



The Changing System Over the Next Ten Years and Beyond

Environmental Business Council of New England

Brent Oberlin

DIRECTOR | TRANSMISSION PLANNING



INTRODUCTION



Background

- The power system is undergoing unprecedented shifts in the way that energy is generated and consumed
- The system must evolve to ensure continued reliability, which will require the addition of significant transmission infrastructure
 - New study assumptions and processes are required
 - New means of coordinating transmission system upgrades must be considered
- Today's presentation is a short introduction to a few of the hurdles that must be overcome



ISO FORECASTING



CELT Report and Beyond

- Each spring, the ISO produces the Forecast Report of Capacity, Energy, Loads, and Transmission ([CELT Report](#))
- The CELT Report is a ten year forecast that includes the following:
 - Customer load (includes the impact of heating and transportation electrification)
 - Energy efficiency programs
 - Photovoltaic (PV) solar resources (the largest component of Distributed Energy Resources (DER))
 - Generally small, “behind the meter” resources – rooftop and small-scale ground-mounted
 - Utility scale PV solar is not included in this forecast
 - Based on state incentives for PV solar development
- The CELT Report forms the basis for many of the assumptions in the ISO’s “typical” Needs Assessments, which identify system concerns over the 10 year horizon
- Transmission planning beyond ten years requires additional information that is not readily available
 - Assumptions must be made regarding the amount and location of customer load and resources
 - For the ISO’s 2050 Transmission Study, which considers 2035, 2040, and 2050, and the Future Grid Reliability Study, which considered 2040, the ISO used the “All Options” pathway in the “[Energy Pathways to Deep Decarbonization](#)” report
- As the region looks beyond ten years, assumptions are inherently less accurate and stakeholders have varying views regarding the future



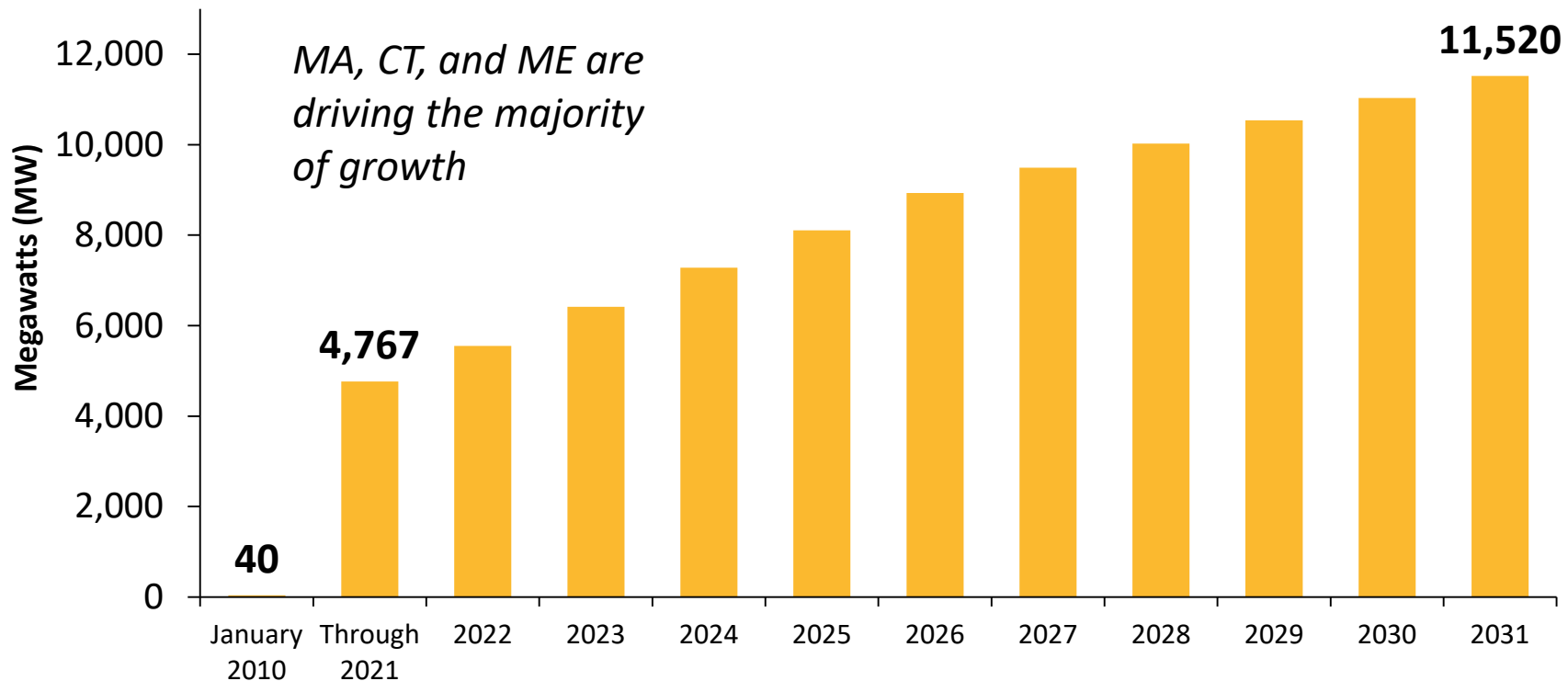
GROWTH OF DER IN NEW ENGLAND



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



Cumulative Growth in Solar PV through 2031 (MW)

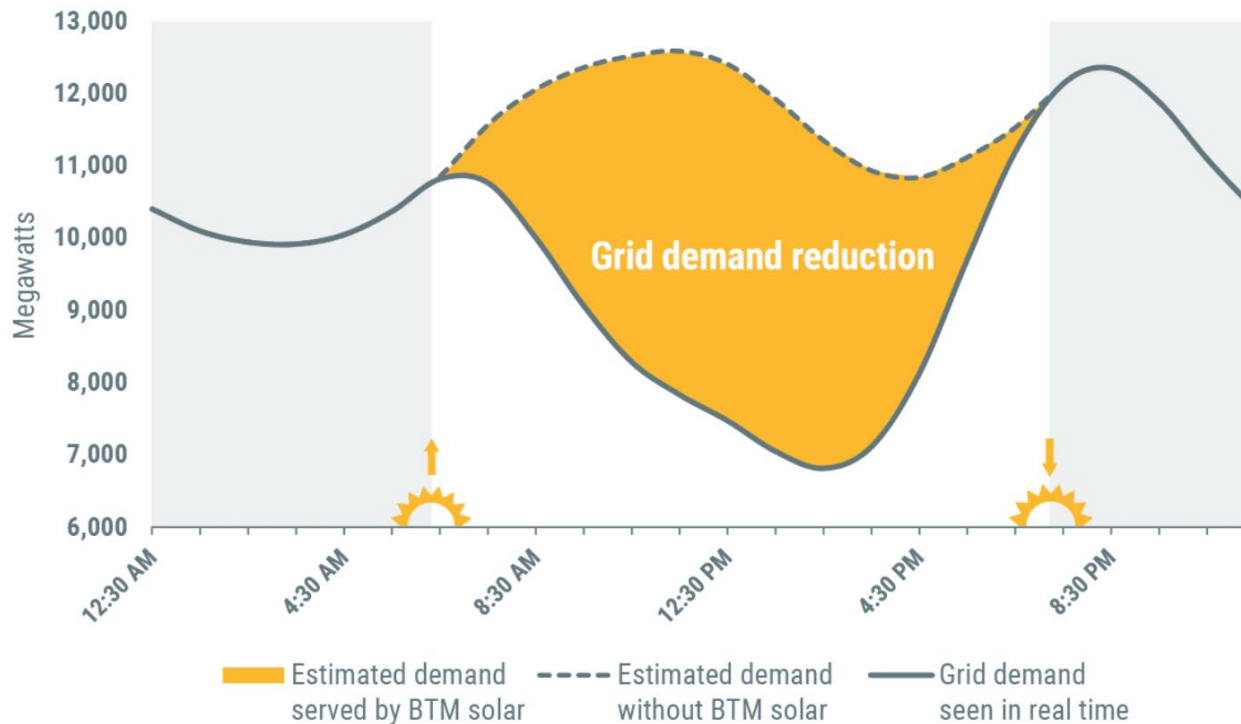


Note: The bar chart reflects the ISO's projections for nameplate capacity from PV resources participating in the region's wholesale electricity markets, as well as those connected "behind the meter." The forecast does not include forward-looking PV projects > 5 MW in nameplate capacity. Source: [ISO New England 2022-2031 Forecast Report of Capacity, Energy, Loads, and Transmission](#) (2022 CELT Report) (May 2022); MW values are AC nameplate. State specific details are available in the final report.

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

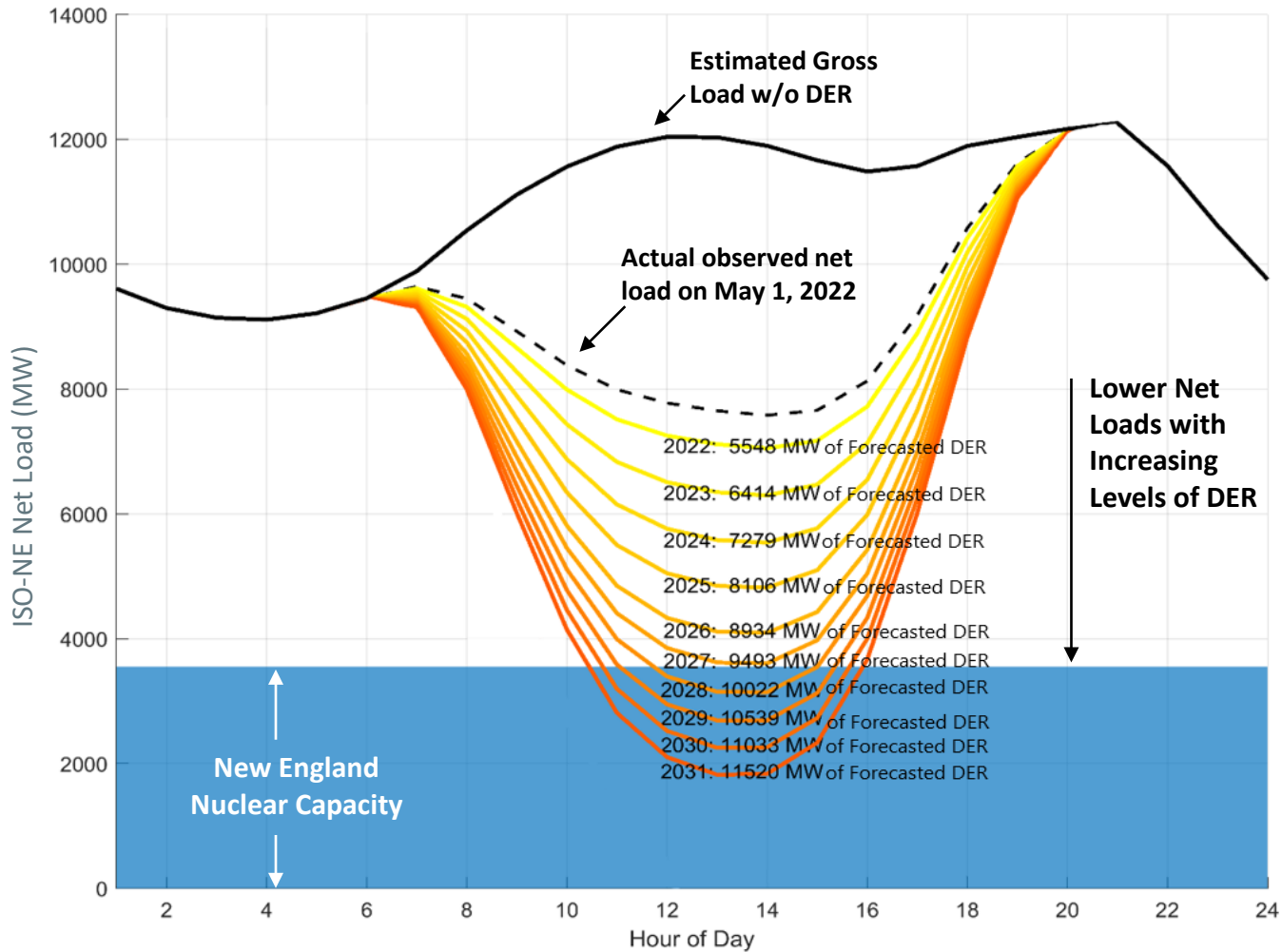
Estimated impact of behind-the-meter solar on April 9, 2023



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

Projections of Daytime Minimum Loads in New England

Load Profile based on May 1, 2022*



* New England saw its historical lowest net load on April 9, 2023; the prior lowest net load occurred on May 1, 2022

Impact of Increased DER Levels

- In New England a majority of the DER is not visible to the ISO and cannot be curtailed
 - The ISO is working on ways to estimate DER output in real-time, but direct control over output is still not possible
- Under system conditions with high levels of DER, if DER cannot be curtailed, it is possible that large synchronous generators, such as nuclear, may not be able to run
- Without a lot of synchronous generation online, the result is low system strength and low system inertia
 - This impact is not unique to DER and could be observed for a system with high levels of any type of inverter-based resources, such as solar, wind, or battery storage
 - Depending on the technologies used, this impact may also be exacerbated by interconnections to other regions
- Lack of system strength and inertia may cause significant system performance issues



PEAK LOAD

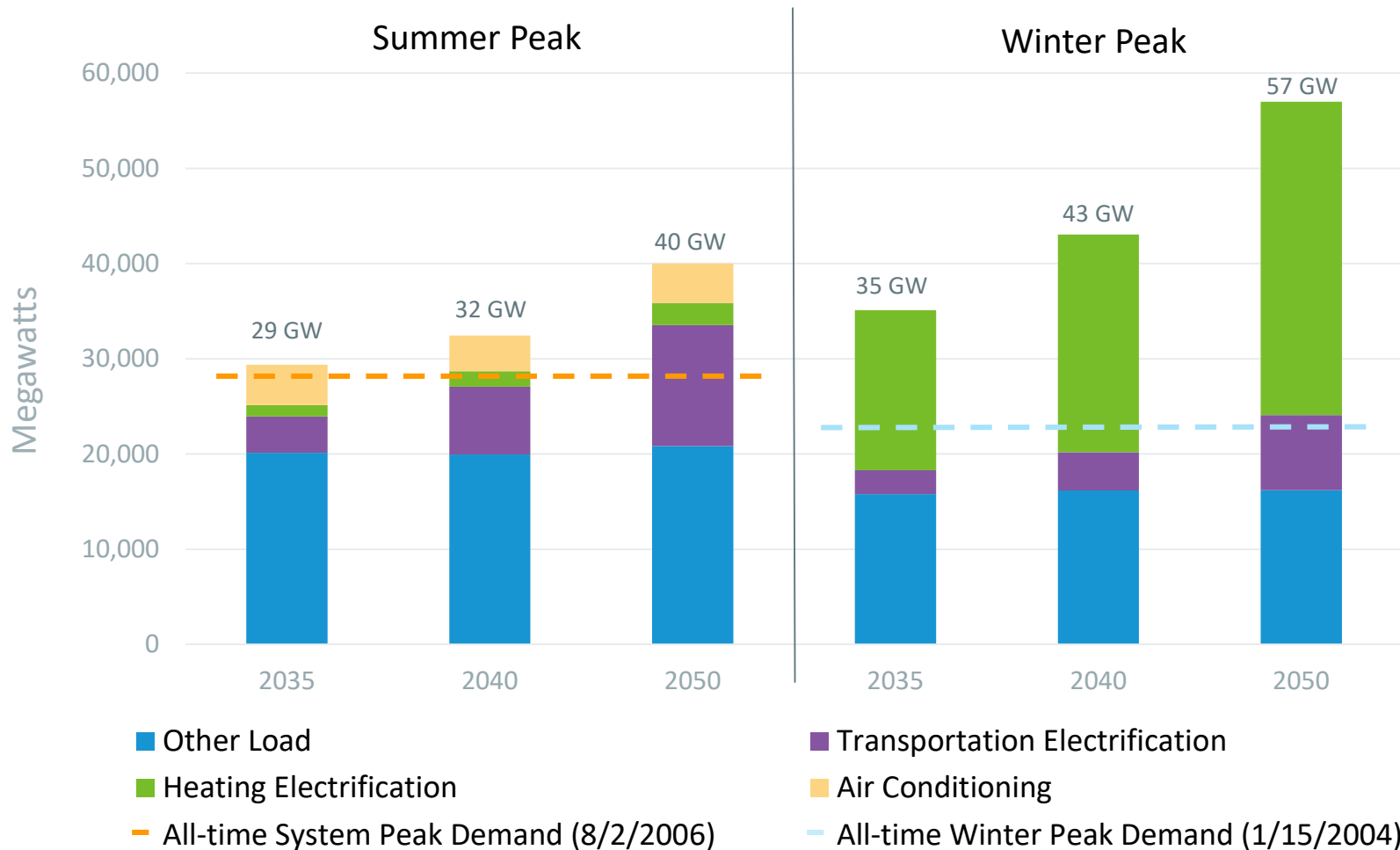


Serving Peak Load

- The system is expected to undergo significant changes in peak load
- In recent history, New England has had its peak load in the afternoon during the summer
 - This is largely driven by air conditioner use
- However, a number of factors will change this over time
 - As discussed earlier, the proliferation of DER will continue to drive down the load the transmission system must serve in the afternoon
 - PV solar provides no benefit at night, causing early morning and late evening peaks to be higher than mid-day consumption
 - Adoption of electric vehicles and heating electrification will contribute to overall load, but are expected to have a greater impact on the morning and evening peaks when people are home
 - Heating electrification will have a significant impact on electric use in the winter, driving consumption to be greater than the summer
 - New England could become “winter peaking” again around the mid-2030’s

New England System Peak Grows Substantially and Shifts to Winter-Peaking

2050 Transmission Study



2050 Transmission Study

- New England's all-time highest peak load occurred on August 2, 2006, with a peak of 28,130 MW
- The assumptions for the 2050 Transmission Study yield a 2050 winter evening peak load of ~57,000 MW – over double what has occurred in the past
- With the assumptions used in the study, this winter evening peak load resulted in approximately 4,000 miles of overloaded transmission lines in New England
- The ISO is developing frameworks for potential solutions to address these concerns, which may include
 - Increasing the ability for existing lines to carry more power, possibly through installation of larger conductors
 - Installation of new transmission facilities to off-load existing transmission facilities

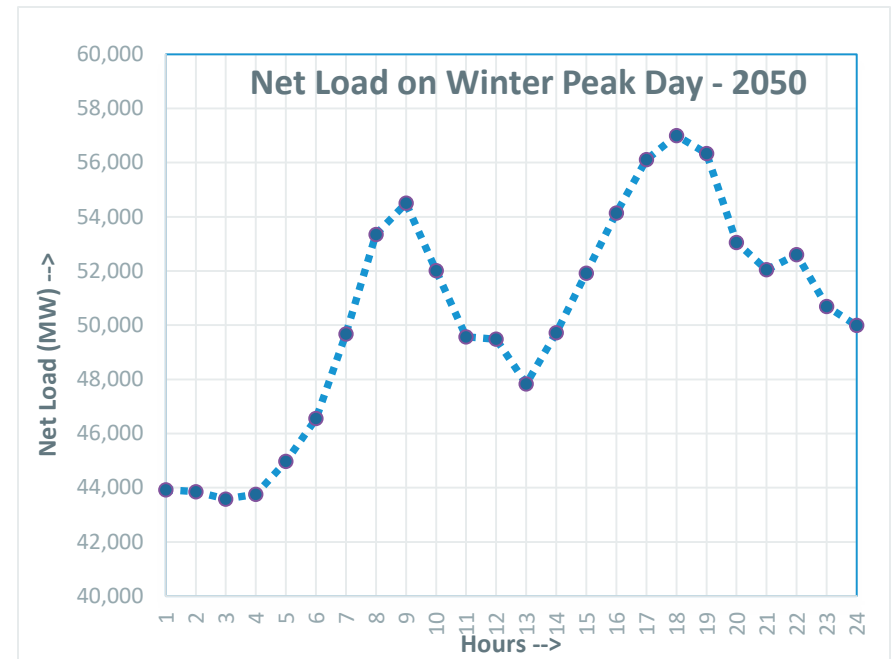


COMBINING IT ALL



A System of Extremes

- The previous slides explain how the system must be designed to handle new extremes in the load to be served from the transmission system
 - DER will create new minimum load conditions
 - Electrification of vehicles and heating will create new maximum load conditions
 - Both of these conditions could occur over the course of the same year
 - Even in the same day, the system could be exposed to a variety of load levels. An example from the 2050 Transmission Study is shown to the right



Flexibility

- Not only will the system need resources that are capable of quickly adjusting their output to compensate for changes in wind and solar production, but the transmission system will also need to be designed with similar flexibility in mind
- Manually switched, static shunt devices will likely be of limited value in the future
 - Dynamic shunt devices that automatically respond to changes on the system are necessary



PROCESS CHANGES



Processes are Evolving – One Example

- In the past, the ISO used to design the system by looking approximately 10 years into the future
- While this has served the region well, the potential changes to customer load and the resources on the system (technology and location) require looking out further into the future to ensure efficient system development
- As a first step, the ISO created a new process, Longer-term Transmission Studies, to allow the ISO to analyze the system beyond ten years
 - The first example has already been discussed – the 2050 Transmission Study
- The ISO has committed to work with the New England states to create a follow-on effort that creates a mechanism for moving forward with transmission upgrades to address system concerns identified in a Longer-term Transmission Study

CONCLUSION

Conclusion

- The system is evolving into a state that has never existed before
- A simple discussion on how much load the system must serve has become much more complex
- The transmission system will need to be expanded to reliably serve expected future conditions
- There are numerous additional hurdles to overcome to make sure that this journey is successful
 - Today's discussion should be considered the tip of the iceberg



Questions

