The Growth of Solar in New England and its Impact on the Wholesale Market

Consumer Liaison Group

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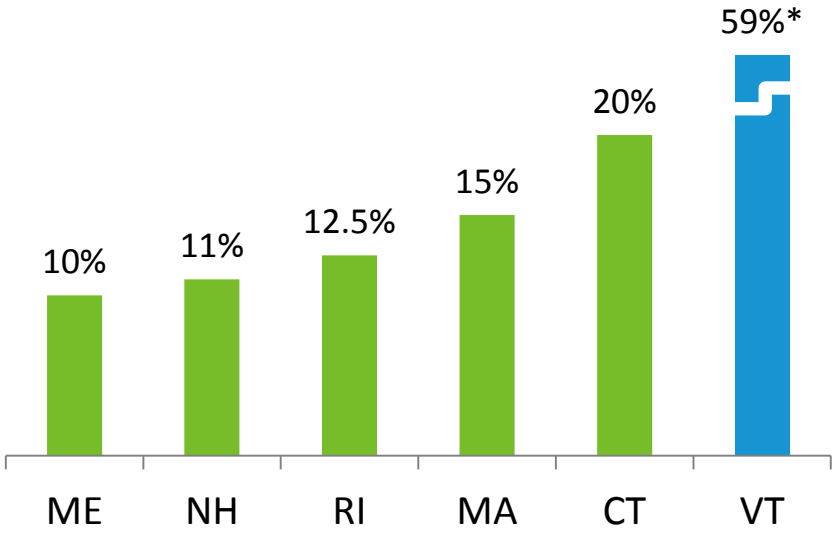
New England Has Seen Significant Growth in Solar Photovoltaic (PV) Resources

- Solar PV installations across the region are predominantly small (i.e., less than 5 MW) and interconnected to the distribution system through state-jurisdictional interconnection standards
- Because the ISO cannot observe or dispatch most solar PV in the region, these projects act as a **modifier of system load**

- Solar PV must be accurately forecasted to support the efficient administration of the day-ahead market and the reliable operation of the system in real time
- The growth of solar PV in the region is due in large part to the policies and programs put in place by the New England states

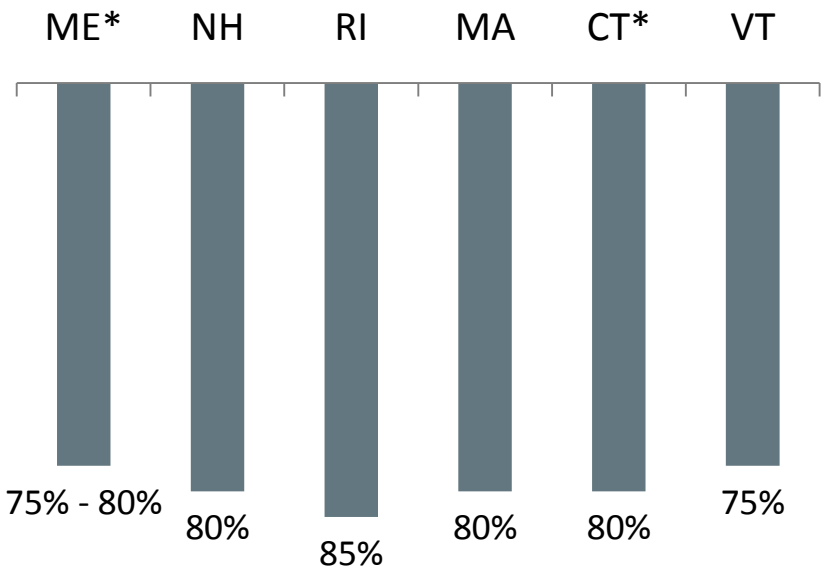
States Have Set Goals to *Increase* Renewable Energy and *Reduce* Greenhouse Gas Emissions



State Renewable Portfolio Standard (RPS) for Class I or New Renewable Energy by 2020

* Vermont's standard recognizes all forms of renewable energy, and is unique in classifying large-scale hydro as renewable.

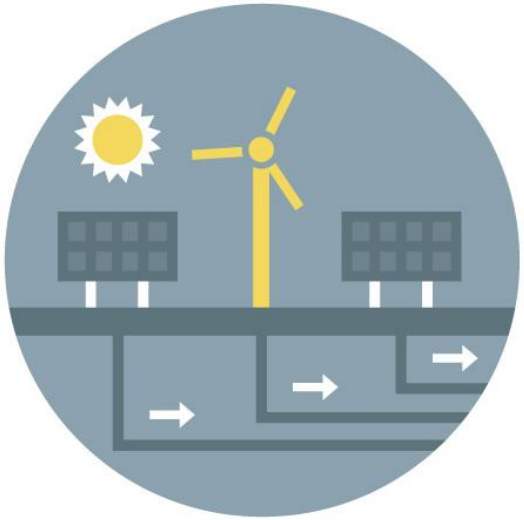
Percent Reduction of Greenhouse Gas (GHG) Emissions Below 1990 Levels* by 2050 (economy wide)



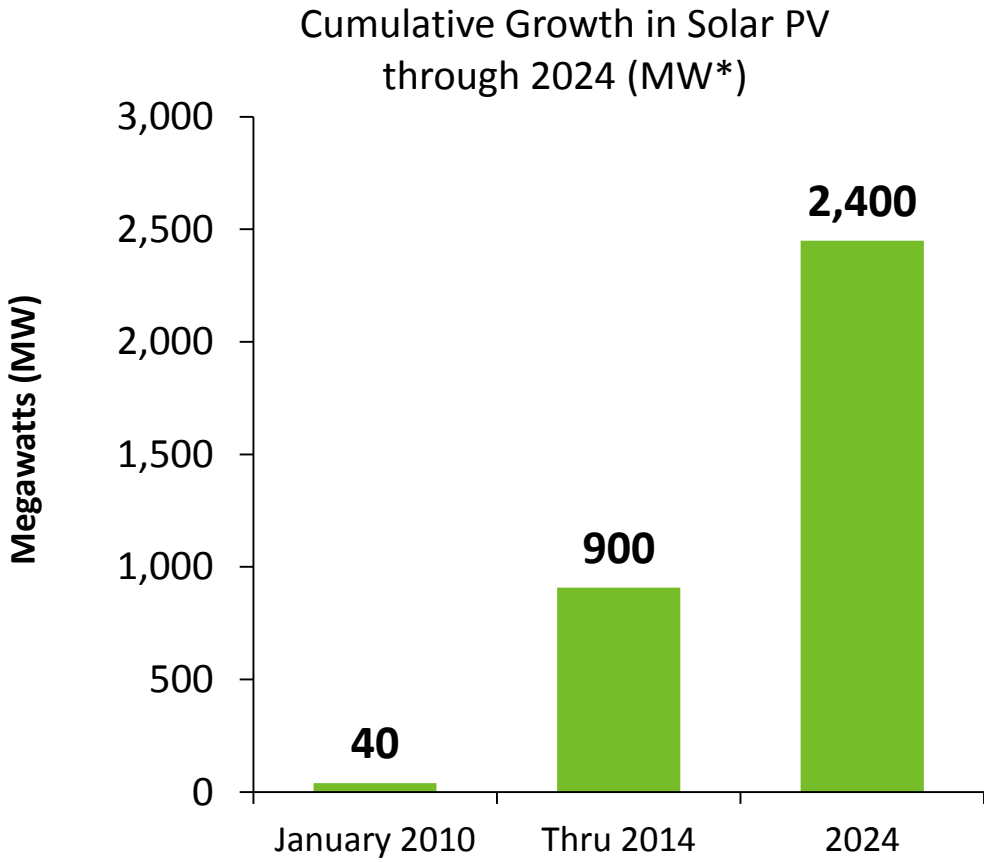
* Connecticut's goal is tied to 2001 levels. Maine's goal is tied to 2003 levels.

ISO New England Forecasts Growth in Distributed Generation Resources

- Since 2013, the ISO has led a regional **Distributed Generation Forecast Working Group** (DGFWG) to collect data on distributed generation (DG) policies and implementation, and to forecast long-term incremental DG growth in New England
- The DGFWG focuses on the following types of DG resources:
  - Under 5 MW
  - Connected to the distribution system
  - Not visible to the ISO directly
  - Specifically solar PV resources, the largest DG component
- The ISO forecasts strong growth in solar PV over the next 10 years



ISO New England Forecasts Strong Growth in Solar PV



Draft 2016 Forecast projects more than 3,200 MW installed by 2025

Source: Final PV Forecast (April 2015); Note: MW values are AC nameplate

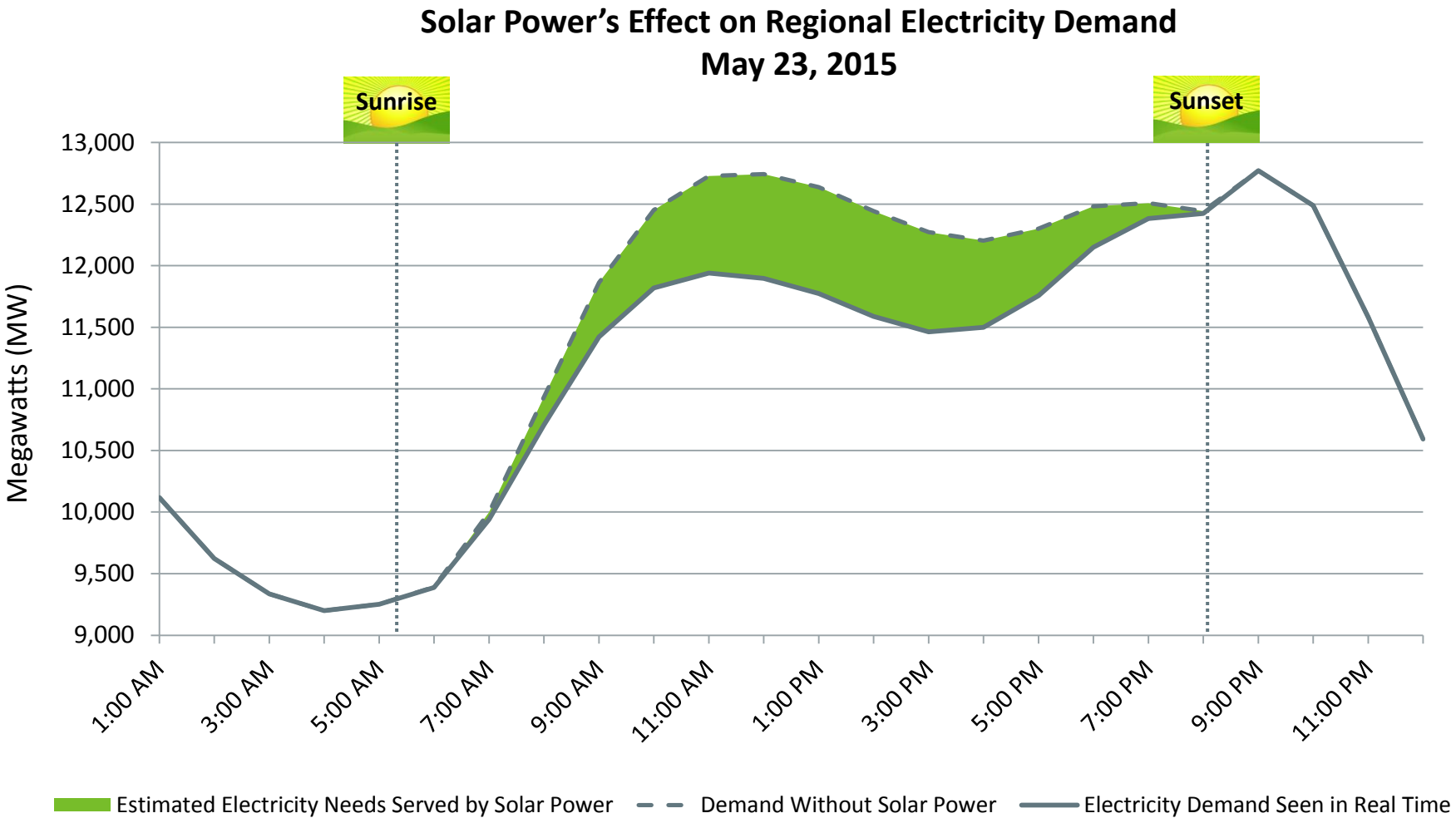
Solar PV Installed Through December 2015

- The table below reflects statewide aggregated solar PV data provided to the ISO by regional distribution owners, representing installed nameplate as of December 31, 2015

State	Nameplate Capacity (MW_{ac})
Connecticut	188.01
Maine	15.34
Massachusetts	947.11*
New Hampshire	26.36
Rhode Island	23.59
Vermont	124.57*
Total	**1,325.00**

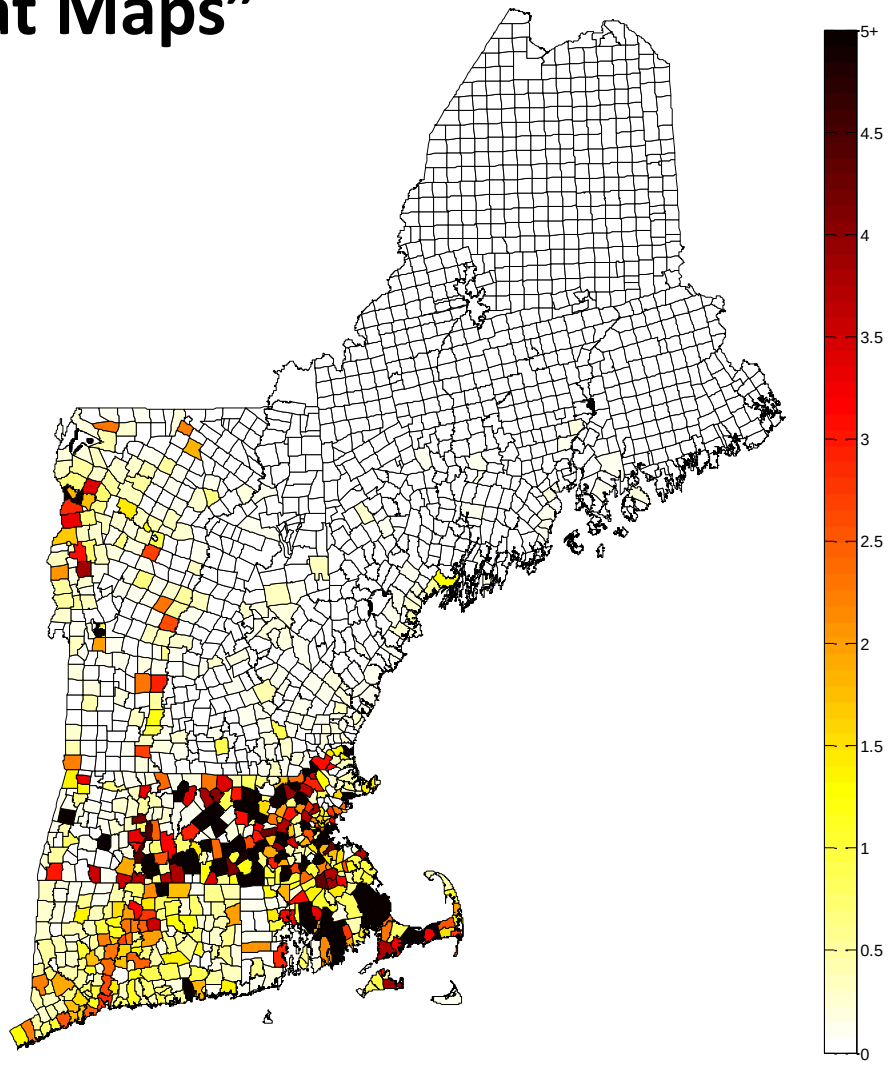
* Includes values based on MA SREC data associated with 43 MA municipalities and VT SPEED data for 3 VT municipalities that did not provide individual responses
http://www.iso-ne.com/static-assets/documents/2016/02/pvsurveyresults_20160224.pdf

Solar Power Has a Significant Impact on New England's Electricity Demand



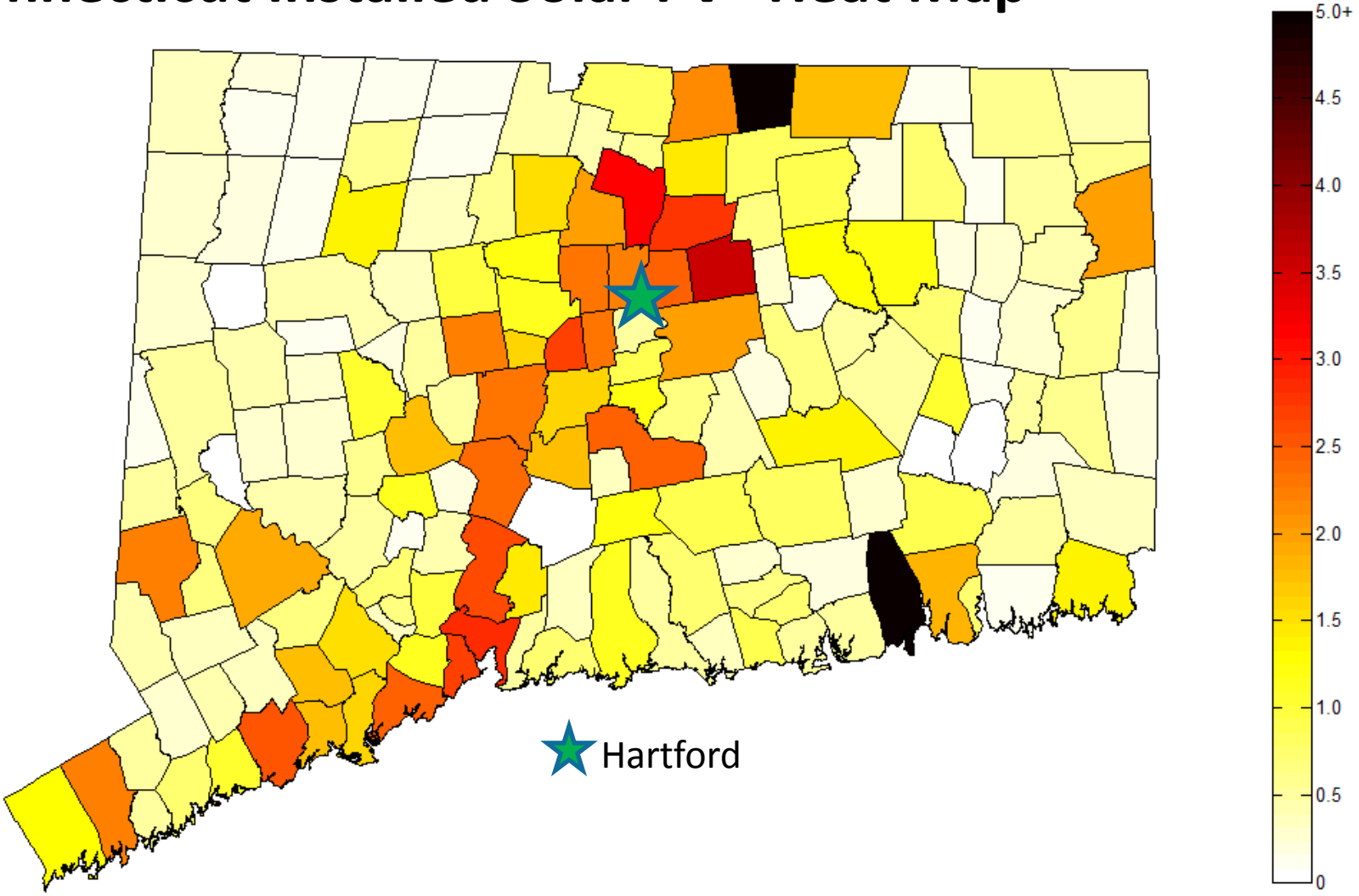
State Installed Solar PV "Heat Maps"

- Understanding the spatial distribution of existing solar PV resources will be critical to the ISO's ongoing integration activities within both System Planning and System Operations
- Based on the data provided by distribution owners, the ISO has aggregated the installed nameplate capacity by town within each state, and generated heat maps showing the results



Note: Heat map reflects solar PV installed through August 31, 2015.

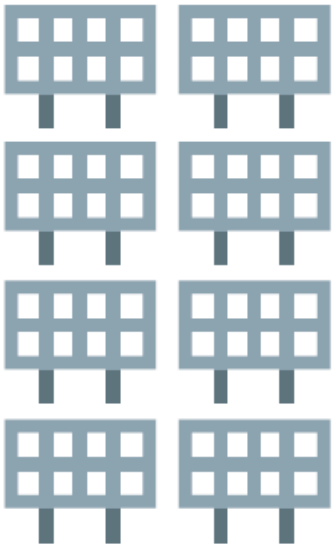
Connecticut Installed Solar PV "Heat Map"



Note: Heat map reflects solar PV installed through August 31, 2015.

The ISO Is Leading Efforts to Account for Solar Resources Connected to the Distribution System

- **Forecasting Long-Term Solar Growth**
  - The ISO tracks historical growth and predicts levels of solar development 10 years into the future
  - The solar forecast is used in transmission planning and market needs assessments
- **Forecasting Short-Term Solar Performance**
  - The ISO creates daily forecasts of solar generation production to improve daily load forecasts and situational awareness for grid operators
- **Improving Interconnection Rules**
  - The ISO is engaged with industry stakeholders to strengthen interconnection standards and reduce reliability concerns

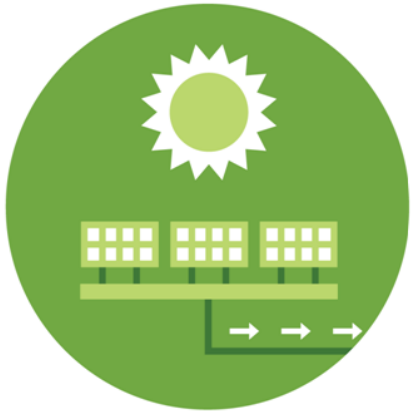


The ISO Accounted for Solar PV Resources in the Most Recent Forward Capacity Auction

- The Installed Capacity Requirement (ICR) for a Forward Capacity Auction (FCA) is the **minimum level of capacity** required to meet reliability requirements for the New England Control Area for the relevant Capacity Commitment Period (three years in the future)
- The ICR is based on **three essential components**: the load forecast, resource availability, and tie benefits
- In its order accepting the ICR for FCA #9, the Federal Energy Regulatory Commission (FERC) directed the ISO to fully explore the incorporation of distributed generation resources into the ICR calculation for **FCA #10**

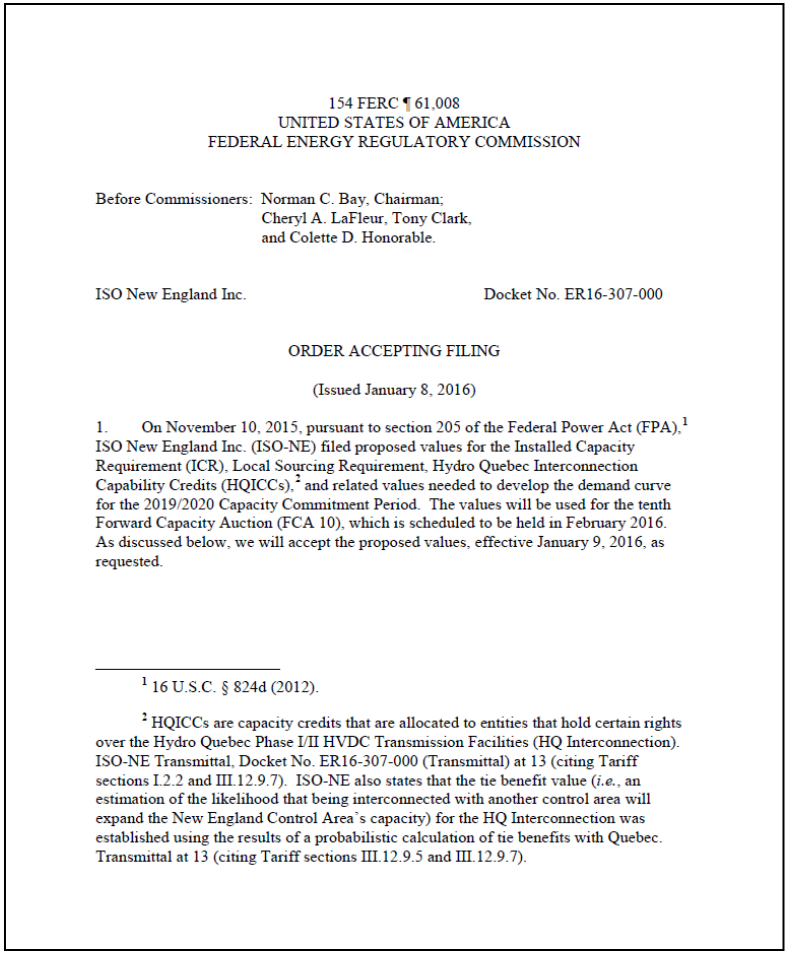
The ISO Accounted for Solar PV Resources in the Most Recent Forward Capacity Auction, *continued*

- The ISO worked with stakeholders through the DGFWG to develop the 2015 solar PV forecast
- Through that forecast, the ISO identified behind-the-meter solar PV resources that are forecasted to be installed, or that have already been installed, but are not yet reflected in historical loads
  - Referred to as **"behind-the-meter not-embedded-in-load"** solar PV resources
- The ISO adjusted the load forecast by the forecasted "behind-the-meter not-imbedded-in-load" solar PV resources, resulting in a **390 MW reduction** in the ICR for FCA #10



The ISO Accounted for Solar PV Resources in the Most Recent Forward Capacity Auction, *continued*

- On **January 8, 2016**, FERC accepted the ICR for FCA #10 and found that the ISO properly incorporated "behind-the-meter not imbedded-in-load" solar PV resources into the ICR calculation
- On **February 8, 2016**, the ISO conducted FCA #10, procuring the capacity resources needed to meet the ICR for the 2019-2020 Capacity Commitment Period
  - About **35,567 MW** of capacity cleared the auction to meet the **34,151 MW** ICR for 2019-2020



154 FERC ¶ 61,008
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Norman C. Bay, Chairman;
Cheryl A. LaFleur, Tony Clark,
and Colette D. Honorable.

ISO New England Inc. Docket No. ER16-307-000

ORDER ACCEPTING FILING

(Issued January 8, 2016)

1. On November 10, 2015, pursuant to section 205 of the Federal Power Act (FPA),[1] ISO New England Inc. (ISO-NE) filed proposed values for the Installed Capacity Requirement (ICR), Local Sourcing Requirement, Hydro Quebec Interconnection Capability Credits (HQICCs),[2] and related values needed to develop the demand curve for the 2019/2020 Capacity Commitment Period. The values will be used for the tenth Forward Capacity Auction (FCA 10), which is scheduled to be held in February 2016. As discussed below, we will accept the proposed values, effective January 9, 2016, as requested.

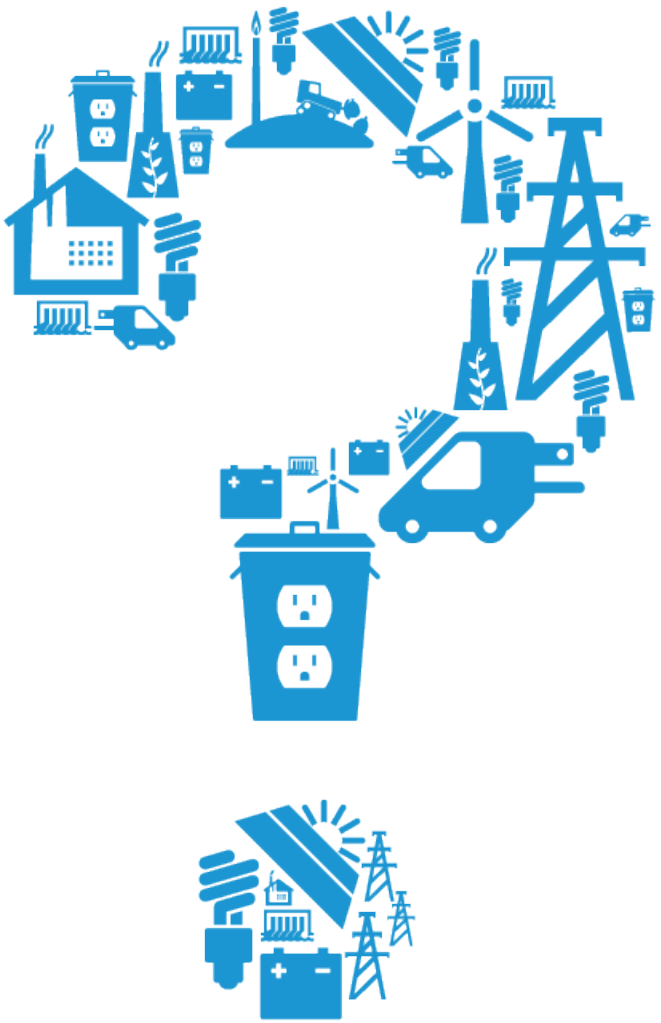
[1] 16 U.S.C. § 824d (2012).

[2] HQICCs are capacity credits that are allocated to entities that hold certain rights over the Hydro Quebec Phase I/II HVDC Transmission Facilities (HQ Interconnection). ISO-NE Transmittal, Docket No. ER16-307-000 (Transmittal) at 13 (citing Tariff sections I.2.2 and III.12.9.7). ISO-NE also states that the tie benefit value (*i.e.*, an estimation of the likelihood that being interconnected with another control area will expand the New England Control Area's capacity) for the HQ Interconnection was established using the results of a probabilistic calculation of tie benefits with Quebec. Transmittal at 13 (citing Tariff sections III.12.9.5 and III.12.9.7).

Conclusions

- The ISO will continue to actively track and forecast the growth of solar PV in the region
- The ISO will continue to evaluate its potential impacts on the efficient administration of wholesale electricity markets and the reliable operation and planning of the region's electric power system
- Because many other regions of North America also are witnessing the large-scale adoption of solar PV, the ISO will continue to engage with other ISOs/RTOs to share relevant methods and experience

Questions



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