ISO New England Regional Update

Vermont System Planning Committee
July 2023 Quarterly Meeting

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STATE POLICY ADVISOR

Today's Updates

- ISO New England Engagement in FERC Forum
- Operational Impact of Extreme Weather Update
- ISO Interconnection Queue Snapshot
- ISO New England Publications and Resources
- Notable ISO Planning and Improvement Efforts

ISO NEW ENGLAND ENGAGEMENT IN FERC FORUM

ISO New England Engagement in FERC Forum

- On June 20, the ISO participated in FERC's second New England Winter Gas-Electric Forum
  - Gordon van Welie, ISO President and CEO
  - Vamsi Chadalavada, Executive Vice President and COO
  - Bob Ethier, Vice President, System Planning
  - Mark Karl, Vice President, Market Development and Settlements
  - Stephen George, Director, Operational Performance, Training and Integration
- The ISO pre-filed comments responding to the Commission's questions, and presentations were submitted before the Forum
  - Winters 2023/2024 and 2024/2025 in New England and the Role of Everett
  - Extreme Weather Risks to ISO-NE
- A recording of the forum is available online
- ISO External Affairs Page
  - Presentation and speeches delivered by technical experts, senior management, and external affairs team members at industry events in New England and across the nation

OPERATIONAL IMPACT OF EXTREME WEATHER UPDATE

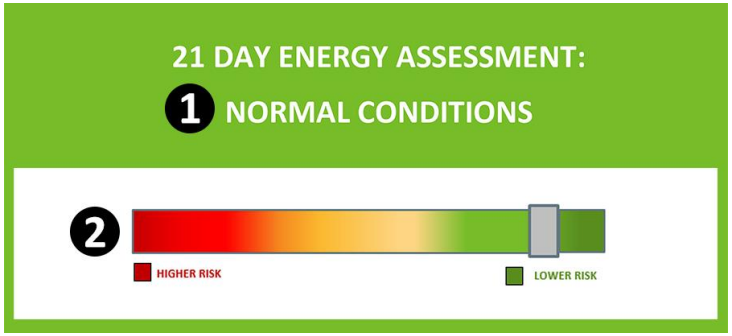
Operational Impact of Extreme Weather Events – Energy Adequacy Study

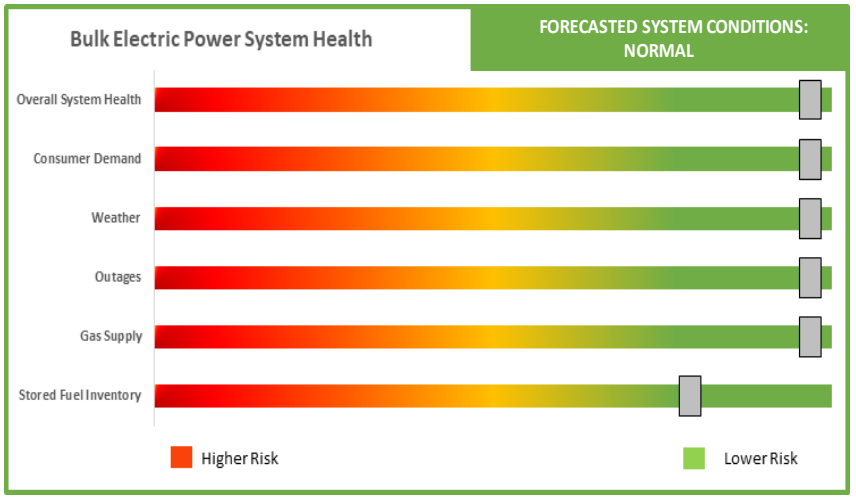
- ISO is working with the Electric Power Research Institute (EPRI) to conduct a probabilistic energy adequacy study for New England under extreme weather events
- Study results are intended to inform the region on energy adequacy risks
  - These results may help in 'quantifying' a problem statement on energy adequacy, against which possible solutions can be assessed
- Study establishes a framework for risk analysis that can be updated as climate projections are refined and the resource mix evolves
- This section briefly reviews preliminary results of the energy assessments completed for 2027 winter events
- ISO will continue reviewing outputs of the 2027 winter events while completing studies of summer 2027 and both winter and summer events for 2032

ISO's Energy Security Assessment Practices

21-Day Energy Assessment

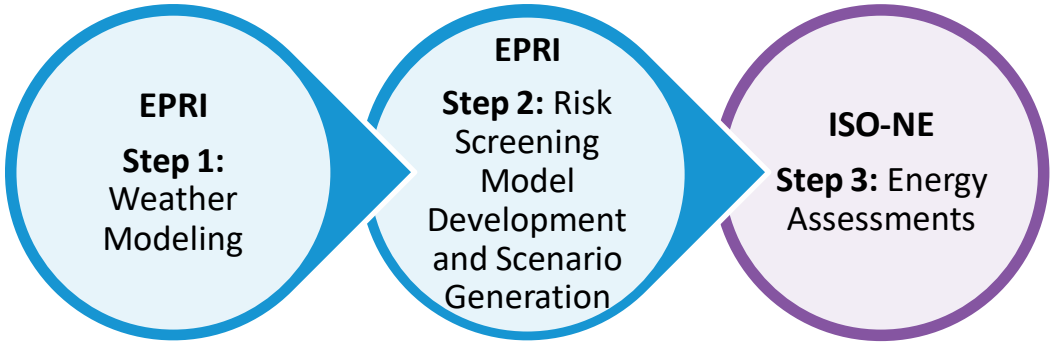
- Since 2018, ISO has published a 21-Day Energy Assessment Forecast to provide early warning of potential energy shortfalls
- The rolling three-week forecast:
  - Considers anticipated power system conditions, forecasted weather and consumer demand, and expected fuel inventories, and
  - Compares hourly energy forecasts against thresholds established in OP-21
- Results of the assessment give ISO New England, public officials, and stakeholders time to take action to prevent shortfalls from materializing





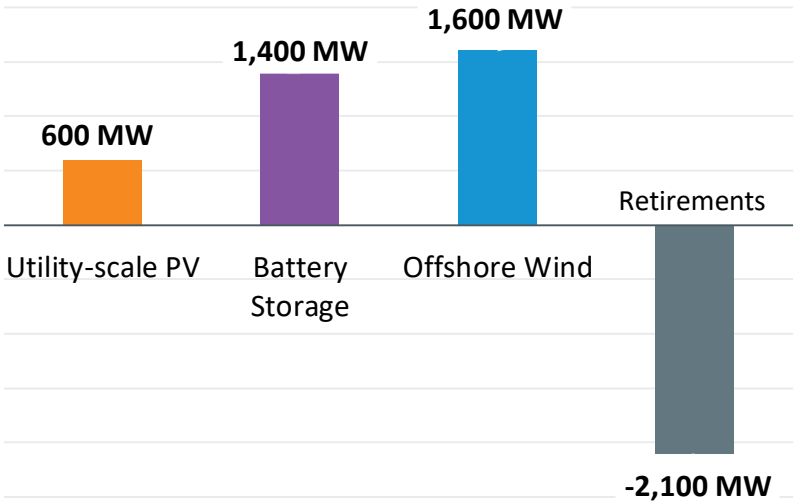
Key Steps and Assumptions for Study Year 2027

- Framework contains three major steps:

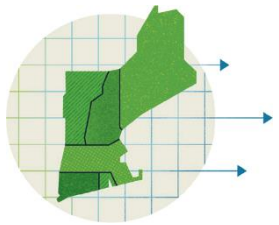


- Generation assumptions include resources that cleared the latest Forward Capacity Auction (FCA 16) and state-sponsored resources under contract or that have been selected under recent RFPs
- Demand forecasts incorporate ISO's 2022 forecasts (i.e., load and electrification of heating and transportation)
  - Includes the effects of ~9,500 MW behind-the-meter (BTM) PV

Key Changes From Today's Generation Fleet



Key Takeaways

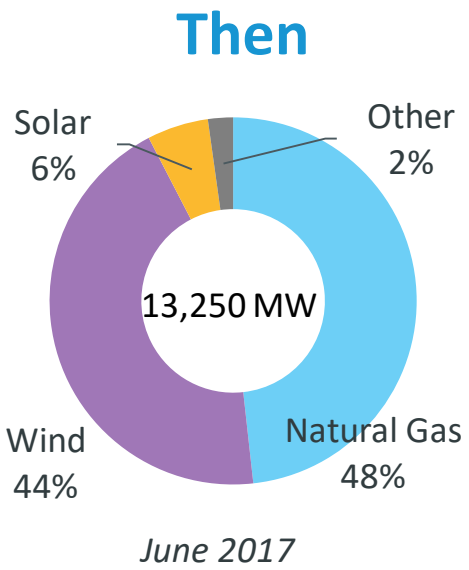


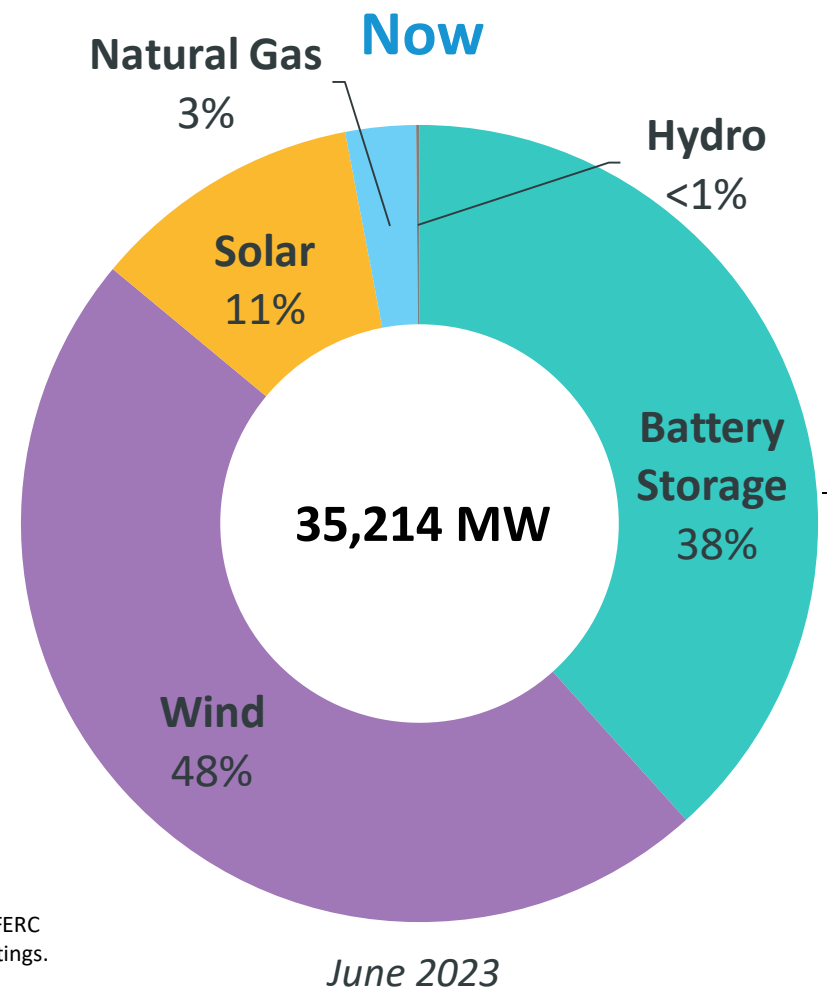
- Results reveal a range of energy shortfall risks and associated probabilities
  - Near-term energy shortfall risk appears manageable over a 21-day period
  - Results are consistent with the significant quantities of PV (BTM and utility scale), offshore wind, and storage expected while experiencing minimal load growth
  - Risks are mitigated by incremental imports from New England Clean Energy Connect
- Results of preliminary studies reveal similar energy adequacy risk with and without EMT in-service
  - Increases in fuel oil and coal burn are notable in cases without EMT in-service
  - The ISO has previously stated the qualitative factors that may warrant the region retaining EMT facility in the mid-term
- The energy adequacy risk profile is dynamic and will be a function of the evolution of both supply and demand profiles
- This energy adequacy study framework provides a much needed foundation for the ISO to monitor these risks and to study the system as it continues to evolve

ISO GENERATOR INTERCONNECTION QUEUE SNAPSHOT

The ISO Generator Interconnection Queue Provides a Snapshot of Resource Proposals

Dramatic shift in proposed resources from natural gas to battery storage and renewables





Battery Storage

CT	3,328 MW
MA	8,165 MW
ME	419 MW
NH	628 MW
RI	797 MW
VT	285 MW

Source: ISO Generator Interconnection Queue, FERC Jurisdictional Proposals; Nameplate Capacity Ratings.

ISO NEW ENGLAND PUBLICATIONS AND RESOURCES

2023 Capacity, Energy, Loads, and transmission (CELT) Report

2022 Annual Markets Report

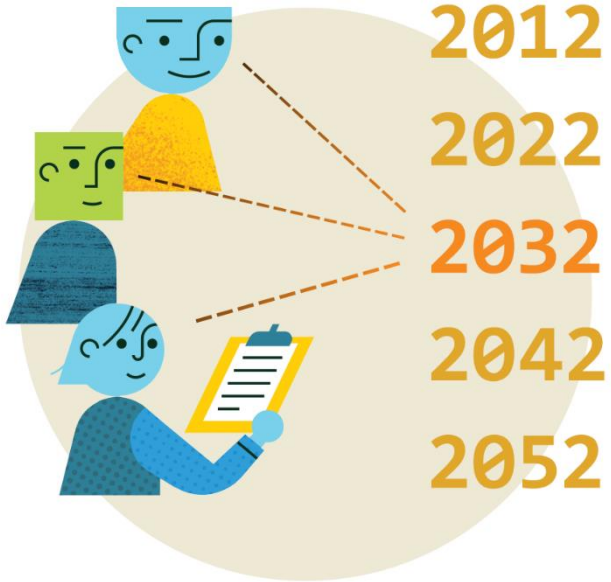
2023 Summer Outlook

Consumer Liaison Group

2023 CAPACITY, ENERGY, LOADS, AND TRANSMISSION (CELT) REPORT

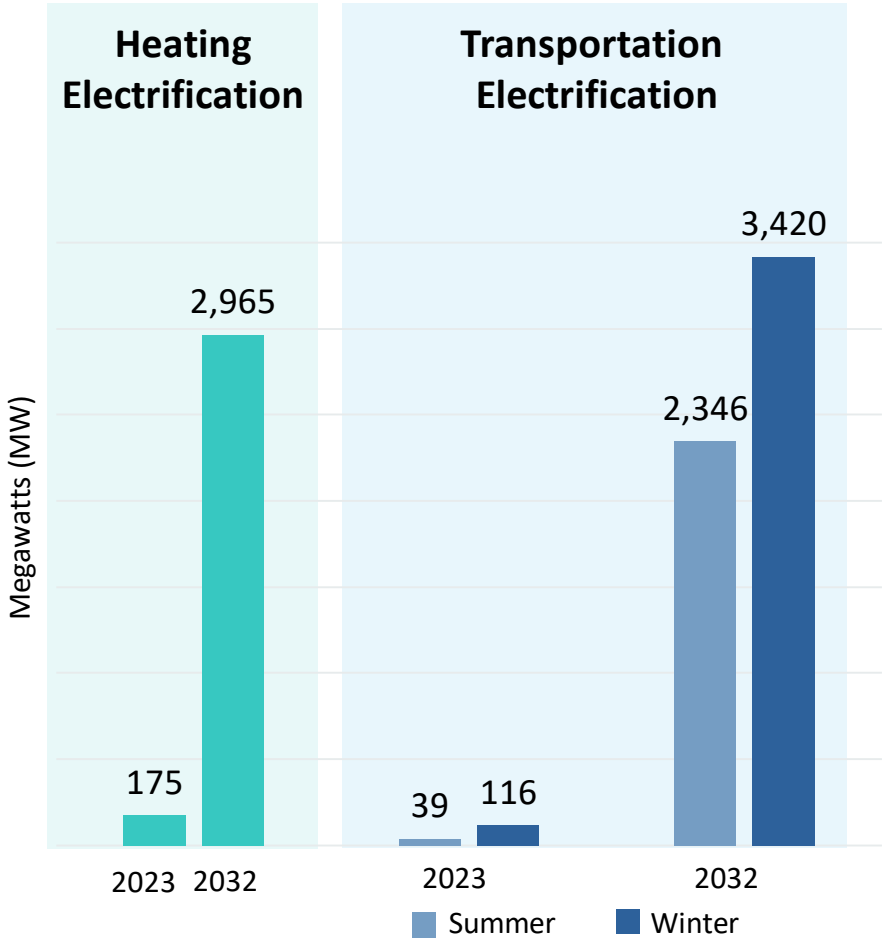
ISO Releases Annual 10-Year Forecast Report

- Issued on May 1, the annual Capacity, Energy, Loads, and Transmission (CELT) Report is the **primary source** for assumptions used in ISO system planning studies
- **Overall** electricity use is expected to **increase** 2.3% annually over the ten year period (2023–2032)
- **Summer peak demand** is expected to **increase** 1.1% annually
- **Winter peak demand** is expected to **increase** 2.9% annually



2023 CELT Includes 10-Year Forecasts for Heating and Transportation Electrification

- The ISO began including **forecasted impacts** of heating and transportation electrification on state and regional electric energy and demand in the 2020 CELT report
- In New England by **2032**, the ISO forecasts that there will be:
  - **>1 M households with heat pumps**
  - **> 600 M square feet of commercial space heated with heat pumps**
  - **~ 3M light-duty EVs**
  - **> 10,000 medium and heavy-duty EVs** (includes delivery vehicles, school buses, and transit buses)



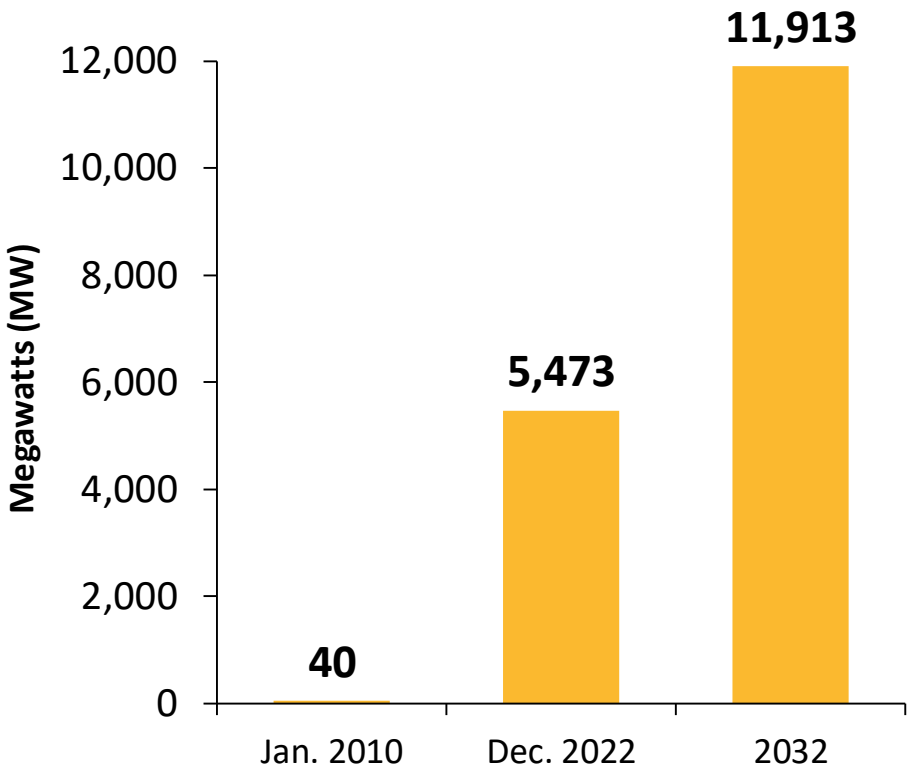
Sources: : ISO New England 2023-2032 Forecast Report of Capacity, Energy, Loads, and Transmission (2023 CELT Report) (May 2023), Final 2022 Transportation Electrification Forecast, and Final 2022 Heating Electrification Forecast

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

December 2022 Solar PV Installed Capacity (MW_{ac})

State	Installed Capacity (MW_{ac})	No. of Installations
Connecticut	912	73,553
Massachusetts	3,289	150,020
Maine	295	8,583
New Hampshire	183	14,427
Rhode Island	326	17,034
Vermont	468	19,348
New England	**5,473**	**282,965**

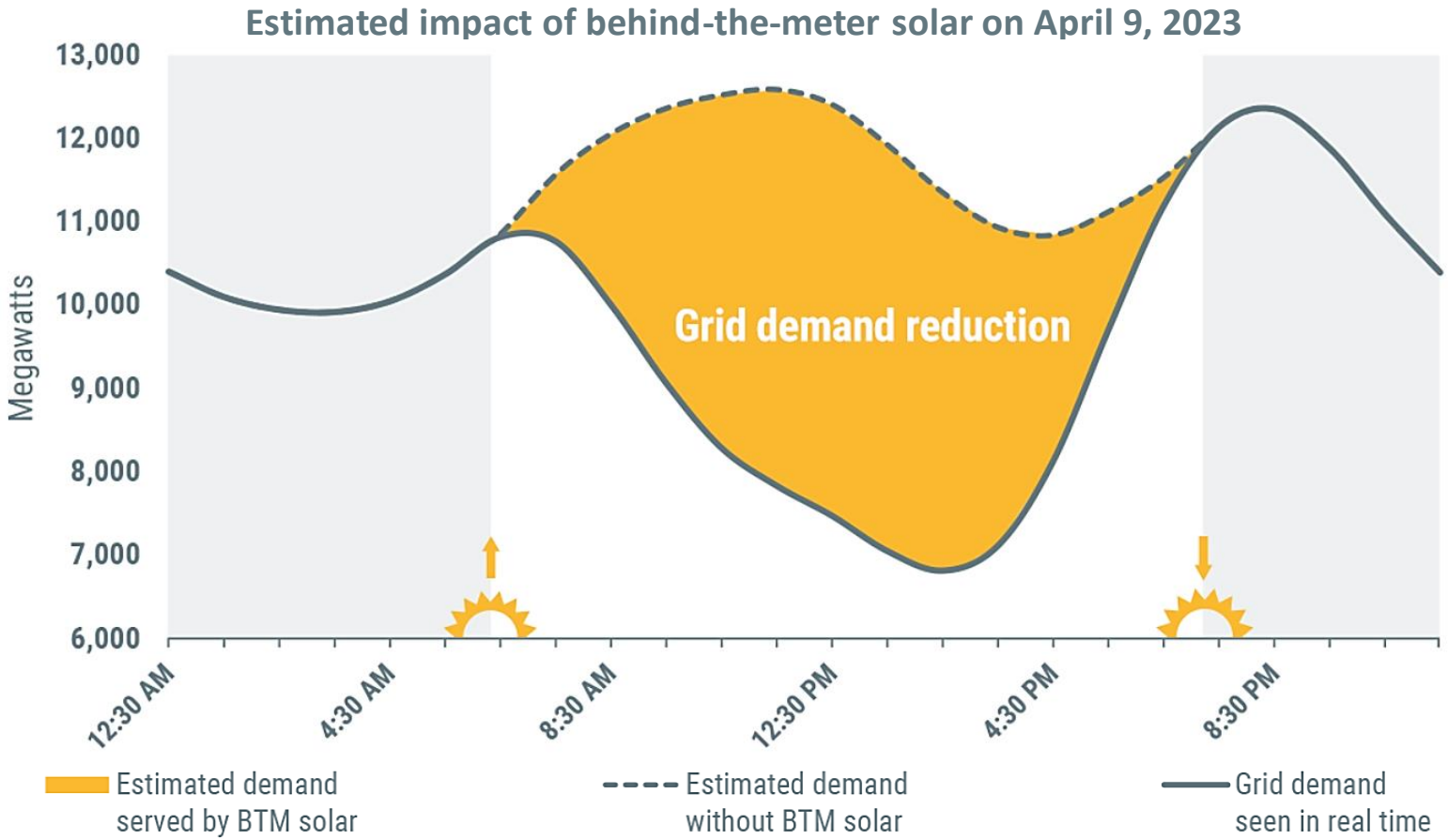
Cumulative Growth in Solar PV through 2032 (MW_{ac})



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: ISO New England 2023-2032 Forecast Report of Capacity, Energy, Loads, and Transmission (2023 CELT Report) (May 2023), and 2023 Photovoltaic (PV) Forecast; MW values are AC nameplate.

Nighttime Electricity Load on the Region's Electric Grid is Exceeding Daytime Consumption On Sunny Days

Continued development of solar deployment drives down afternoon load, especially in spring when demand is lower



Source: ISO Newswire Article from April 11, 2023, New England again sets record for low demand on regional power system - ISO Newswire

2022 ANNUAL MARKETS REPORT

2022 Annual Markets Report Overview

- In June, ISO New England's **Internal Market Monitor** (IMM) issued the *2022 Annual Markets Report* (AMR)
  - The IMM functions **independently** of ISO management and reports directly to the ISO Board of Directors
- The AMR assesses the **state of competition** in the wholesale electricity markets administered by the ISO during the most recent operating year
- The AMR also presents the most important findings, market outcomes, and market design changes of New England's wholesale electricity markets for 2022

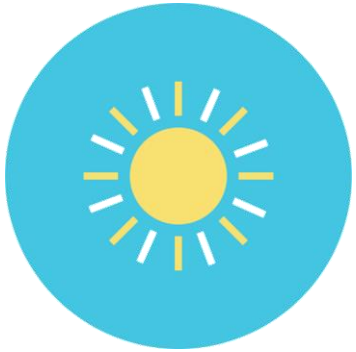
Note: The *2022 Annual Markets Report* is available on the Internal Market Monitor webpage
Also of interest: Winter 2023 Quarterly Markets Report

Energy Costs Drove an Overall Increase in Total Wholesale Costs in 2022

- High natural gas prices drove higher prices in the energy markets, leading to a **49% year-over-year increase in the total wholesale market cost of electricity**, which rose from $11.2 billion in 2021 to $16.7 billion last year
- Energy market costs totaled $11.7 billion, **up 92% from 2021**
  - Natural gas prices drove the increase, rising 101% year over year
  - Energy costs accounted for 70% of the year's total wholesale electricity costs, compared to 55% in 2021
- Capacity costs totaled $2 billion, **down 10% from 2021**
- Cost per megawatt-hour (MWh) of load served last year was $140, compared to $94 in 2021
  - The average price in the Real-Time Energy Market was up 89% year over year, at $84.92/MWh. The average price in the Day-Ahead Energy Market was up 86%, at $85.56/MWh
- Regional network load costs, which pay for the use of transmission facilities, reliability, and certain administrative services, were $2.8 billion, **up just 2%** from 2021

2023 SUMMER OUTLOOK

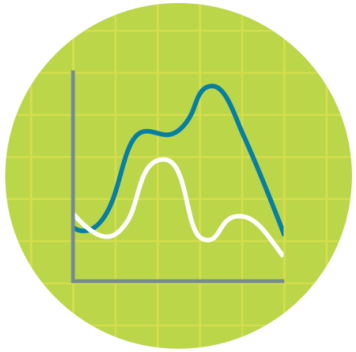
2023 Summer Outlook Highlights



- New England is expected to have adequate resources to meet peak summer demand
  - Peak demand for typical summer weather: **24,605 MW**
  - Peak demand for above-average summer weather: **26,421 MW**
- Both forecasts take into account the demand-reducing effects of energy-efficiency measures (more than **1,900 MW**) acquired through the Forward Capacity Market and behind-the-meter solar (more than **980 MW**)
- New England has more than **30,000 MW** of total capacity available this summer
- The ISO released the 2023 Summer Outlook on June 1

Summer Outlook Press Release: https://www.iso-ne.com/about/news-media/press-releases/

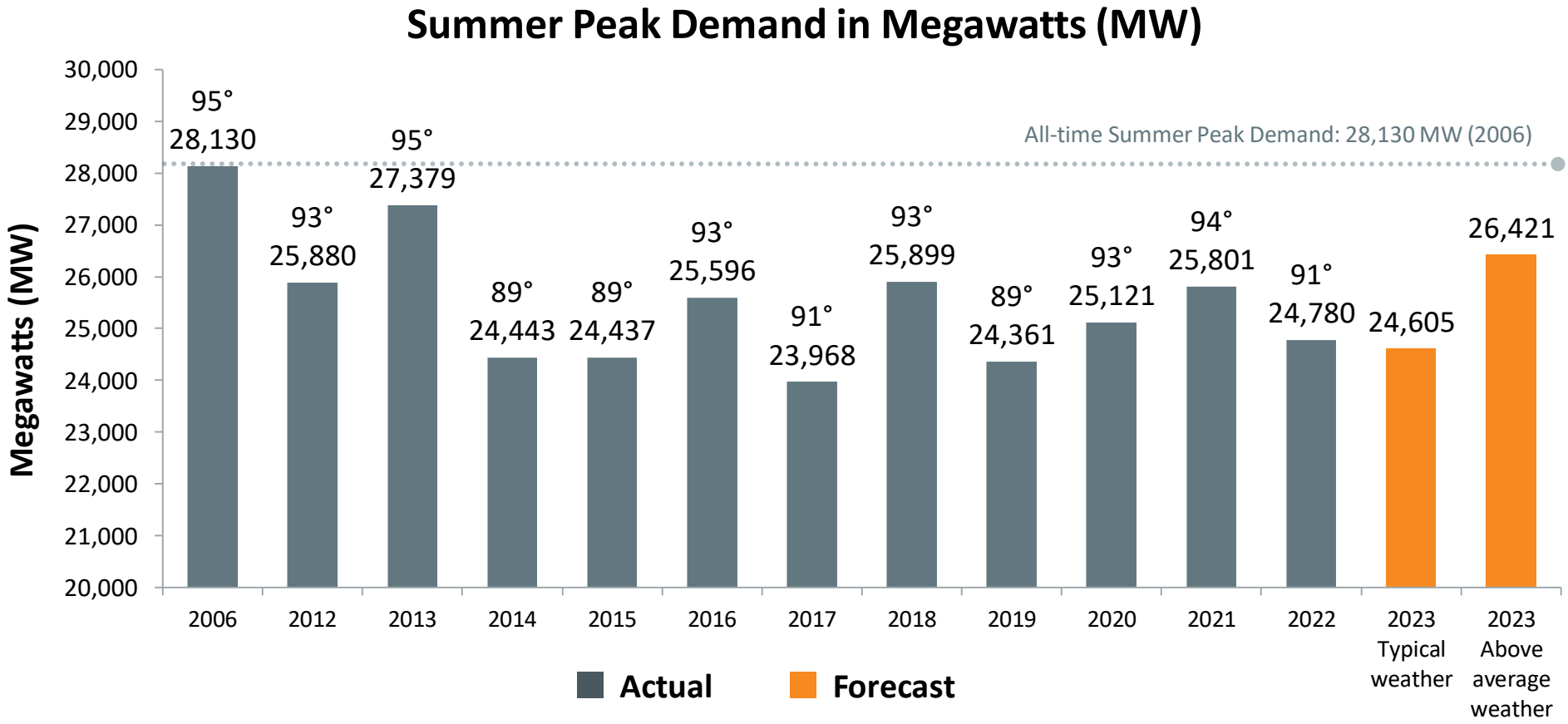
Preparations for Summer Peak Demand



- New England's peak summer demand period runs from **June 1** through **September 30**
- In preparation for the summer, ISO New England will:
  - Forecast New England's demand for electricity and reserves
  - Evaluate the region's summer capacity outlook
  - Exercise the communications plan
- The ISO prepares **short-term forecasts** for the summer and winter seasons, taking into account estimated supplies for all resources; unplanned resource outages; imports from neighboring regions; resource retirements; and delays in commissioning new resources
- The purpose of the communications plan is to provide **timely**, **complete**, and **consistent** updates to key stakeholders on power system conditions

Weather Drives Summer Peak Demand

Historical and Projected Peak Demand in New England



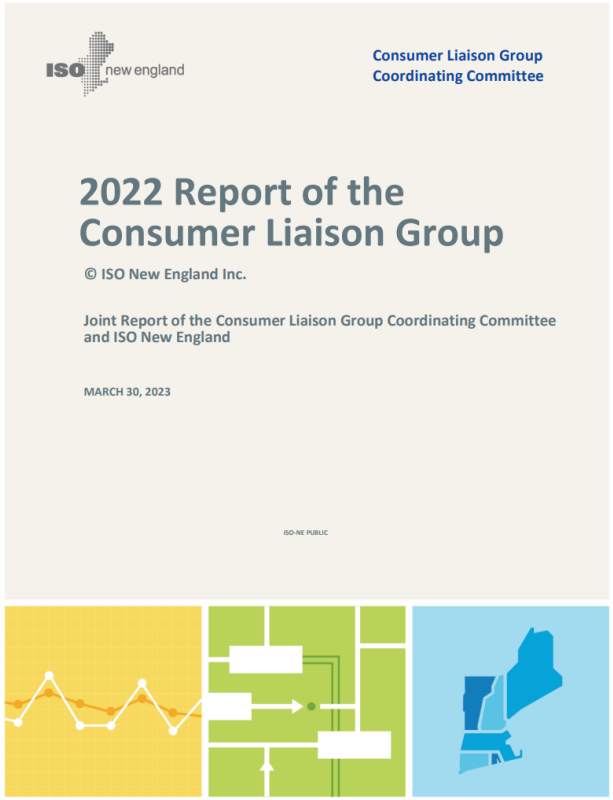
Sources: ISO-NE Seasonal Peaks Since 1980, 2023 CELT Forecast

*Temperature is dry-bulb temperature in degrees Fahrenheit based on weighted average of eight New England weather stations.

CONSUMER LIAISON GROUP

Consumer Liaison Group Provides a Forum for Consumers to Learn about Regional Electricity Issues

- A forum for sharing information between the ISO and electricity consumers in New England
- The CLG Coordinating Committee consists of 12 members who represent various stakeholder groups
- Quarterly meetings are free and open to the public, with in-person and virtual options to participate
- 2023 Meetings
  - **Thursday, September 21 – Vermont**
  - Wednesday, December 6



2022 CLG Annual Report

More information on the CLG is available at: https://www.iso-ne.com/committees/industry-collaborations/consumer-liaison/

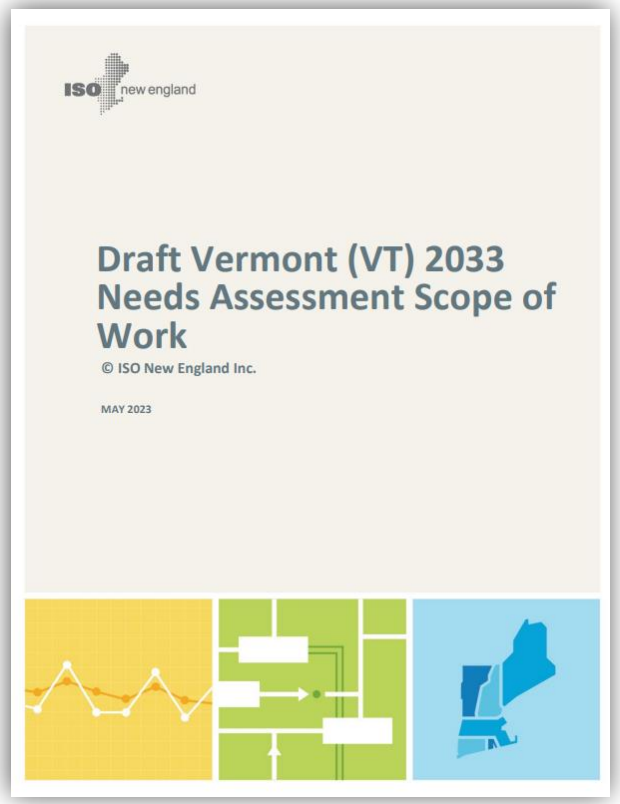
NOTABLE ISO PLANNING AND IMPROVEMENT EFFORTS

Storage as a Transmission-Only Asset (SATOA)

- In December 2022, the ISO filed revisions to the Tariff and Transmission Operating Agreement to incorporate rules that will enable electric storage facilities to be planned and operated as transmission-only assets to address system needs identified in the regional system planning process
- The change would create a new, separate class of storage resources that would not participate in the markets – meaning they would have minimal effect on wholesale electricity prices – but would be purpose-built as transmission equipment
- While SATOAs would be owned and maintained by transmission companies, ISO system operators would control their use
- The revisions will allow storage to be considered as a solution to needs in both the Solutions Study process and the competitive solution process
  - Construction of SATOAs by transmission companies would depend upon selection in the open regional system planning process administered by the ISO, similar to the way reliability-based system upgrades are handled today

Vermont 2033 Needs Assessment

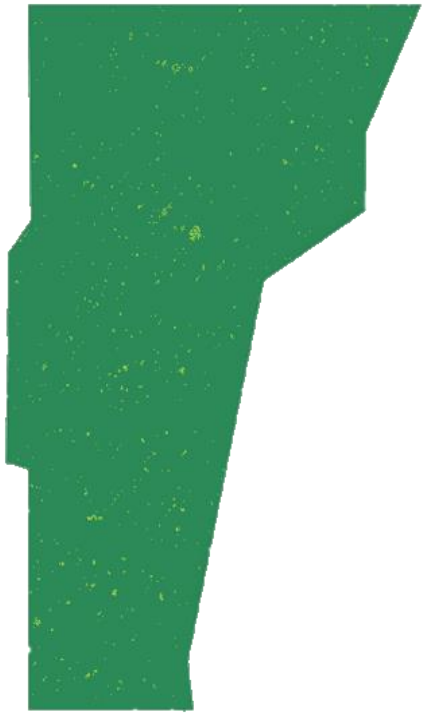
- On May 31, the ISO posted the draft VT 2033 Needs Assessment Scope of Work and the draft intermediate study files that will be used for the Needs Assessment
- The Scope of Work was presented to the Planning Advisory Committee (PAC) in December 2022 and February 2023
- Based on significant changes to load, EE forecast and PV forecast, the study cases were updated to reflect draft 2023 CELT data and the study year was advanced to 2033
- Additional updates were made to the scope of work to incorporate the results of FCA 17 and the submitted retirement delist bids for FCA 18



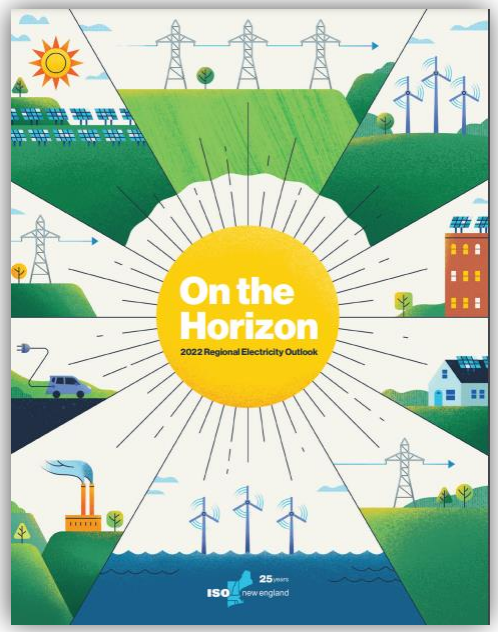
Vermont 2033 Needs Assessment

Schedule and Next Steps

- A Needs Assessment Report will be developed based on the assumptions discussed in the scope of work
- The report will:
  - Identify specific NERC, NPCC, and ISO-NE criteria violations associated with Pool Transmission Facilities (PTF) elements in the study area that the PTF system failed to meet
  - Specify the time-sensitive needs and the need-by-date for all time-sensitive needs in the study area
- The Vermont 2032 Needs Assessment is expected to be completed and presented to the PAC in Q3/Q4 2023

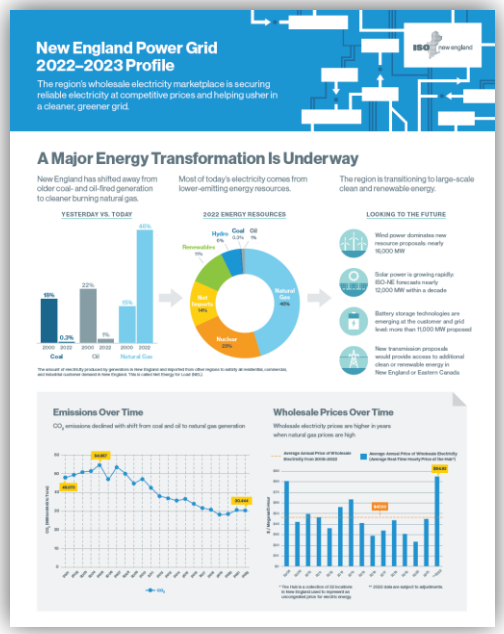


ISO New England Releases Several Publications



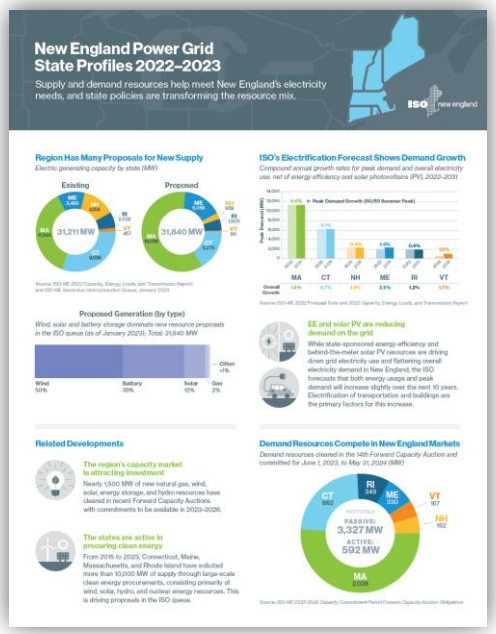
2022 Regional Electricity Outlook

Provides an in-depth look at New England's biggest challenges to power system reliability, the solutions the region is pursuing, and other ISO New England efforts to improve services and performance



New England Power Grid Profile

Provides key grid and market stats on how New England's wholesale electricity markets are securing reliable electricity at competitive prices and helping usher in a cleaner, greener grid



New England State Profiles

Provides state-specific facts and figures relating to supply and demand resources tied into the New England electric grid and state policies transforming the resource mix in the region

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ISO Newswire is your source for regular news about ISO New England and the wholesale electricity industry within the six-state region

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ISO Express provides real-time data on New England's wholesale electricity markets and power system operations

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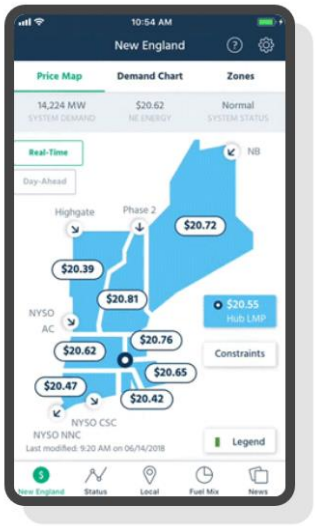
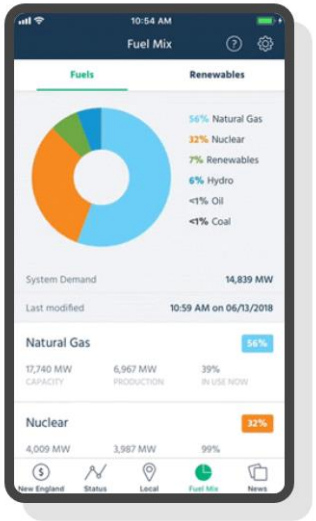
ISO to Go is a free mobile application that puts real-time wholesale electricity pricing and power grid information in the palm of your hand





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Questions