

The Evolving Role of Energy Storage in New England's Power System



*New England Conference of Public Utilities
Commissioners Battery Storage Webinar*

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FIRST ... A LITTLE ABOUT YOU

Which State Do You Represent?

(Listed in Reverse Alphabetical Order)

- a. Vermont
- b. Rhode Island
- c. New Hampshire
- d. Massachusetts
- e. Maine
- f. Connecticut



What Is Your Professional Background?

- a. Engineer/Scientist
- b. Attorney
- c. Economist
- d. Other



How Long Have You Been In The Energy Industry?

- a. 0-3 years
- b. 3-5 years
- c. 5-10 years
- d. 10+ years



What Do You Think is the Most Promising Application for Batteries?

- a. Resilience
- b. Peak management
- c. Wholesale market revenue
- d. Carbon reductions



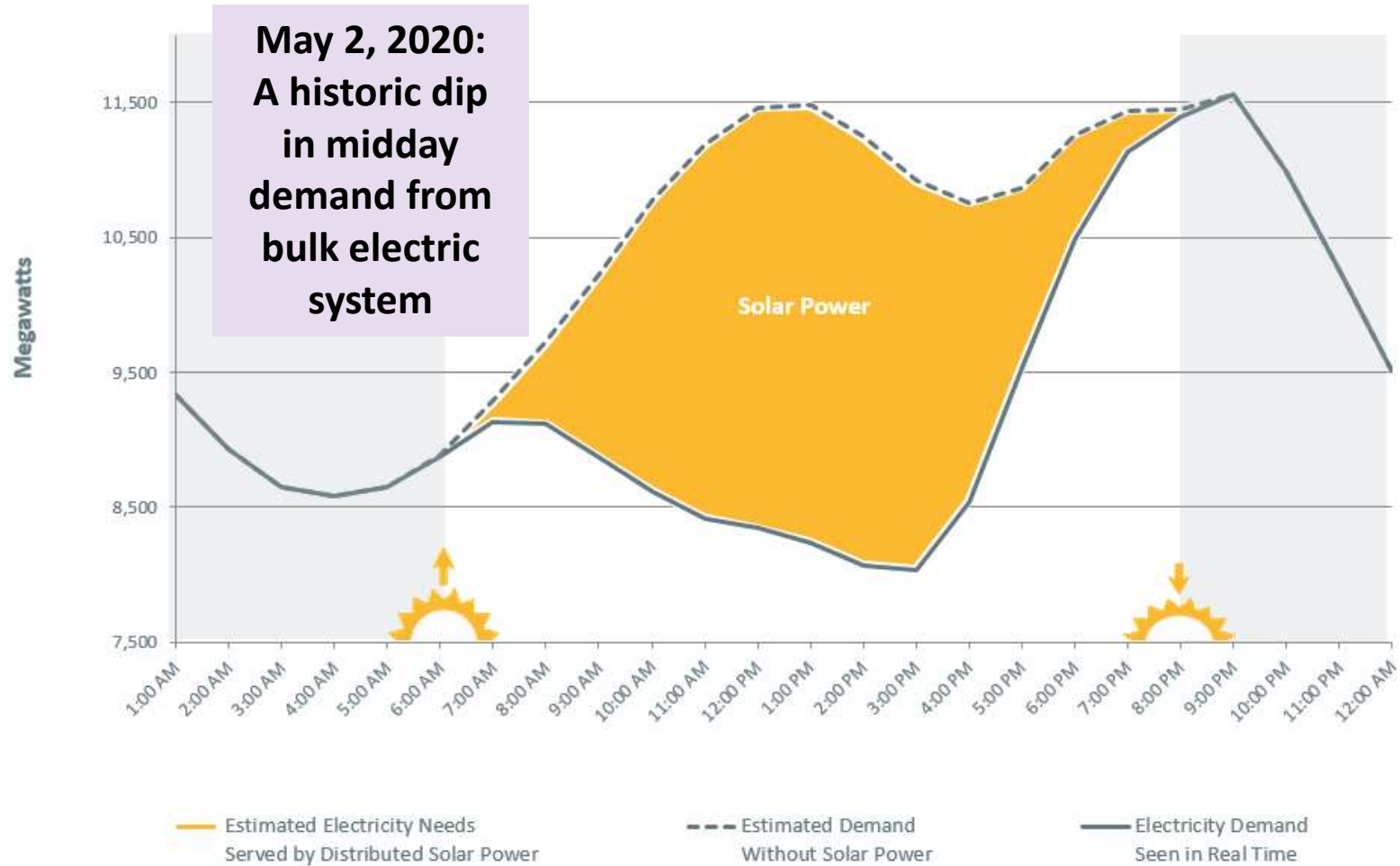
STORAGE IN NEW ENGLAND

ISO New England Continually Evaluates Opportunities to Enhance the Market Design to Enable New Technologies

- Storage has a long history of providing services to the regional electric grid
- Batteries can participate in all of ISO New England's markets **today**
- The ISO recently implemented **rule changes** to better integrate storage and other technologies into the markets
- The ISO is looking **at further enhancements** to better incorporate technologies into the markets and value reliability services



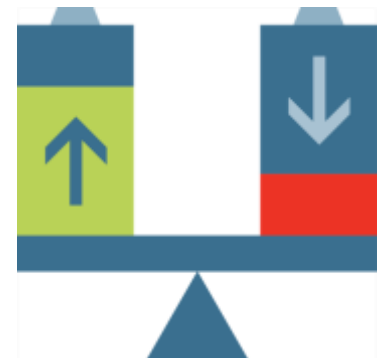
The Evolving Resource Mix Is Creating Opportunities for Fast-Ramping Resources



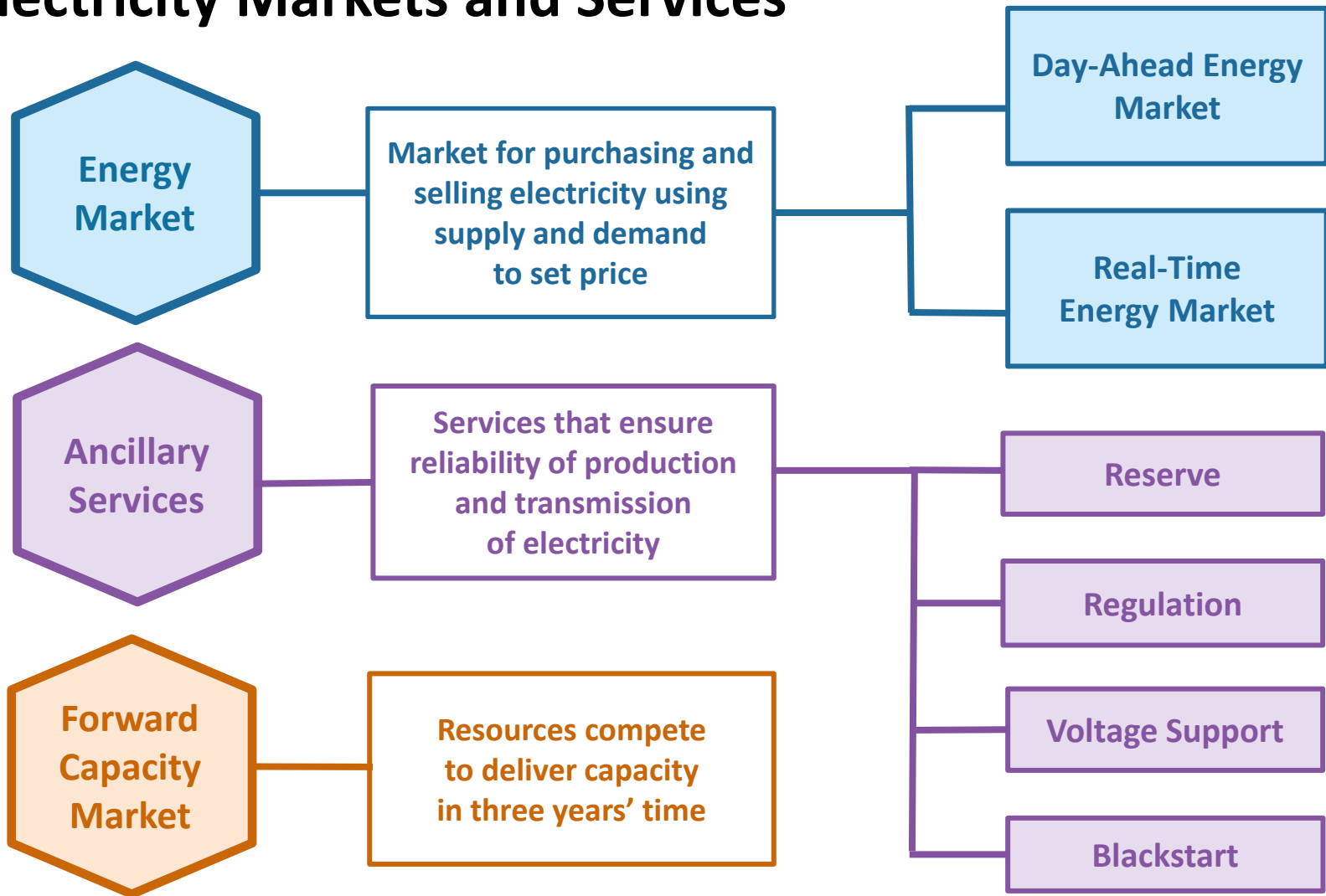
Source: ISO New England

Storage Has Been Integral to the New England Power Grid for Decades

- New England has long relied on two pumped-storage facilities for reliability
- Can supply up to **1,800 MW** of power within **10 minutes for up to 7 hours**
- The **Energy Storage Device Project**
 - Created **new participation models** for batteries
 - **Predated** FERC Order 841
 - Largely addressed the major requirements of Order 841
- Currently, **20 MW** of batteries can be dispatched by the ISO New England control room

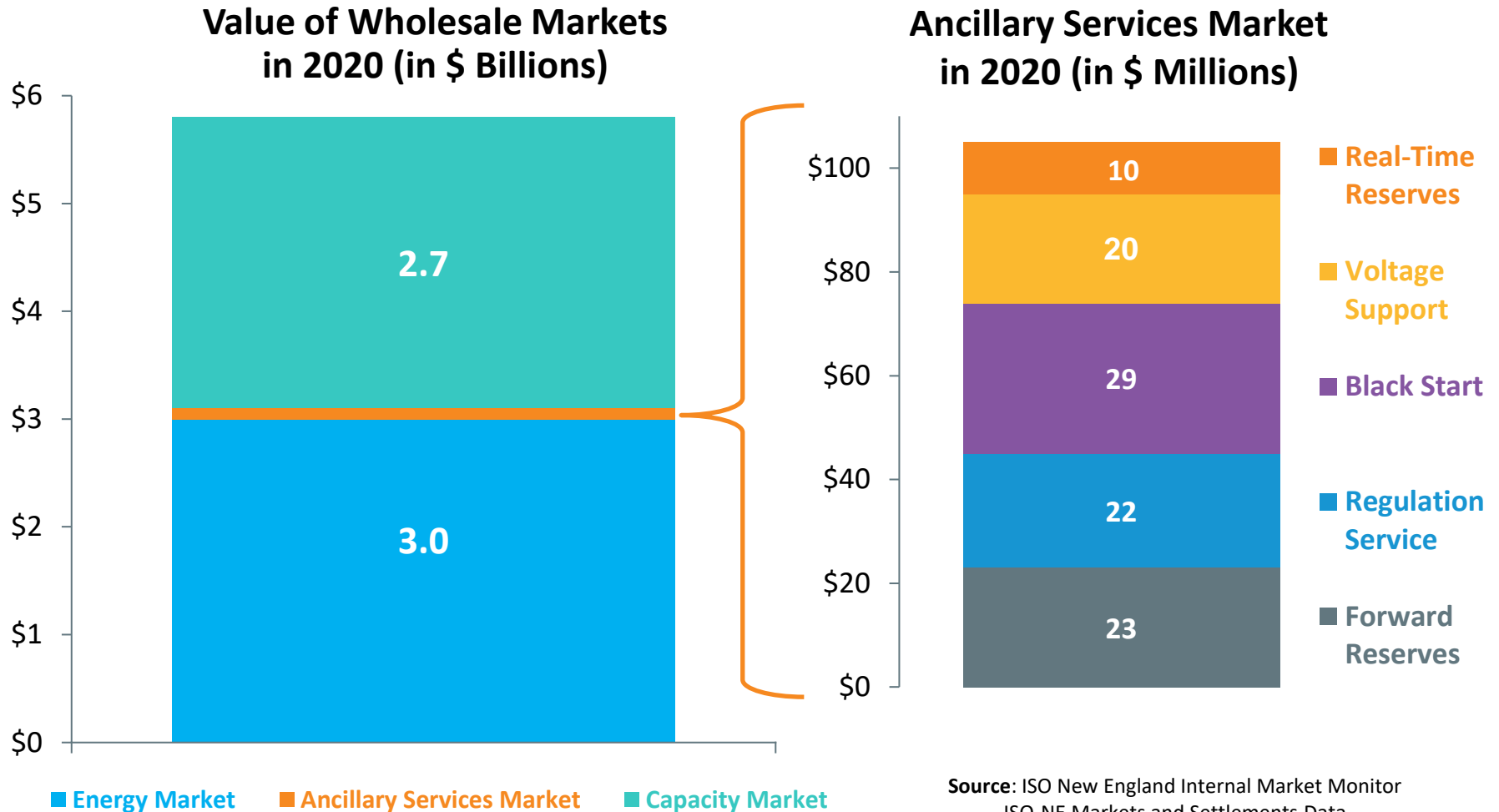


Storage Can Participate in All of the Region's Wholesale Electricity Markets and Services



Ancillary Services Are a Relatively Small Part of the Wholesale Electricity Markets

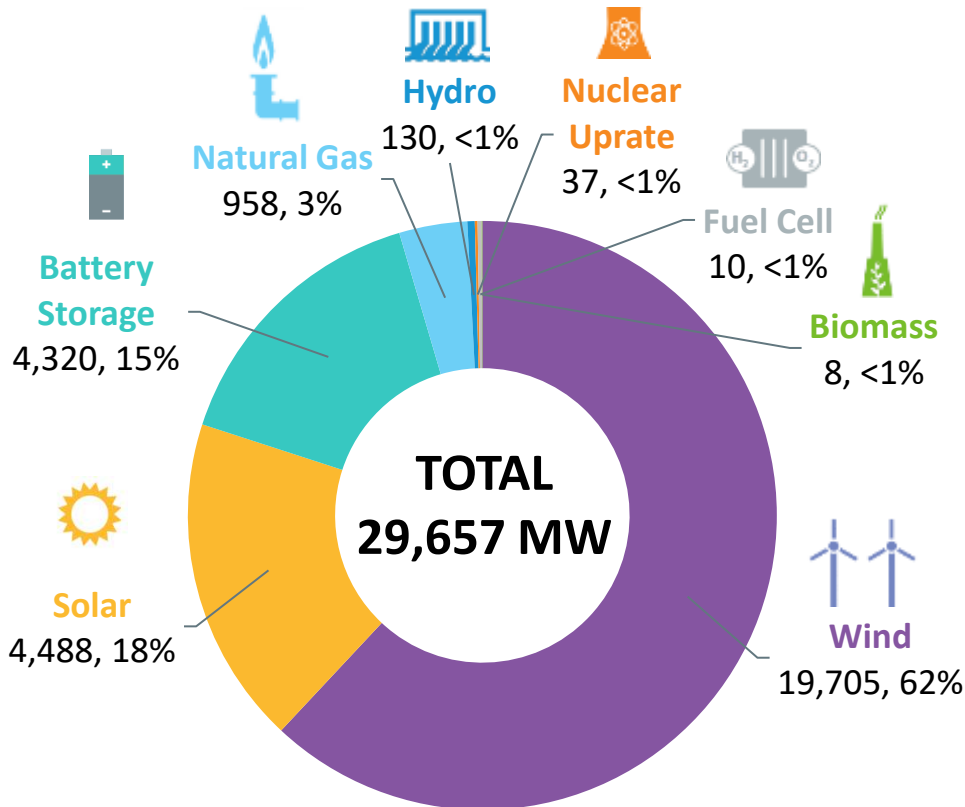
May Grow As Resource Mix Evolves



Source: ISO New England Internal Market Monitor
ISO-NE Markets and Settlements Data

Flexible Resources (Such as Storage) Will Be Needed to Balance Increasing Levels of Variable Generation

All Proposed Resources



Source: ISO Generator Interconnection Queue (May 2021)

FERC and Non-FERC Jurisdictional Proposals; Nameplate Capacity Ratings

Note: Some natural gas proposals include dual-fuel units (with oil backup).

Some natural gas, wind, and solar proposals include battery storage.

Proposals by State

(all proposed resources)

State	Megawatts (MW)
Massachusetts	17,305
Connecticut	7,608
Maine	2,621
Rhode Island	1,542
New Hampshire	456
Vermont	125
Total	29,657

Source: ISO Generator Interconnection Queue (May 2021)

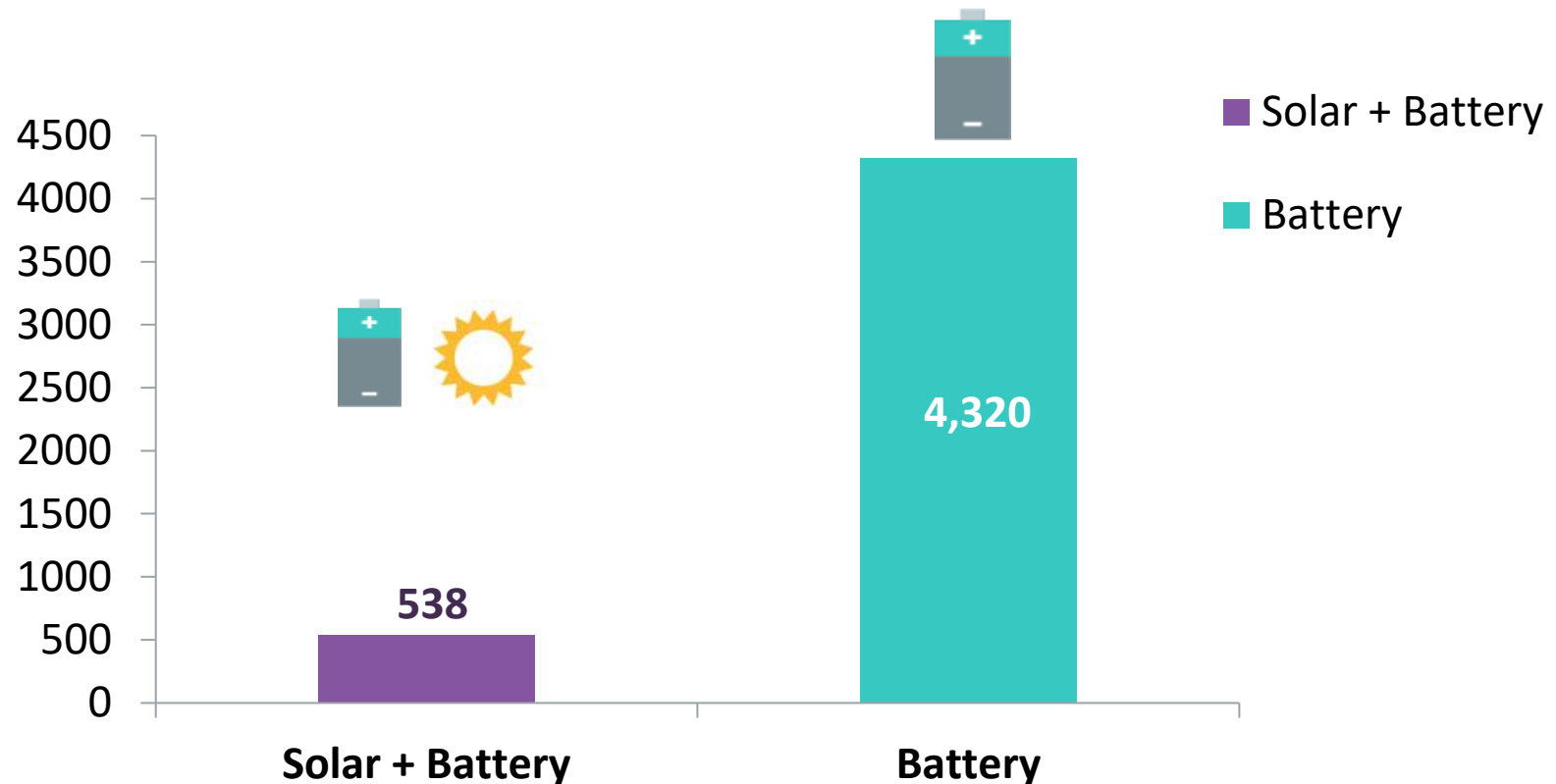
FERC and Non-FERC Jurisdictional Proposals

Battery Storage Participation in the Forward Capacity Market is Also Increasing

Forward Capacity Auction/ Commitment Period	Total MW	New	Existing
FCA 15 (2024/2025)	613.6	595.7	17.875
FCA 14 (2023/2024)	21.9	16.9	4.99
FCA 13 (2022/2023)	4.9	4.9	0
FCA 12 (2021/2022)	n/a	n/a	n/a

Interest In Pairing Energy Storage With Renewables Is Also Growing

Proposed Battery and Co-Located Projects In ISO New England queue*
(MW)

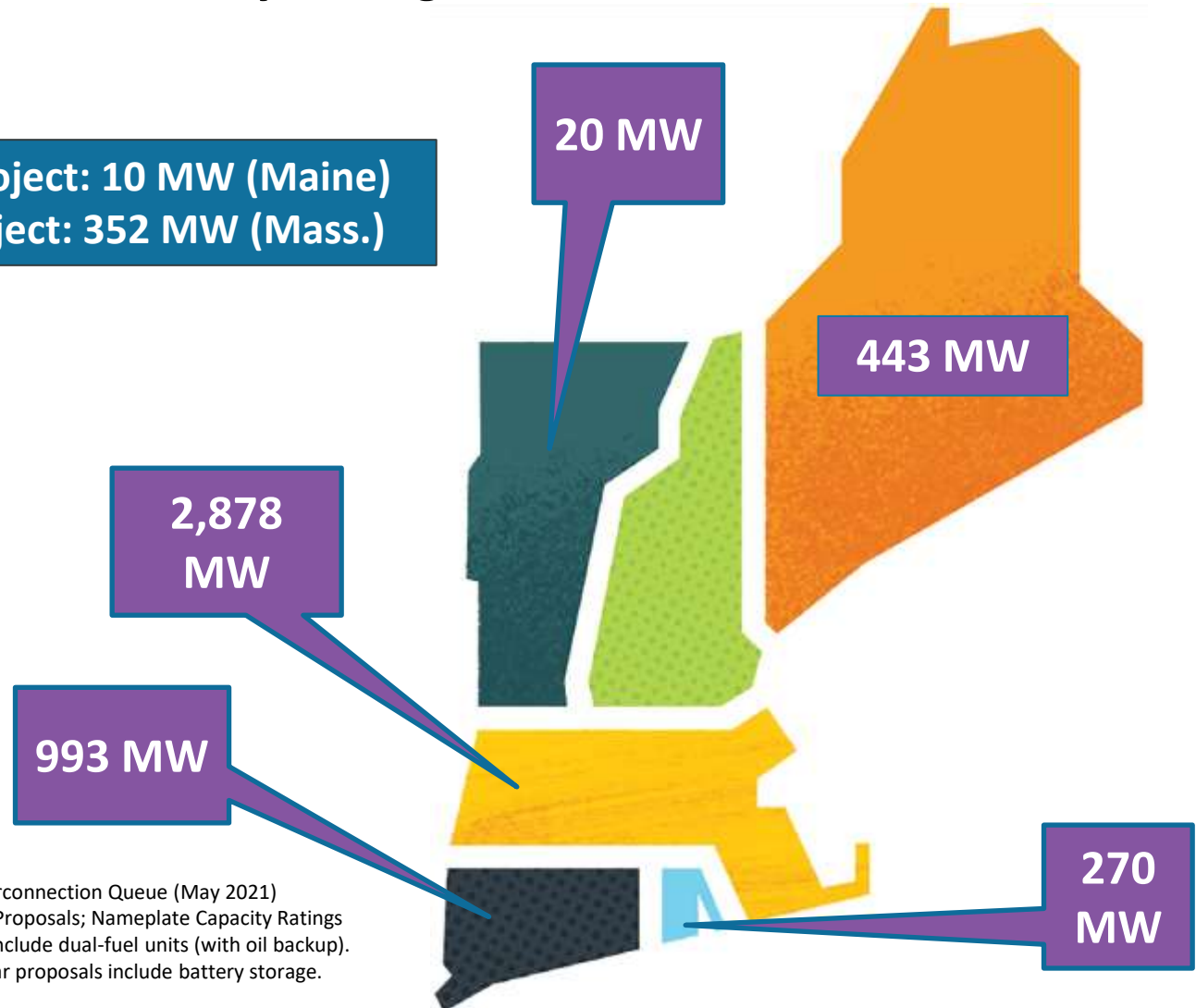


*Figures from ISO New England Generator Interconnection Queue, as of May 2021 and excludes solar projects proposed without co-located batteries.

Proposed Batteries Show Diversity of Size and Location

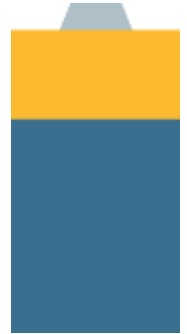
Total MW of Proposed Battery Storage in Each State

Smallest single project: 10 MW (Maine)
Largest single project: 352 MW (Mass.)



Source: ISO Generator Interconnection Queue (May 2021)
FERC and Non-FERC Jurisdictional Proposals; Nameplate Capacity Ratings
Note: Some natural gas proposals include dual-fuel units (with oil backup).
Some natural gas, wind, and solar proposals include battery storage.

Concluding Thoughts and Open Questions



- Storage has a long history of providing services to the regional electric grid
- Will batteries' proliferation and size continue to increase? Or plateau? Will the increases be enough to address the challenges posed by an energy system powered by intermittent and energy-limited resources?
- How will batteries' durations and output evolve over time?

Questions



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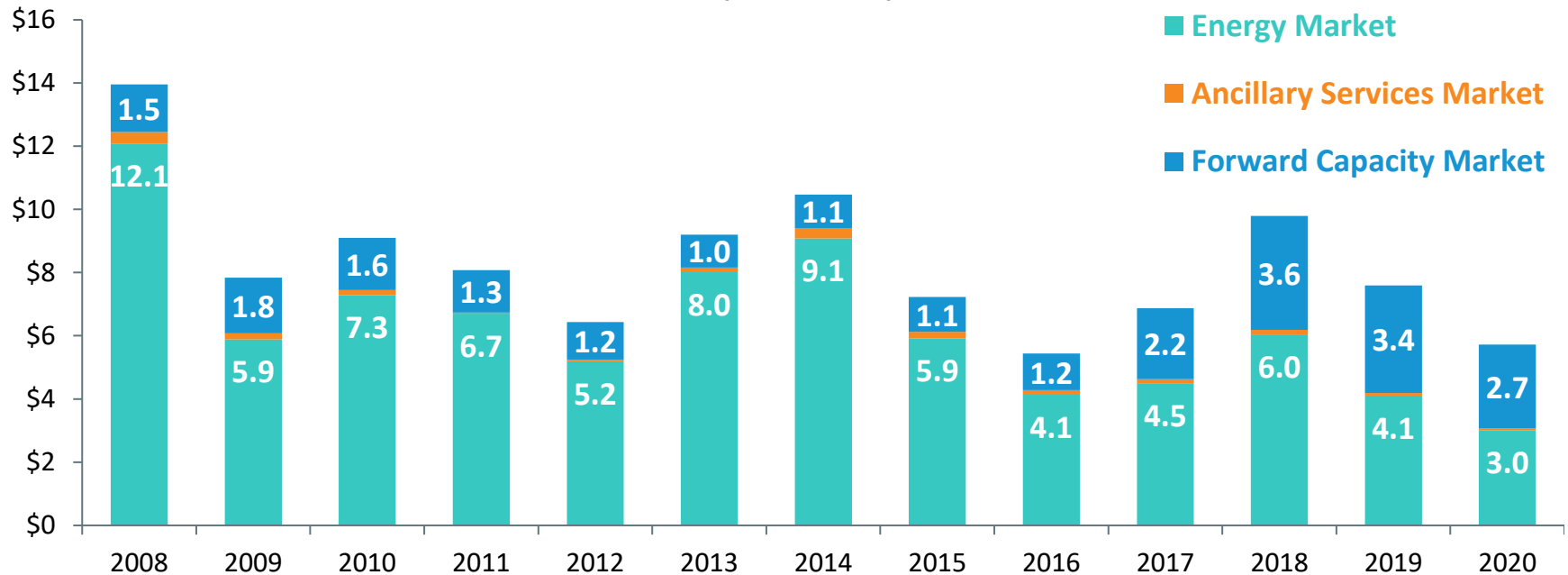


APPENDIX

Additional Background Information

Energy Market Values Vary with Fuel Prices, While Capacity Market Values Vary with Changes in Supply

Annual Value of Wholesale Electricity Markets
(in billions)



Source: [2019 Report of the Consumer Liaison Group](#); 2020 data are subject to adjustment

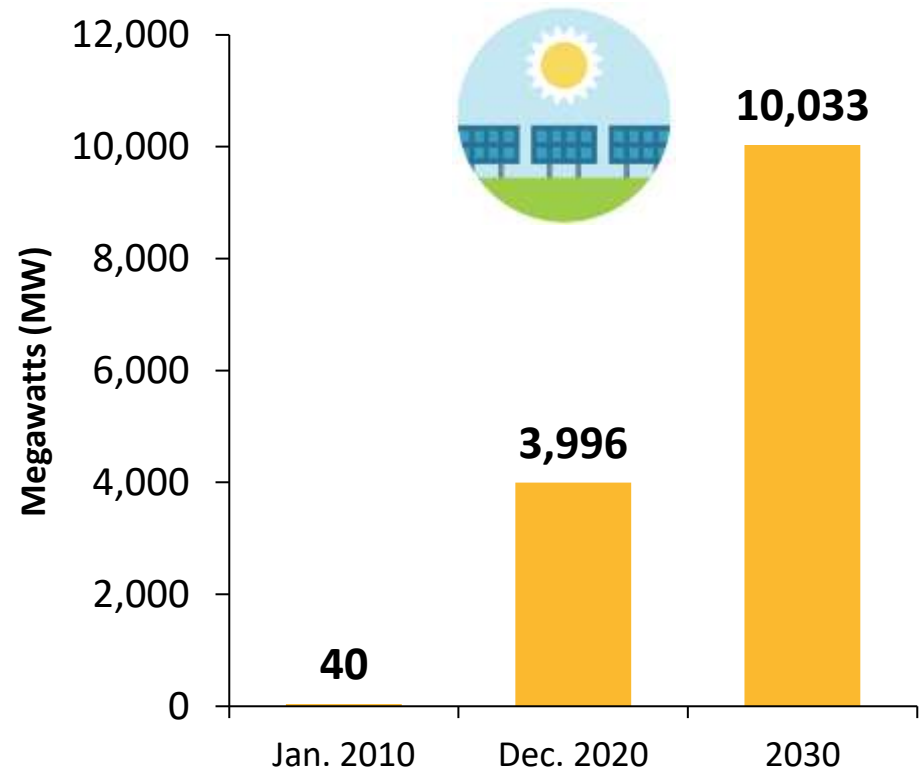
Note: Forward Capacity Market values shown are based on auctions held roughly three years prior to each calendar year. The 2020 projection is the sum of preliminary 2020 January-October actuals and November-December projected values. The November-December projected values were derived as follows: on average, over the last two years (2018-2019), the value of the Energy Market accrued over the first ten months of the year was approximately 80.90% of the annual total. This percentage was applied to the total from the first ten months of 2020 to produce the November-December Energy Market projections. An analysis of the historical relationship between the Energy Market totals and the Ancillary Services Market totals suggests that the total for the Ancillary Services Market is approximately 2.23% of the Energy Market total. The November-December projections for the Ancillary Services Market represent the value needed to bring the 2020 ten month total to the expected annual total. The Forward Capacity Market values reflect the October 2020 value held constant for the remainder of the year. Please note that this projection is for illustrative purposes only. Data are preliminary and subject to reconciliation.

ISO New England Forecasts Strong Growth in Solar Photovoltaic (PV) Resources

December 2020 Solar PV Installed Capacity (MW_{ac})

State	Installed Capacity (MW _{ac})	No. of Installations
Connecticut	682.3	53,758
Massachusetts	2,502.3	114,487
Maine	68.8	5,591
New Hampshire	125.3	10,757
Rhode Island	223.8	9,688
Vermont	393.5	15,328
New England	3,995.9	199,868

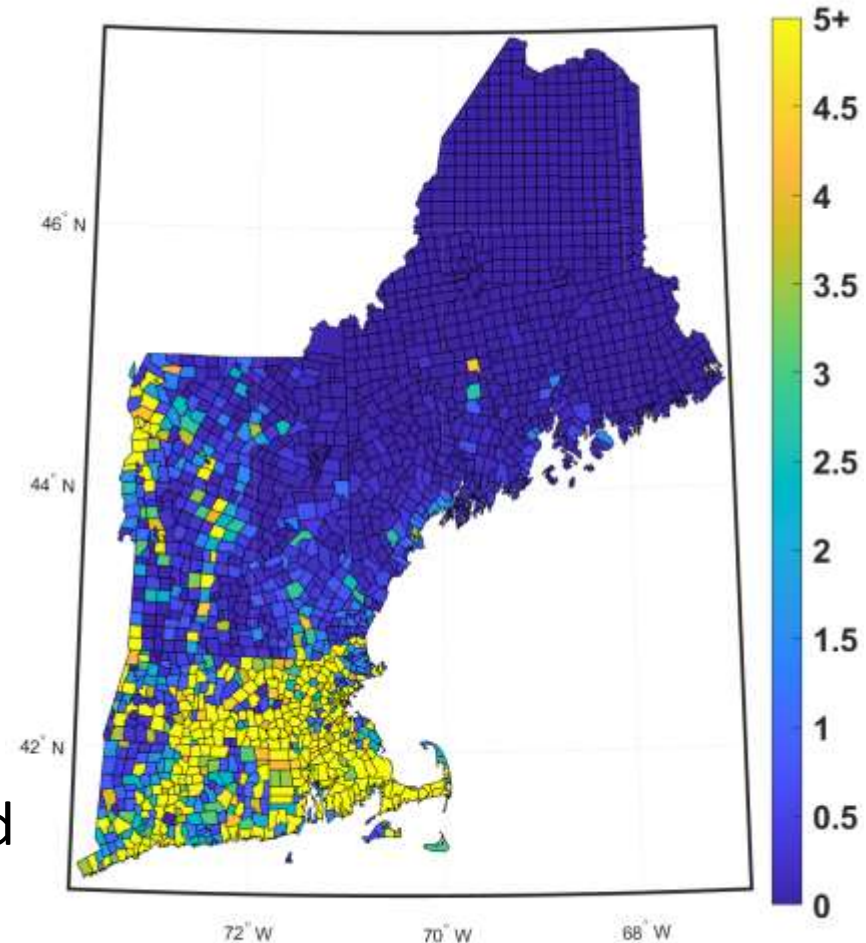
Cumulative Growth in Solar PV through 2030 (MW_{ac})



Note: The bar chart reflects the ISO's projections for nameplate capacity from PV resources participating in the region's wholesale electricity markets, as well as those connected "behind the meter." The forecast does not include forward-looking PV projects > 5 MW in nameplate capacity. Source: [Final 2021 PV Forecast](#) (April 2021); and [December 2020 Distributed Generation Survey Results](#); MW values are AC nameplate.

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 MW of solar PV installed through December 2020.