Energy Storage for Winter Grid Reliability

Joshua R. Castigliego

Elizabeth A. Stanton, PhD

Applied Economics Clinic

www.aeclinic.org

December 16, 2021

Webinar Presentation

Applied Economics Clinic

Economic and Policy Analysis of Energy, Environment and Equity

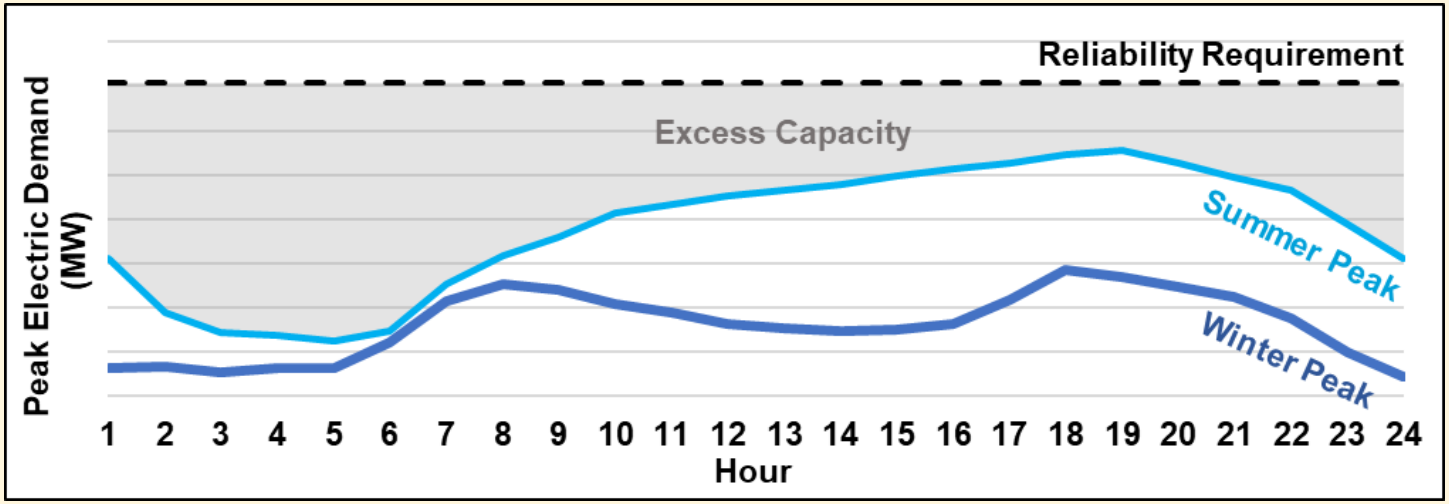
Presentation Outline

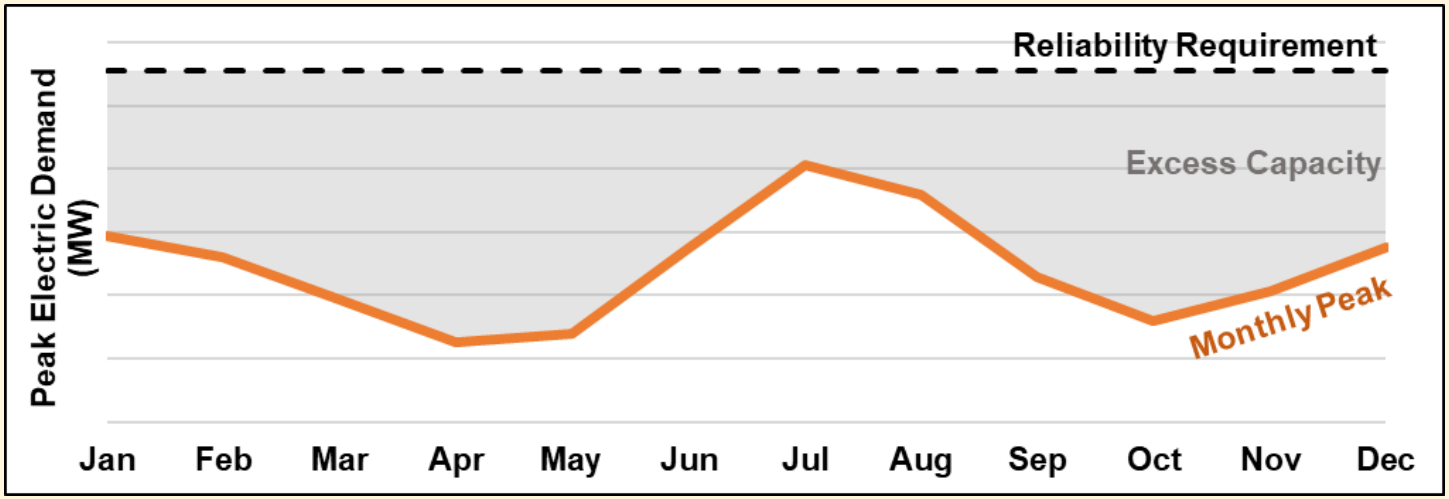
- The avoided cost of electric capacity
- What is winter reliability? Does it have a monetary value?
- Policy recommendations
- Important areas for related research going forward

The Avoided Cost of Electric Capacity

Electric costs include not only fuel and other expenses needed to produce a given megawatt-hour (MWh) but also the cost of having excess electric generating capacity at the ready to meet unexpected spikes in demand or decreases in generating capacity.

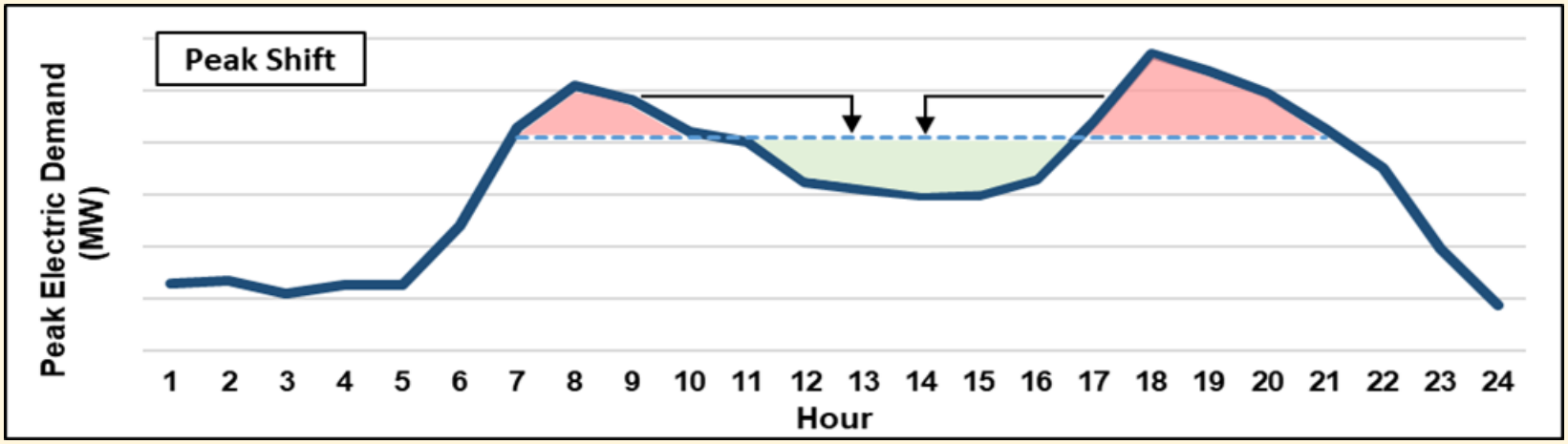
Electric usage varies greatly over the course of a day and a year, causing excess capacity to be available even when it is not needed.





Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

Technologies—like battery storage—that can shift effective electric demand away from hours of peak use have the potential to lower customer electric rates.



Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

What is Winter Reliability?

Winter electric peaking capacity (called "winter reliability" in New England) provides an important value to the electric grid by helping to avoid winter blackouts.

Winter reliability is defined as the assurance of adequate electric capacity during periods of critical need called “capacity scarcity conditions” (CSC).

Peak management options in New England

Customer Performance Payments	Peak Supply Technologies
Electric Vehicle (EV) Load Management	Gas Peaker Plant
Winter Interuptible Load Curtailment	Electric Battery Storage
Demand Response	Solar Photovoltaics (PVs) with Battery Storage
Massachusetts Clean Peak Standard	Hydroelectric Pumped Storage
ISO-New England Winter Reliability Program	
ISO-New England Pay-for-Performance	

Does Winter Reliability have a monetary value?

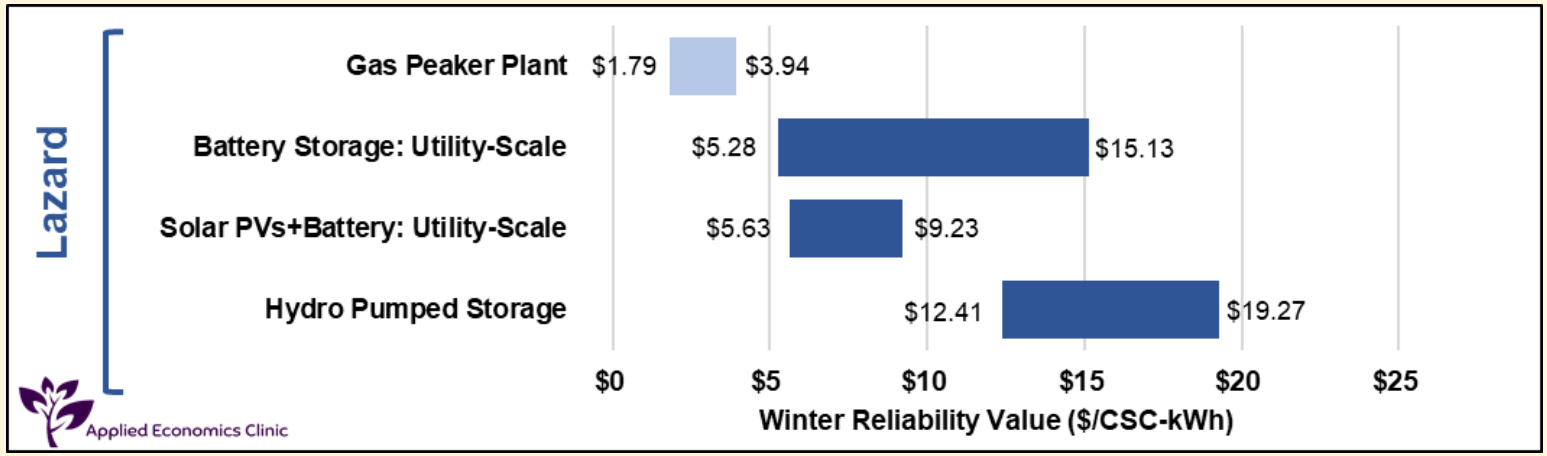
- Currently, the value of winter grid reliability is assumed to be $0 in battery program cost-benefit analyses by program administrators in Massachusetts.
- The Commonwealth's approved 2019-2021 energy efficiency plan explained that a winter reliability benefit was under development:

> *The Program Administrators have agreed with DOER and the Attorney General to conduct a study to be commenced in Q1 of 2019 to quantify any benefits associated with winter peak capacity reduction. The PAs will issue an RFP and conduct this study in collaboration with the DOER, the Attorney General and the Council consultants. Study results will be aligned with and compatible with the 2018 AESC. If new benefits are identified as a result of this study, the Program Administrators will apply those benefits to reported values.*

Source: Massachusetts Department of Public Utilities. Docket Nos. 18-116, 18-117, 18-118, 18-119. *Three Year Energy Efficiency Plan for 2019 through 2021*. October 31, 2018. BCR Spreadsheet submitted with "Massachusetts Joint Statewide Electric and Gas Three Year Energy Efficiency Plan: 2019-2021."

Electric distributors are designing their customer performance payments to meet, but not exceed, the cheapest large-scale supply alternative.

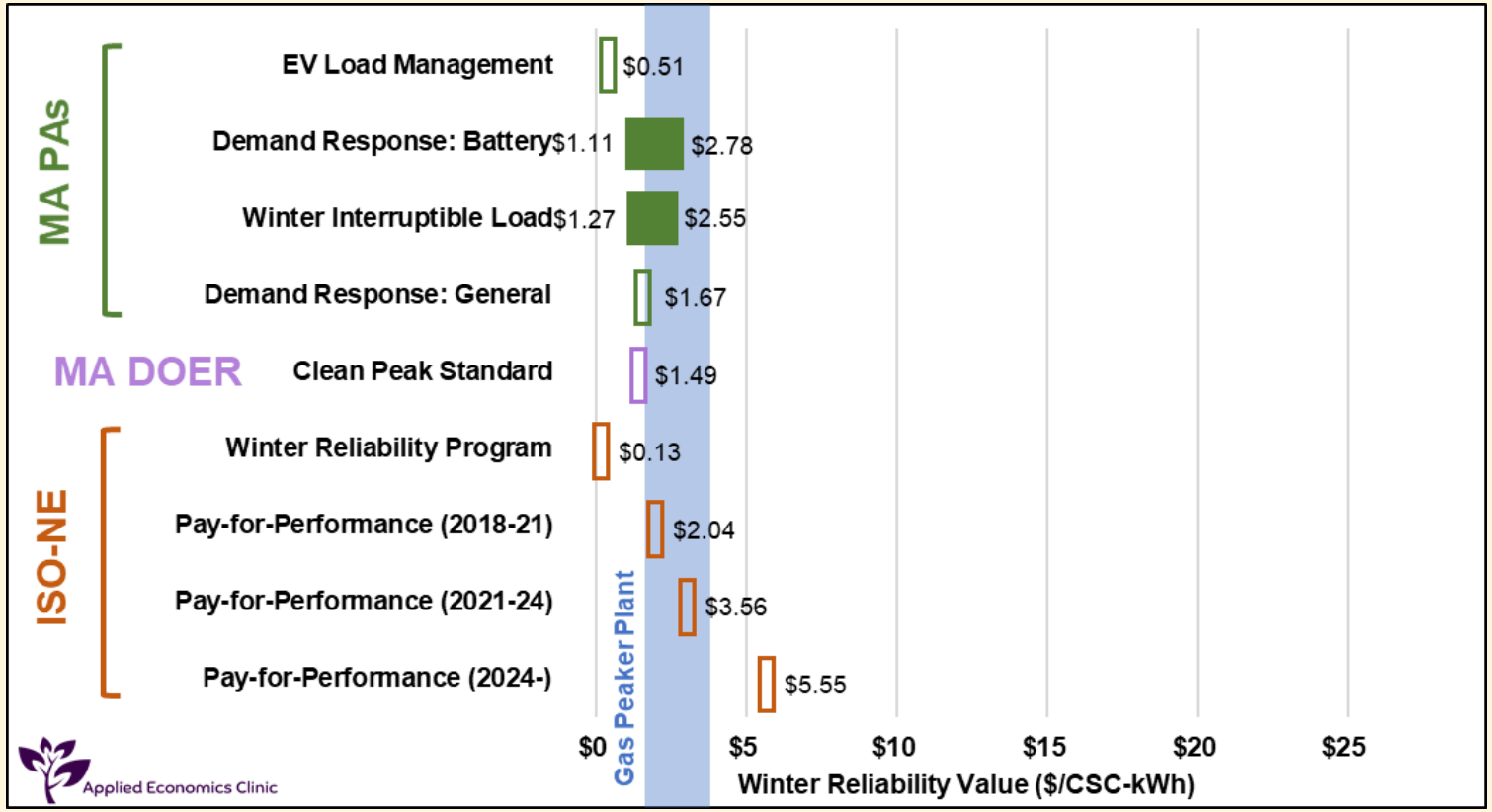
Peak supply technologies



Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

All current performance payments in Massachusetts are equal to or less than the cost for new gas peakers.

Customer Performance Payments

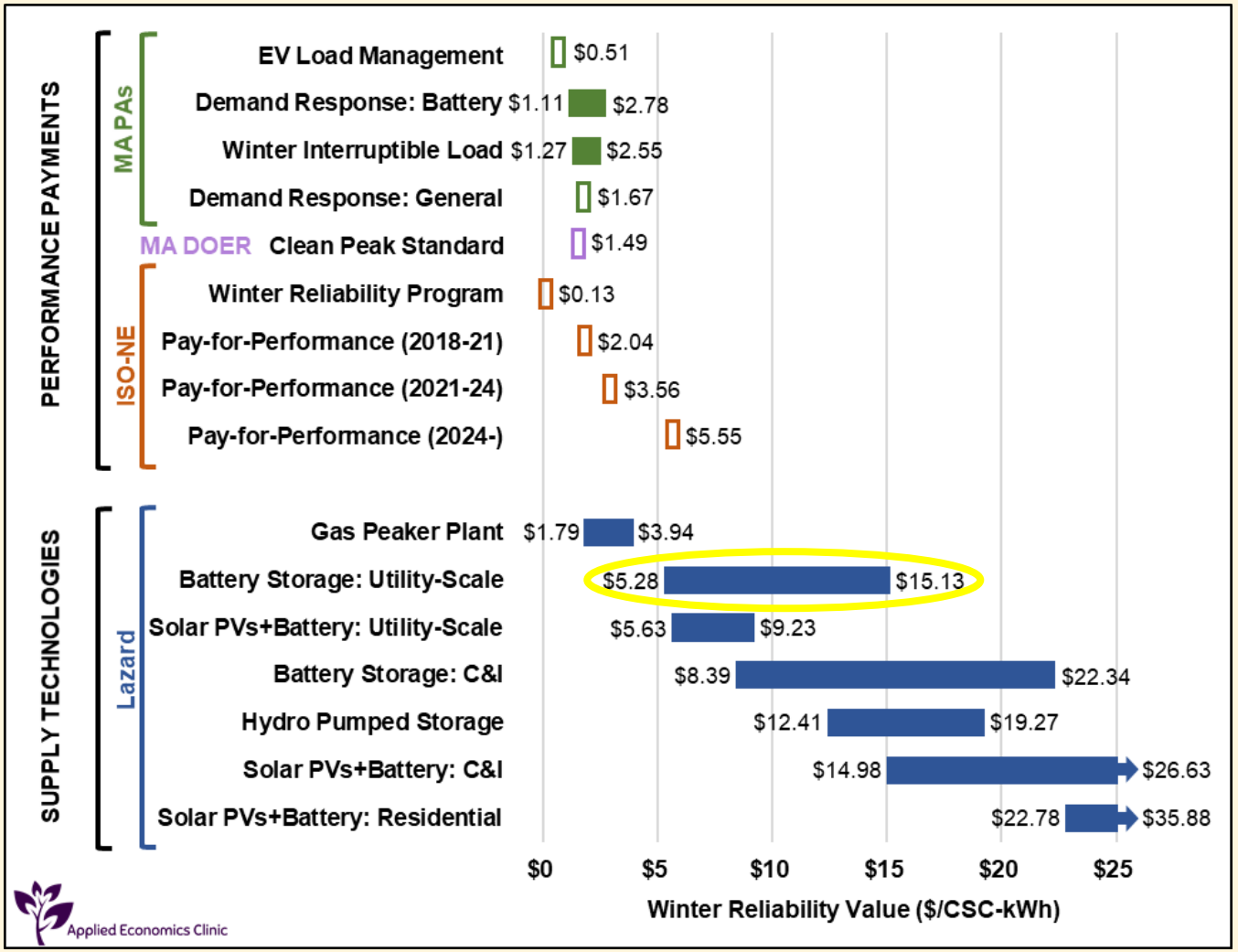


Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

Gas peakers are exiting the Massachusetts generation portfolio

- Massachusetts aims to reduce greenhouse gas emissions from in-state power plants through its environmental regulations (310 CMR 7.74 and 310 CMR 7.75)
- The CO_2 emissions limit for new power plants has already been exceeded; no additional emitting power plants can be built in Massachusetts, including gas peakers, without exceeding the limit established by the statute.
- Although winter peaking capacity has historically been provided by gas and oil peaker plants, peak demand can also be supplied by demand measures and cleaner, "behind-the-meter" customer resources such as battery storage.

Winter reliability services provided by energy storage are currently undervalued.



Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

Policy Recommendations

1. **Customer battery performance payments should be increased by at least 33 percent.** Customer battery program budgets should be increased to support higher performance payments and needed program expansion.
2. **The value of winter reliability services is greater than zero**; the true value of these services should be calculated and used in cost-benefit analyses conducted by program administrators, and these values should be reflected in customer performance payments.
3. **The time to make positive changes to battery program performance payments and budgets is now.**

Going forward, important areas for related research include:

- A specific valuation of winter reliability services, as distinct from summer capacity value
- Appropriate customer incentive levels as a consequence of this value
- The most cost-effective scale of incentive program budgets given their value and their costs, and taking into consideration upcoming retirements of emitting resources
- Consideration of what other programs and regulations may require adjustment as a result of updated winter reliability values and customer performance payments

Questions?

Joshua Castigliego, joshua.castigliego@aeclinic.org
Liz Stanton, liz.stanton@aeclinic.org

Thanks!

Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

Appendix

Methodology: Performance Payments

Battery Demand Response: $1.11-$2.78/CSC-kWh

- The seasonal value for battery-specific demand response is the Massachusetts program administrators' performance payment ($/kW-winter).
- The winter reliability value for this peak management measure is the calculated capacity value *divided* by the 45-hour CSC period specified for small-scale batteries and the 18-hour CSC period specified for commercial- and industrial-scale batteries (maximum number of events multiplied by maximum event duration).

Methodology: Peak Supply Technologies

Gas Peaker Plant: $1.78-$3.94/CSC-kWh

- The annual value ($/kW-yr) for a gas peaker plant is Lazard's levelized cost of energy (LCOE) *multiplied* by its annual capacity factor (10 percent) less energy and capacity payments.
- The winter reliability value ($/CSC-kWh) for this peak management measure is the calculated capacity value *divided* by the assumed CSC period of 20 hours.