To: Chris Geissler, James Woods
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Date: August 30, 2024
Re: Feedback on Capacity Auction Reforms straw scope

The undersigned public interest organizations (PIOs) wish to express concern about several ways in which ISO-NE is limiting the scope of the Capacity Auction Reform (CAR) process. FERC approved ISO-NE's request to extend the timeline on capacity accreditation reforms,[1] and the reforms now must be completed in time for the February 2028 Forward Capacity Auction. The next four years are critical to address the largest challenges with resource adequacy in New England, including a changing generation mix with different operational characteristics, fossil fuel supply constraints, historic load growth, and climate-induced extreme weather. These two issues must be addressed in the scope of CAR:

1. Correlated outages and ambient temperature adjustments.
2. Start up times and other operating parameters that limit flexibility.

Without addressing these factors, ISO-NE will not achieve any of the design objectives guiding the entire CAR effort: reliability, sustainability, and cost effectiveness. Reliability cannot accurately be measured while omitting operational characteristics that impact the ability of resources to perform during constrained hours. The sustainability of the system will not be ensured if the market is sending signals for resources with the wrong characteristics. The capacity market will not be cost effective if price signals do not consider the true resource adequacy value of resources, harming consumers with inaccurate costs and increasing the potential for blackouts. We urge the ISO to include these two elements in its CAR scope to ensure an accreditation construct that promotes reliability in a cost-effective manner that is sustainable as the resource mix evolves.

1. Correlated outages and ambient temperature adjustments must be reflected in accreditation and risk modeling

In its presentation at the August 2024 Markets Committee meeting, ISO-NE indicated that "ambient temperature adjustments and correlated outages" might be out of scope for the CAR effort, and that the ISO would "continue to assess this item with respect to the scope objectives."[2] As described below, correlated outages and ambient temperature adjustments must be considered within scope to ensure CAR reforms deliver resource adequacy.

[1] *ISO New England, Inc.*, 187 FERC ¶ 61,083 (May 20, 2024).
[2] ISO New England, Inc., "Capacity Auction Reforms: Continued Discussion of Project Scope." August 6, 2024, Slide 41. https://www.iso-ne.com/static-assets/documents/100014/a02_mc_2024_08_06_scope_considerations_car_iso_presentation.pdf (hereinafter "August 2024 CAR Scope Slides").

Generators failures do not occur independently of one another. Instead, generator failures are often correlated–occurring simultaneously during temperature and weather events, and often during peak demand. These reliability gaps must be reflected in the capacity market. PIOs urge ISO-NE to include the modeling and rule changes needed to support correlated outages and ambient temperature adjustments in accreditation. We understand that the ISO wishes to limit the scope of CAR to ensure reforms can be completed in time for the next capacity auction, but PIOs believe that this consideration is paramount and must be considered in scope.

a. Many resource adequacy events arise due to outages and derates correlated with temperature and demand.

Abundant existing literature illustrates the correlation of generator outages, temperature, and weather. Research from Carnegie Mellon University showed that resources, particularly gas and diesel resources, are susceptible to both cold and hot temperature-dependent forced outages, concluding that "there are systematic relationships between temperature, load, and generator availability."[3] Further research found that correlated outages occur in all regions and in all seasons.[4] Climate change will only increase the frequency, duration, and severity of these events.

Winter Storm Elliot and Winter Storm Uri are two real-world examples of the consequences of correlated outages and ambient temperature adjustments for fossil resources. According to the joint FERC and NERC report on Winter Storm Elliot, "1,702 individual generating units experienced 3,565 outages, derates, or failures to start, of which 825 units were natural gas-fired generators,"[5] resulting in the loss of 90,500 MW at the same time. This event was the "fifth in the past 11 years in which unplanned cold weather-related generation outages jeopardized grid reliability."[6] Winter Storm Uri, which resulted in catastrophic outages and the loss of 276 lives, was also a product of correlated outages related to an extreme winter storm. According to the joint FERC and NERC report on Winter Storm Uri, "34,000 MW of generation [was] unavailable for over two consecutive days"[7] due to extreme winter temperatures. Furthermore, the report found that since a 2018 reliability event, every cold temperature outage event has revealed the same pattern: "...the total generating unit outages were correlated with temperatures—again, as temperatures fell, the incidence of unplanned outages and derates increased."[8] It is clear that the highest

[3] S. Murphy, F. Sowell, J. Apt, "A time-dependent model of generator failures and recoveries captures correlated events and quantifies temperature dependence." *Applied Energy, Vol. 253*, 2019. https://doi.org/10.1016/j.apenergy.2019.113513

[4] S. Murphy, J. Apt, J. Moura, F. Sowell, "Resource adequacy risks to the bulk power system in North America," *Applied Energy, Volume 212*, 2018, https://doi.org/10.1016/j.apenergy.2017.12.097.

[5] FERC, NERC, and Regional Entity Joint Staff. "December 2022 Winter Storm Elliott Grid Operations: Key Findings and Recommendations Presentation," September 21, 2023, at slide 5. https://www.ferc.gov/news-events/news/presentation-ferc-nerc-regional-entity-joint-inquiry-winter-storm-elliott.

[6] FERC, NERC, and Regional Entity Joint Staff. "Inquiry into Bulk-Power System Operations During December 2022 Winter Storm Elliott" October 2023, at 5-6 (hereinafter "Elliott Report"). https://www.ferc.gov/media/winter-storm-elliott-report-inquiry-bulk-power-system-operations-during-december-2022.

[7] FERC, NERC, and Regional Entity Joint Staff. "The February 2021 Cold Weather Outages in Texas and the South Central United States," November 2021, at 8 (hereinafter "Uri Report"). https://www.ferc.gov/news-events/news/final-report-february-2021-freeze-underscores-winterization-recommendations.

[8] *Id.* at 217.

risk periods–the very periods that the capacity market seeks to address–often see generator failures *en masse*.

ISO-NE has routinely experienced resource inadequacy due to the effects of correlated outages and ambient derates:

> January 17, 2014 event
> On January 7, 2014, ISO-NE experienced 1,500 MW of capacity losses after cold temperatures caused compressor failures on interstate gas pipelines, resulting in 15 forced generation outages and derates due to inadequate gas fuel supplies. Wholesale electricity totaled $5 billion for the region for the Winter season. *1,500 MW of forced generation outages occurred simultaneously with extreme cold temperatures and peak demand.*
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> September 3, 2018 event
> On September 3, 2018, hotter-than forecasted weather, high demand, and a string of unplanned generator outages caused power system operating reserves to run short in New England. Consumer demand for power soared, driving the highest peak ever recorded on a Labor Day in New England–ultimately about 2,400 MW higher than expected. The ISO was forced to purchase emergency energy from New York and New Brunswick and to ask market participants to reduce energy consumption at their own facilities, plus alerts to notify market participants of stressed system conditions. *1,600 MW of forced generation outages occurred simultaneously with extreme temperature and peak demand.*
>
> December 24, 2022 event (Winter Storm Elliott)
> On Christmas Eve 2022, a historic cold snap forced ISO-NE to implement emergency operating procedures, stopping just a few steps short of asking the public for voluntary conservation measures. Power plant outages and reductions coincided with net imports being approximately 100 MW less than had been expected. Prices in the Real-Time Energy Market averaged approximately $484/MWh over the course of the day, with averages reaching more than $2,200/MWh during the 5 p.m. hour. *Thirty six different power plants simultaneously failed to deliver energy due to extreme weather and peak demand.*
>
> Summer 2024 events
> On June 18, 2024 and August 1, 2024, ISO-NE experienced capacity deficiency events related to hot temperatures and high demand. The June 18 capacity deficiency event occurred after 1,600 MW of generator outages and ambient derates. The August 1 capacity deficiency event occurred in a similar way, in which the region experienced a 750 MW shortage over the course of the day due to "a large thermal unit with a delayed startup due to electrical issues, as well as the tripping of generation due to plant auxiliary systems,"[9] in addition to a 335 MW combined cycle plant tripping offline. *Both events*

[9] Jonathan Gravelin, "Implementation of ISO-NE Operating Procedure #4 on Thursday August 1, 2024," *ISO New England*. Aug. 2, 2024. https://www.iso-ne.com/static-assets/documents/100014/op4-report-nepool-committees-8-1-24.pdf.

showed that unexpected outages occurred simultaneously during periods of hot weather and high demand.

It is clear that New England has a long history with risk events related to correlated outages and extreme weather events, and these considerations must be part of ISO-NE's CAR scope.

b. Experts and regulators agree that correlated outages and ambient temperature adjustments are essential factors in accreditation and market risk assessment.

FERC has made it clear that correlated outages and ambient temperature adjustments are a key part of resource reliability, and should thus be reflected in accreditation. In February 2024, FERC adopted changes to PJM's capacity accreditation process.[10] These capacity accreditation changes included correlated outages and ambient temperature adjustments. Specifically, FERC found that "PJM's marginal ELCC framework is just and reasonable because it: (1) incorporates the risk of correlated outages, especially in cold weather conditions, of all supply-side resources, including thermal resources."[11]

Accounting for correlated outages and ambient temperature adjustments has been a long-standing recommendation from resource adequacy experts, including Potomac Economics, General Electric International, Synapse Energy Economics, the Brattle Group, and the Electricity Systems Innovation Group. The 2021 State of the Markets report for the New England region by Potomac Economics found that "multiple units that can be lost in a single contingency provide less reliability than ones whose outages are uncorrelated,"[12] and recommended that the ISO's capacity accreditation methodology must "account for the diminishing value of resources whose availability is correlated and discourage over-dependence on a single resource type."[13] A 2022 report by General Electric International, Inc., evaluated accreditation methodology in the ISO-NE footprint, concluding that the ISO must "ensure the RCA market design and modeling assumptions reflect the realities of thermal limitations, including correlated outage risk due to fuel supply constraints and ambient derates."[14] A report by Synapse Energy Economics concluded that "Correlated forced outage risk is yet another challenge for which inflexible resources have limited utility, even if they do not face outages themselves."[15] A 2022 report from the Brattle Group concluded that the capacity market should "explicitly model causation of outages based on weather, system conditions, and unit-specified characteristics."[16] Electricity Systems Innovation Group

[10] *See PJM Interconnection, LLC*, 186 FERC ¶ 61,080 (2024).
[11] *Id*. at P 42.
[12] Potomac Economics, "2021 Assessment of the ISO New England Electricity Markets," June 2022, at xii. https://www.iso-ne.com/static-assets/documents/2022/06/iso-ne-2021-som-report-full-report-final.pdf (hereinafter "2021 SOM").
[13] *Id.* at 50.
[14] Ibanez, Eduardo, Ph.D. et al. "Evaluation of ELCC Methodology in the ISO-NE Footprint." *General Electric International, Inc.* Oct. 10, 2022. https://www.iso-ne.com/static-assets/documents/2022/10/a09b_mc_2022_10_12-13_rca_nrdc_report.pdf
[15] J. Frost, et al. "The Impact of Resource Inflexibility on Capacity Accreditation in New England," *Synapse Energy Economic*s, March 7, 2023, at 17 (hereinafter "Synapse Inflexibility Report"). https://www.synapse-energy.com/sites/default/files/Capacity%20Accreditation%20for%20Inflexible%20Resources%202023_03_07.pdf.
[16] S. Newell, et al., "Capacity Resource Accreditation for New England's Clean Energy Transition," *The Brattle Group*, June 2, 2022, at 15.

cites correlated events as one of the top two driving factors that require new approaches to resource adequacy.[17] The CAR initiative must not abandon this essential element of resource adequacy recommended by experts.

Modeling constraints are an important consideration when determining the scope of CAR, but should not limit the ability for ISO-NE to consider correlated outages and ambient temperature adjustments. ISO-NE should endeavor to model these reliability impacts as accurately as possible. If this is not possible within the limitations of the GE-MARS model, ISO-NE should either look for models that have these capabilities, or look for additional ways to account for these realities within accreditation. For example, MISO and SPP use a "cold weather outage adder" as a proxy for temperature correlated outages in the winter. ISO-NE should look to other regions for creative solutions to modeling constraints in the near term, while pursuing the modeling upgrades needed for a more robust accreditation method as soon as practicable.

Not accounting for correlated outages and ambient derates will lead to inaccurate accreditation. It may result in overstating the capacity value of resources that are impacted by correlated outages and ambient derates, including many fossil resources, and will not capture the true reliability of the New England system. Whether consumers end up paying for phantom capacity or paying elevated prices because a portion of the supply is derated without good reason, the resulting rates will be unjust and unreasonable. Furthermore, to the extent that ISO-NE's chosen methodology accounts for correlated outages among or effects of weather conditions on output from certain types of resources, but not others, it may result in rates that are unduly discriminatory.

2. Resource start times must be reflected in accreditation

In its presentation at the August 2024 Markets Committee meeting, ISO-NE indicated that "modeling resource start times" was out of scope for the CAR effort.[18] As explained below, this omission will undermine the efficacy of the market design reforms that ISO is pursuing, and leave the region with a significant blind spot when it comes to resource adequacy. Units with lengthy start up times simply do not offer the same resource adequacy value as more flexible ones. PIOs urge ISO-NE to reconsider and include in the CAR scope modeling and market updates needed to reflect start up and notification times in accreditation. We understand that this will involve substantial resources, but given that ISO has already committed to spending several years on overhauling its capacity market reform, now is the best time to address this important consideration.

In the last several years, ISO-NE's external market monitor, Potomac Economics, has noted the importance of accounting for resource inflexibility when assessing resource adequacy. In its 2021 State of the Market report for ISO-NE, Potomac listed the failure to account for lengthy start-up times as a

https://www.brattle.com/wp-content/uploads/2022/06/Capacity-Resource-Accreditation-for-New-Englands-Clean-Energy-Transition-Foundations-of-Resource-Accreditation-1.pdf.

[17] D. Stenclik, et al. "Redefining Resource Adequacy for Modern Power Systems," *Electricity Systems Innovation Group*, 2021. https://www.esig.energy/wp-content/uploads/2022/12/ESIG-Redefining-Resource-Adequacy-2021-b.pdf.

[18] August 2024 CAR Scope Slides, at slide 45.

major deficiency of the ISO's current approach to accreditation. It explained that "[i]f such a unit is not already online or committed, it may not be able to provide output if a period of critical system need occurs with short notice. Hence, inflexible units with low capacity factors have less reliability value than more flexible units."[19] Likewise, in critiquing MISO reforms to capacity accreditation, Potomac noted that "inflexible resources with long lead times are less valuable than more flexible resources." It explained further that "Long-lead time units that seldom run are much less available than other resources in reality because MISO often does not recognize emergency conditions until 30 minutes to 4 hours ahead of real-time. Offline long-lead time resources would predictably be unavailable for most of these emergencies, so accrediting them comparably to online resources or fast-starting gas turbines is not consistent with their reliability contributions."[20]

a. Many resource adequacy events in New England can and do arise on short notice.

Resource flexibility is a critical factor in resource adequacy because loss of load events do not always arise with sufficient notice for ISO-NE to commit slow-start resources in time to be available to serve load. In circumstances where system risks arise on short notice, slow-start resources may provide little to no resource adequacy value. Synapse's 2023 report describes two events in the preceding five years in which ISO-NE was short on operating reserves, noting that "[i]n both instances, the ultimate causes of the reserve shortage were unknown to system operators in advance, so operators were left with only hours to mitigate the problems."

> <u>September 3, 2018, event</u>
> In September 2018, higher-than-forecast temperatures and humidity increased loads above ISO New England's expectations. In addition, about 1,600 MW of unanticipated outages occurred throughout the day, including a loss of approximately 1,000 MW that occurred between 3:00 PM and 3:30 PM. These factors combined to create a reserve shortage of approximately 700 MW. ISO New England implemented OP-4 between 3:30 PM and 8:00 PM to manage the shortage. *Nearly 6,500 MW of capacity was offline and unavailable to respond to the event due to long start-up times*.
>
> <u>December 24, 2022, event (Winter Storm Elliott)</u>
> Most recently, on the evening of December 24, 2022, the New England grid fell short of needed operating reserves between 4:40 PM and 6:05 PM. The shortage followed unexpected outages affecting 2,275 MW of generation resources throughout the day on December 24, in addition to lower-than-planned imports from adjacent regions, especially Quebec. By the time it was clear the system was at risk of reserve shortage, there were only a few hours to prepare for the peak load hour, and *more than 8,500 MW of available generation sat on the sidelines unable to start up in time to help*.[21]

[19] 2021 SOM at 35.
[20] Potomac Economics, "2021 State of the Market Report for the MISO Electricity Markets," June 2022, at 85-86. https://www.potomaceconomics.com/wp-content/uploads/2022/06/2021-MISO-SOM_Report_Body_Final.pdf
[21] Synapse Inflexibility Report at 2 (citing ISO-NE reports) (emphasis added).

Slow-start resources should have lower capacity value to the extent that possible loss-of-load events in New England arise on notice that is shorter than the time it takes these units to start up. While the two examples provided above are significant given the scale of those events, ISO-NE should undertake and publish a more comprehensive analysis of the extent to which the tightest hours on its system arise on short notice, and the extent to which the ISO would need to rely on slow-start resources to meet that demand.

b. Flexibility is intrinsic to accurate accreditation and cannot be left to energy and ancillary service markets alone.

In its August 2024 presentation, ISO states that "[o]ther markets (e.g., energy and ancillary services) may be better suited to ensure that the region develops a next day operating plan to account for uncertainty and contingencies that may arise in the operational timeframe." That energy and ancillary service markets play an essential role in planning for operating contingencies is no excuse for ignoring the role of start up times in resource adequacy contributions. FERC has recognized that capacity markets themselves should incentivize flexibility and that less flexible resources should make less in capacity revenues. For instance, in approving PJM's 2015 introduction of Capacity Performance requirements (equivalent to ISO-NE's Pay for Performance), the Commission reasoned that a unit with restrictive operating parameters (e.g., slow start-up times) "provides less capacity value to customers than a resource that is able to perform during these hours" and thus should receive less net capacity revenue."[22] When ISO New England filed its Pay for Performance proposal, it defended the greater impacts of the penalty structure on inflexible resources noting that all resources should be paid based on what they contribute to system reliability, and that the capacity market design up until that point had created a disincentive for investors to build resources with more flexible capabilities.[23] In approving those rule changes, the Commission rejected arguments that it was unfair to impose penalties on resources that were "unable to provide energy or reserves during a Capacity Scarcity Condition[. . .] due to start time or ramp rate constraints," finding that "these resources are not providing equivalent reliability contributions as compared to other higher performing resources and thus should not be compensated equally."[24] In sum, considerations of resource flexibility are central to designing capacity markets that accurately compensate resources for their reliability value.

Furthermore, it is risky for ISO-NE to plan to deplete operating reserves to compensate for a fleet heavy in slow-start resources. In a 2023 paper, Synapse Energy Economics found that a significant percentage of generators in New England have lengthy start up times,[25] and "that within these long start-up periods there is considerable risk of forecast error or forced outages that push the system into shortage before long start-up time units can respond."[26] Synapse further observed that the degree to which load was under-forecast on the worst 10 percent of days was about half of the operating reserves that ISO-NE must maintain to protect the system against its largest contingency.[27] Depleting operating

[22] *See PJM Interconnection, LLC*, 151 FERC ¶ 61,208, at P 441 (2015).
[23] *ISO New England*, 147 FERC 61,172 at P 76 (2014).
[24] *Id.* at P 68.
[25] Synapse Inflexibility Report, at ii-iii ("2022 U.S. EIA data shows that 25.7 GW of the region's 38.3 GW of total operating nameplate capacity takes more than an hour to start up. Of that amount, 7.6 GW takes over 12 hours.").
[26] *Id.* at ii.
[27] *Id.* at 19.

reserves to respond to load forecast error because a significant portion of the region's capacity is unable to start on short notice could leave the ISO dangerously unprepared for significant generation or transmission system outages. As Synapse explained, "operating reserves are needed for other uncertainties, not known and avoidable ones like a fleet that is too slow to start up."

For all these reasons, it is essential that ISO-NE prioritize development of a capacity accreditation method that accurately accounts for the resource adequacy implications of resource inflexibility. Leaving this issue unaddressed now, despite the comprehensive effort being undertaken, would mean that a significant portion of the resources that clear in ISO's capacity auction have inflated capacity values. As a result, the auction will not send the correct price signals to guide entry and exit, and could lead to more flexible resources retiring (or failing to enter) since their increased resource adequacy value is not recognized or compensated. ISO-NE correctly endeavors to develop a market design that is sustainable in the sense that it will incent the levels of investment needed to meet resource adequacy objectives over time as system and market conditions change. As the weather becomes more extreme and unpredictable, and the consequences of wind and solar forecast error grow with their increased penetration, it will become increasingly untenable for ISO to have an accreditation scheme that ignores start up times and other aspects of resource flexibility. Compensating resources for their true resource adequacy value, after accounting for their availability in the case of short-notice events, will also promote affordability as it will encourage a more flexible and efficient set of capacity resources.

We acknowledge that the associated changes to ISO's accreditation framework, including the needed software updates, are significant. However, the ISO has never provided any detail to demonstrate that these changes are not feasible within the multiple years dedicated to the overall CAR effort. Absent some further evidence and explanation of what specific tradeoffs would be associated with tackling resource start times now, our organizations cannot support excluding it from the CAR scope. Even if the effort were too significant to tackle in the next several years, or the tradeoffs would be unacceptable, ISO-NE must commit to addressing this issue in a soon-to-follow second phase. As it stands, ISO appears to be taking the position that it can indefinitely ignore the role of resource flexibility in calculating accurate capacity values. For the reasons described above, this view is untenable and will undermine reliability and distort prices in the region.

ISO-NE has embarked on an ambitious overhaul of its Forward Capacity Market that will shape resource investment and consumer costs during a critical period in New England's transition to clean energy. While ISO-NE is heading in the right direction in many respects, such as finally confronting the limited reliability value that gas plants can offer when fuel supply is constrained, it must not overlook other critical factors affecting reliability in the region. We urge ISO-NE to work with NEPOOL, states, and other stakeholders to develop a truly comprehensive accreditation framework that fully accounts for correlated outages, ambient temperature adjustments, and resource inflexibility.

Sincerely,

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