Demand Resources in ISO-NE Markets and Planning

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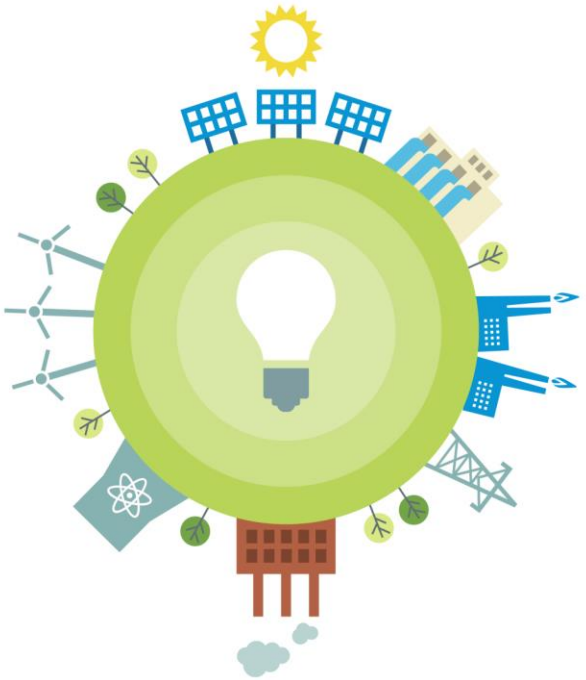
Overview of Presentation

- ISO New England Overview
- Overview of Demand Resources in ISO-NE Markets
- Forward Capacity Market
- Long-Range Planning and Economic Studies
- Opportunities and Challenges for Demand Resources in Markets and Planning



ISO New England (ISO) Has Two Decades of Experience Overseeing the Region's Restructured Electric Power System

- **Regulated** by the Federal Energy Regulatory Commission
- **Reliability coordinator** for New England under the North American Electric Reliability Corporation
- **Independent** of companies in the marketplace and neutral on technology

Reliability Is the Core of ISO New England's Mission

Fulfilled by three interconnected and interdependent responsibilities

Overseeing the day-to-day operation of New England's electric power generation and transmission system

Managing comprehensive regional power system planning

Developing and administering the region's competitive wholesale electricity markets

OVERVIEW OF DEMAND RESOURCES IN ISO-NE MARKETS

Types of Demand Resources

- Demand resources can take many forms – equipment, system, service, practice, or strategy that can verifiably reduce end-use demand for electricity from the bulk power system
- These resources fall into two general types:
  - **Active demand resources** are activated only when needed (also referred to as demand-response resources)
    - Examples: turning off lights or switching to power from an on-site generator
  - **Passive demand resources** reduce electrical demand at all times (reduced energy use is a function of the unit's operation rather than a direct action on the equipment)
    - Examples: energy-efficient (EE) appliances and lighting, advanced cooling and heating technologies, distributed generation (DG) and load management (LM) processes that permanently shift electricity use to off-peak

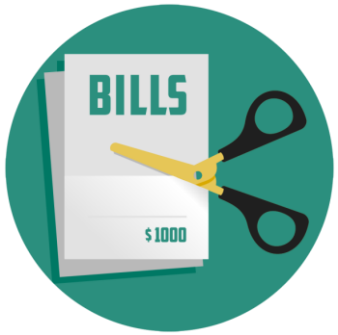
Demand Resources Provide Significant Benefits

Reliability

Fast and predictable resources that are a tool for system operators

Environmental

Displace older less efficient generation



Customer Savings

Reduce risk premiums and wholesale prices, and shift use from high- to low-cost hours

Economic

Improve resource utilization, displace expensive power plants, and can defer transmission

Demand Resources Can Participate in Several Wholesale Electricity Markets

Energy Market

Daily market for wholesale customers to buy and sell electric "**energy**"

Forward Capacity Market

Three-year forward market that commits "**capacity**" resources to meet system resource-adequacy needs

Ancillary Markets

"**Reserves**" and "**regulation**" provide support for system operations to maintain reliability

Opportunities for Demand Resource Participation in Regional Wholesale Electricity Markets

	ENERGY	CAPACITY	ANCILLARY MARKETS	
			REGULATION	RESERVES
Passive DR (EE, DG, LM)	NO	YES	NO	NO
Demand Response	YES	YES	YES	2018
Emergency Generation	2018	YES	NO	NO

FORWARD CAPACITY MARKET

Forward Capacity Market Overview

- The Forward Capacity Market (FCM) is a **locational** market that procures capacity to meet New England's forecasted Installed Capacity Requirement (ICR) three years in the future
  - Capacity Zones are developed to align with system transmission constraints and are a mechanism to signal areas of need to the marketplace
- The FCM allows **new capacity projects** to compete in the market and set the price for capacity in the region
- The FCM selects a portfolio of **generation** and **demand-side** resources through a competitive Forward Capacity Auction (FCA) process
  - Resources must be pre-qualified to participate in the auction
  - Resources must clear in the auction and perform to be paid for capacity during the Capacity Commitment Period (CCP)
- The FCM provides a **long-term** (up to 7-year) **commitment** to new supply and demand resources to encourage investment

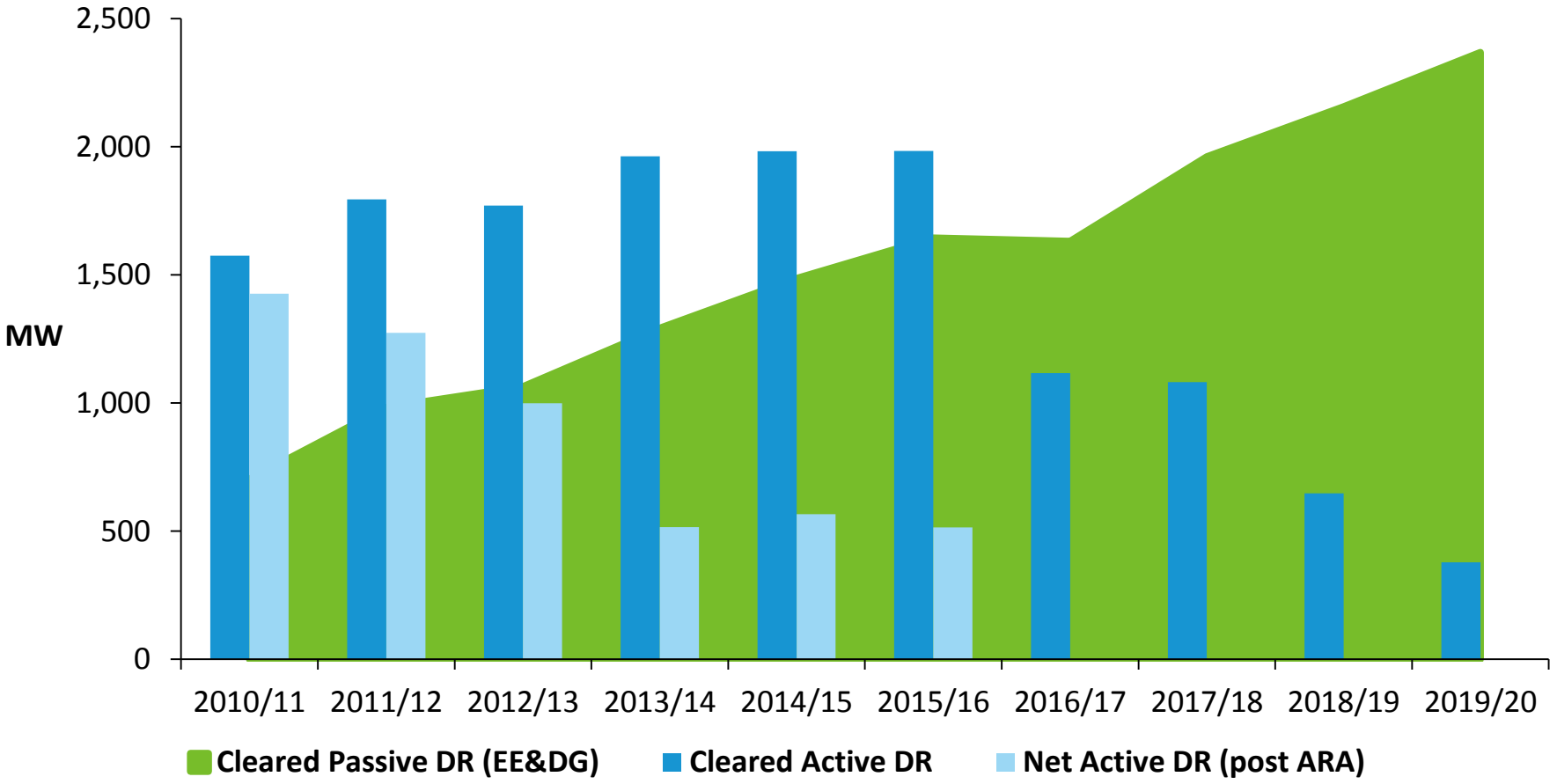
Forward Capacity Market Objectives and Results

- New England's capacity market has **two main objectives**:
  1. Ensure sufficient resources to meet New England's electricity demand and reliability standards, and
  2. Ensure that sufficient resources are procured in appropriate locations and in a cost-effective manner
- The capacity market aims to foster **competition** by creating a level playing field with respect to technology, investors, and existing versus new entrants
- Ten Forward Capacity Auctions have been conducted and six commitment periods completed
  - Market has generated participation from **diverse** types of resources, including demand-response and energy-efficiency resources
    - ***Connecticut demand-side resources participate***
  - Lowest-cost resources have been developed and brought to market

Installed Capacity Requirement

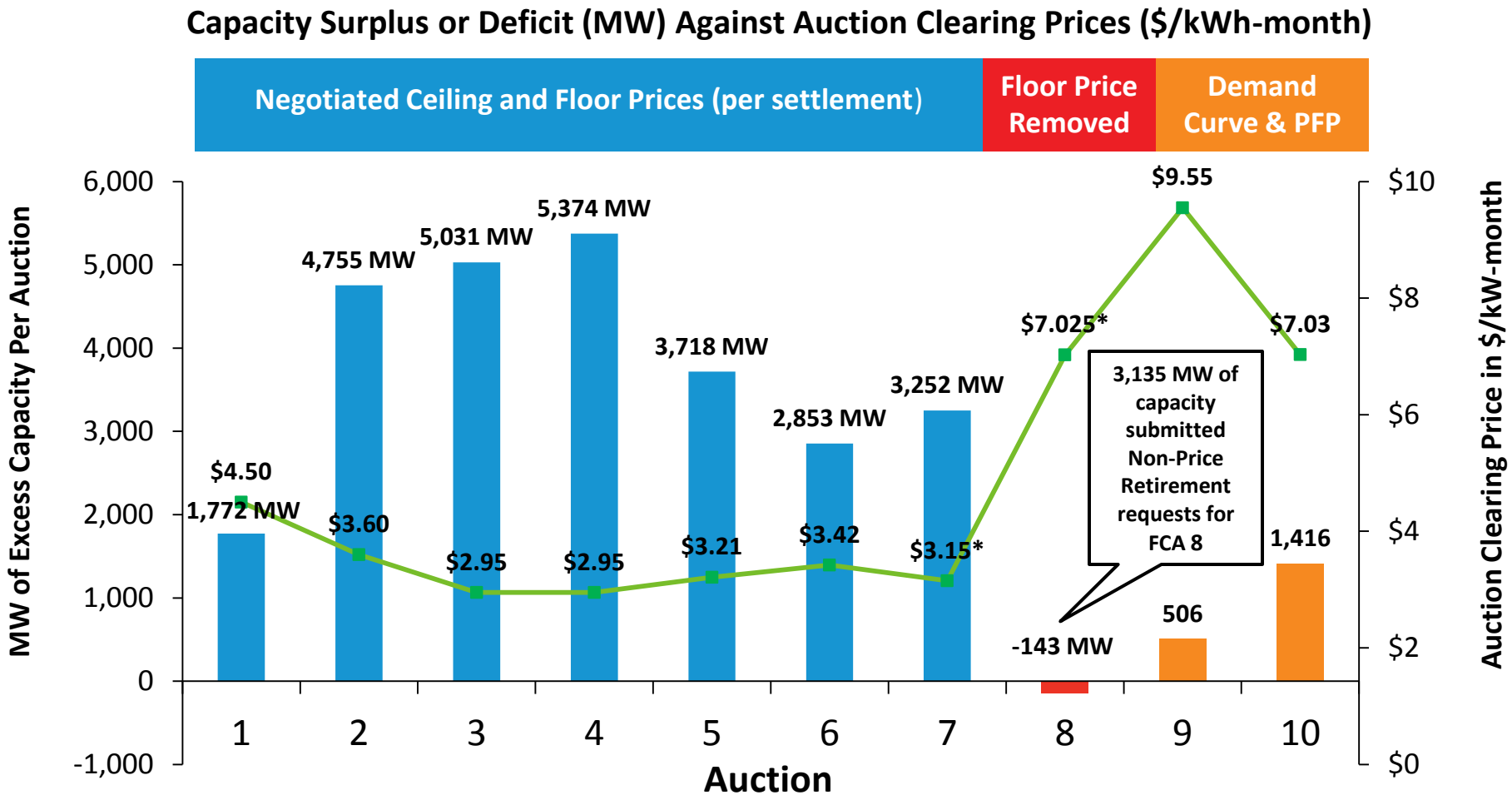
- ICR is the amount of installed capacity that New England needs to meet the ISO New England resource planning reliability criterion
- The **reliability criterion** requires that the interruption of firm customer load, due to insufficient resources, be expected no more than one day in ten years
  - This is the Loss-of-Load Expectation (LOLE) criterion of 0.1 interruption per year or one interruption in 10 years (1-in-10 LOLE)
- The NET ICR is the amount of capacity ISO procures in the FCA to meet the reliability criterion after accounting for the capability contribution of the Hydro Québec Interconnection Capability Credits toward meeting ICR

FCM Has Attracted a Significant Amount of Demand Resources and the Mix Has Changed Over Time



Notes: *Cleared Active DR* represents Real-Time DR and Real-Time Emergency Generation that cleared in the FCA. *Net Active D*R represents Active DR remaining at the start of the CCP, net of resources that shed Capacity Supply Obligations after the FCA in reconfiguration auctions.

Changes in Supply, Performance Rules, Drive Prices

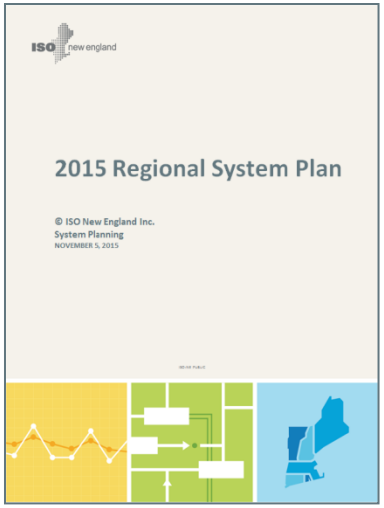


* Prices cleared at the floor price in the first seven auctions due to excess capacity; therefore, resources were paid a slightly lower prorated price. The clearing price in NEMA/Boston was $14.999/kW-month for FCA 7 (new capacity received $14.999/kW-month and existing capacity received an administrative price of $6.66/kW-month). The clearing price in FCA 8 was $15.00/kW-month (new capacity in all zones and existing capacity in NEMA/Boston received $15.00/kW-month and existing capacity in all other zones received an administrative price of $7.025/kW-month). The clearing price in FCA 9 was $9.55/kW-month, except in SEMA/RI where administrative pricing rules were triggered due to inadequate supply (new capacity in the zone will receive the auction starting price of $17.73/kW-month and existing capacity in the zone will receive an administratively set price of $11.08/kW-month).

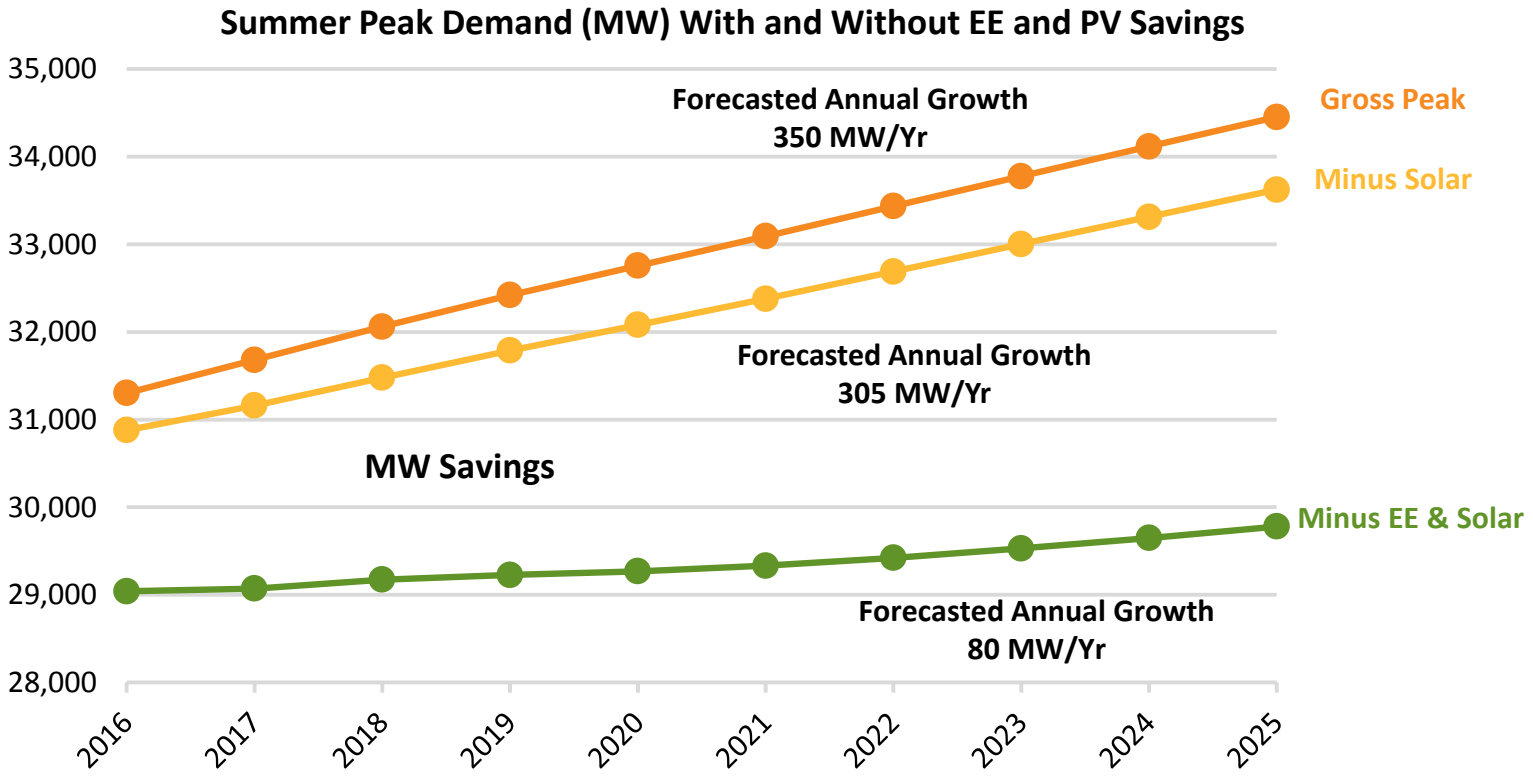
LONG-RANGE PLANNING AND ECONOMIC STUDIES

Overview of Transmission Planning

- As the **Regional Transmission Organization**, the ISO is required to identify transmission infrastructure solutions that are essential for maintaining power system reliability in New England
- Through an **open stakeholder process**, the ISO develops long-range plans for the region's networked transmission facilities to address future system needs over the ten-year planning horizon
  - Summarized in a **Regional System Plan (RSP)**
- The transmission planning process is governed by a **FERC-approved tariff**
- The transmission planning process has been revised to comply with the Federal Energy Regulatory Commission's **Order 1000**, which requires planning for public policy



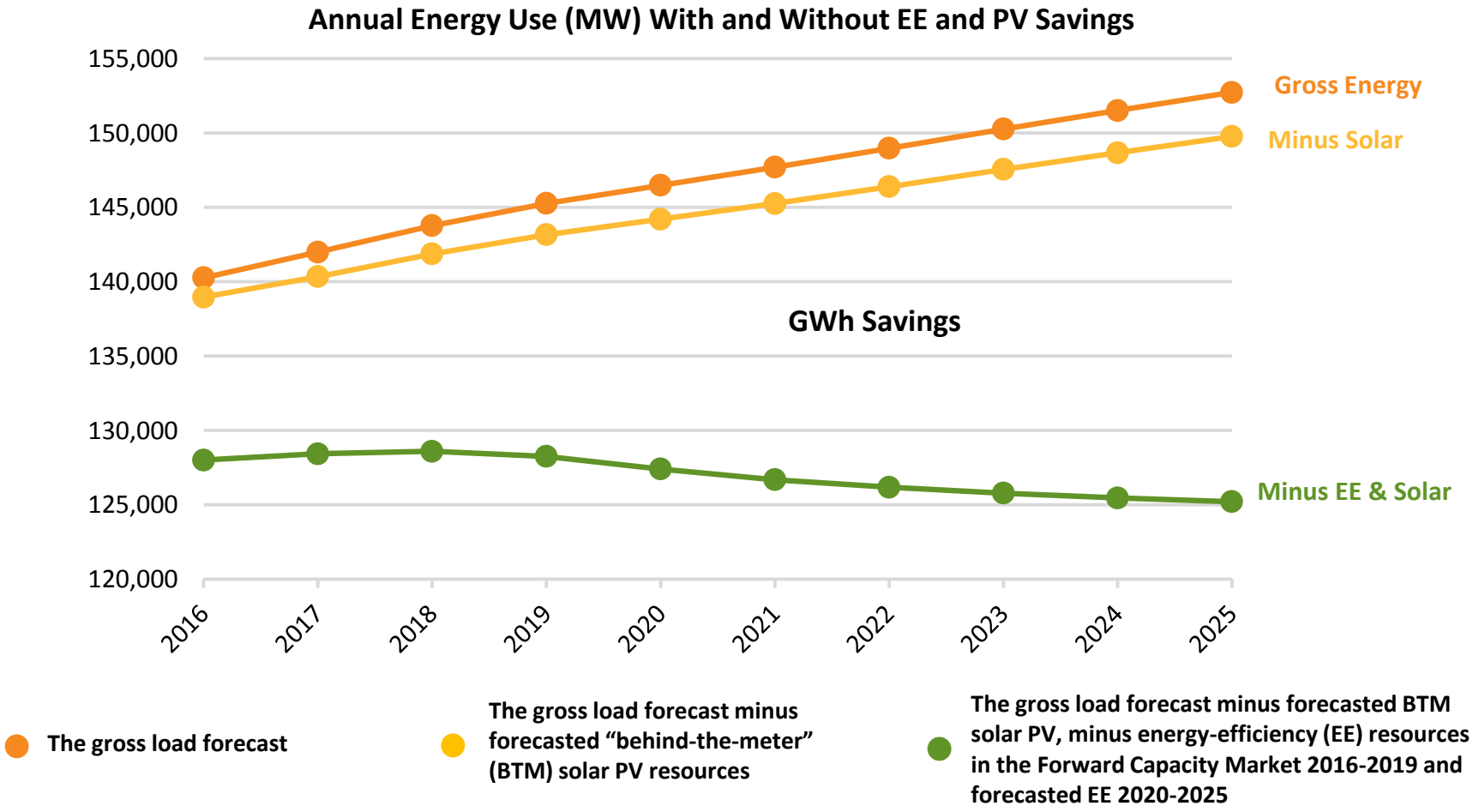
Energy Efficiency and Behind-the-Meter Solar Are Reducing Peak Demand Growth



- The gross peak demand forecast
- The gross peak demand forecast minus forecasted "behind-the-meter" (BTM) solar PV resources
- The gross peak demand forecast minus forecasted BTM solar PV, minus energy-efficiency (EE) resources in the Forward Capacity Market 2016-2019 and forecasted EE 2020-2025

Note: Summer peak demand is based on the "90/10" forecast, which accounts for the possibility of extreme summer weather (temperatures of about 94° F).
Source: Final ISO New England Energy-Efficiency Forecast 2020-2025 and Final 2016 Solar PV Forecast Details (May 2016)

Energy Efficiency and Behind-the-Meter Solar Are Flattening Annual Energy Use



Source: Final ISO New England Energy-Efficiency Forecast 2020-2025 and Final 2016 Solar PV Forecast Details (May 2016)

OPPORTUNITIES AND CHALLENGES FOR DEMAND RESOURCES IN MARKETS AND PLANNING

Impact of Peak Demand Reductions on Bulk Power and Distribution Systems

- Impact ICR for future FCAs
- Impact positions for demand and generation in reconfiguration auctions
- Lower 90/10 load forecast influencing transmission system upgrades
- Potential to improve capacity factor of system
  - Reduce amount of peaking generators operating for very few hours
- ICR cost allocation to load in area of demand reduction transferring cost to areas with higher demand
- Reduce need for distribution system upgrades

Potential Technical and Financial Challenges from Peak Load Reduction

Bulk Power System

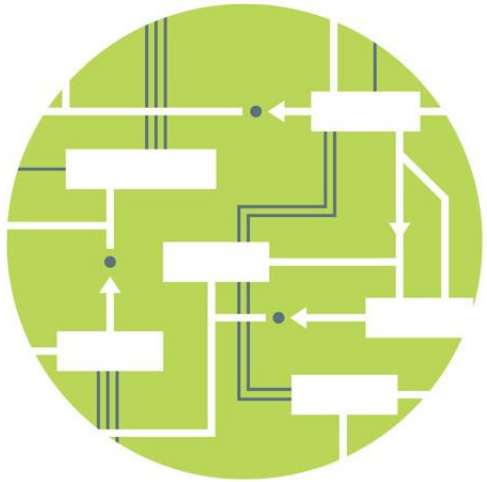
- Increase transmission import/export constraints creating zones of separation and changes to transfer limits
- Capacity factor changes with corresponding large energy reductions from energy efficiency
- Shift in system peak due to variable generating resources
- Impacts to existing supply and new market entrants

Distribution System

- Increased fixed costs due to lower volumetric sales and stranded infrastructure
- Increased costs at distribution level due to more variable load and distributed generation
  - Spur the need for more sophisticated monitoring and controls
  - Investment in technology to handle two-way flow of energy with increased penetration of distributed generation

On-Going Efforts at ISO New England to Manage Future System Changes

- Real-time forecasting of variable generating resources (wind and solar)
- Long-range EE and solar forecasting
- Integration of demand response into energy and reserve markets (FERC Order No. 745)
- Improvements to FCM
  - Zonal Demand Curves, Retirement Reforms, FCM Performance Incentives
- Transmission planning for public policy (FERC Order No. 1000)
- Integration of storage and other electrification initiatives



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