume program capacity is divided over years as tabulated below

Year	Thru 2021	2022	2023	2024	2025	2026	2027	Total
% Remaining		19	19	19	19	19	5	100
MW	713.6	472.4	472.4	472.4	472.4	472.4	124.3	3,200

- Post-policy development assumed to occur such that a total of 472.4 MW is carried forward from 2027 onward at constant rate throughout the remaining years of the forecast period, and post-policy discount factors are applied

Connecticut Forecast Assumptions



- [CT DEEP's 12/6/21 DGFWDG presentation](#) serves as primary source for CT policy information
- CT Distribution Owner survey results
 - 809.1 MW_{AC} installed by 12/31/21
- Existing LREC/ZREC program assumptions
 - Assume a total of 175 MW divided over 3 years, 2022-2024, as tabulated below

Year	2022	2023	2024
MW	58.33	58.33	58.33

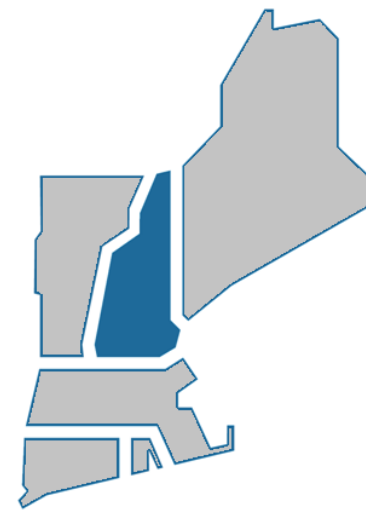
- Non-Residential Tariff will result in 47.5 MW/year (95% of 50 MW annual procurement) over the period 2024-2029
- Residential Solar Investment Program (RSIP) and subsequent Residential Renewable Energy Solutions program will promote 51 MW_{AC}/year (60 MW_{DC}) through year 2031
- Shared Clean Energy Facility (SCEF)
 - Successor SCEF program: Promotes 25 MW/year over the period 2021-2027
- At the end of Non-Residential Tariff and SCEF successor programs, all MWs from last year of each program are carried forward until 2031 at a constant rate, and post-policy discount factors are applied

Vermont Forecast Assumptions



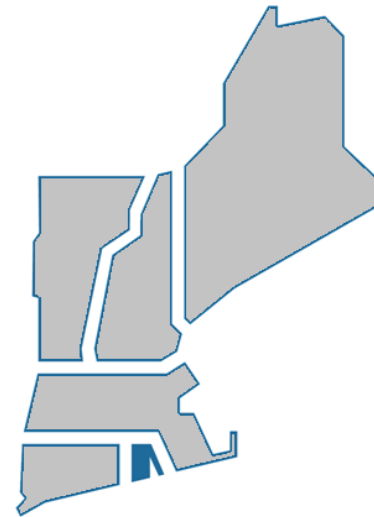
- [VT DPS' 12/6/21 DGFWG presentation](#) serves as the primary source for VT policy information
- VT Distribution Owner survey results
 - 434.2 MW_{AC} installed by 12/31/21
- A total of 30 MW/year is forecast in VT due to the DG carve-out of the Renewable Energy Standard (RES) and its supporting policies (Standard Offer Program, net metering)
 - All forward-looking renewable energy certificates (RECs) from Standard Offer and net metered projects will be sold to utilities and count towards RES DG carve-out

New Hampshire Forecast Assumptions



- [NH PUC's 12/6/21 DGFWDG presentation](#) serves as the primary source for NH policy information
- NH Distribution Owners survey results
 - 156.9 MW_{AC} installed by 12/31/21
 - 31.56 MW_{AC} installed in 2021
- Assume the Net Energy Metering Tariff continues to support the 2021 rate of growth throughout the forecast horizon
 - No limit on state-wide aggregate net metered capacity

Rhode Island Forecast Assumptions



- [RI OER's 12/6/21 DGFVG presentation](#) serves as the primary source for RI policy information
- RI Distribution Owner survey results
 - 288.4 MW_{AC} installed by 12/31/21
 - 64.6 MW installed in 2021 (not including projects > 5 MW nameplate capacity)
- Renewable Energy Growth Program (REGP)
 - Assume REGP supports 36 MW_{DC}/year of PV through 2029
 - Convert: 36 MW_{DC} = 29.88 MW_{AC} (83% AC-to-DC ratio assumed)
- Renewable Energy Development Fund, Net Metering, and Virtual Net Metering (VNM)
 - No limit on state-wide aggregate net metered capacity
 - Assumed to yield 25 MW/year of projects < 5 MW in size over the forecast horizon
- At the end of existing REGP, all MWs from last year of program are carried forward until 2031 at a constant rate, and post-policy discount factors are applied

Maine Forecast Assumptions



- [ME PUC's 12/6/21 DGFWDG presentation](#) serves as the primary source for ME policy information
- ME Distribution Owner survey results
 - 125.1MW_{AC} installed by 12/31/21
 - 56.2 MW installed in 2021
- Net Energy Billing (NEB) Rule (per L.D. 1711) assumptions
 - A total of 1,175 MW of projects in the NEB queue will be developed from 2021-2026 as tabulated below
 - Total represents the average of the conservative and middle scenarios described by ME PUC (see slide 7 of [ME PUC presentation](#))
 - NEB will continue to support 30 MW/year of growth starting in 2027

Year	Thru 2021	2022	2023	2024	2025	2026
% remaining		10	22	22	23	23
MW	40	113.5	249.7	249.7	261.05	261.05



Discount Factors

- Discount factors are:
 - Developed and incorporated into the forecast to ensure a degree of uncertainty in future PV commercialization is considered
 - Developed for two types of future PV inputs to the forecast, and all discount factors are applied equally in all states
 - Applied to the forecast inputs (see slide 23) to determine total nameplate capacity for each state and forecast year

<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 over the forecast horizon up to a maximum value of 15%	Discounted by 35-50% 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 Used in Draft 2022 Forecast

Policy-Based

Forecast	Final 2021	Draft 2022
2021	10%	5%
2022	15%	10%
2023	15%	15%
2024	15%	15%
2025	15%	15%
2026	15%	15%
2027	15%	15%
2028	15%	15%
2029	15%	15%
2030	N/A	15%

Post-Policy

Forecast	Final 2021	Draft 2022
2021	36.7%	35.0%
2022	38.3%	36.7%
2023	40.0%	38.3%
2024	41.7%	40.0%
2025	43.3%	41.7%
2026	45.0%	43.3%
2027	46.7%	45.0%
2028	48.3%	46.7%
2029	50.0%	48.3%
2030	N/A	50.0%

Draft 2022 Forecast Inputs

Pre-Discounted Nameplate Values

States	Pre-Discount Annual Total MW (AC nameplate rating)											Totals
	Thru 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	
CT	809.1	119.3	124.3	178.7	123.5	123.5	123.5	123.5	123.5	123.5	123.5	2,095.9
MA	2953.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	7,677.5
ME	125.1	113.5	249.7	249.7	261.1	261.1	30.0	30.0	30.0	30.0	30.0	1,410.1
NH	156.9	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	472.4
RI	288.4	54.9	54.9	54.9	54.9	54.9	54.9	54.9	54.9	54.9	54.9	837.2
VT	434.2	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	734.2
Pre-Discount Annual Policy-Based MWs	4767.1	821.7	962.9	1017.3	973.4	973.4	394.3	269.9	244.9	167.6	167.6	10,759.9
Pre-Discount Annual Post-Policy MWs	0.0	0.0	0.0	0.0	0.0	0.0	348.1	472.4	497.4	574.8	574.8	2,467.5
Pre-Discount Annual Total (MW)	4767.1	821.7	962.9	1017.3	973.4	973.4	742.3	742.3	742.3	742.3	742.3	13,227.4
Pre-Discount Cumulative Total (MW)	4767.1	5,588.7	6,551.6	7,568.9	8,542.3	9,515.7	10,258.0	11,000.4	11,742.7	12,485.1	13,227.4	13,227.4

Notes:

- (1) The above values **are not the forecast**, but rather pre-discounted inputs to the forecast (see slides 14-20 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 2022 PV NAMEPLATE CAPACITY FORECAST

Includes FCM, non-FCM EOR, and BTM PV

Draft 2022 PV Forecast

Nameplate Capacity, MW_{ac}

States	Annual Total MW (AC nameplate rating)											Totals
	Thru 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	
CT	809.1	113.4	111.9	151.9	105.0	105.0	105.0	105.0	97.1	80.8	79.6	1,863.6
MA	2953.4	448.8	425.2	401.6	401.6	401.6	302.9	259.8	252.0	244.1	236.2	6,327.0
ME	125.1	107.8	224.7	212.2	221.9	221.9	25.5	25.5	25.5	25.5	25.5	1,241.1
NH	156.9	30.0	28.4	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	429.8
RI	288.4	52.1	49.4	46.6	46.6	46.6	46.6	46.6	46.6	36.7	36.2	742.7
VT	434.2	28.5	27.0	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	693.7
Regional - Annual (MW)	4767.1	780.6	866.6	864.7	827.4	827.4	532.4	489.3	473.5	439.4	429.8	11,298.0
Regional - Cumulative (MW)	4767.1	5547.6	6414.2	7278.9	8106.3	8933.7	9466.1	9955.3	10428.8	10868.2	11298.0	11,298.0

Notes:

- (1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
- (2) The forecast values are net of the effects of discount factors applied to reflect a degree of uncertainty in the policy-based forecast
- (3) All values represent end-of-year installed capacities
- (4) Forecast does not include forward-looking PV projects > 5MW in nameplate capacity

Final 2021 PV Forecast (For Comparison)

Nameplate Capacity, MW_{ac}

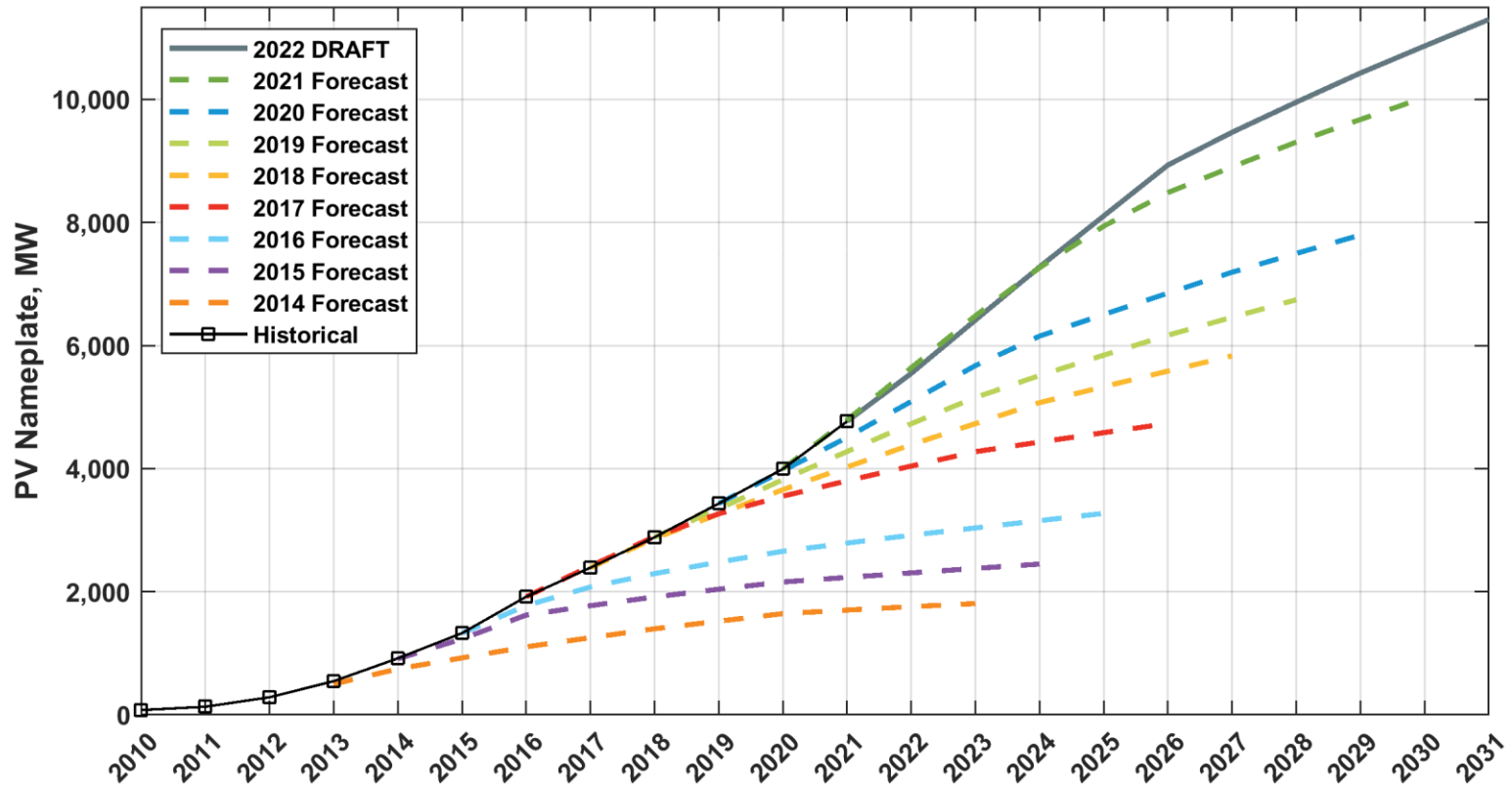
States	Annual Total MW (AC nameplate rating)											Totals
	Thru 2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
CT	682.3	108.1	131.6	147.6	91.1	91.1	91.1	91.1	83.2	55.4	53.6	1,626.0
MA	2502.3	454.3	430.4	406.5	406.5	406.5	358.7	232.1	225.1	218.0	211.0	5,851.5
ME	68.8	138.8	199.0	209.2	201.7	97.8	12.8	12.8	12.8	12.8	12.8	979.1
NH	125.3	19.1	18.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	299.4
RI	223.8	49.1	46.5	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	658.5
VT	393.5	24.7	23.4	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	618.4
Regional - Annual (MW)	3995.9	794.1	849.1	844.9	781.0	677.0	544.1	417.5	402.6	367.8	358.9	10,032.9
Regional - Cumulative (MW)	3995.9	4790.0	5639.1	6484.0	7264.9	7941.9	8486.1	8903.6	9306.2	9674.0	10032.9	10,032.9

Notes:

- (1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
- (2) The forecast values are net of the effects of discount factors applied to reflect a degree of uncertainty in the policy-based forecast
- (3) All values represent end-of-year installed capacities
- (4) Forecast does not include forward-looking PV projects > 5MW in nameplate capacity

PV Nameplate Capacity Growth

Historical vs. Forecast

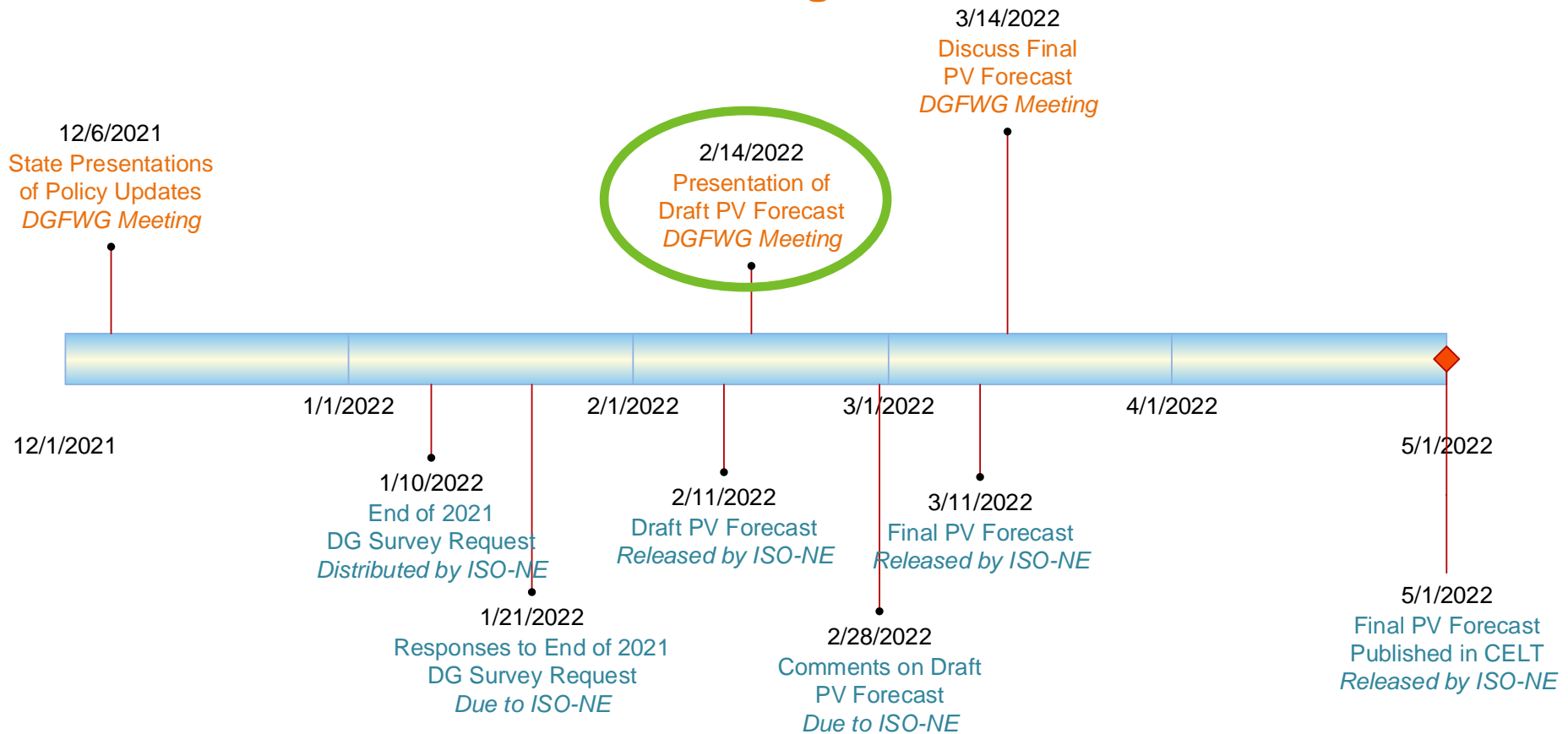


NEXT STEPS



2022 PV Forecast Schedule

Meetings



Milestones

Next Steps for CELT 2022

- Other components of the forecast can be developed once the 2022 nameplate PV forecast is finalized, including:
 - Breakdown of the forecast by market participation category
 - For reference, approximately 59% of PV was behind-the-meter at the end of 2020; however, note that BTM shares differ across states
 - PV energy forecast
 - Estimated summer peak load reductions
 - Discussion of the relevant methodology is available here: https://www.iso-ne.com/static-assets/documents/2020/04/final_btm_pv_peak_reduction.pdf
 - Accounting for PV panel degradation using the same approach as last year
- ISO will reconstitute PV into the historical loads used to develop the long-term gross load forecast
 - As in prior forecasts, three PV categories will be used for CELT 2022:
 1. PV as a capacity resource in the FCM
 2. EOR
 3. BTM PV
- As part of the 2021 Capacity, Energy, Loads, and Transmission forecast (CELT 2021), the ISO will produce BTM PV forecasts for:
 - Nameplate, energy, and estimated peak load reductions (CELT Section 3)
 - See: <https://www.iso-ne.com/system-planning/system-plans-studies/celt/>
 - The overall system, states, and Regional System Plan (RSP) subareas

We Want Your Feedback

ISO Thanks the DGFWG for Its Input!



- Stakeholders may provide written comments on the draft forecast by February 28, 2022 @ 5:00 p.m.
 - Please submit comments to DGFWGMatters@iso-ne.com

Questions

