

Grid Action Report:
July 4th Heat Wave

How clean energy provides cost savings and boosts grid reliability during extreme heat

Acadia Center

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Solar and other clean energy resources helped make New England's power grid more affordable and more reliable during the early July 101°F peak event

This analysis is the third *Grid Action Report* developed by Acadia Center in response to recent extreme weather events affecting energy systems and consumers in the Northeast. The region's experience with last week's heatwave again points to the power of a portfolio approach to deliver savings and resource adequacy: a combination of clean energy resources helped the region ride through a period of significant grid stress – periods which will only increase in frequency, duration, and cost under a changing climate. This portfolio of resources – including solar, energy efficiency, demand response, battery storage, interregional transmission, and on/offshore wind – will serve as the foundation for a less volatile, more affordable, and more secure energy system.

Summary and Key Takeaways:

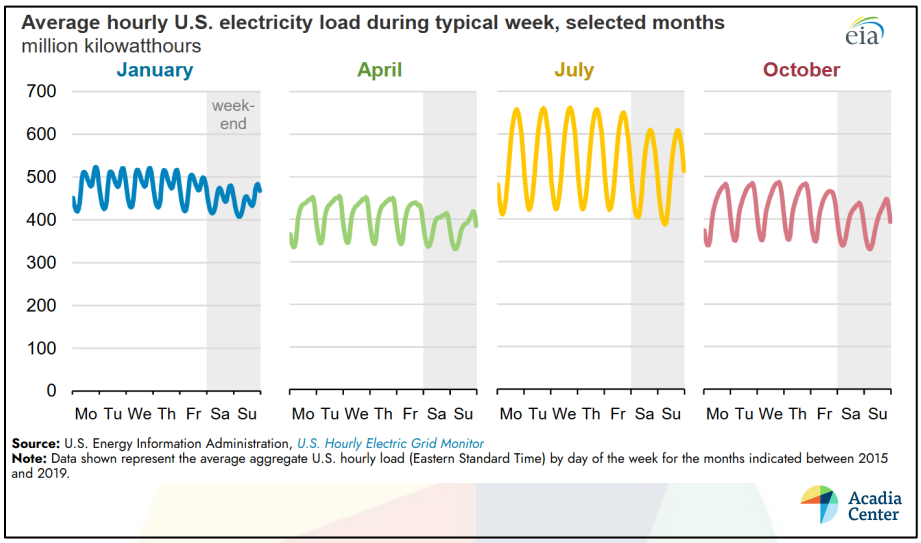
- **Distributed solar drives major savings during heat wave:** Acadia Center analysis estimates 6+ gigawatts (GW) of distributed solar[ii] saved New England ratepayers **$130-149 million** in wholesale electricity (energy) costs during the week of June 28 through July 4, 2026. Distributed solar output exceeded 25% of all demand on the grid at times and contributed more to the grid mix than the region's nuclear fleet between 2PM and 7PM on the peak heatwave day of July 2.
- **Higher single-day peak cost relief:** The energy market savings driven by distributed solar on July 2 alone totaled **$39-54 million**, much higher than the $8-20 million estimated in last year's single-day peak analysis – driven by an increase of solar production year-over-year, higher Day-Ahead market prices, and a more thorough accounting of the direct and indirect market savings provided by solar.
- **Billion-dollar annualized benefits**: In 2025, distributed solar demonstrated that these savings are not confined to specific peak episodes – instead accumulating **$1.26 to $1.37 billion** in savings in the wholesale energy market over the entire year. These estimates are derived from two new statistical models developed by Acadia Center and trained on multiple years of market data to analyze an alternative scenario with greater natural gas reliance instead of the solar fleet the region has built. These energy market savings alone are enough to offset a substantial share of the region's total estimated annual *costs* of solar through net metering and other policy mechanisms – before taking into account other categories of energy system savings such as avoided capacity, transmission, and distribution cost, never mind avoided emissions compliance and social cost of carbon and pollutants.
- **The unheralded role of energy efficiency**: energy efficiency and other passive demand-reducing measures also played an outsized role, despite not being visible in real-time fuel mix figures. Acadia Center's model estimates that roughly 2,000 MW of energy efficiency and other passive demand resources (as cleared in the most recent capacity auction) delivered energy market savings of **$94-97 million** during the weeklong heatwave, with **$28-29 million** in savings occurring on July 2 alone.

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Summertime Prices Surge

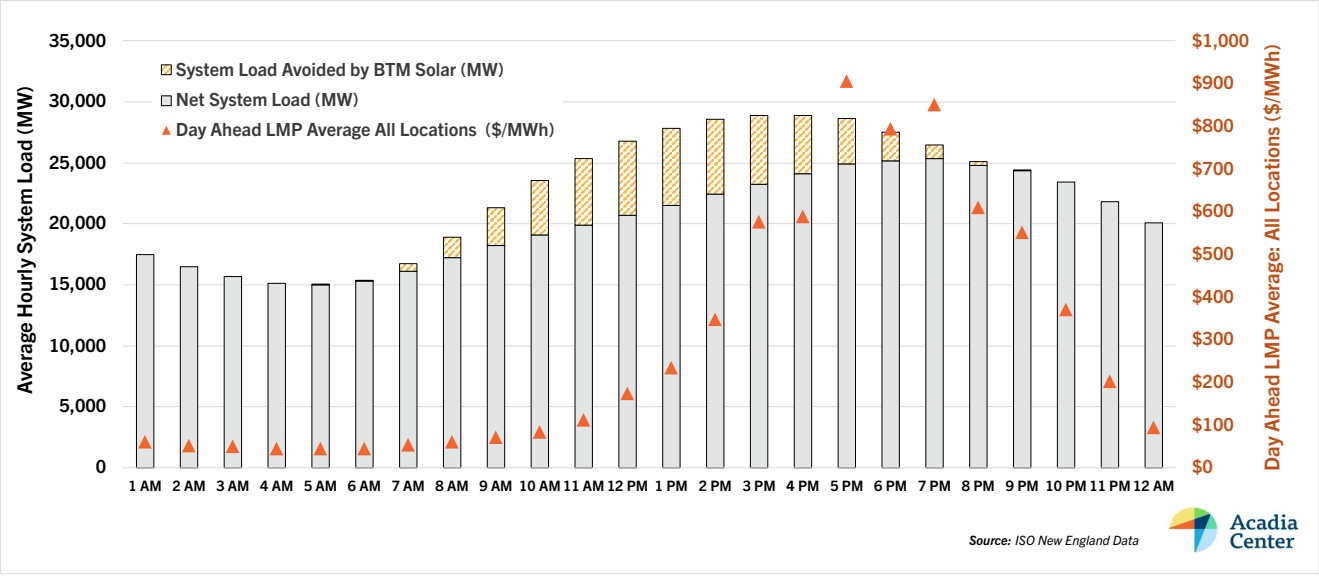
As temperatures rise each summer, use of air conditioning in homes and businesses drives increased electricity demand. This phenomenon is true across the country and in the Northeast, where the region's grid is "summer-peaking" (**see**, Fig. 1) – meaning that annual peak demand occurs each year during the summer (though that is expected to change in future decades as heating electrification increases wintertime demand).

Figure 1: An example of electricity usage in a summer-peaking system



High demand for electricity means prices will rise. Last week, a historic heat wave presented the latest example of this dynamic in stark terms. The heatwave peaked on July 2, and Day-Ahead locational marginal prices (LMPs) – or prices for energy that clears the auction in the wholesale electricity market run by the regional grid operator, ISO New England – soared to $934.98 per megawatt-hour (**see**, Fig 2.), as compared to the 2025 average Day-Ahead LMP price of $67.53/MWh.

Figure 2: ISO New England Total System Load, Estimated Load Avoided by Distributed Solar, and Average Day-Ahead Electricity Locational Marginal Prices for July 2, 2026

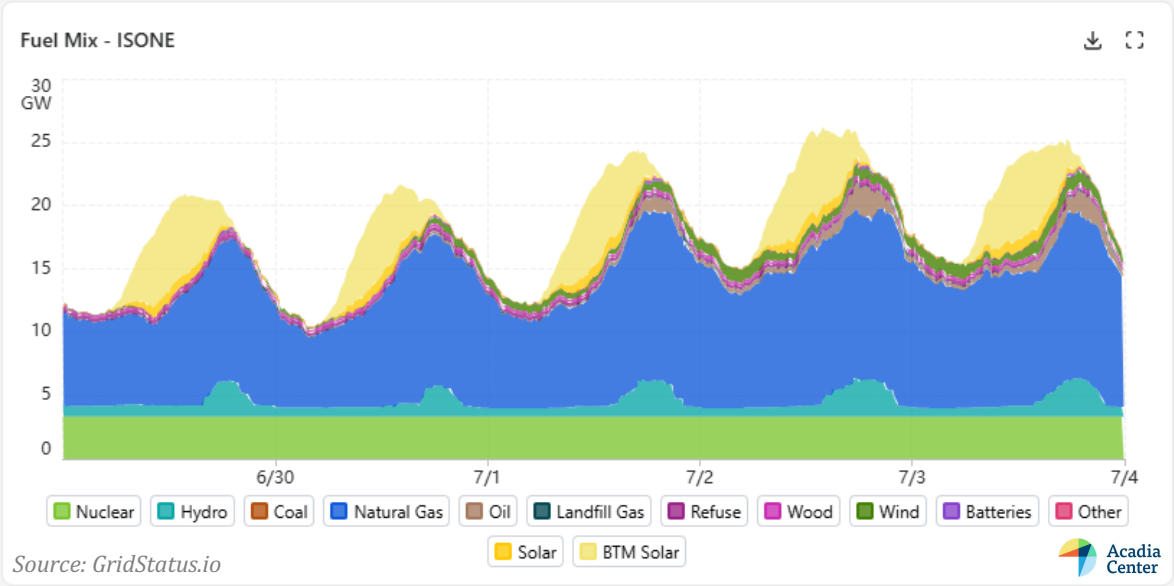


How Distributed Solar and Energy Efficiency Helped New England Save Big

Clean and affordable technologies like distributed solar and energy efficiency help reduce costs, both year round and especially on energy intensive days. Distributed solar – including a range of projects from residential and commercial rooftop to community solar arrays up to ~5 MW in size – reduces the need for electricity purchased on the wholesale markets by supplying local energy, which offsets local energy usage (e.g., a house that needs less energy from the grid because it has solar panels on the roof). The savings from energy that does not need to be purchased (due to distributed solar or energy efficiency) are referred to as **avoided energy costs**.

With so much distributed solar spread across New England (6+ GW), there is enough reduction in demand for energy in the wholesale market to suppress the price of electricity across all MWh served, saving ratepayers even more money. This suppression happens because, as more energy is needed, it gets directionally more expensive to serve that energy on the wholesale market. So, by reducing the total amount of energy the grid needs from the market, the price for all of the energy that does get served is pushed down. The savings from this form of price suppression are called **DRIPE, or Demand Reduction Induced Price Effects.**

Figure 3: Five-Day Fuel Mix for ISO-NE Region (June 29, 2026 – July 3, 2026)



Similarly, energy efficiency provides savings from avoided energy costs and DRIPE. However, instead of producing extra local energy to reduce the need for energy from the wholesale market, efficiency measures reduce the total amount of energy used, which still results in overall less need for energy – meaning less energy is purchased and prices are further suppressed.

Even without considering energy efficiency, distributed solar output exceeded 25% of all demand on the grid at times and contributed more to the electric fuel mix than the region's nuclear fleet between 2PM and 7PM on the peak heatwave day of July 2 (**see,** Fig. 3). Without distributed solar, the peak hour of demand on the grid would have been between 4PM and 5PM (featuring hotter temperatures), but distributed solar was still providing 3.73 GW of energy in that hour (14.5% of all energy), helping to shift the peak 2 hrs later and reduce it by 2.30 GW.[iii]

Energy efficiency **also** helped meet significant energy demand in the region. In fact, approximately 2 GW of energy efficiency and other passive resources are committed to meeting energy demand in the region for July 2026, and during the peak hour of last year's biggest heat wave (7PM on June 24, 2025), 2,557 MW of energy efficiency were passively reducing demand.[iv] Energy efficiency made a similar contribution in passively reducing demand during this latest heat wave.

However, these savings tend to be invisible to the public. When ISO-NE reports its fuel mix, it is generally reporting the electricity supplied to the ISO-administered bulk power system by generators and imports. Although some energy efficiency resources participate in ISO-NE markets, energy efficiency is a passive demand-reduction resource, so its effect is reflected in lower forecasted and actual load rather than as a source of energy in the fuel mix. Similarly, most behind-the-meter solar is not included in the fuel mix because it serves on-site load and reduces demand on the bulk power system rather than supplying energy into the ISO-administered system, as well as for reasons of data visibility/availability. Because the cost impacts of both distributed solar and energy efficiency both occur outside the actual operation of the wholesale market, the benefits provided by these resources are not always apparent in wholesale market data reporting, although contributions from distributed solar are visible in the ISO To Go app and ISO-NE Express platform.

A Clear and Present Need: More Battery Storage

Figure 2 (above) compares electricity demand (gray), the demand offset by distributed solar generation (yellow), and regional wholesale power prices. The high-value opportunity for energy storage technologies is clearly visible in this figure: if some of the solar energy had been stored and used later in the day, prices during the day's peak demand periods could have been reduced even further. In simple terms, shifting some of the yellow area to later hours would better match solar energy with the times when electricity demand and prices are highest. While this is a simplified illustration, the underlying principle is clear: combining solar with battery storage allows more solar energy to be used when it delivers the greatest value. States such as California and Texas have already demonstrated that increased battery storage can improve grid reliability and help moderate price spikes during periods of high demand.[v,vi] New England states are pursuing greater energy storage deployments, but the region as a whole has real ground to make-up when it comes to matching the pace and impact of battery deployments in other grid regions.[vii]

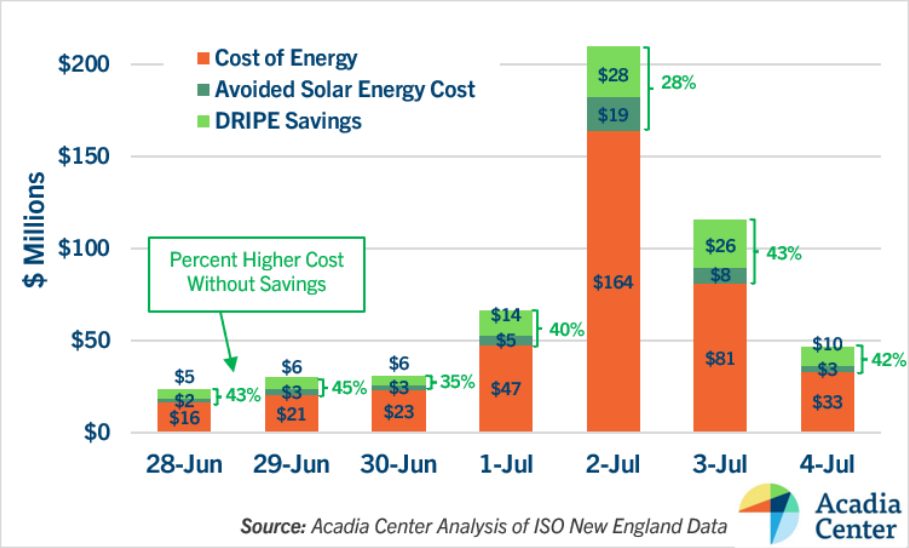
Invisible Savings, Quantified

While distributed solar and energy efficiency may be "invisible" resources when examining the regional fuel mix, the cost savings from them are making a tremendous, underacknowledged impact. From an economic perspective, **distributed solar and energy efficiency saved ratepayers a combined $224 to $246 million over the weeklong heat wave, with $67 to $83 million in savings coming on July 2 alone**, the peak day of the heat wave and possibly the year.

Table 1: Savings from Distributed Solar and Energy Efficiency

Resource	Single-Day Savings – July 2	Weekly Savings – June 28-July 4
Distributed Solar	$39 to $54 million	$130 to $149 million
Energy Efficiency and Passive Demand Reductions	$28 to $29 million	$94 to $97 million
Combined Total:	**$67 to $83 million**	**$224 to $246 million**

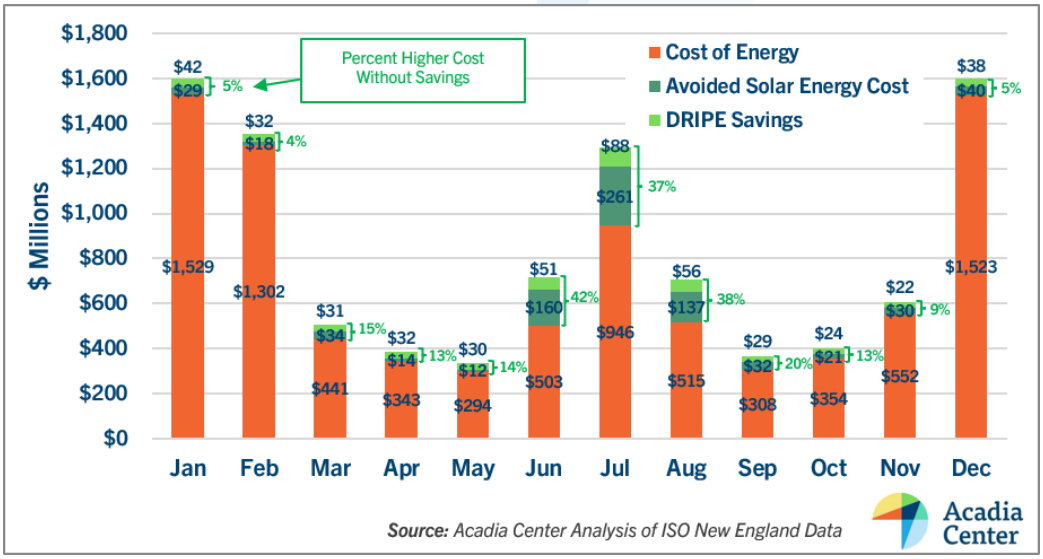
Figure 4. The Wholesale Cost of Energy, With and Without Avoided Energy & DRIPE Savings from Solar, June 28, 2026 - July 4, 2026



During the heat wave week of June 28- July 4, energy costs across the region rose sharply as demand surged to meet cooling needs. Costs climbed from ~$16 million on June 28th to a peak of ~$164 million on July 2, more than a 10-fold increase in just five days.

The avoided energy costs and DRIPE savings from distributed solar helped offset a meaningful share of these costs throughout the week. On July 2, the day of peak temperatures and load on the grid, these savings totaled ~$47 million, meaning energy costs would have been ~28% higher that day without them. Across the rest of the week, avoided energy costs and DRIPE savings similarly reduced what customers would have otherwise paid, showing how demand-side programs provide the greatest value when the grid is stressed.

Figure 5. The Wholesale Cost of Energy, With and Without Avoided Energy & DRIPE Savings from Solar, by Month in 2025



Across 2025, energy costs followed a seasonal pattern, rising during periods of high cooling and heating demand. Summer peak costs reached ~$946 million in July and more than $500 million in both June and August. Winter costs were even higher, with January and December each exceeding $1.5 billion. These increases reflect the additional generation needed to meet demand during higher demand and extreme weather conditions.

Avoided energy costs and DRIPE savings from solar provide a large benefit during these high demand months. In July, the peak month of the summer, savings of $349 million meant energy costs would have been approximately 37% higher without them. June and August saw even larger relative impacts, at 42% and 38% respectively, showing the impact that all consumers get from the demand side solutions. During milder shoulder months like March, April and September, savings were smaller but remained consistent, at 13-20%. This demonstrates that demand-side solutions deliver meaningful benefits year-round, not just during periods of extreme weather. The figures above refer only to savings from distributed solar, not to energy efficiency.

Over all of 2025, **distributed solar saved New England consumers a combined estimated $1.26 to $1.37 billion in savings in the wholesale energy market**. These savings are equivalent to 12 to 14% of the $9.9 billion in annual wholesale energy costs (LMPs) in the region in 2025.[viii]

Methods

For all models, avoided cost of energy was calculated as the amount of distributed solar in an hour multiplied by the Day-Ahead LMP for the same hour. Similarly, the cost of energy was calculated as the amount of load on the grid in an hour multiplied by the Day-Ahead hourly LMP. The Day-Ahead LMP was used to estimate costs as most energy (>90%) is cleared in the Day-Ahead markets.[ix] To calculate DRIPE, two statistical models developed by Acadia Center were used, more detail on which can be found in the Technical Appendix. The plots in this section depict the average results from the two models. The range of numbers in Table 1 represent the estimates from both models.

The Full Savings Are Likely Even Larger

Notably, the calculated savings only account for the avoided energy costs and price suppression effects (DRIPE). These cost savings are likely an underestimation because they do not account for various other savings pathways:

- **Avoided Capacity Costs**: Distributed resources like solar and energy efficiency can reduce the need to build or maintain power plants that would otherwise only be needed during peak demand periods. The grid must maintain enough generating capacity to meet the highest hours and days of demand throughout the year. When distributed resources lower those peaks, it is possible to avoid paying for some of that backup generation capacity.
- **Avoided Transmission Costs:** Local solar (and other local resources) can reduce the need for expensive high-voltage power lines. When electricity is generated close to where it is used, there is less need for power to travel across long-distance transmission infrastructure. Over time, this reduced need can defer investments in transmission, such as postponing building a new transmission line.
- **Avoided Distribution Costs:** Local energy resources can also reduce strain on distribution infrastructure, like substations and local power lines (the type you see in neighborhoods). Similarly to avoided transmission costs, when electricity is produced near customers, it can enable the deferral of upgrades to distribution infrastructure – like postponing an upgrade to a substation because local resources are reducing the peak demand on that equipment.

- **Capacity DRIPE:** (different, but similar, to energy DRIPE discussed earlier in this piece) Distributed resources lower peak demand on the grid, which can lead to a decreased need for generation capacity. This can translate to lower prices in capacity markets, which pay generators to maintain enough future capacity for the electric grid.
- **Social Cost of Emissions Reduction:** Carbon, sulfur dioxide, and nitrogen oxide – also known as greenhouse gas – emissions contribute to climate change, which can increase costs from flooding, heat waves, storms, health impacts including increased respiratory problems, and other damage. Distributed resources reduce those emissions, providing savings across storm restoration, adaptation, insurance, healthcare, and other costs.

Additionally, this analysis only looks at the avoided energy and price suppression effects that distributed solar and energy efficiency provide in the Day-Ahead energy markets. There are likely additional savings in the real-time markets that are not captured in this analysis. Further, the model does not capture costs which would be incurred to further build out the region's gas infrastructure in order to help serve the increased regional electric demand if there were no distributed solar or energy effiency. Nor does the model account for the fact that the increased regional demand would be more than the demand offset by distributed solar and energy efficiency – if that local demand reduction were instead supplied by energy from power plants, there would be losses along the transmission and distribution lines supplying the energy, meaning even more energy would actually be needed to serve regional demand.

It is also noteworthy that abnormally hot conditions during this El Nino summer underscore the hidden and mounting added costs of climate change affecting New Englanders in real-time. Early research shows that climate change directly contributed to this heat wave – and climate change is only continuing to make summers hotter and further strain the region's (and nation's) aging electric grid.[x] In other words, more heatwaves – and high electricity prices – will be coming. Distributed resources like solar and energy efficiency will help to offset those costs.

While there are numerous reasons this analysis may undercount savings from distributed solar and energy efficiency, there are some counter assumptions. In the analysis, it is assumed that the effects of DRIPE are not diminishing. In other words, the model does not make assumptions that customers will be influenced by electric prices being lower than they otherwise would be without distributed resources and in turn use more electricity. Additionally, the model does not assume any impacts to regional utility scale renewable (i.e., renewables that participate in the wholesale market) buildout due to distributed resources. In theory, for every MWh of electricity demand avoided through distributed resources, generation service providers would correspondingly be required to procure fewer renewable energy certificates (RECs) from new renewable resources under binding Renewable Portfolio Standard (RPS) policies (i.e., policies that influence the development of new renewable resources in New England). However, this analysis does not assume that the resulting reduction in REC requirements leads to less renewable energy development. Instead, renewable resource buildout is assumed to remain unchanged, meaning that energy-efficiency-driven load reductions are not offset by a decrease in renewable generation capacity.

Technical Appendix

About the Models

Acadia Center developed two statistical models to estimate the price suppression effects of distributed solar and energy efficiency. For both models, the general concept was to use inputs to accurately estimate the wholesale price (LMP) of electricity in the region during every hour. With an accurate model, it is then possible to run multiple scenarios:

1. **The baseline case –** A scenario that uses all actual conditions (e.g., natural gas and oil fuel prices, amount of each type of resource being used each hour to satisfy the regional wholesale market electric needs, etc.).
2. **The solar counterfactual case –** A scenario where the models use all actual conditions *except* for behind the meter solar. In this case, the models are run again, but all variables related to natural gas and total demand on the grid are *increased* by the amount of distributed solar that is fueling the grid in that hour. In other words, this scenario imagines if distributed solar did not exist, and thus there was more demand on the grid, which was served by increased natural gas.
3. **The efficiency counterfactual case –** A scenario like scenario 2, but in the counterfactual case, a flat 2,000 MW of energy served by energy efficiency is added to the variables related to regional demand and natural gas instead of the behind-the-meter solar production in each hour.

When the counterfactual cases are run through the models, they estimate what the wholesale price of electricity each hour – the hourly LMPs – would be for the region if we did not have distributed solar and energy efficiency. For each hour, the difference in the counterfactual LMP and the actual Day-Ahead LMP is then multiplied by the amount of energy in the region (the actual demand in the wholesale market, plus the energy displaced by the counterfactual case), to get a value for the DRIPE, or price suppression savings.

How We Know the Models are Working

For such an analysis, it is important that the models accurately capture LMPs, so there is confidence that the model is appropriately learning the correlation between the input variables and market prices. One way to evaluate a model's ability to predict values, in this case LMPs, is r-squared. R-squared measures the proportion of the statistical variance in the actual results that is explained by the model, with higher r-squared values indicating that the model's predictions are more closely aligned with observed outcomes. As an example, a model with an r-squared of 0.7 explains 70% of the variance in observed, or actual, LMP values. Both Acadia Center models have strong r-squared values (generally 0.7 and above, but dependent on application), as explained further below.

Multi-Year Model

One of the models Acadia Center built predicts LMP values using no historical LMP data. Instead, it only uses variables related to the amount of each type of fuel (e.g., natural gas, nuclear, etc.), gas and oil prices, total demand on the grid, temperatures in the region, projected surplus capacity on the grid, and the time of day. Two different sub-models are fit – one for on-peak hours (7AM-11PM), and one for off-peak hours (11PM-7AM). The sub-models are trained on their respective hours of data for the years 2022-July 5, 2026. The results of each sub-model are combined to test the overall performance in predicting LMPs. To ensure the models fit well, initially a test set of data was held out from training – 3 consecutive months from Spring 2024 and another 3 months from Summer 2025. The model is fit on the training data, and r-squared on the test set was 0.82, meaning 82% of the variance in LMP values is explained by the model. These results validate that the model is able to accurately

understand data it has not seen before – as the model was able to understand 82% of the variance in LMP values from months of data it was not trained on.

To allow the model to best learn from all data before using it to assess the value of energy efficiency and distributed solar, the model was re-trained using all available data. The resulting r-squared was 0.79. It was likely slightly lower than the r-squared for just the test set as the model tends to underpredict extreme LMP values, and the highest LMP values since 2022 were recorded during this recent July 4, 2026, heatwave, which was not included in the test set. Yet, the model performance is still noteworthy as it is able to largely account for the variance in LMPs and predict the values accurately across months, years, on-and off-peak hours, including international price shocks (e.g., Russia's invasion of Ukraine, the Iran War).

Monthly Model

The second model Acadia Center developed builds on- and off-peak sub-models for each month of each year from 2022 through June 2026 (data for July 1-5, 2026, was included in the June 2026 models). For each model, a best-fit polynomial is plotted for the relationship between load on the ISO-NE grid and the LMP price. The difference between each actual LMP, and the expected polynomial LMP (the LMP value from the best-fit line with the same hourly load on the grid) is taken. This difference in LMPs is called the 'residual'. Each monthly model then uses inputs from the same categories as the Multi-Year Model, specifically: fuel type, gas and oil prices, total demand on the grid, temperatures in the region, projected surplus capacity on the grid, and the time of day. To get predicted LMP values, the predicted residual is added to the best-fit line LMP value. For each month, the r-squared values between predicted LMPs and actual LMPs ranged from 0.76-0.95. Again, these strong r-squared values indicate that the models are able to relatively accurately reflect the variance in actual LMP values.

Getting Results

Both models were used to run the 3 scenarios outlined above (baseline, solar counterfactual, and efficiency counterfactual) for various time intervals. Specifically, the models were used to evaluate the peak heatwave day of July 2, 2026, and the week of the heatwave from June 28, 2026-July 4, 2026. The baseline and solar counterfactual scenarios were also run for the year 2025 to get an idea of annual avoided energy cost and DRIPE savings from distributed solar. For the graphs included in this piece (Figures 4 and 5) the average results from both the Multi-Year and Monthly models were used. Ranges included in the table reflect the outputs of both models, which were generally well aligned. Acadia Center intends to continue refining and making use of these models to examine the savings and benefits of certain resource categories during other time periods and grid conditions.

For more information on methodology, please reach out to Acadia Center at wtaylor@acadiacenter.org.

Defining Distributed Solar

For the purposes of this analysis, distributed solar is defined in a manner aligned with how ISO-NE defines distributed generation. In other words, "Generation provided by relatively small, on-site installations directly connected to distribution [grid] facilities or retail customer facilities and not the regional power system, which reduces the amount of energy the regional power system consumes and can alleviate or prevent regional power system transmission or distribution constraints or reduce or eliminate the need to install new transmission or distribution facilities. A small (24 kilowatt) solar photovoltaic system installed by a retail customer is an example of distributed generation."[xi] Notably, distributed generation can be owned by residential customers, as well as commercial or industrial facilities. To-date, New England's investments in distributed solar have been roughly two-third larger-scale, ground-mounted solar arrays (roughly 1-5 MW each, often community solar, and many not

directly co-located with load), and one-third composed of smaller residential and small commercial systems (many thousands of rooftop and other small arrays from ~3 kW and up). So, while this piece refers to 6+ GW of distributed solar contributing to the grid, this reflects a range of rooftop, groundmounted, behind-the-meter, and standalone solar systems, all of which contribute important value to overall system performance.

Differences from Last Year's Analysis

Acadia Center conducted a similar analysis last year that did not use statistical techniques to model the price impacts of distributed solar. The previous analysis was intended to be as conservative as possible to provide an absolute floor for the benefits that distributed solar provided on the peak demand day of 2025 – this analysis is intended to more closely examine the actual benefits that distributed solar provides, as well as examining the cost benefits energy efficiency provides. Specifically, this analysis evaluates the DRIPE savings for all energy (that which is avoided due to distributed solar, as well as the actual energy in the wholesale market) whereas the previous analysis did not evaluate DRIPE of the energy used on the grid, but instead only evaluated DRIPE of the avoided energy (energy not needed in the wholesale market due to the presence of distributed solar).

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[i] With supporting contributions from Noah Berman, Paola Tamayo, Joseph LaRusso, Ben Butterworth, and other team members.

[ii] See the Technical Appendix for a detailed definition of "distributed solar".

[iii] ISONE BTM Solar | Grid Status; ISONE Load | Grid Status; ISONE Fuel Mix | Grid Status.

[iv] https://www.iso-ne.com/static-assets/documents/2018/02/fca_obligations.xlsx, FCA17 and FCA16

[v] https://www.energy.ca.gov/news/2025-11/californias-battery-storage-fleet-continues-record-growth-strengthening-grid

[vi] https://www.ercot.com/files/docs/2026/02/02/4-Understanding-Battery-Energy-Storage-Systems-Current-and-Future.pdf

[vii] See: https://gridlab.org/the-bess-deployment-gap-structural-barriers-in-eastern-u-s-markets/; https://macleanenergy.com/2026/07/02/83e-i-long-term-contracts-filed-for-dpu-approval/

[viii] https://www.iso-ne.com/static-assets/documents/100033/clg_meeting_johnson_iso_new_england_update_presentation_3_25_2026.pdf

[ix] Actual energy costs and savings may be less due to hedging arrangements (such as power purchase agreements for offshore wind) made pursuant to contracts for energy set at prices different than those settled in the Day-Ahead market; however, there is limited public insight into the exact amount of hedged energy settled in the market.

[x] Fossil Fuels Are Heating America's 250th Birthday – World Weather Attribution

[xi] Glossary and Acronyms