From Rates to Resources: Considerations for Managing Peak Demand in a Changing Grid

Northeast Public Power Association Annual Conference

August 2025

Energy+Environmental Economics

Jon Blair, Senior Managing Consultant

Energy + Environmental Economics (E3)

130+ full-time consultants

30+ years of deep expertise

Engineering, Economics, Mathematics, Public Policy…


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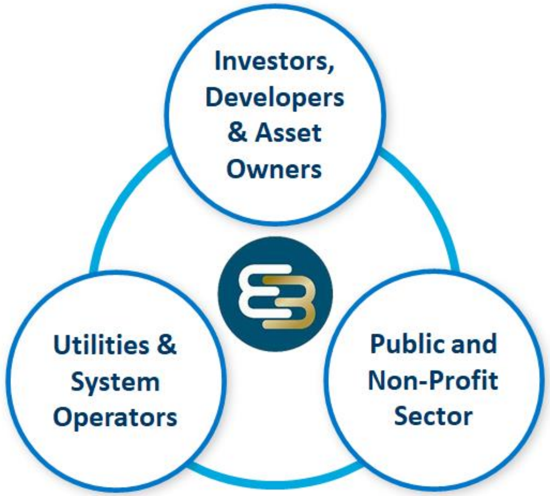
E3 Clients

350+ projects per year across diverse client base



Recent Examples of E3 Projects

Maine Governor's Energy Office, Energy Storage Market Assessment (2022)

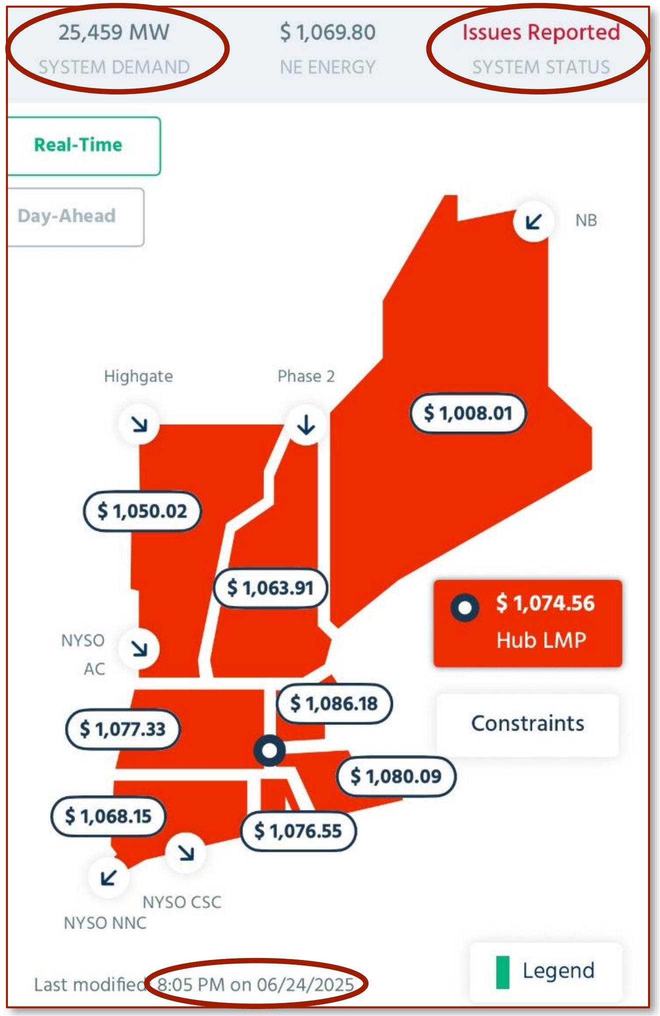
MassCEC/DOER, *Charging Forward* energy storage roadmap (2023)

Rhode Island Energy, Future of gas distribution business technical analysis and stakeholder support (2024)

Massachusetts Interagency Rates Working Group (IRWG), Rate design for electrification and affordability (2024-2025)

Massachusetts Office of Energy Transformation (OET), Support initiatives for Energy Transformation Advisory Board and *Decarbonizing the Peak* working group (2024-2025)

Our ongoing energy transformation introduces many challenges, uncertainties, and competing priorities

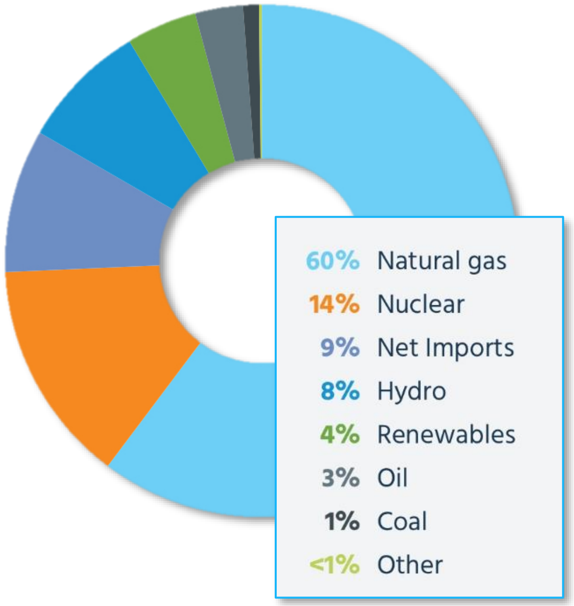


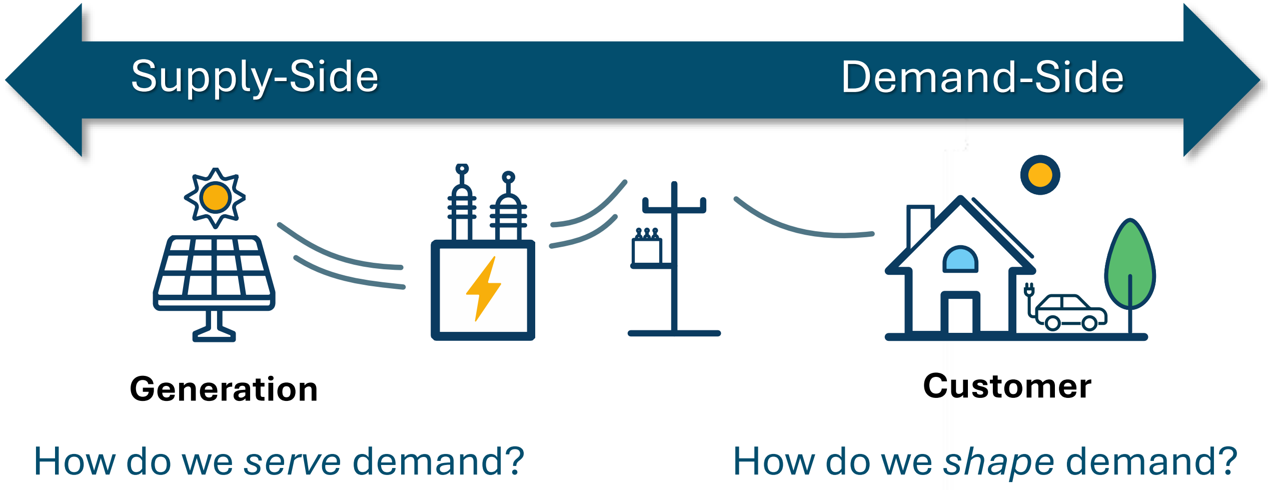
- *Reliability*
- *Affordability*
- *Decarbonization*
- *Large loads & electrification*
- *Market reform*
- *Regulation*
- *Subsidies & tariffs*

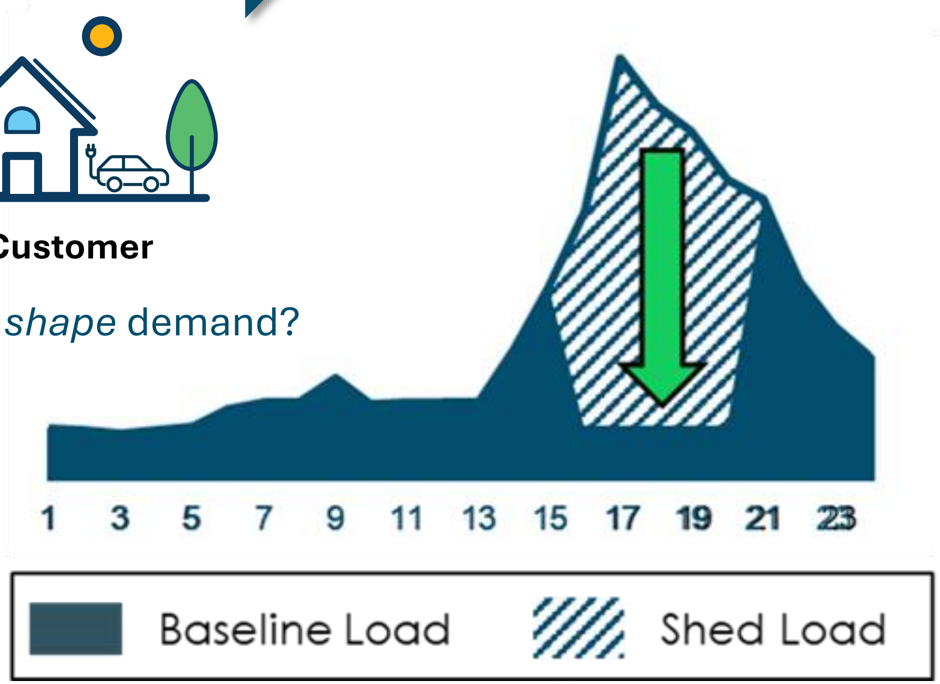
+ **Peak demand stresses grid reliability and is served by the most expensive and carbon-intensive resources; managing peak demand is central to these challenges**

Approaches to peak management can consider supply-side impacts, like portfolio resources, and demand-side influences, like rates and programs

+ **Demand-side features like rates and load management will play a role in managing peak demand**
+ **A diverse portfolio of supply-side resources will be required to reliably serve peak demand**







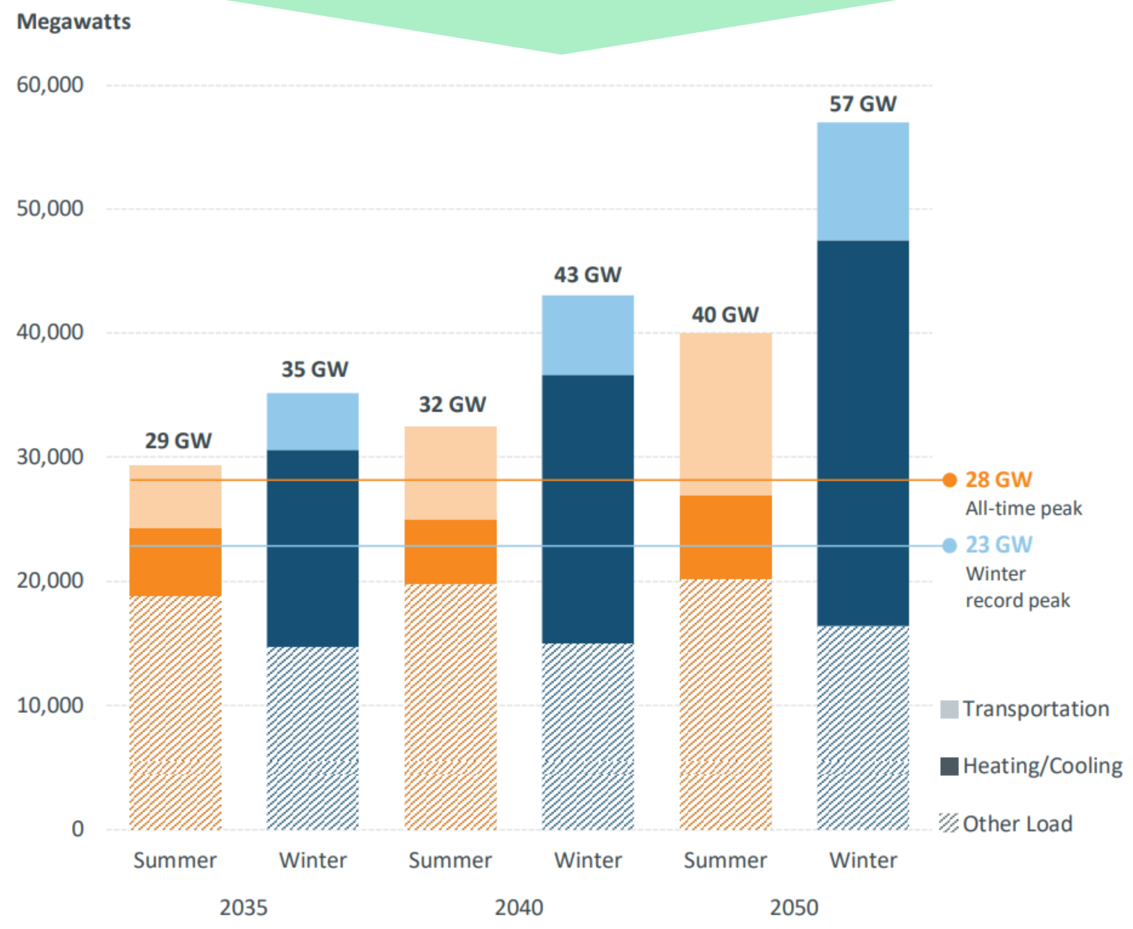
+ **New England's states, utilities, and ratepayers have diverse priorities; there is no one-size-fits-all solution**
+ **Public power can continue to lead the energy transformation**

Managing Peak Demand: Supply-Side

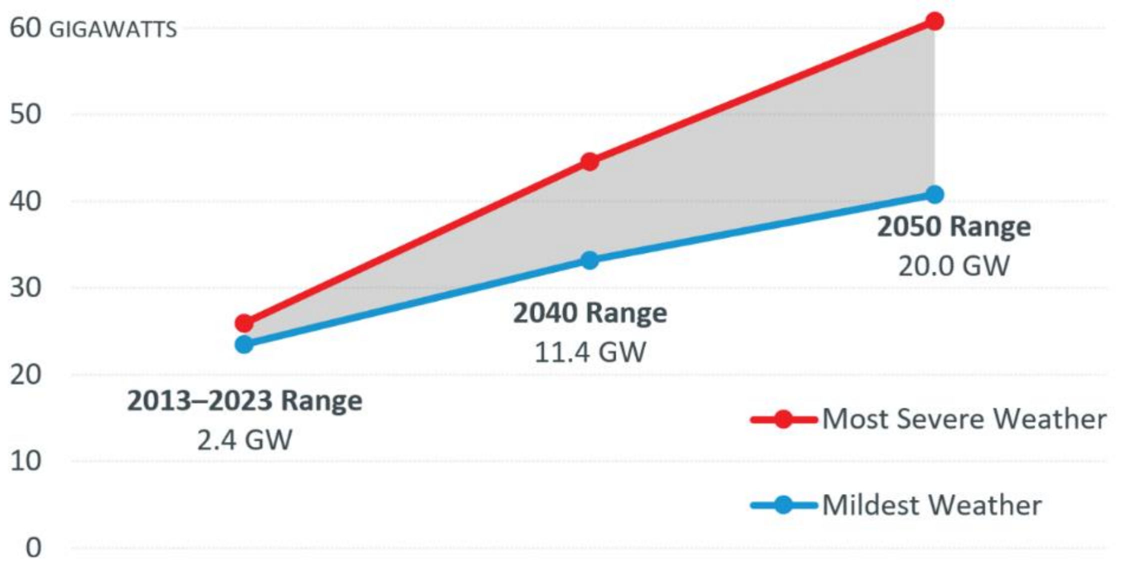
Energy+Environmental Economics

Changes in consumer demand, driven primarily by electrification, are expected to result in significant changes to system peaks

ISO-NE projects peak demand will shift from summer to winter in the mid-2030's and double in magnitude by 2050



Annual peak demand is expected to vary significantly year to year, depending on severity of weather



Source: https://www.iso-ne.com/static-assets/documents/100009/necpuc_retail_demand_load_flexibility_working_group_iso_presentations_final.pdf

As the resource portfolio evolves, so do periods of need

+ **Modeling the average month-hour net load reveals greatest periods of resource need after renewable dispatch***

Average Month-Hour Net Load

*Loss of load analysis based on CECP 2020 portfolios

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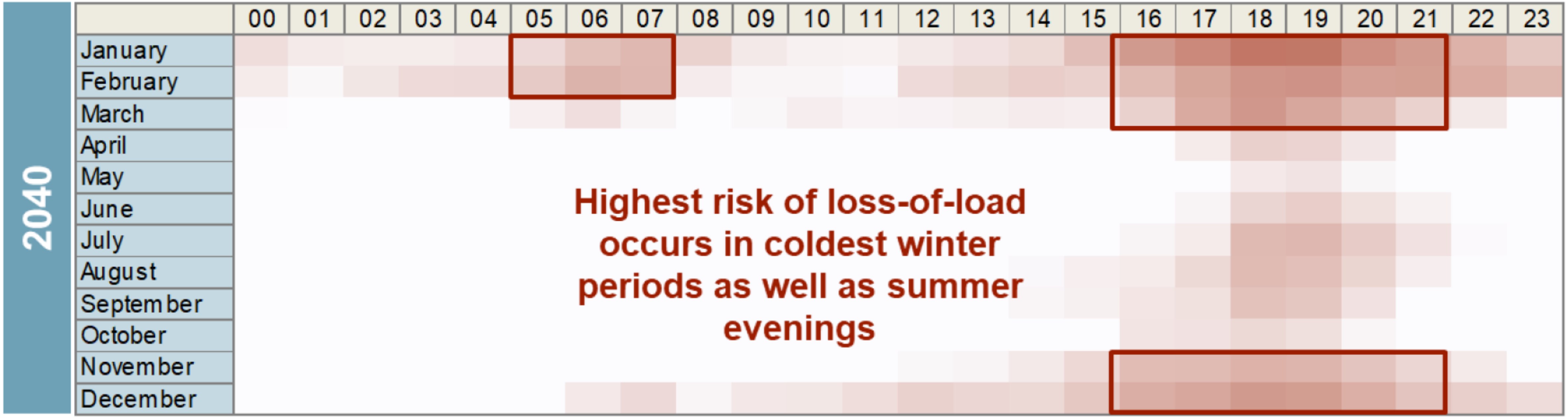
Average Month-Hour Net Load



*Loss of load analysis based on CECP 2020 portfolios

As the resource portfolio evolves, so do periods of need

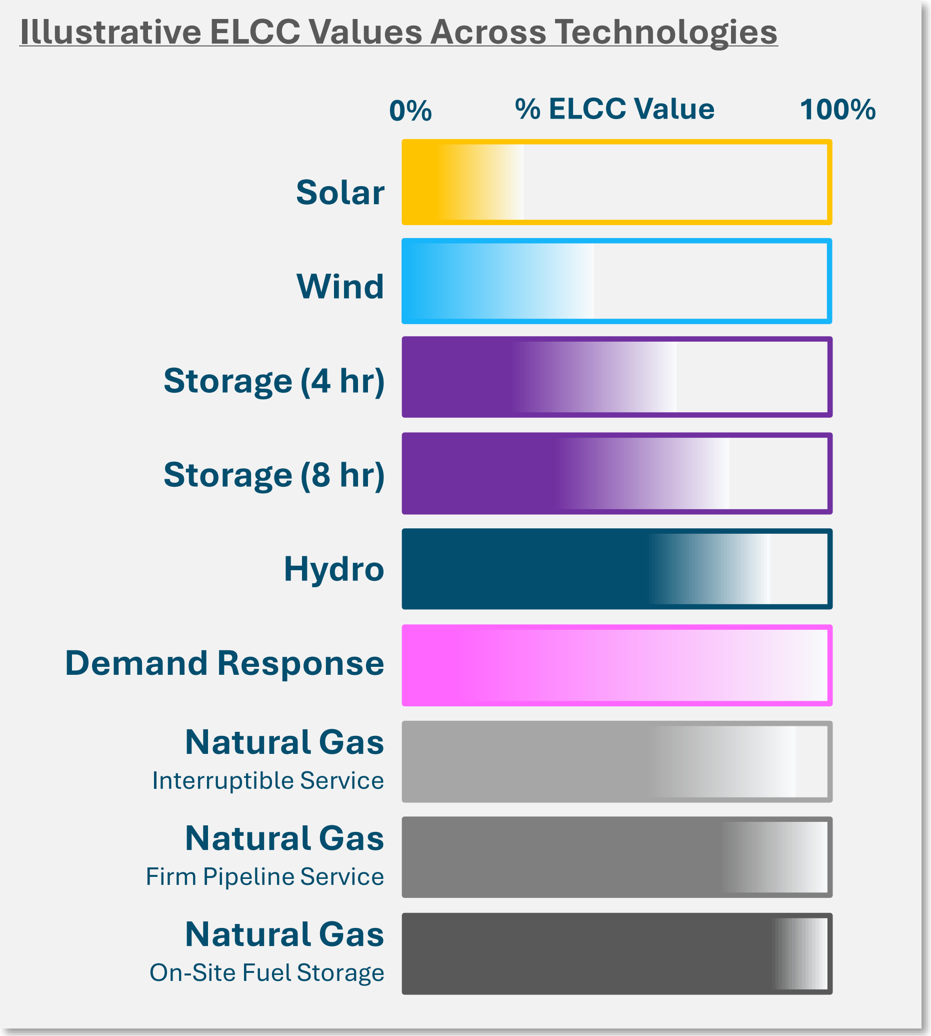
+ **Modeling the average month-hour net load reveals greatest periods of resource need after renewable dispatch***

Average Month-Hour Net Load

*Loss of load analysis based on CECP 2020 portfolios

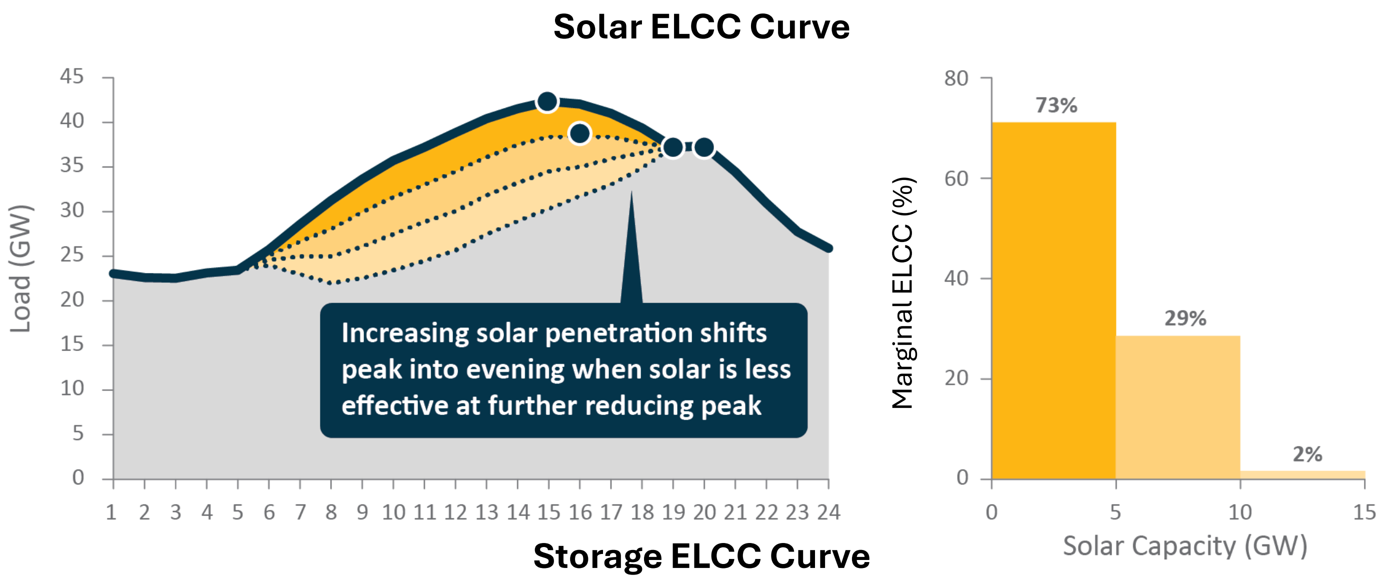
Effective capacity contributions of resources and portfolios require consideration to ensure system reliability

+ Resource adequacy is "the ability of the electric system to supply the aggregate electrical demand and energy requirements of the end-use customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements."*
+ Effective load carrying capability ("ELCC") measures a resource's contribution to the system's needs relative to perfect capacity, accounting for its limitations and constraint
+ All resources can contribute to resource adequacy and no resource provides perfect capacity

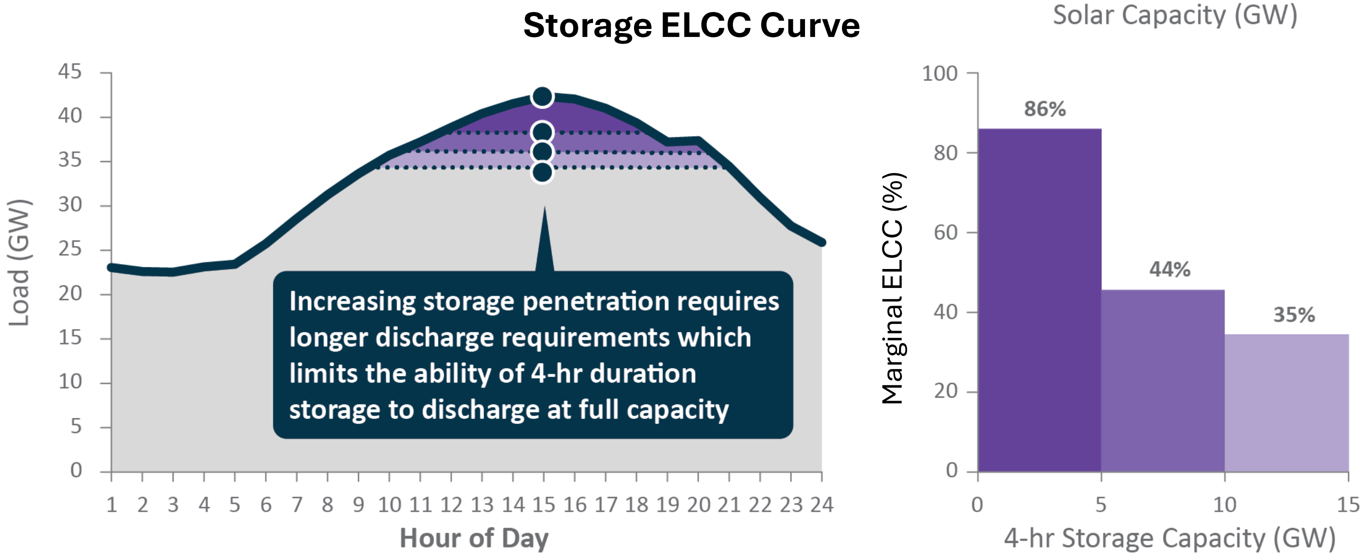


*Source: NERC Glossary of Terms

Individual resources exhibit saturation effects at higher penetrations



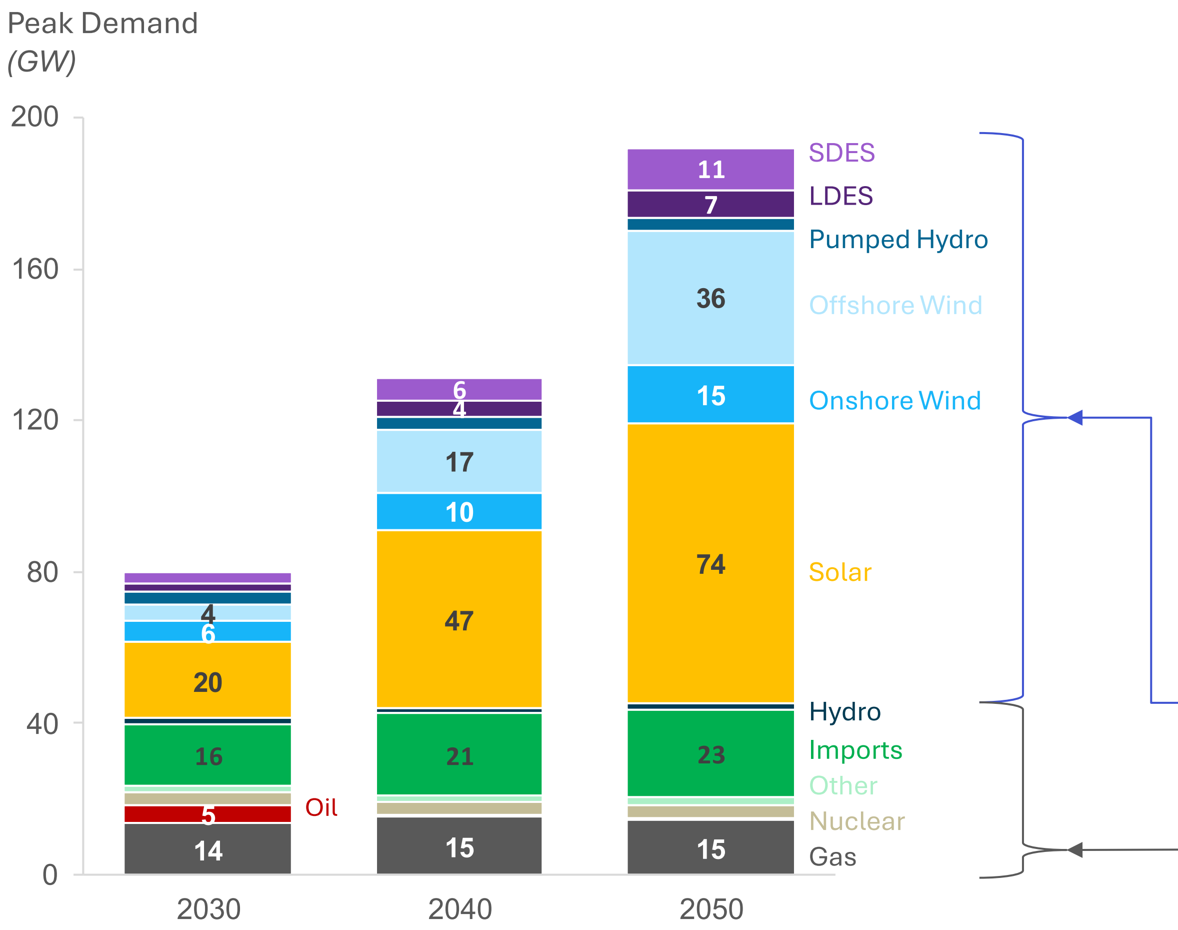
Solar and other **variable resources** (e.g. wind) exhibit declining value due to variability of production profiles



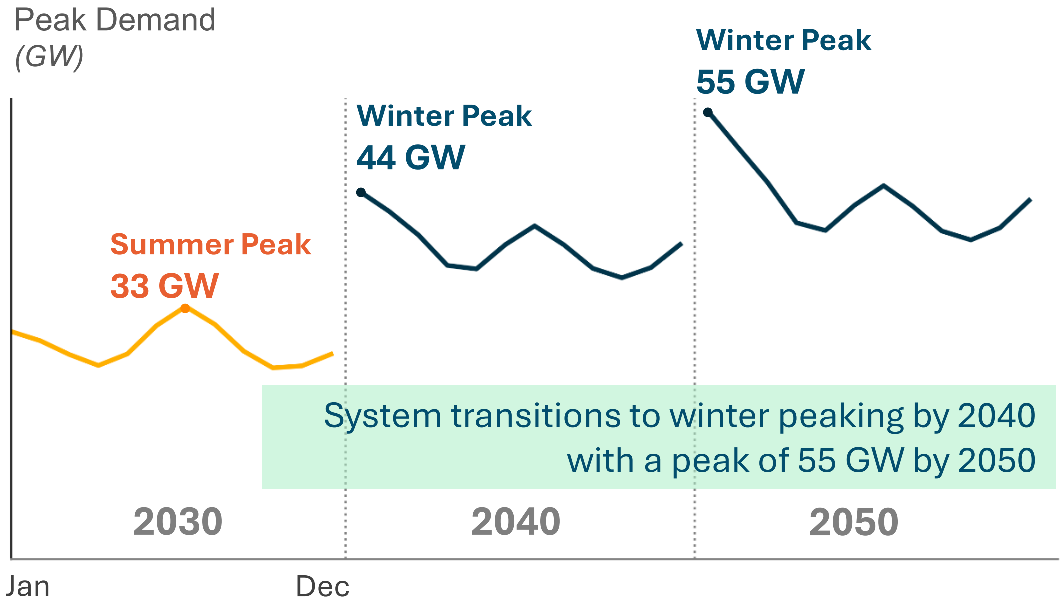
Storage and other **energy-limited resources** (e.g. DR, hydro) exhibit declining value due to limited ability to generate over sustained periods

Scenario modeling demonstrates the potential role of various resources in providing reliability

Installed Electric Capacity in New England
Massachusetts CECP 2050, Phased Scenario



New England Peak Load Profile

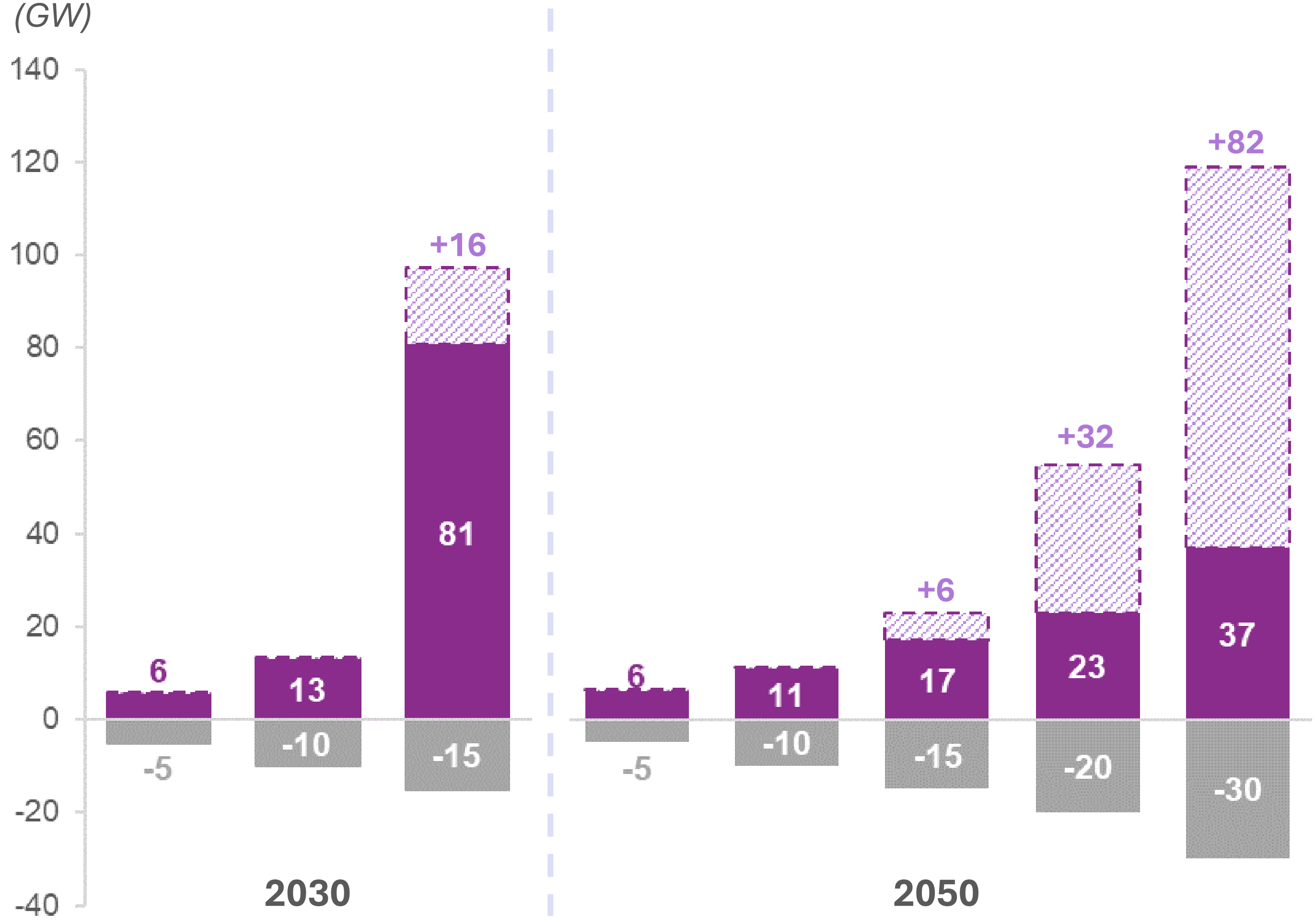


Renewable and storage resources (including 7 GW of LDES) are the major resource additions to meet load growth

Firm capacity retained for system reliability

Reliably decarbonizing New England's grid with LDES requires significant amount of renewable energy

Capacity of 100-hour LDES needed to replace Perfect Capacity in New England
Massachusetts CECP 2050, Phased Scenario

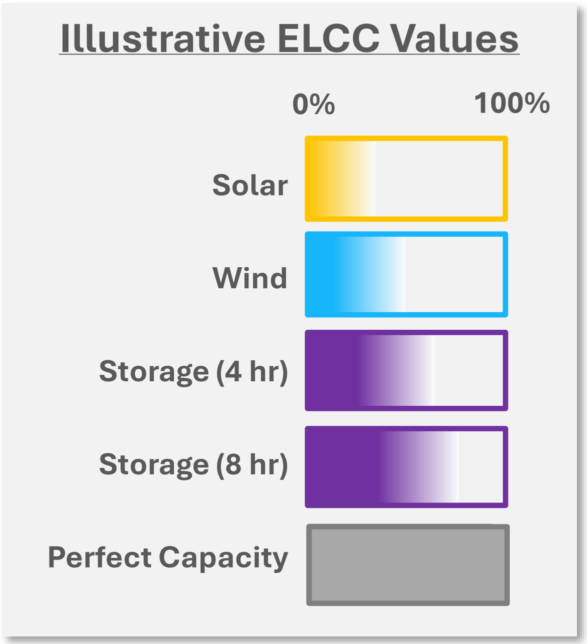


Long duration energy storage (LDES) can provide a zero-carbon alternative to significant quantities of dispatchable generation, which are otherwise needed to support system resource adequacy in futures with high levels of renewable energy

Additional LDES MW needed under a low RE future (40% lower builds)

LDES needed to maintain system reliability in very high renewable future

Amount of 100% ELCC perfect capacity removed

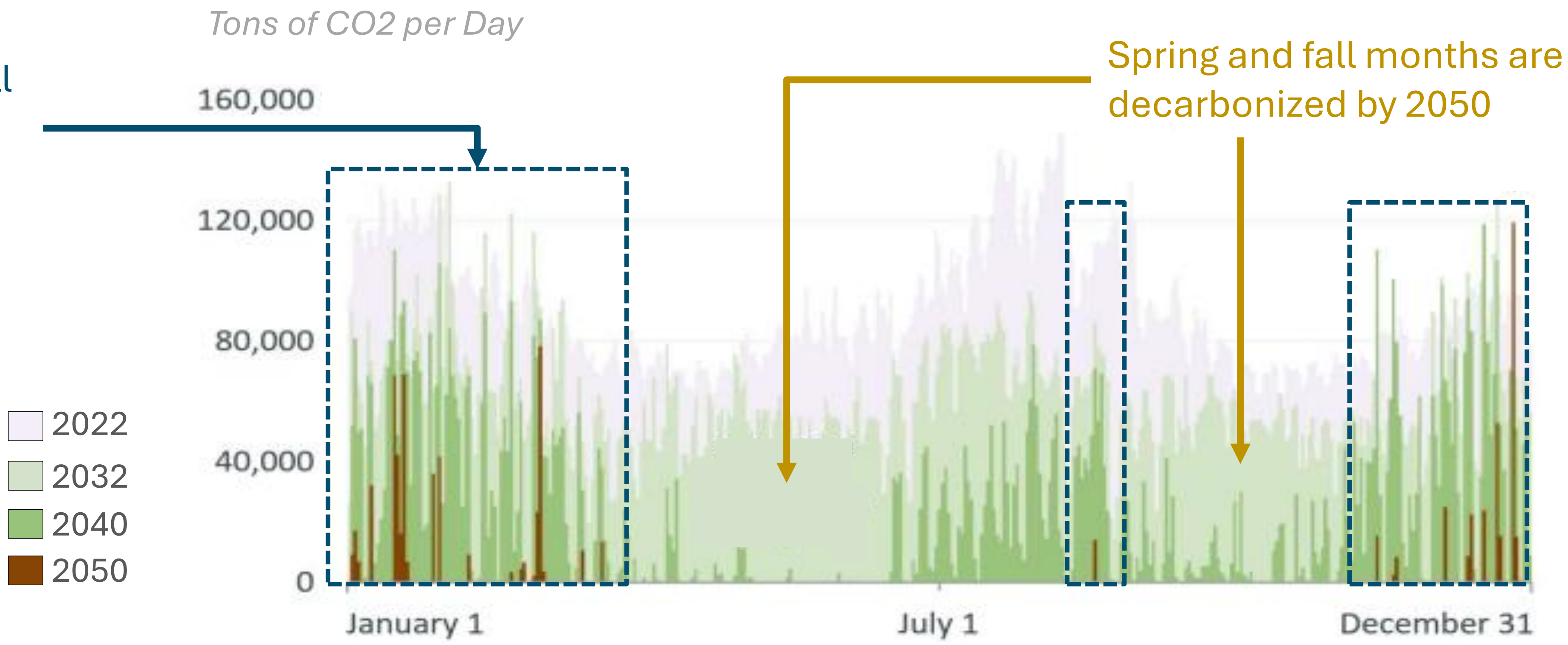


Substantial dispatchable capacity will likely remain necessary to support winter reliability in a deeply decarbonized system

Even with high volumes of renewable capacity on the system, there will be extended (i.e. multi-day) periods of low renewable output, in which storage is exhausted and dispatchable generation is required

Emitting resources are still required to support peak demand in 2050

Reducing Grid Emission Across Decades and Seasons



Source: Economic Planning for the Clean Energy Transition: Illuminating the Challenges of Tomorrow's Grid, ISO New England Inc., 2024, https://www.iso-ne.com/static-assets/documents/100016/2024-epcet-report.pdf

Managing Peak Demand: Load-Side

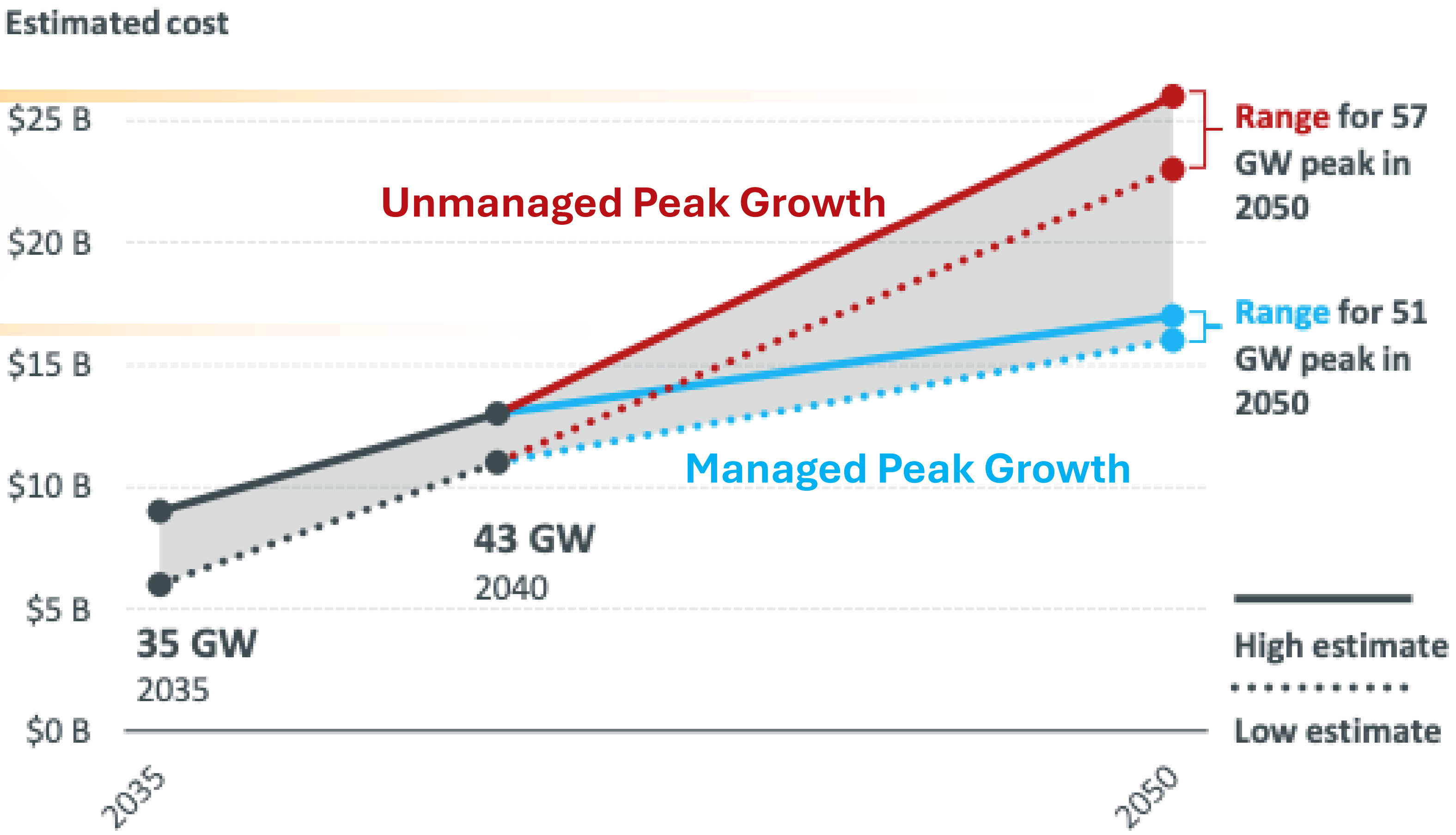
Peak load management will be crucial to limiting the required electric system buildout and associated costs of electrification

+ Savings from avoided costs of energy and carbon

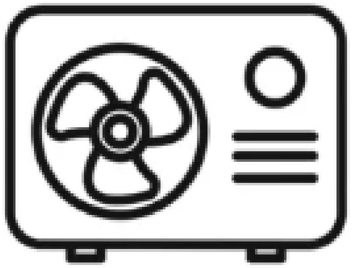
Managing peak load growth represents potential savings of up to $10B in transmission costs alone

+ Additional, potential savings from avoided/deferred investments in capacity, transmission, and distribution system infrastructure

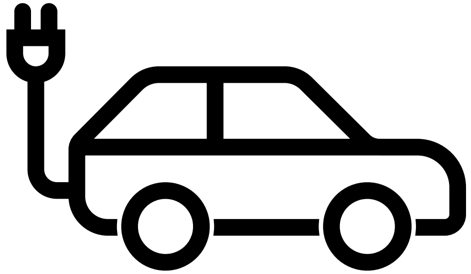
ISO-NE Transmission Cost Savings from Peak Reduction
ISO-NE 2050 Transmission Study



Ultimately, the extent to which electrification increases costs will depend on our ability to manage increasing loads

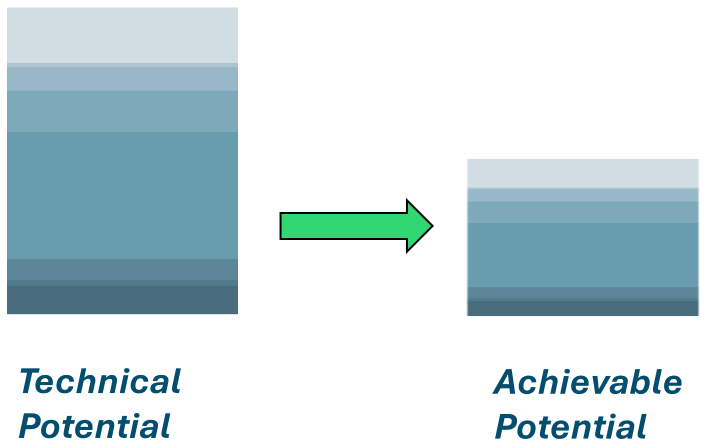


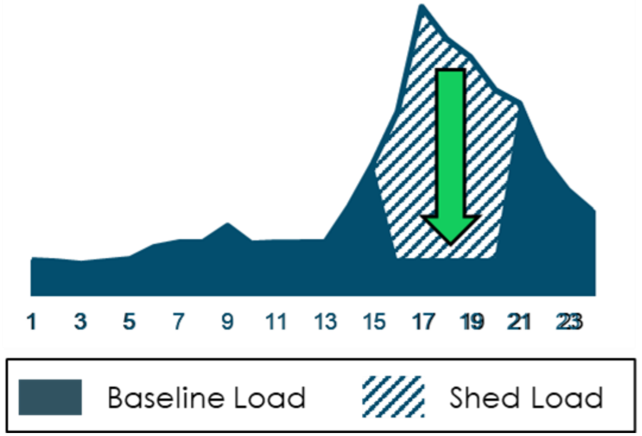
Less Flexible ⟷ More Flexible



Electrification of transportation & heating is expected to drive incremental peak load, but flexibility varies

We need to understand the technical, economic, and achievable potential of load management strategies





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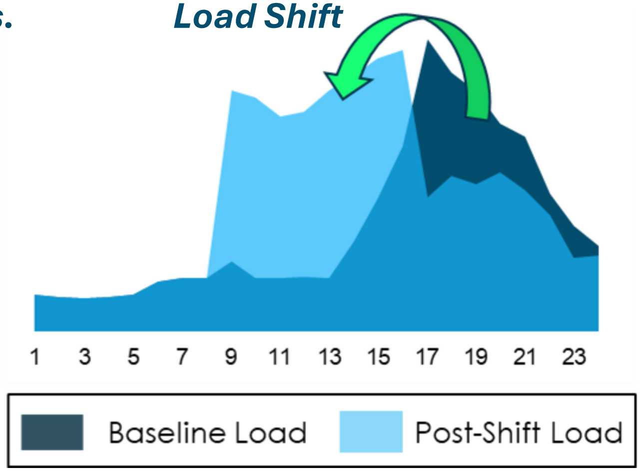
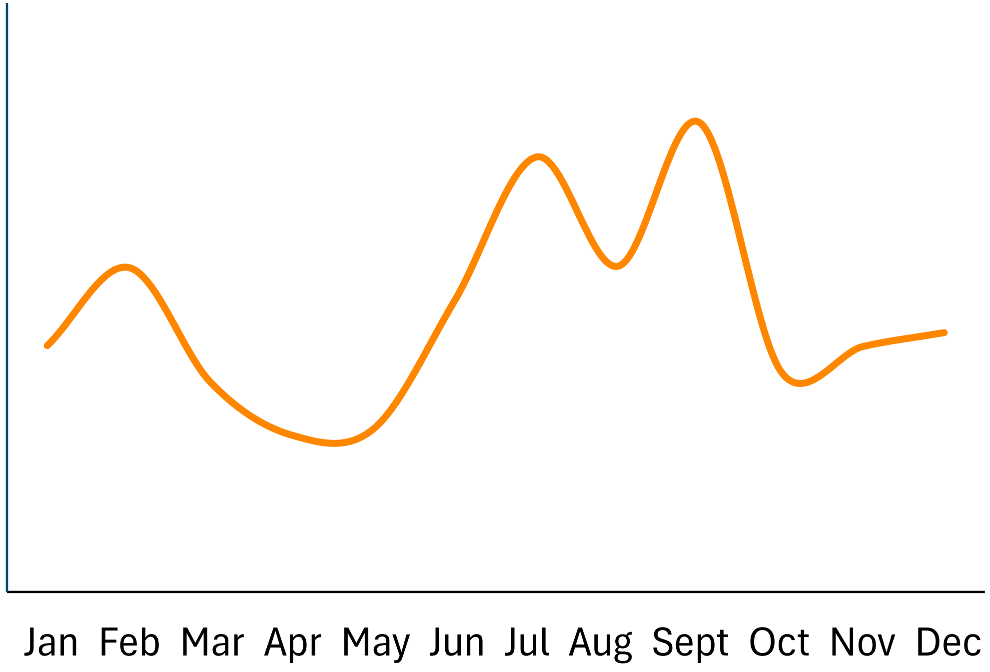
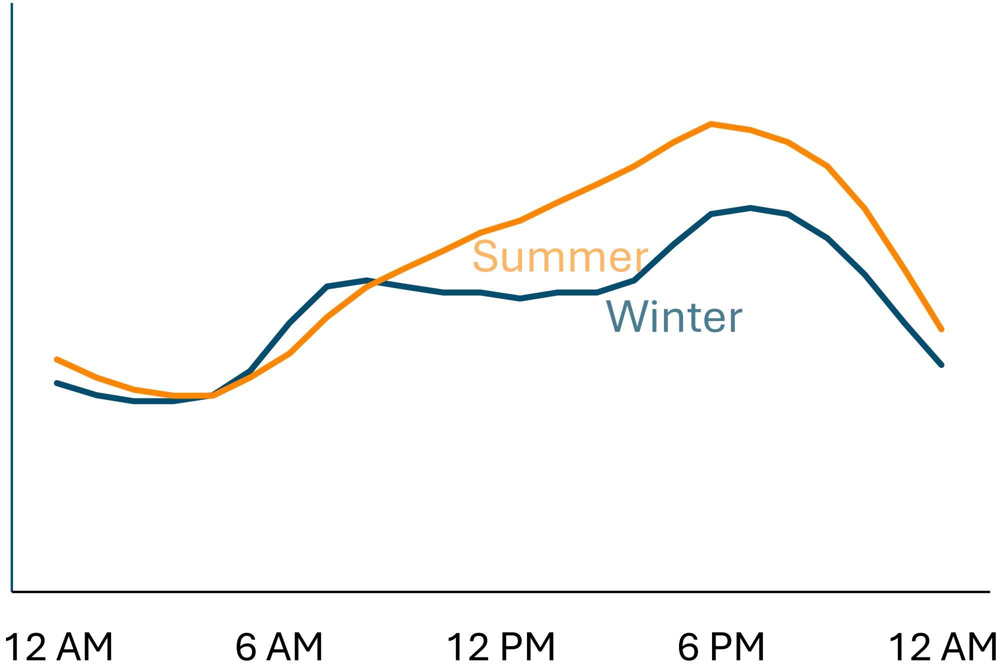


Current load shapes in New England inform predictable periods of peak demand

Annual ISO-NE Gross Load, 2023
Normalized MW

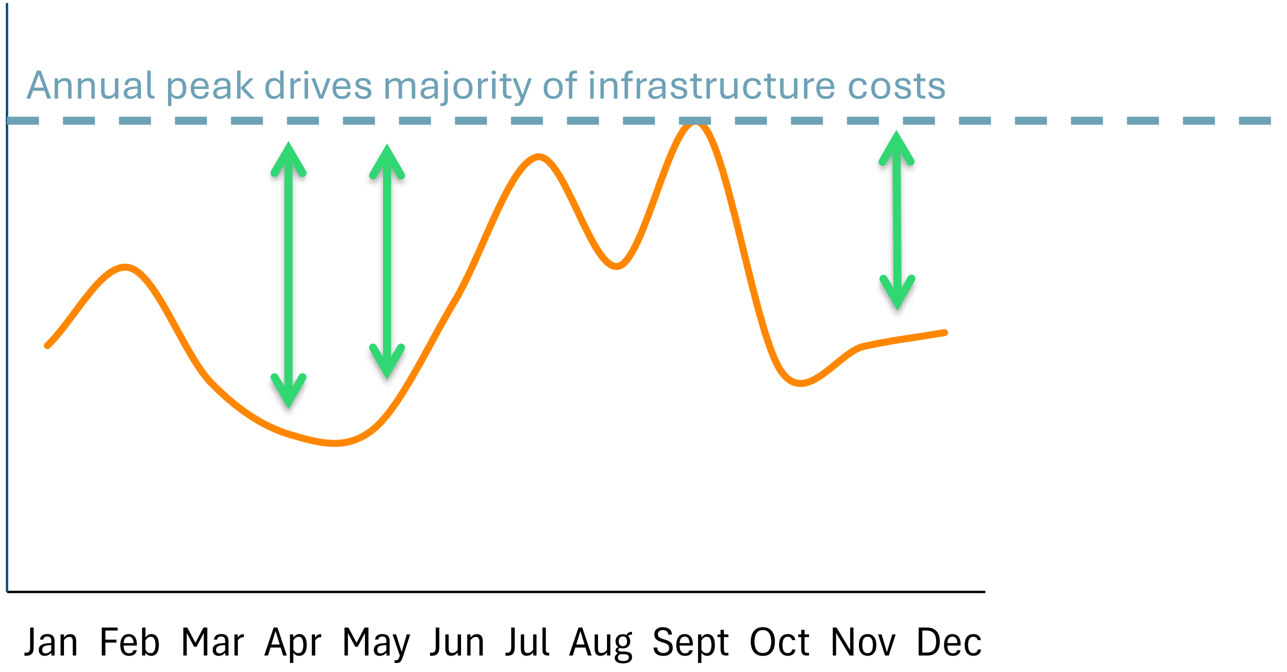


Daily ISO-NE Gross Load, 2023
Normalized MW



Annual and daily load shapes indicate times during which adding load does not add to utility costs

Annual ISO-NE Gross Load, 2023
Normalized MW



Daily ISO-NE Gross Load, 2023
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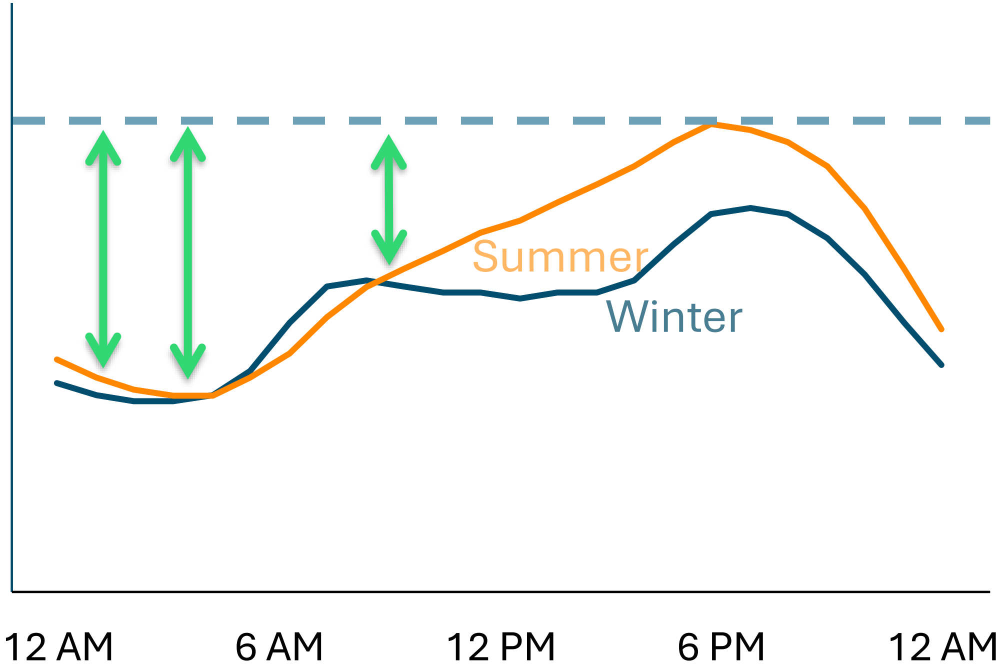
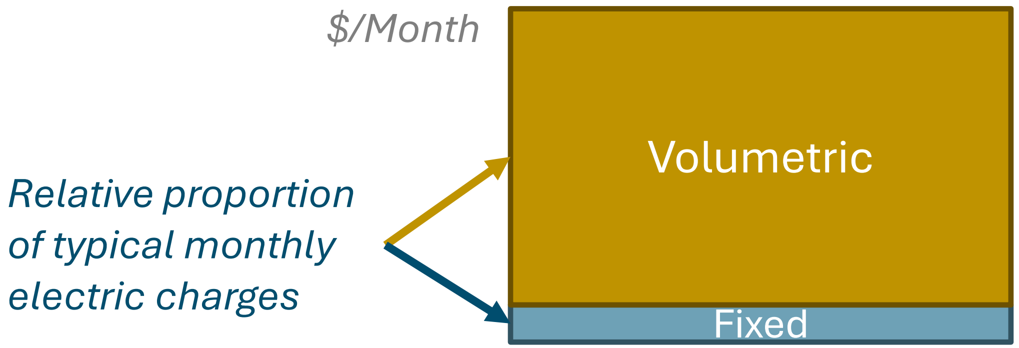


Core policy objectives have changed since the 1970s… How can rate design keep up?

1970s through 2000s
Conservation **as the overarching policy goal**

- **Key rate design priority: *increase volumetric rates to incentivize energy conservation***
- **Rate design approaches include:**
  - *Volumetric pricing*, with most costs recovered through a *volumetric* (¢/kWh) charge
  - Very low *fixed charges*

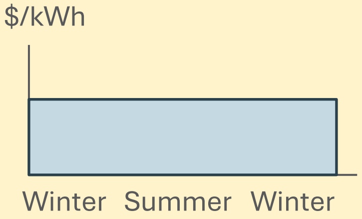
Illustrative Cost Comparison

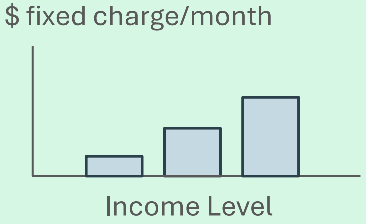


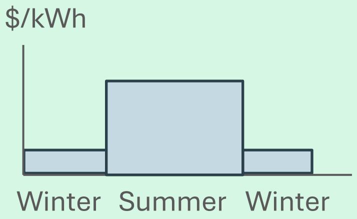
2020-2045:
Electrification **as the overarching policy goal**

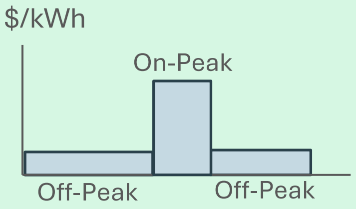
- **Key rate design priority: *increase customer control and electrification to decrease energy costs and emissions***
- **Rate design approaches include:**
  - Higher *fixed charges* that reduce the *volumetric* (¢/kWh) rate
  - *Declining block* pricing that decreases the price of electricity at the margin
  - *Seasonal rates* that reduce prices in winter
  - *Time-varying* rates that provide lower prices for flexible technologies
  - *Technology-specific* rates that reflect different charges for electrified customers

Multiple options can improve near-term electrification economics





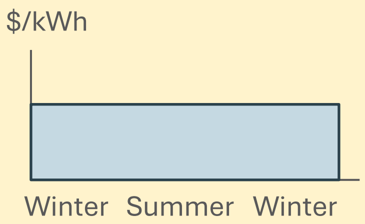


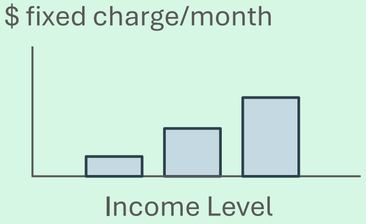


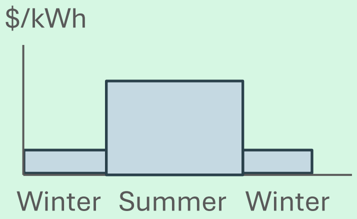
	Existing	Higher Fixed Charge	Seasonal (Tech-specific)	Time of Use
Concept	All usage subject to same volumetric rate	Moving some delivery costs to fixed charge collection, potentially based on income level to mitigate affordability concerns	A heat pump-only rate allows for recovery of all delivery costs in the summer rate without unintended impacts on non-heat pump customers	Time of day rates use price signals to reflect hours when power is typically more constrained (and expensive)
Example	Fixed charge: **$5/month** Volumetric rate: **25¢/kWh**	Fixed charge: **$25** (+$20/month) Volumetric rate: **21¢/kWh** (-4¢/kWh)	Summer rate: **30¢/kWh** (+5¢/kWh) Winter rate: **16¢/kWh** (-9¢/kWh)	On-Peak rate: **30¢/kWh** (+5¢/kWh) Off-Peak rate: **16¢/kWh** (-9¢/kWh)

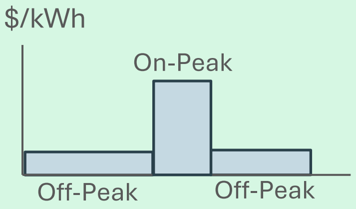
Each rate option can be combined with other rate design options and programs

Multiple options can improve near-term electrification economics







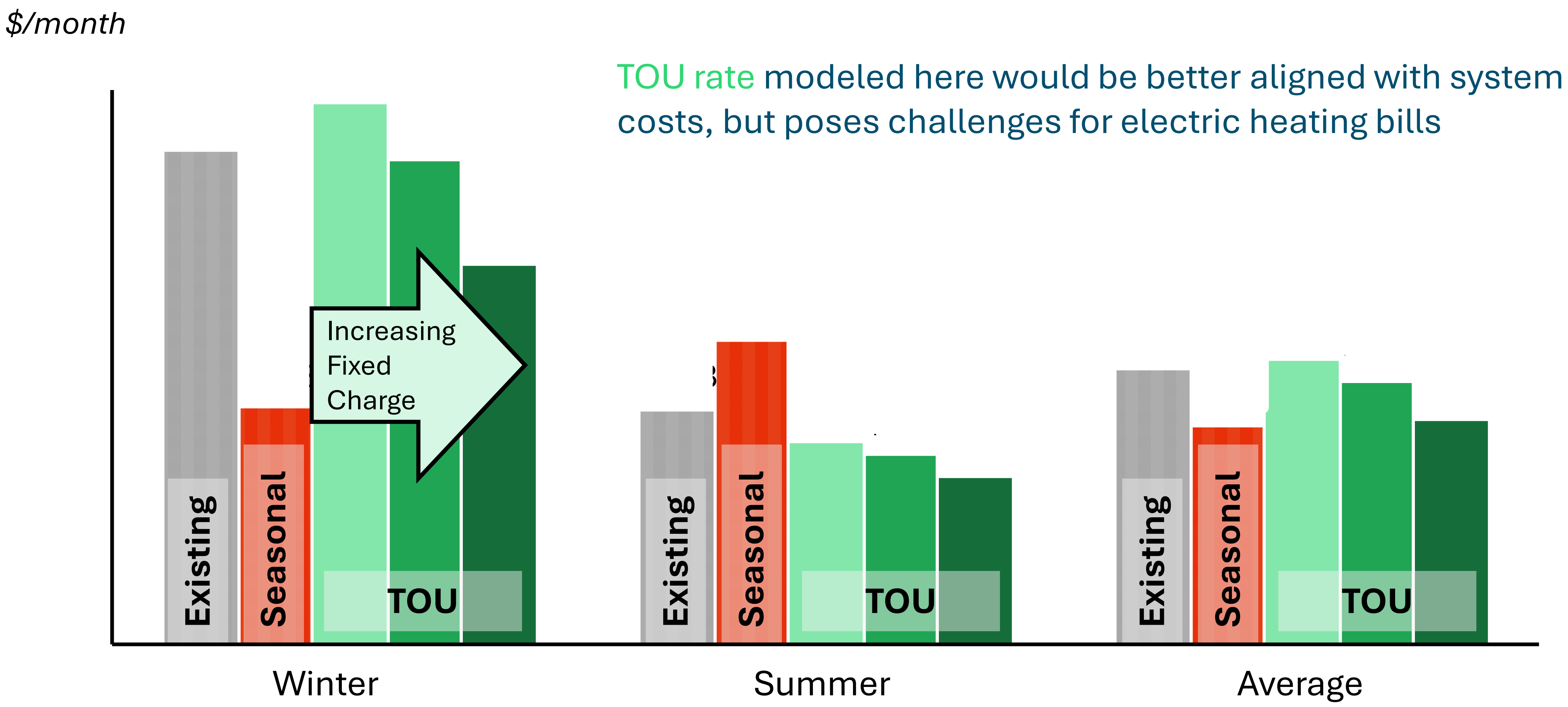


Desired Attribute	Existing	Higher Fixed Charge	Seasonal (Tech-specific)	Time of Use
Promotes EVs	✗	✓	✗	✓
Promotes Heat Pumps	✗	✓	✓	✗
Provides Price Signals	✗	✗	✓	✓

Each rate option can be combined with other rate design options and programs

Rate structures influence affordability in a winter-peaking system

Illustrative Monthly Energy Bills for Full Electrification* Customers

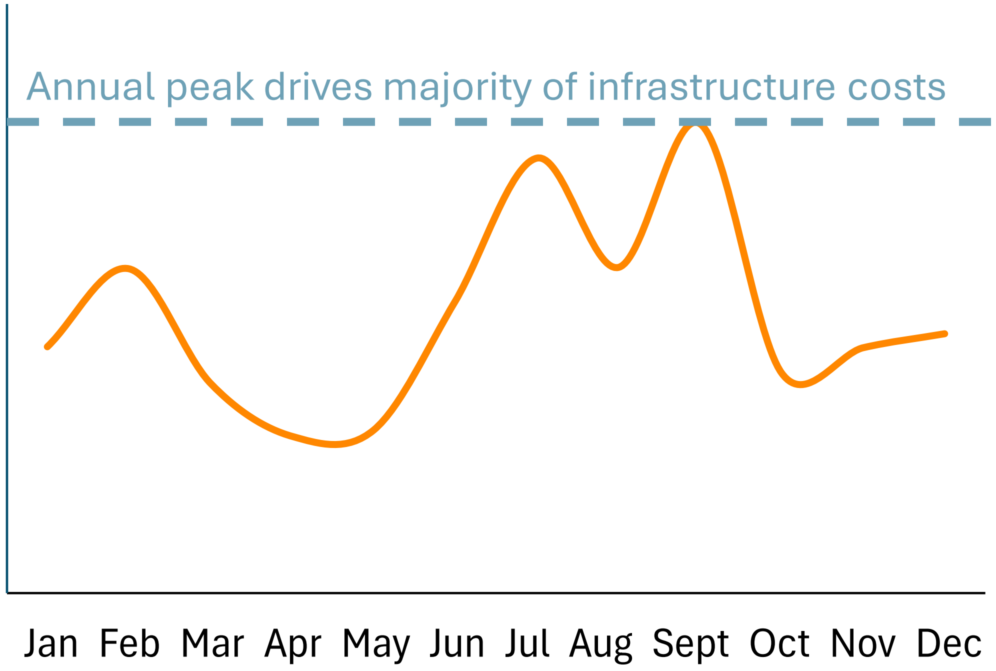


*Full electrification includes heat pumps and electric vehicles

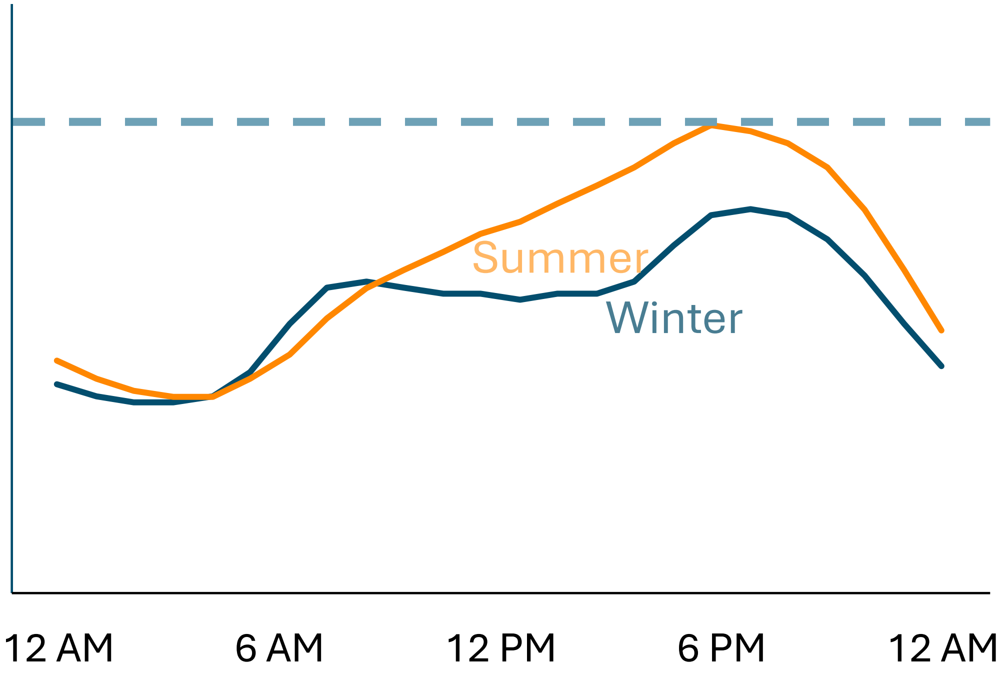
Annual and daily load shapes indicate times during which adding load does not add to utility costs

- Building electrification adds load when we want it, based on the current system load profile
- As our system transitions in the coming decade, the winter season will no longer be “off-peak”

Annual ISO-NE Gross Load, 2023
Normalized MW



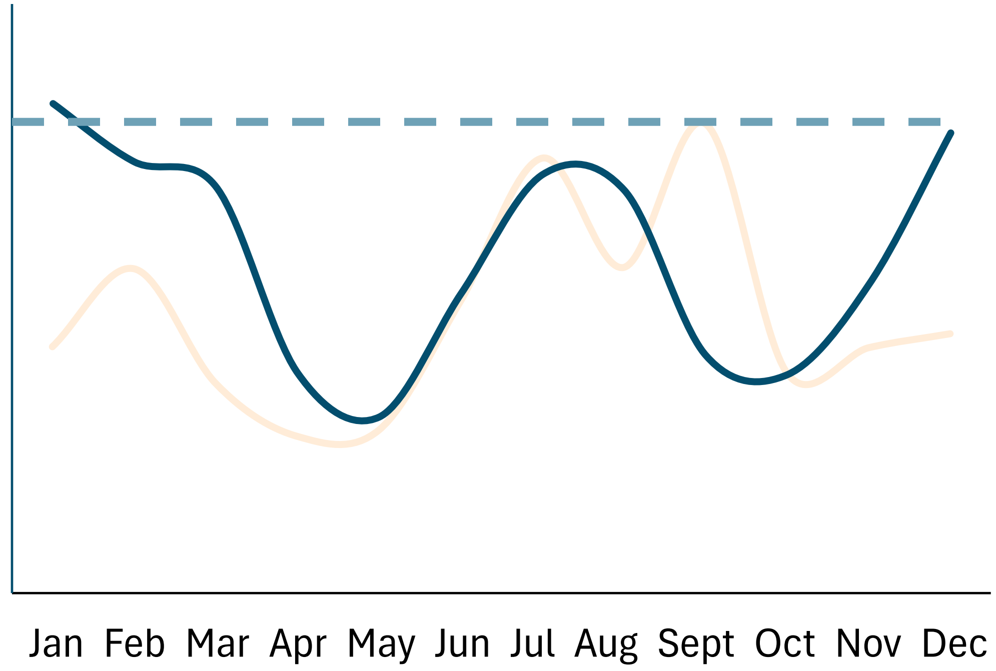
Daily ISO-NE Gross Load, 2023
Normalized MW



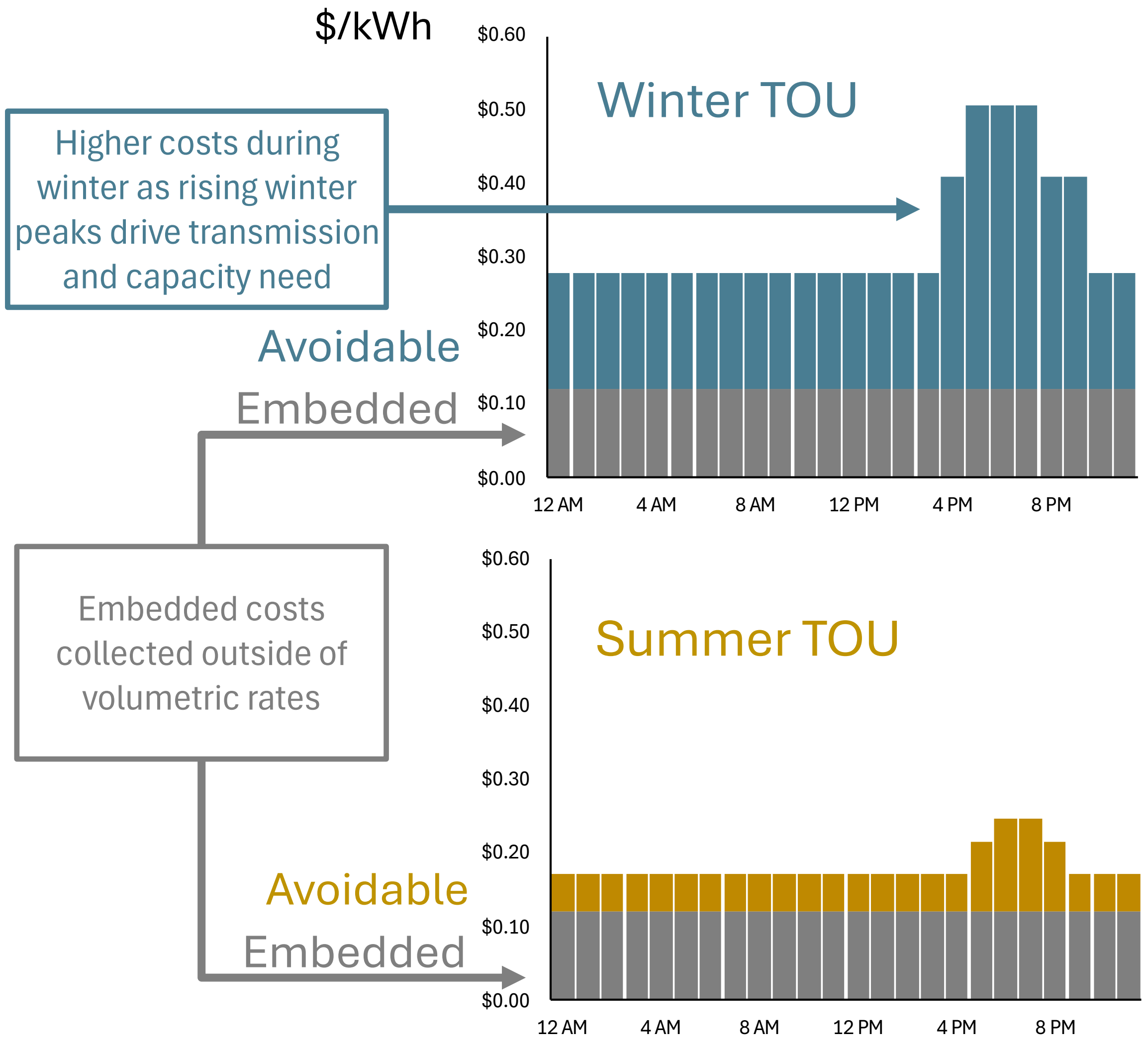
Emergence of a winter peak changes opportunity, priorities, and flexibility of peak management

- **Winter heating drives seasonal load shape, which is less flexible than other loads, like EVs**
- **Daily peaks become more important**

Annual ISO-NE Gross Load, 2035 projected
Normalized MW



Illustrative 2035 TOU Residential Rate*



*Assuming $40/month fixed charge for policy costs

Key Takeaways

- **The needs of New England's electric grid are evolving**
  - Growing and shifting peak demand
  - New England needs a substantial amount of renewable energy development to achieve net zero policy targets
  - Even in a deeply decarbonized future, firm resources will still be required for system reliability-- and that's okay
  - Portfolio analysis using a resource adequacy framework is important to understanding how various resources contribute to maintain reliability
- **Our systems are designed for peak demand; additional, off-peak load can be added at relatively low cost**
- **New England, its states, utilities, and ratepayers have diverse priorities-- no one-size-fits-all solution**
  - Reassess fixed charge (e.g., $20/month)
  - Consider seasonal heat pump rate
  - Implement AMI for TOU rates by early 2030's
  - Identify target group(s) that require tailored programming to avoid cost burden
  - Develop supporting communication strategy

Thank You

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