**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

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| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

**ANSWER OF PJM INTERCONNECTION, L.L.C.**

PJM Interconnection, L.L.C. ("PJM"), pursuant to Rule 213 of the Federal Energy Regulatory Commission's ("Commission") Rules of Practice and Procedure,[1] answers the complaint filed by Invenergy Nelson LLC ("Invenergy" or "Complainant") on May 12, 2023.[2] The Commission should deny the Complaint because it fails to establish that PJM's actions to maintain reliability during Winter Storm Elliott[3] violated PJM's Open Access Transmission Tariff ("Tariff"), Amended and Restated Operating Agreement ("Operating Agreement"), or manuals.

## I. INTRODUCTION

Invenergy is a Capacity Market Seller[4] in PJM; its gas-fired generation facility, located in Illinois and interconnected with the transmission facilities owned by

[1] 18 C.F.R. § 385.213.

[2] *Invenergy Nelson LLC v. PJM Interconnection, L.L.C.*, Complaint of Invenergy Nelson LLC and Request for Fast Track Processing, Docket No. EL23-67-000 (May 12, 2023) ("Complaint").

[3] Winter Storm Elliott refers to a large winter storm that passed through the PJM Region between December 23 and December 25, 2022. *See Winter Storm Elliott Info*, PJM Interconnection, L.L.C., https://pjm.com/markets-and-operations/winter-storm-elliott (last visited June 9, 2023) (collecting PJM's public statements addressing Winter Storm Elliott's impact on PJM's operations and markets).

[4] Capitalized terms used, but not otherwise defined, in this pleading have the meaning provided in, as applicable, the Tariff, the Operating Agreement, or the Reliability Assurance Agreement Among Load-Serving Entities in the PJM Region ("RAA").

Commonwealth Edison Company ("ComEd"), is a PJM Capacity Resource. For each year since the start of the Capacity Performance construct that Invenergy's facility has been committed to provide capacity, Invenergy has been well paid by PJM Region loads to support resource adequacy at the times of greatest need. But, during Winter Storm Elliott, when the PJM Region encountered its most acute resource adequacy challenge since the inception of the Capacity Performance construct, Invenergy's facility underperformed and PJM therefore assessed Invenergy Non-Performance Charges pursuant to Tariff, Attachment DD, section 10A.[5]

Invenergy argues it should be excused from these Non-Performance Charges because PJM did not provide sufficient advance notification of the storm's severity, did not provide 24-hour advance notice so that Invenergy could purchase natural gas, violated Manual 13[6] by not curtailing all non-firm exports prior to commencing emergency procedures and calling for Load Management Reductions, and incorrectly implemented Emergency Actions when there allegedly was no emergency in the ComEd Zone after 06:00[7] on December 24.[8]

Beyond these sweeping and inaccurate claims concerning PJM's actions, Invenergy does not explain why the Non-Performance Charges assessed to its specific Capacity Resource should be excused under the limited exceptions set forth in PJM Tariff,

[5] Tariff, Attachment DD, section 10A(a).

[6] *See* System Operations Division, *PJM Manual 13: Emergency Operations*, PJM Interconnection, L.L.C. (Nov. 3, 2022), https://www.pjm.com/-/media/documents/manuals/archive/m13/m13v86-emergency-operations-11-03-2022.ashx ("Manual 13"). References to all PJM Manuals herein are to the versions in effect during Winter Storm Elliott.

[7] Unless otherwise specified, all dates in this answer are in 2022 and all times in this answer are in 24-hour time and are Eastern Prevailing Time.

[8] Complaint at 2, 6-7, 10-15.

Attachment DD, section 10A(d).[9] Nor does Invenergy explain exactly how PJM, which has great discretion in emergency operations, violated its Tariff, Operating Agreement, or manuals in the course of maintaining reliability notwithstanding extreme weather and generators' poor performance. PJM, at all times during Winter Storm Elliott, acted consistent with its primary obligation of maintaining reliability in the PJM Region, while lending support to neighboring regions in need, when possible. Michael E. Bryson, PJM's Senior Vice President of Operations, and Steven T. Naumann, an outside expert on planning operations, reliability, and regulatory aspects of electric power systems, explain that PJM operators' actions during Winter Storm Elliott were appropriate and followed all applicable rules of the Tariff, Operating Agreement, the North American Electric Reliability Corporation ("NERC"), and PJM's manuals.[10]

Invenergy's assertion that PJM's actions during Winter Storm Elliott "created or exacerbated the emergency conditions that generators like [Invenergy] were called upon to abate,"[11] rests on a complete lack of understanding of Capacity Performance. In addition, Invenergy fails to acknowledge PJM's operational discretion, particularly during emergency conditions and mischaracterizes PJM's emergency procedures. The Commission should not be led down the path of parsing individual PJM operator actions during an emergency to determine whether the specific declarations made, and specific steps taken (or not) support such declarations. Micro-managing those decisions after the fact, as Invenergy and other Winter Storm Elliott complainants would have the

[9] Tariff, Attachment DD, section 10A(d).

[10] *See* Attachment B, Affidavit of Michael E. Bryson on Behalf of PJM Interconnection, L.L.C. at Exhibit 1 ("Bryson Aff."); Attachment C, Affidavit of Steven T. Naumann, P.E. on Behalf of PJM Interconnection, L.L.C. at Exhibit 1 ("Naumann Aff.").

[11] Complaint at 2.

Commission do, amounts to the very sort of "second-guess[ing]" that the Commission has made clear it will avoid when it comes to regional transmission organizations ("RTOs") exercising their "operational and reliability-related discretion."[12] Monday morning quarterbacking as to the fine details of PJM's implementation of its assigned responsibility, and discretion, to manage emergencies[13] is not only inappropriate, but would create a dangerous precedent that the Commission should be very reluctant to set.

As explained in detail below, PJM and its operators managed the many difficult challenges posed by Winter Storm Elliott,[14] including unusually high overnight and holiday weekend demand, massive amounts of generator forced outages, the need to manage hydro-pumped storage resources to best extract their desperately needed benefits, and to provide assistance to neighboring systems. Importantly, during this entire event, PJM did not direct a single mandatory load curtailment—*the lights stayed on*. The Commission should keep these facts in mind as it evaluates Complainant's request to second guess PJM's actions in order to excuse Complainant's Capacity Resource non-performance.

Under the Tariff's Capacity Performance rules, Capacity Market Sellers "bear the burden of delivering on their capacity obligation."[15] Invenergy's facility did not meet those obligations during Winter Storm Elliott and PJM therefore properly assessed Non-

[12] *Big Sandy Peaker Plant, LLC v. PJM Interconnection, L.L.C.*, 154 FERC ¶ 61,216, at P 50 (2016).

[13] *See* Operating Agreement, section 10.4(xx).

[14] The severity of the event and the threat to maintaining grid reliability was recognized by the Secretary of Energy who issued an emergency order on December 24, 2022. *See* Department of Energy, Order No. 202-22-4 (Dec. 24, 2022), https://www.pjm.com/-/media/documents/ferc/orders/2022/20221224-pjm-202c-doe-order.ashx.

[15] *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208 (2015) ("CP Order"), *order on reh'g & compliance*, 155 FERC ¶ 61,157, at P 110 (2016) ("CP Rehearing Order"), *aff'd sub nom. Advanced Energy Mgmt. All. v. FERC*, 860 F.3d 656 (D.C. Cir. 2017).

Performance charges. Invenergy's efforts to nullify those charges through its Complaint are unavailing.

## II. BACKGROUND

### *A. The Capacity Performance Construct Shifted Performance Risk to Generators from Load by Requiring Generators to Perform when Needed, or Pay Stringent Non-Performance Charges. Excuses from Such Charges Were Limited by Design and Explicitly Approved by the Commission to Meet the Intended Goal of Ensuring Reliability During Stressed System Conditions*

Following severe weather events in January 2014 during which generating resources in the PJM Region performed very poorly, PJM proposed, and the Commission accepted, capacity market reforms to incent committed Capacity Resources to deliver the promised energy and reserves when PJM calls upon them in emergencies.[16] Central to these reforms was a new capacity product, the Capacity Performance Resource, which must be "capable of sustained, predictable operation such that the resource will be reliably available to provide energy and reserves in an emergency condition."[17]

To incent Capacity Performance Resources to deliver the capacity and reliability they are paid to provide, the Tariff provides that, in emergency conditions, underperforming Capacity Resources face stringent[18] Non-Performance Charges.[19] Specifically, for the period (known as Performance Assessment Intervals) when certain PJM-declared Emergency Actions are in effect, the Tariff requires PJM to assess Non-

[16] *See* CP Order at P 7.

[17] CP Order at P 28.

[18] The Non-Performance Charge is based on the Net Cost of New Entry (Tariff, Attachment DD, section 10A(e)) even if the Capacity Resource Clearing Price for the relevant Delivery Year is set at a level well below the Net Cost of New Entry.

[19] The details for applying and determining Non-Performance Charges are set forth in Tariff, Attachment DD, section 10A.

Performance Charges when a Capacity Resource underperforms.[20] The Commission found that Non-Performance Charges will "act as a strong incentive for performance,"[21] explaining that "if and to the extent [a Capacity Resource] fails to perform during an emergency, when it is most needed, it is appropriate that the compensation for that resource be reduced and possibly entirely forfeited."[22]

There are only two excuses from Non-Performance Charges, and they are "strictly circumscribed."[23] Specifically, a resource's performance shortfall may be excused only if the resource was on a PJM-approved Generator Planned Outage, Generator Maintenance Outage, or the resource "was not scheduled to operate by [PJM], or was online but was scheduled down, by [PJM], based on a determination by [PJM] that such scheduling action was appropriate to the security-constrained economic dispatch of the PJM Region."[24]

Moreover, there is a crucial caveat to that second exception: a resource shall be assessed Non-Performance Charges to the extent it "otherwise was needed and would have been scheduled by [PJM] to perform, but was not scheduled to operate, or was scheduled down, solely due to: (i) any operating parameter limitations submitted in the resource's offer, or (ii) the seller's submission of a market-based offer higher than its cost-based [offer]."[25]

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[20] *See* Tariff, Attachment DD, section 10A(c) (prescribing comparison of Actual Performance against Expected Performance); Tariff, Definitions – E-F (defining Emergency Action), *id.*, Definitions – O-P-Q (defining Performance Assessment Interval).

[21] CP Rehearing Order at P 72.

[22] CP Rehearing Order at P 29.

[23] CP Order at P 167.

[24] Tariff, Attachment DD, section 10A(d).

[25] Tariff, Attachment DD, section 10A(d).

As a result of the very limited excuses from Non-Performance Charges, Capacity Market Sellers are responsible for ensuring resource performance, and thus "bear the burden of delivering on their capacity obligation."[26] When it comes to the issue of fuel procurement, "[a] natural gas generator is held responsible for arranging sufficient natural gas deliveries despite pipeline outages and this same principle should apply to all such outages."[27] In other words, Capacity Market Sellers, not PJM or load, bear the responsibility and risks associated with ensuring Capacity Resources are available to perform during emergencies. In this way, the Non-Performance Charge "holds capacity resources accountable for delivering on their capacity commitments"[28] and "provide[s] incentive to capacity sellers to invest in and maintain their resources by tying capacity revenues more closely with real-time delivery of energy and reserves during emergency system conditions."[29]

Capacity Resources are not paid to simply stand by; they are paid to be available to perform and serve PJM's loads. Thus, Capacity Market Sellers should assume that their resources will be needed, at a minimum, any time the PJM Region is under a declared emergency for capacity shortages. If Capacity Market Sellers need to purchase natural gas and self-schedule to ensure that their Capacity Resources can be available when needed,

[26] CP Rehearing Order at P 110.

[27] CP Rehearing Order at P 110.

[28] CP Rehearing Order at P 18.

[29] CP Order at P 158; *see also* CP Rehearing Order at P 88 ("Capacity sellers need to make the investment and maintenance decisions ahead of time to reduce the probability that they will consistently, and for prolonged periods, be unable to deliver energy during Performance Assessment Hours.").

then sellers of gas-fueled Capacity Resources should engage in such forward-looking behavior.[30]

### *B. PJM Exercised Its Discretion to Declare Emergency Actions During Winter Storm Elliott in Response to Very Challenging, Rapidly Changing Conditions, Including Unexpectedly High Demand and Unexpectedly High Forced Outages*

#### *1. The PJM Region faced unprecedented, rapidly changing conditions during Winter Storm Elliott.*

Winter Storm Elliott, lasting from December 23, 2022, through December 25, 2022, caused record cold temperatures across the PJM Region.[31] The severe cold weather on December 23,[32] including a record-breaking temperature drop of 29 degrees Fahrenheit over 12 hours on that day surpassed the previous PJM record of a 22-degree drop during the 2014 Polar Vortex.[33] Adding to the grid management challenges, the overnight minimum load in the early morning hours of December 24 was by far the highest on record for that date—exceeding by 40,000 megawatts ("MW") the second highest minimum overnight load on that date in the prior decade.[34] The challenges were

[30] Generators have recognized that the Capacity Performance rules require that "the generator must manage its fuel supply risks and ensure that it is able to perform when called to do so by PJM." *See PJM Interconnection, L.L.C.*, Answer of Direct Energy to PJM Interconnection, L.L.C.'s Motion for Leave to Answer and Answer, Docket No. ER19-664-000, at 3 (Feb. 14, 2019).

[31] *See Winter Storm Elliott Frequently Asked Questions*, PJM Interconnection, L.L.C., 3 (Apr. 12, 2023), https://www.pjm.com/-/media/markets-ops/winter-storm-elliott/faq-winter-storm-elliott.ashx ("Winter Storm Elliott FAQ").

[32] All dates noted in this chronology are in 2022.

[33] *See* Winter Storm Elliott FAQ at 3.

[34] *See* Mike Bryson, Sr. et al., *Winter Storm Elliott*, PJM Interconnection, L.L.C., 8 (Jan. 13, 2023), https://pjm.com/-/media/committees-groups/committees/mic/2023/20230111/item-0x---winter-storm-elliott-overview.ashx ("Winter Storm Elliott Overview").

exacerbated by almost a third of PJM's generation fleet (about 47,000 MW) taking unplanned (i.e., forced) outages during these emergency conditions.[35]

*2. PJM deployed its available tools to give generators advance notice of the need to prepare for challenging conditions.*

Beginning on December 20, PJM issued multiple Cold Weather Advisories and Cold Weather Alerts on both a regional basis and an entire RTO basis. These various types of advisories and alerts, detailed in the timeline presented in Attachment A, were intended to elevate awareness of impending conditions and provide notice to Members—including those responsible for Capacity Resources—so they could prepare personnel and facilities for extreme cold weather conditions.

*3. PJM declared Emergency Actions during December 23 and December 24 as part of PJM's successful effort to preserve reliability.*

On the morning of December 23, PJM started the operating day with approximately 133 gigawatts ("GW") of energy committed in the Day-Ahead Market and an additional 9 GW of available 30-minute reserves, notwithstanding the approximately 12 GW of unplanned (forced) outages that were reported for the PJM generation fleet.[36] A total of 158,000 MW of generation reported as available on the morning of December 23, exceeding the then-forecasted PJM Region peak of about 127,000 MW and leaving (at that time) almost 29 GW of reserve capacity expected to be available to absorb load increases and generation contingencies and support PJM's neighboring systems.[37] For comparison,

[35] Operating Committee, *Winter Storm Elliott Generator Performance*, PJM Interconnection, L.L.C. (Feb. 9, 2023), https://www.pjm.com/-/media/committees-groups/committees/oc/2023/20230209/20230209-item-04---winter-storm-elliott-generator-performance.ashx.

[36] *See* Winter Storm Elliott FAQ at 3, 7.

[37] *See* Winter Storm Elliott Overview at 5.

PJM's day-ahead reserve requirement for December 23 was 3 GW, making the projected 29 GW of reserves very conservative.

However, as the day went on, temperatures plunged incredibly quickly and demand spiked. At the same time, PJM began seeing high levels of forced generation outages.[38] PJM responded by exercising its discretion to invoke its Emergency-related authorities, including calling upon generators with capacity commitments, deploying Synchronized Reserves, initiating RTO-wide Maximum Generation Emergency Actions, and calling on demand response resources. At 17:30 on December 23, PJM declared a Pre-Emergency Load Management Reduction Action and a Maximum Generation Emergency Action through 23:59 on December 23.[39] The declaration of the Maximum Generation Emergency Action triggered Performance Assessment Intervals and put all on notice of the severity of the emergency conditions facing the PJM Region.[40] During the evening of December 23, with (as previously noted) power demand rising to a peak of about 135,000 MW and generator forced outages increasing to 34,500 MW,[41] at 23:00, PJM declared a Maximum Generation Alert and Load Management Alert, starting December 24 at 00:00.[42]

Given the persistent high load demand and high forced outage rates (rising up to about 47,000 MW by the morning peak, as previously noted) on the morning of December

[38] *See* Winter Storm Elliott Overview at 12.

[39] *See* Attachment A at 3. Although it was issued to be in effect through 23:59, PJM cancelled the Maximum Generation Emergency Action at 23:00. *Id.*

[40] Performance assessment hours are triggered when PJM declares an Emergency Action. Tariff, Attachment DD, section 10.A(a). An Emergency Action is defined as "locational or system-wide capacity shortages" that cause "pre-emergency mandatory load management reductions or . . . a more severe action." Tariff, Definitions – E-F.

[41] *See* Winter Storm Elliott FAQ at 3.

[42] *See* Attachment A at 3.

24, PJM continued to invoke its various alerts and authorities to manage the Emergency and maintain reliability, and to put all Market Participants on notice of the urgent need for capacity. Thus, PJM issued a rare public Region-wide call for conservation from 04:00 on December 24 to 10:00 on December 25.[43] At 04:20, PJM issued a Pre-Emergency Load Management Reduction Action, and an Emergency Load Management Reduction Action.[44] On December 24, PJM issued a Maximum Generation Emergency for the period from 04:28 to 22:00, triggering Performance Assessment Intervals.

Additionally, around 06:30 on December 24, in response to generators starting to inform PJM operators that their resources were reaching their emission runtime limits, PJM began working with the U.S. Department of Energy ("DOE") to obtain an emergency order pursuant to section 202(c) of the Federal Power Act ("FPA"). PJM petitioned DOE for a declaration of energy emergency on the afternoon of December 24.[45] At 17:30, DOE issued the requested FPA section 202 emergency order,[46] authorizing all electric generating units serving the PJM Region to operate up to their maximum generation output levels under limited, prescribed circumstances, even if doing so exceeded their air quality or other permit limitations. The DOE emergency order lasted from 17:30 on December 24 through 12:00 on December 26.[47]

[43] *See* Attachment A at 4.

[44] *See* Attachment A at 4.

[45] Request for Emergency Order Under Section 202(c) of the Federal Power Act of PJM Interconnection, L.L.C., Dept. of Energy (Dec. 24, 2022) https://www.energy.gov/sites/default/files/2022-12/PJM%20202%28c%29%20Request.pdf.

[46] *See* Department of Energy, Order No. 202-22-4 (Dec. 24, 2022), https://www.pjm.com/-/media/documents/ferc/orders/2022/20221224-pjm-202c-doe-order.ashx.

[47] *Id*.

PJM's actions helped preserve reliability during this very challenging period. *Most importantly, PJM did not shed any load during Winter Storm Elliott.*

## III. ANSWER TO COMPLAINT

### *A. PJM Prepared for Winter Storm Conditions and Provided Notice to Capacity Market Sellers in Accordance with Its Emergency Procedures.*

From the outset, the Complaint seeks to put the onus of Capacity Performance back on PJM and, by extension, back on load, by blaming PJM for its inability to perform when called upon.[48] According to Invenergy, PJM's Cold Weather Advisories and Cold Weather Alerts did not provide generators with adequate notice of the storm's severity and "PJM's load forecasts gave no indication that additional resources would be needed to satisfy demand."[49] As Joseph Mulhern, Lead Engineer, Market Coordination, for PJM explains in his affidavit, PJM's load forecasts for December 23 and 24, 2022, were reasonable given the information PJM had at the time.[50] However, as Mr. Mulhern explains, "the weather and load conditions on December 23 and 24 could not have reasonably been anticipated because, by every objective measure, those conditions were extremely abnormal."[51] More to the point, Mr. Mulhern notes that load forecasts are not the only driver of PJM's generation commitments.[52]

Invenergy further argues that because it was not committed in the day-ahead market for December 23, was not committed to operate on December 23 in the Reliability

[48] Complaint at 1-3.

[49] Complaint at 3.

[50] Attachment D, Affidavit of Joseph Mulhern on Behalf of PJM Interconnection, L.L.C., Exhibit 1 ¶ 7 ("Mulhern Aff.").

[51] Mulhern Aff. ¶ 8.

[52] Mulhern Aff. ¶ 12.

Assessment Commitment Run, and "had not been directed by PJM to operate" on December 23 or 24, it was not aware that it would be expected to operate on December 24.[53] These assertions ignore PJM's markets, designed to send economic signals to incent Capacity Market Sellers to ensure that their Capacity Resources will be able to perform, and reduce them to PJM directing Capacity Market Sellers that they will be needed to operate a day in advance.

Day-ahead indications from the market obviously cannot be determinative of emergency operations; indeed, day-ahead results do not limit real-time operations. Lack of a day-ahead commitment does not mean a generating facility will not be needed in real-time or in emergency conditions, as conditions change from the day-ahead to real-time and tend to change even more in emergencies. Invenergy's claims regarding unit commitment the day before therefore have no bearing on Invenergy's unavailability during the capacity emergency.

Invenergy also tries to turn a specific advance commitment of gas-fired generators for reliability into a general requirement for PJM to give all gas-fired generators 24 hours' advance notice that they will be needed online and should procure fuel.[54] Invenergy argues that the following provision requires PJM to give them 24-hours' notice of when they will be dispatched so they know they need to procure gas: "PJM Dispatch will notify the generator owner that the unit is required to be online and ready to follow PJM Dispatch signals at XX:XXhrs on XX day for reliability."[55] Invenergy ignores the immediately

[53] Complaint at 3.

[54] Complaint at 12 (citing Manual 13, section 3.3.2).

[55] Complaint at 6 (quoting Manual 13, section 3.3.2).

preceding provision, however, which limits the application of the advance notice of dispatch time to a specific set of circumstances, namely:

> PJM Dispatch reviews the load forecast, interchange forecast, the increased MW unavailability from the tables below and generator Times to Start (Start-Up + Notification in Markets Gateway) to confirm if the Day Ahead Market will be able to clear sufficient generation that can be on-line to meet the reliability needs of the system for the operating day. *If sufficient generation cannot be cleared in the Day Ahead market based the start-up + notification time, the following processes will be used to commit generation in advance of the Day Ahead Market*: . . . .[56]

Complainants do not allege—and cannot allege because it did not occur—that the predicate for the notice provision they rely upon was ever met: PJM operators *never* determined that the Day Ahead Market could not clear sufficient resources to meet reliability needs. And, in fact, the Day Ahead Market did clear for both December 23 and 24 with sufficient resources to meet anticipated load. In short, the provision Invenergy relies upon has no application here and thus could not possibly supply a basis for excusing the assessment of Non-Performance Charges on Invenergy.

In addition, at the time that Invenergy would have PJM providing 24-hours' advance notice of the need to procure fuel for the early morning hours of December 24, i.e., in the early morning hours of December 23, PJM operators had no reason to expect they would need Invenergy's facility to operate. At that time, PJM operators anticipated having approximately 29 GW of reserve capacity and could not have reasonably expected the extraordinarily poor generator performance that occurred, in which many of the generating units that were committed in the Day-Ahead Market for December 23 failed to come online. Invenergy is simply applying 20/20 hindsight.

[56] Manual 13, section 3.3.2 (emphasis added).

Invenergy's argument seems to be that it was somehow unfair for PJM not to direct it to procure fuel in advance and then penalize it for not doing so. But the inability of certain generators to be available when called by PJM resulted from their own economic decisions. Many other generators whose primary fuel is natural gas operated without the kind of advance notice that Invenergy asserts they should have received.[57] Invenergy chose not to make the necessary investments to be available when called during an emergency like Winter Storm Elliott and now complains about the consequences of its decisions.

### *B. PJM's Emergency Actions—Including Its Support to Neighboring Systems in Distress—Complied with the Tariff, Operating Agreement, NERC Requirements, and Manuals.*

#### *1. Commission policy and the governing provisions of the Tariff and Operating Agreement afford PJM substantial discretion and the needed tools and flexibility to declare, manage, and resolve emergencies.*

As noted above in Section II.A, Non-Performance Charges are assessed during Performance Assessment Intervals, which are triggered by PJM's declaration of certain types of procedures that qualify as Emergency Actions. The Commission has repeatedly recognized the importance of affording RTOs, such as PJM, the discretion to respond to operational circumstances related to reliability concerns, and the Tariff and Operating Agreement assign PJM the central role in declaring and managing emergencies, with few if any express Tariff conditions on how PJM implements that vital responsibility.

For context, the Commission has long recognized that "[t]he reality of pool operations is a continuous matching of load and supply that requires every system operator

[57] Other natural gas generators "procure[d] gas despite not having prior notice that PJM would need the facility to operate," including "purchasing same-day natural gas at an extremely high price without any guarantee that [the Capacity Market Seller] would be able to recover the gas costs through market prices." Protest of Constellation Energy Generation, LLC, to PJM Interconnection L.L.C.'s Motion for Establishment of Settlement Judge Procedures, Docket Nos. EL23-53, et al., at 8 (Apr. 24, 2023).

to have the flexibility to respond to operational crises as they develop."[58] Applying this policy, the Commission recently declined to specify requested criteria that "could restrict operators' ability to apply their expert judgment to actual conditions on the system in making decisions to maintain reliable operations."[59] In the same vein, the Commission has found that "it may be appropriate to provide operational and reliability-related discretion to independent system operators, and to not second-guess their decisions in that regard."[60]

Understandably, the need for such discretion is most acute during emergencies, and PJM's governing documents are designed to not unduly constrain PJM's efforts to address emergencies. Most importantly, the Operating Agreement (executed by all Capacity Market Sellers, among others), without elaboration, assigns to PJM the authority to declare an Emergency and manage grid operations to ensure reliability and alleviate or end the Emergency.[61] The Operating Agreement broadly defines "Emergency" to include "an abnormal system condition requiring manual or automatic action to maintain system frequency, or to prevent loss of firm load, equipment damage, or tripping of system elements that could adversely affect the reliability of an electric system or the safety of persons or property;" and "a condition that requires implementation of emergency procedures as defined in the PJM Manuals."[62]

[58] *Me. Pub. Utils. Comm'n*, 97 FERC ¶ 61,322, at P 26 (2001).

[59] *PJM Interconnection, L.L.C.*, 180 FERC ¶ 61,051, at P 82 (2022).

[60] *Big Sandy Peaker Plant, LLC*, 154 FERC ¶ 61,216, at P 50; *see also Midcontinent Indep. Sys. Operator, Inc.*, 164 FERC ¶ 61,129, at P 37 (2018) ("We find that it is appropriate for MISO to have discretion to respond to operational circumstances related to reliability concerns.").

[61] Operating Agreement, section 10.4(xx).

[62] Operating Agreement, Definitions – E-F.

Implementing this responsibility, PJM has an entire manual solely devoted to Emergency Operations.[63] That manual opens with policy statements that provide the essential context for the details that follow, explaining that "Power system disturbances" which can occur "as the result of loss of generating equipment . . . or as the result of unexpected load changes . . . may be of, or develop into, a magnitude sufficient to affect the reliable operation of the PJM RTO and/or the Eastern Interconnection;" and stressing that "[t]hese events demand timely, decisive action to prevent further propagation of the disturbance."[64] PJM's overarching responsibility during Emergencies is "[t]aking actions *[PJM] determines* are consistent with Good Utility Practice and are necessary to maintain the operational integrity of the PJM RTO and the Eastern Interconnection."[65]

As particularly relevant here, the Tariff defines "Emergency Actions" that trigger Performance Assessment Intervals as "any emergency action for locational or system-wide capacity shortages that either utilizes pre-emergency mandatory load management reductions or other emergency capacity, or initiates a more severe action."[66] One such action, declared here, is a "Maximum Generation Emergency" which means "an Emergency *declared by [PJM]* to address either a generation or transmission emergency in which *[PJM] anticipates* requesting one or more Generation Capacity Resources . . . to operate at its maximum net or gross electrical power output, subject to the equipment stress limits for such Generation Capacity Resource . . . in order to manage, alleviate, or end the Emergency."[67]

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[63] *See generally* Manual 13.

[64] Manual 13, section 1.1.

[65] *Id.* (emphasis added); *see also* Tariff, Definitions – G-H (defining Good Utility Practice).

[66] Tariff, Definitions – E-F.

[67] Tariff, Definitions – L-M-N (emphasis added).

*2. PJM's Manual 13 does not require the prerequisite steps Invenergy claims are necessary.*

Invenergy asserts that PJM's Manual 13 *requires* PJM to curtail non-firm exports before it can initiate Emergency Actions (i.e., a Maximum Generation Emergency Action or a Pre-Emergency or Emergency Load Management Reduction Action) that trigger Performance Assessment Intervals. Having established this false premise, Invenergy argues that PJM's failure to curtail non-firm exports before declaring a Maximum Generation Emergency Action and initiating Load Management Reductions constitutes a violation of the Tariff and Manuals and effectively forced Capacity Resources to support neighboring Control Areas.[68] Invenergy cites Manual 13, section 2.3.2 and the complaint filed by an *ad hoc* group of complainants called the "ComEd Zone Generators"[69] that own or operate natural gas-fired generation facilities located in the portion of northern Illinois, including the Chicago metropolitan area, served by ComEd. Invenergy errs, just as the ComEd Zone Generators erred, in arguing that Manual 13 *requires* PJM to curtail exports before declaring or during an Emergency Action. In fact, the Tariff, Operating Agreement, Manual 13, and applicable NERC standards provide PJM with great authority and discretion in declaring emergencies and great flexibility in addressing emergency conditions.

Contrary to Invenergy's assertions, PJM acted properly throughout Winter Storm Elliott. PJM properly exercised its authority under the Operating Agreement authority to declare an Emergency and manage grid operations to ensure reliability and alleviate or end

[68] Complaint at 10.

[69] *See Aurora Generation, LLC*, Complaint Requesting Fast Track Processing and Shortened Answer Period, and Request for Interim Order Suspending Billing and Payment Provisions, Docket No. EL23-54-000 (Apr. 4, 2023) ("ComEd Zone Generators Complaint").

the Emergency.[70] PJM maintained reliability in the face of severe weather and unprecedented generator performance failures. When able, PJM also lent support to neighboring systems in their time of need, but recalled such exports when needed to maintain reliability. As discussed below, and in the attached affidavits of Messrs. Bryson and Naumann, PJM had ample authority to allow non-firm exports during Winter Storm Elliott when PJM believed it could assist neighboring systems without jeopardizing PJM. In addition, "because PJM did not initiate Load Management procedures for the purpose of assisting other regions, PJM was not constrained from providing exports to regions experiencing or attempting to avoid capacity deficient conditions."[71] PJM committed no Manual 13, Tariff, or Operating Agreement violations.

Mr. Bryson explains that PJM is required under the Tariff, Operating Agreement, Manual 37, Manual 13, NERC reliability standards, and agreements with other Balancing Authorities to provide emergency assistance to neighboring regions when possible.[72] PJM met these obligations and satisfied Good Utility Practice by "help[ing] adjacent Balancing Areas to the extent feasible without shedding load in PJM."[73] If PJM had done otherwise it would have been acting contrary to such requirements and contrary to how PJM operators are trained to act in emergency situations. In the face of an uncertain load forecast and "shockingly poor" generator performance, PJM operators appropriately took pre-

[70] Operating Agreement, section 10.4(xx).

[71] Bryson Aff. ¶ 6.

[72] *See* Bryson Aff. ¶¶ 7-19.

[73] Bryson Aff. ¶ 19. Further, PJM is authorized by the Tariff "to direct or coordinate corrective action, whether or not specified in the PJM Manuals, as necessary to alleviate unusual conditions that threaten the integrity or reliability of the PJM Region, or the regional power system." *See* Tariff, Attachment K-Appendix, section 1.7.15; Operating Agreement, Schedule 1, section 1.7.15.

emergency and Emergency Actions and avoided "risking that PJM could avoid load-shedding by curtailing non-firm exports."[74] As Mr. Bryson explains, "PJM prioritized meeting its own load by cutting exports—both firm and non-firm—when necessary."[75] But "once PJM had sufficient capacity to provide assistance to other Balancing Areas, it was obligated to do so."[76] On both December 23 and 24, 2022, even if PJM had curtailed all non-firm exports, pre-emergency and Emergency Actions would still have been necessary.[77]

*a. Manual 13 does not and cannot prohibit exports to neighboring systems during emergencies.*

Invenergy asserts that Manual 13, section 2.3.2 requires PJM to curtail exports *prior* to calling an emergency.[78] This claim has no merit.

As an initial matter, "[t]he PJM Manuals are the instructions, rules, procedures, and guidelines established by PJM for the operation, planning, and accounting requirements of PJM and the PJM Energy Market."[79] Thus, Manual 13 refers to "expected" behaviors, not compulsory conduct, and Manual 13, like all manuals, is supplementary to the Tariff and Operating Agreement. As discussed, PJM has broad authority under the Tariff and Operating Agreement to declare emergencies and decide what steps to take to avoid, mitigate, or shorten emergencies.[80] Nothing in the PJM Manuals could limit the ability of

[74] Bryson Aff. ¶ 19.

[75] Bryson Aff. ¶ 23.

[76] Bryson Aff. ¶ 30.

[77] *See* Bryson Aff. ¶¶ 21-22.

[78] Complaint at 10.

[79] Manual 13 at 9.

[80] *See, e.g.*, Operating Agreement, section 10.4(xx).

the PJM operators to address emergency conditions under the discretionary authority conferred in the Tariff and Operating Agreement, including *requiring* PJM to curtail non-firm exports upon declaring an emergency.

There are good and obvious reasons for the Tariff, Operating Agreement, and Manual 13 to give PJM broad flexibility during emergencies.[81] As Mr. Naumann explains, preserving reliability can be extremely challenging "when system operators face severe conditions, especially where decisions need to be made within a short period of time and circumstances are rapidly changing."[82] It therefore, "should be no surprise that operators may take actions in real-time to address difficult problems that others may question after the fact as being overly conservative or uneconomic."[83] That is exactly what Invenergy seeks to do here. But it is critical to remember that during emergencies, "delaying actions can result in unnecessary loss of load" and it is vitally "important for operators to be proactive—i.e., stay ahead of potential problems, not reactive after problems occur—to ensure reliability, especially during periods of severe stress."[84] Simply stated, "operators have to make decisions based on current conditions, expected conditions, and the

[81] PJM's Tariff and Operating Agreement also incorporate mutual assistance principles. *See* Tariff, Attachment K-Appendix, section 1.6.2(vi) (PJM shall "[a]dminister . . . agreements for the transfer of energy in conditions constituting an Emergency in the PJM Region or in an interconnected Control Area, and the mutual provision of other support in such Emergency conditions with other interconnected Control Areas"); Operating Agreement, Schedule 1, section 1.6.2(vi) (same); Tariff, Attachment K-Appendix, section 1.6.2(vii) (PJM shall "[c]oordinate the curtailment or shedding of load, or other measures appropriate to alleviate an Emergency, in order to preserve reliability in accordance with NERC, or Applicable Regional Entity principles, guidelines and standards, and to ensure the operation of the PJM Region in accordance with Good Utility Practice and this Agreement"); Operating Agreement, Schedule 1, section 1.6.2(vii) (same).

[82] Naumann Aff. ¶ 6.

[83] Naumann Aff. ¶ 6.

[84] Naumann Aff. ¶ 6.

uncertainty of various elements of the system with an eye to preventing loss of load. They must have flexibility."[85]

Given the well-founded need for flexibility, Manual 13 does not and cannot prohibit non-firm exports to neighboring systems during emergencies. Manual 13 is replete with statements confirming that operators have broad discretion to deviate from the Manual 13 procedure when necessary to preserve reliability.[86] Section 1.1 of Manual 13 begins by declaring that "the policy of PJM is to maintain, at all times, the integrity of the PJM RTO transmission systems *and* the Eastern Interconnection, and to give maximum reasonable assistance to adjacent systems when a disturbance that is external to the PJM RTO occurs."[87] Section 1.1 continues that PJM must take actions "it determines are consistent with Good Utility Practice and are necessary to maintain the operational integrity of the PJM RTO *and* the Eastern Interconnection."[88] In this vein, section 2.3 explicitly provides that "PJM dispatchers have the flexibility of implementing the emergency procedures in whatever order is required to ensure overall system reliability" and "the flexibility to exit the emergency procedures in a different order than they are implemented when conditions necessitate."[89]

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[85] Naumann Aff. ¶ 16.

[86] *See* Bryson Aff. ¶¶ 11-12; Naumann Aff. ¶¶ 14-15. Other PJM Manuals likewise reflect the broad range of PJM's discretion to take appropriate actions during emergencies. Manual 37 states that "PJM Members are responsible for . . . [t]aking any action, as requested or directed by PJM, to manage, alleviate, or end an Emergency or other reliability issue." Systems Operation Division, *PJM Manual 37: Reliability Coordination*, PJM Interconnection, L.L.C., 9 (Mar. 23, 2022), https://www.pjm.com/-/media/documents/manuals/archive/m37/m37v19-reliability-coordination-03-23-2022.ashx.

[87] Manual 13, section 1.1 (emphasis added).

[88] Manual 13, section 1.1 (emphasis added).

[89] Manual 13, section 2.3.

Similarly, section 2.3.2, which addresses "Real-Time Emergency Procedures (Warnings and Actions)," preserves PJM's operational flexibility during emergencies. Section 2.3.2 provides that "[d]ue to system conditions and the time required to obtain results, PJM dispatchers may find it necessary to vary the order of application [of Warnings and Actions in real time] to achieve the best overall system reliability."[90] PJM can therefore "deviate from or change the order of the above actions [pertaining to Maximum Generation Emergency Action] as/if necessary."[91] A specially highlighted "Note" in section 2.3.2 emphasizes that "[t]he Real-Time Emergency Procedures section combines Warnings and Actions in their most probable sequence based on notification requirements during extreme peak conditions."[92]

Section 2.3.2 has a specific procedure for determining whether to cut transactions to other Balancing Authorities if PJM has declared a Maximum Emergency Action. Specifically, Mr. Bryson explains that "[t]his provision gives such transactions, when made known to PJM, a priority almost as high as native load stating that '[i]f the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed then PJM will not curtail the transactions unless it would prevent load shedding within PJM.'"[93] Accordingly, Mr. Bryson concludes that "[c]learly, given this directive, there cannot be a mandatory requirement that PJM must cut all non-firm exports before taking an Emergency Action."[94]

[90] Manual 13, section 2.3.2.

[91] Manual 13, section 2.3.2.

[92] Manual 13, section 2.3.2.

[93] Bryson Aff. ¶ 15 & n.35 (quoting Manual 13, section 2.3.2).

[94] Bryson Aff. ¶ 15.

*b. Curtailing non-firm exports would not have resolved the emergency conditions.*

Underlying the Complaint's arguments is the notion that if PJM had curtailed exports PJM would not have triggered Performance Assessment Intervals by declaring Emergency Actions, including Pre-Emergency Load Management Reduction Actions, Emergency Load Management Reduction Actions, and Maximum Generation Emergency Actions. But, as Mr. Bryson testifies, "[c]urtailing all non-firm transactions would not have alleviated the conditions that compelled the decision of the PJM operators to take Emergency Actions."[95]

Mr. Bryson demonstrates that, for the Emergency Actions triggering Performance Assessment Intervals on December 23, "even if the operators had cut all non-firm exports there would have been a deficit of at least 1,789 MW needed to satisfy PJM load and firm exports," and "Pre-Emergency and Emergency Actions thus would have been necessary to satisfy capacity needs even if all non-firm exports had been cut."[96] Likewise, for the Emergency Actions triggering Performance Assessment Intervals on December 24, "even if the operators had cut all non-firm exports there would have been a deficit between about 4,688 MW and 2,920 MW during this period needed to satisfy PJM load and firm exports."[97] PJM's declaration of "Pre-Emergency and Emergency Actions thus would have been necessary even if all non-firm exports had been cut."[98]

[95] Bryson Aff. ¶ 19.

[96] Bryson Aff. ¶ 21.

[97] Bryson Aff. ¶ 22.

[98] Bryson Aff. ¶ 22.

Moreover, PJM *did curtail* non-firm exports when necessary. Mr. Bryson provides evidence that there were a "significant number of hours in which the assistance requested by other regions was not supplied," and that those hours "correlate[] to the periods when PJM needed most of its generation for internal loads notwithstanding that during some [of] these times other regions were seeking emergency supplies."[99]

Finally, Mr. Bryson provides insight that "the PJM's operators' reasons for taking Pre-Emergency and Emergency Actions [on December 24] related mainly to uncertainty in the load forecast and the surprisingly poor overall performance of generation."[100] He explains that the poor performance of Capacity Resources on December 23 reasonably informed PJM operators' decisions on December 24, and led to concerns about PJM's ability to meet the evening peak on December 24. "In particular, operators were concerned that if the Maximum Generation Emergency Action and the Pre-Emergency/Emergency Load Management Reduction Action were rescinded and PJM attempted to reinstate them in the face of a high evening peak on December 24, there could be a significantly lower response rate," i.e., "[i]f allowed to go offline, some generators might not restart due to the cold weather conditions or units running on gas might resell their gas supply."[101] Thus, "PJM's ability to allow some non-firm exports to flow during the time leading up to the [December 24] evening peak was not indicative as to whether PJM could meet the evening peak without Emergency Actions even if all non-firm exports were curtailed."[102]

[99] Bryson Aff. ¶ 23.

[100] Bryson Aff. ¶ 40.

[101] Bryson Aff. ¶ 26.

[102] Bryson Aff. ¶ 25.

*3. PJM has the ability to declare an RTO-wide capacity emergency and appropriately did so.*

Invenergy argues that it should be excused from Non-Performance Charges assessed for Performance Assessment Intervals after 06:00 on December 24 because beginning at that time "there was no emergency in the ComEd Zone that warranted emergency actions by PJM."[103] Invenergy again relies on complaints filed by other generators that supposedly "demonstrate[]" that after that time there was excess energy supply in the ComEd Zone due to congestion on transmission lines between the ComEd Zone and the rest of PJM, such that generators could not alleviate the capacity emergency in the rest of PJM even if they were operating.[104] Invenergy even argues that the alleged congestion amounts to an excuse for Non-Performance Charges based on the second exception to the charges, for generators PJM schedules down consistent with security-constrained economic dispatch in the PJM Region.[105]

As with its other claims, Invenergy is mistaken. Its argument as to conditions in the ComEd Zone on December 24 is based on 20/20 hindsight that was obviously not available to PJM's operators confronting emergency conditions in real time. Mr. Naumann points out the fundamental flaws in the approach taken in the other complaints on which Invenergy relies, "[t]his type of *post hoc* economic analyses and other varieties of 'Monday morning quarterbacking' are irrelevant to the question of whether operators acted reasonably and in accordance with Good Utility practice."[106] Complainants effectively

[103] Complaint at 14.

[104] Complaint at 14-15 & n.48 (citing ComEd Zone Generators Complaint at 4-5).

[105] Complaint at 15.

[106] Naumann Aff. ¶ 29.

claim that "PJM should have rolled the dice, wagering that generation from their units would not be needed for the duration of the emergency because the Complainants' *post hoc* analysis suggests those units were not arguably needed to supply load to the ComEd Zone."[107] The critical flaw in Complainants' *post hoc* reasoning is that "it treats the successful performance by *other* generators as a given; however, the PJM operators had no such luxury when they were managing the emergency in real time."[108] Complainants overlook the fact that outcomes could have been much different if one or more additional resources had tripped.

The argument that transmission constraints east of the ComEd Zone meant that bringing Invenergy's facility on line could not have helped to increase the supply of energy available to other PJM zones suffers from the same flaw.[109] It is yet another *post hoc* claim that presents an incomplete and misleading view of the operating situation. As Mr. Naumann explains, "even if transmission was constrained east of ComEd at particular times, PJM operators had to be prepared to have sufficient generation available in other time periods and also in the event of foreseeable contingencies that would have required increases in generation in the ComEd Zone."[110]

The Complaint also ignores the fact that "PJM is a centrally dispatched balancing area" and that "PJM does not dispatch the system based on individual transmission owner zones."[111] Thus it does not matter that there was more generation than load in the ComEd

[107] *Id.* ¶ 33

[108] *Id*.

[109] *See* Complaint at 15.

[110] Naumann Aff. ¶ 34.

[111] Attachment E, Affidavit of Paul F. McGlynn on Behalf of PJM Interconnection, L.L.C., Exhibit 1 ¶ 65 ("McGlynn Aff.").

Zone during Winter Storm Elliott. Had resources like Invenergy's been available in addition to the generation resources in the ComEd Zone that were online, "they would have helped to address the PJM-wide capacity emergency and they would have also helped to reduce the constraints in the ComEd Zone."[112] As Mr. McGlynn explains, PJM performed an engineering analysis after Winter Storm Elliott using data reflecting the transmission system topology during the relevant period and showed that PJM could have reliably accommodated 5,001 to 5,845 MW at specific times on December 24.[113]

In short, Invenergy's claims concerning the ComEd Zone are contrary to the reality that the ComEd Zone is not an electrical island, but is an integrated part of the PJM region. Manual 13, sections 2.2 and 2.3.2, both provide PJM with broad flexibility. Section 2.2 incorporates a presumption that "PJM issues capacity emergencies across the entire PJM RTO."[114] Most important, section 2.2 reflects a prevailing understanding that capacity shortages are to be addressed regionally, not locally.

Further, Manual 14B establishes that, "within an area experiencing a localized capacity emergency, or deficiency, energy must be deliverable from the aggregate of the available Capacity Resources to load."[115] Also, "Capacity Resources within a given electrical area must, in aggregate, be able to be exported to other areas of PJM."[116] Taken

[112] McGlynn Aff. ¶ 67.

[113] McGlynn Aff. ¶¶ 68-69.

[114] Manual 13, section 2.2.

[115] Transmission Planning Department, *PJM Manual 14B: PJM Regional Transmission Planning Process*, PJM Interconnection, L.L.C., Attachment C, section C.1.2 (Dec. 15, 2021), https://www.pjm.com/-/media/documents/manuals/archive/m14b/m14bv51-pjm-regional-transmission-planning-process-12-15-2021.ashx.

[116] *Id.*

together, these requirements ensure that the PJM Transmission System is adequate for delivery of energy from the aggregate of Capacity Resources to the aggregate of PJM load.

After 06:00 on December 24, PJM operators continued to be very concerned about the state of the PJM system. They reasonably feared based on events on December 23 and the morning of December 24 that PJM might not be able to meet the RTO-wide evening peak. Contrary to the Complaint, retaining the pre-emergency and Emergency Actions in ComEd during December 24 served an important purpose. It increased the probability that sufficient ComEd Zone generation would be available for the evening peak. At that point in time, ComEd Zone generators might have been needed to serve load in the ComEd Zone or, with changing system conditions, additional ComEd Zone generation may have been deliverable to the rest of PJM consistent with the planning criteria.[117]

PJM operators were also concerned that if the Maximum Generation Emergency Action and the Pre-Emergency/Emergency Load Management Reduction Action were rescinded and PJM then tried to reinstate them to meet a potentially high evening peak on December 24, there could be a significantly lower response rate. If allowed to go offline, some generators might not restart due to the cold weather conditions or units running on gas might resell their gas supply. In addition, if Demand Resources were released and allowed to resume normal power consumption, PJM operators were concerned that those resources might not be willing or able to redeploy if called again prior to the evening peak. These concerns were well grounded in PJM's practical experience with demand response.[118]

[117] *See* Bryson Aff. ¶ 26.

[118] *See id.* ¶ 27.

PJM is under no obligation to avoid declaring regional emergencies solely because emergency conditions might not exist at that moment in a particular zone. Nor must it end regional emergencies as soon as it appears that an emergency might have ceased in a particular zone. Instead, PJM's operators have discretion to exercise their judgment in the face of uncertainty. They must have the ability to exercise that discretion without being distracted by economic arguments such as those in the Complaint.

## IV. ADMISSIONS AND DENIALS PURSUANT TO 18 C.F.R. § 385.213(c)(2)(i)

Pursuant to Rule 213(c)(2)(i) of the Commission's rules of Practice and Procedure,[119] PJM affirms that any allegation in the Complaint that is not specifically and expressly admitted above is denied.

## V. AFFIRMATIVE DEFENSES PURSUANT TO 18 C.F.R. § 385.213(c)(2)(ii)

PJM's affirmative defenses are set forth above in this answer, and include the following, subject to amendment and supplementation.

1. Complainant has failed to satisfy its burden of proof under FPA section 206 (16 U.S.C. § 824e), and has not demonstrated that PJM violated any Commission order, the Tariff, the Operating Agreement, RAA, the Consolidated Transmission Owners Agreement, or any other Commission-jurisdictional governing document.

2. Complainant fails to demonstrate that relief under FPA sections 306 and 309 (16 U.S.C. §§ 825e, 825h) is warranted.

## VI. OPPOSITION TO REQUEST FOR FAST TRACK PROCESSING

The Complaint seeks fast track processing under 18 C.F.R. § 385.206(b)(11) and (h).[120] Fast track processing is inappropriate here. When the Commission adopted its current complaint procedures, including the then-new fast track processing rules, the

[119] 18 C.F.R. § 385.213(c)(2)(i).

[120] Complaint at 16.

Commission expressly stated that fast track processing would be "employed in only limited circumstances because of the extraordinarily compressed time schedule that would place a heavy burden on all parties to the proceeding."[121] Soon after, the Commission recognized that cases involving complex issues "do not lend themselves to the Fast Track process."[122] In subsequent years, the Commission reiterated that fast track processing is suitable only for straightforward and relatively simple issues, not for complex cases.[123]

Given the impact of Winter Storm Elliott on the PJM footprint, the number of disputes concerning Non-Performance Charges assessed by PJM for Performance Assessment Intervals during Winter Storm Elliott, and the Complaint's request for the Commission to second guess PJM's emergency actions and operations, this case is undeniably complex and thus not suited for fast track processing. The Complaint itself appears to acknowledge this, asking in the alternative for the Commission to include Invenergy in any global settlement procedures that may be established to address other complaints concerning Non-Performance Charges assessed in connection with Winter Storm Elliott.[124] As the Commission has granted PJM's request to institute such settlement procedures,[125] the Commission should reject Invenergy's request for fast track processing.

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[121] *Complaint Procedures*, Order No. 602, 86 FERC ¶ 61,324, 1996-2000 FERC Stats. & Regs., Regs. Preambles ¶ 31,071, at 30,766, *order on reh'g & clarification*, Order No. 602-A, 88 FERC ¶ 61,114, 1996-2000 FERC Stats. & Regs., Regs. Preamble ¶ 31,076, *order on reh'g*, Order No. 602-B, 88 FERC ¶ 61,294, 1996-2000 FERC Stats. & Regs., Regs. Preamble ¶ 31,083 (1999).

[122] *See Amoco Energy Trading Corp.*, 89 FERC ¶ 61,165, at 61,498 (1999).

[123] *See Iberdrola Renewables, Inc., v. Bonneville Power Admin.*, 137 FERC ¶ 61,185, at P 11 (2011) (citing *Amoco Energy Trading Corp*., 89 FERC ¶ 61,165, refusing to grant fast track processing, and granting an extended answer period in a case involving complex issues); *Tex. Gas Serv. Co. v. El Paso Nat. Gas Co.*, 133 FERC ¶ 61,079, at P 40 (2010) (finding fast track processing to be "infeasible" for complex issues).

[124] Complaint at 16.

[125] *Essential Power OPP, LLC v. PJM Interconnection, L.L.C.*, Order Establishing Settlement Judge Procedures, 183 FERC ¶ 61,163 (2023).

## VII. COMMUNICATIONS AND SERVICE

PJM requests that the Commission place the following individuals on the official service list for this proceeding:[126]


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[126] To the extent necessary, PJM requests a waiver of Commission Rule 203(b)(3), 18 C.F.R. § 385.203(b)(3), to permit more than two persons to be listed on the official service list for this proceeding.

## VIII. CONCLUSION

For the reasons set forth in this answer, the Commission should deny the Complaint.

Respectfully submitted,

/s/ *Wendy B. Warren*

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June 9, 2023

## ATTACHMENTS

ATTACHMENT A: TIMELINE

ATTACHMENT B: AFFIDAVIT OF MICHAEL E. BRYSON ON BEHALF OF PJM INTERCONNECTION, L.L.C.

ATTACHMENT C: AFFIDAVIT OF STEVEN T. NAUMANN, P.E. ON BEHALF OF PJM INTERCONNECTION, L.L.C.

ATTACHMENT D: AFFIDAVIT OF JOSEPH MULHERN ON BEHALF OF PJM INTERCONNECTION, L.L.C.

ATTACHMENT E: AFFIDAVIT OF PAUL F. MCGLYNN ON BEHALF OF PJM INTERCONNECTION, L.L.C.

# Attachment A

# Timeline of PJM's Actions Related to Winter Storm Elliott

**Timeline of PJM's Actions in Response to Winter Storm Elliott**

This exhibit describes the steps that PJM took before, during, and after Winter Storm Elliott to preserve reliability in the face of unprecedented weather and load conditions, extraordinary failures and uncertainties caused by the poor performance of PJM Capacity Resources and the enormous operational complexities confronting the PJM operators in their management of the PJM system while attempting to provide mutual assistance to other regions.

- **12/20/2022 09:00**: PJM issued a Cold Weather Advisory for the Western Region Zones from 07:00 on 12/23/2022 through 23:00 on 12/25/2022.
    - Because PJM issued a Cold Weather Advisory, generators in the Western Region Zones were required to update unit specific operation limitations associated with cold weather preparedness including fuel supply and inventory concerns.
- **12/21/2022 10:00**: PJM issued a Cold Weather Alert for the Western Region Zones from 07:00 on 12/32/2022 through 23:00 on 12/25/2022; PJM extended the Cold Weather Advisory for the Western Region Zones from 07:00 on 12/23/2022 through 23:00 on 12/26/2022.
    - Because PJM issued a Cold Weather Alert, generation plants in the affected region were required to: review fuel supply/delivery schedules in anticipation of greater-than-normal operation of units, monitor and report projected fuel limitations to the PJM operator and update the unit Max Run field in Markets Gateway if less than 24 hours of run-time is remaining and contact PJM Dispatch if it is anticipated that spot market gas is unavailable, resulting in unavailability of bid-in generation.
- **12/22/2022 17:30:** PJM expanded its Cold Weather Advisory from 07:00 on 12/23/2022 through 23:00 on 12/26/2022 to the entire RTO (originally for Western Region Zones).
    - Because PJM issued an RTO-wide Cold Weather Advisory, all PJM generators were required to update unit specific operation limitations associated with cold weather preparedness including fuel supply and inventory concerns.
    - Given the expected weather, PJM was very conservative in developing its operating plans for 12/23/2022.
    - PJM's forecast load entering 12/23/2022 was 126,968 MW.
    - PJM had approximately 158,000 MW of operating capacity showing as available for 12/23/2022. PJM believed that it was guarding against potential uncertainty by having substantially more capacity available than would normally be needed to meet the load forecast.

- Based on submitted Generator Availability Data, PJM believed that it had almost 29 GW of reserve capacity available to absorb load and generating contingencies and to support neighboring systems.

- **12/23/2022 circa 03:00**: PJM load and generation forced outages/derates began increasing substantially.

- **12/23/2022 between 03:30 and 08:00**: Consistent with normal practices, PJM participated in regularly held conference calls with Tennessee Valley Association (TVA), VACAR South Reliability Coordinator, Mid-Continent Independ System Operator (MISO), New York Independent System Operator (NYISO) and the Florida Reliability Coordinating Council (FRCC) to discuss inter-regional coordination including peak load estimates, reserve requirements, estimated loads and anticipated daily challenges. Further, on an as-needed basis, additional calls between PJM and other regions occurred throughout the entirety of Winter Storm Elliott.

- **12/23/2022 06:30**: PJM sent 500 MWs of Emergency Energy to TVA due to TVA being in an EEA3.

- **12/23/2022 circa 07:30**: PJM began contacting generators to remain online or to come on line to meet morning and evening peaks and discovered that many units shown as available in Markets Gateway and eDART could not actually perform, in particular because gas-fired units lacked fuel. In addition, in a pattern that continued throughout the entire winter storm event, many generators did not provide timely updates of their parameters in Markets Gateway and/or failed to provide timely updates of their status in eDART.

- **12/23/2022 10:14**: 100% RTO Synchronized Reserve Event – PJM deployed Synchronized Reserves to recover low Area Control Error (ACE) due to PJM reserves falling to approximately 1500 MW. PJM canceled the Synchronized Reserves at 10:25.

    - PJM experienced low ACE due to load increasing as generators tripped or failed to start. ACE is a measure of how well the Balancing Authority is matching generation to the load. If load and generation are perfectly balanced, the ACE is zero. When a generator within a Balancing Authority trips off-line the ACE goes negative.

    - "Synchronized Reserves" are "the reserve capability of generation resources that can be converted fully into energy or Demand Resources whose demand can be reduced within ten minutes from the request of the [PJM] dispatcher, and is provided by equipment that is electrically synchronized to the Transmission System." Synchronized Reserves are supplied from both 10-minute synchronized generating resources and 10-minute demand-side response resources.

- **12/23/2022 11:00**: PJM issued a Cold Weather Alert for the entire RTO from 00:00 on 12/24/2022 through 23:59 on 12/25/2022.

    - Because PJM issued an RTO-wide Cold Weather Alert, all PJM generation plants were required to: review fuel supply/delivery schedules in anticipation of greater-than-normal operation of units, monitor and report projected fuel limitations to the PJM operator and update the unit Max Run field in Markets Gateway if less than 24 hours of run-time was remaining and contact PJM Dispatch if it anticipated that spot market gas was unavailable, resulting in unavailability of bid-in generation.

- **12/23/2022 16:00**: PJM began curtailing exports.

- **12/23/22 16:11:** The first of a series of calls occurred with TVA involving potential recall of almost 2500 MW in exports. TVA indicates that implementation would push that region into EEA3 load shed. PJM works with TVA to preserve TVA exports.

- **12/23/2022 16:17**: 100% RTO Synchronized Reserve Event – PJM deployed Synchronized Reserves to recover from low ACE. PJM canceled the Synchronized Reserves at 18:09.

- **12/23/2022 17:05**: PJM requested 500 MW of shared reserves from NPCC.

- **12/23/2022 17:30**: PJM issued an EEA2 with Pre-Emergency Load Management Reduction Action covering 30 minute and 60 minute Demand Response and a Maximum Generation Action. Performance Assessment Intervals triggered.

- **12/23/2022 17:36**: PJM requested an additional 1,000 MW of shared reserves from NPCC.

- **12/23/2022 18:10**: PJM began lifting export transaction curtailments.

- **12/23/2022 22:00**: Pre-Emergency Load Management Reduction Action, Emergency Load Management Reduction Action, and EEA2 ended; all exports were reloaded.

- **12/23/2022 23:00**: PJM declared a Maximum Generation Alert/Load Management Alert, and an EEA1, starting Saturday, 12/24/2022 at 00:00. The Maximum Generation Action for 12/23/2022 ended, terminating the Performance Assessment Intervals.

    - Entire overnight period – PJM was unable to pump at any of the pumped storage facilities (approximately 6 GW).

    - Entire overnight period – The "Christmas Eve Valley" experienced in the early morning hours on 12/24/2022 was 40,000 MW higher than the next

highest "valley" over the last decade and 15,000 MW higher than any peak load on that date in a decade.

- **12/24/2022 00:05**: PJM deployed Synchronized Reserves for the loss due to low ACE. PJM ends the Synchronized Reserves at 00:30.

- **12/24/2022 02:23**: PJM deployed Synchronized Reserves again as a result of a generator unit tripping off-line. PJM ends the Synchronized Reserves at 02:54.

- **12/24/2022 02:25**: PJM received 605 MW of NPCC shared reserves from 02:25 through 04:26.

- **12/24/2022 between 03:30 and 08:00**: Consistent with normal practices, PJM participates in regularly held conference calls with Tennessee Valley Association (TVA), VACAR South Reliability Coordinator, Mid-Continent Independ System Operator (MISO), New York Independent System Operator (NYISO) and the Florida Reliability Coordinating Council (FRCC) to discuss inter-regional coordination including peak load estimates, reserve requirements, estimated loads and anticipated daily challenges. Further, on an as-needed basis, additional calls between PJM and other regions occurred throughout the entirety of Winter Storm Elliott.

- **12/24/2022 04:00**: PJM issued a call for conservation of electricity use at 04:00 though 10:00 on 12/25/2022 and curtailed exports.

- **12/24/2022 04:20**: PJM issued an EEA2 – Pre-Emergency Load Management Reduction Action and Emergency Load Management Reduction Action covering 120 minute Demand Response.

- **12/24/2022 04:26**: PJM receives 1000 MW of NPCC shared reserves from 04:26 to 04:47.

- **12/24/2022 04:28**: PJM issued an EEA2 – Maximum Generation Emergency Action. Performance Assessment Intervals triggered.

    - The purpose of the Maximum Generation Emergency Action is to increase the PJM generation above the maximum economic level. It is implemented whenever generation is needed that is greater than the highest incremental cost level.

- **12/24/2022 04:52**: PJM issued a Voltage Reduction Alert.

- **12/24/2022 05:23**: PJM deployed Synchronized Reserves due to low ACE. PJM ends the Synchronized Reserves at 05:51.

- **12/24/2022 06:00**: Load Management came into effect; PJM curtails Non-Firm energy exports.

- **12/24/2022 06:17**: PJM encouraged Market Participants to submit bids to sell emergency energy into PJM and issued a public appeal to conserve energy.

- **12/24/2022 06:30**: PJM received first notification that generators were having to limit their output due to federal government environmental restrictions.

- **12/24/2022 07:15**: PJM issued Voltage Reduction Warning and Reduction of Non-Critical Plant Load.

- **12/24/2022 07:30**: PJM conducted an SOS conference call with the PJM transmission owners to update their leadership on the situation and to indicate the potential that PJM may need to shed load.

- **12/24/2022 08:00**: Over 24% of the PJM fleet experienced forced outages at around this time. These outages decreased after 08:00, but approximately 32,000 MW of generation was still experiencing forced outages by 22:00 on 12/24/2022.

- **12/24/2022 08:30**: PJM reached morning peak of approximately 130,000 MW; at the peak there were 46,000 MW of forced outages, with PJM experiencing 200 unit trips throughout the event. Approximately 6,000 MW of steam generation was called but was not online as expected for the morning peak. Factoring in start failures, units that operated at reduced output, and lack of pumped storage, PJM was missing approximately 57,000 MW of capacity that it expected to be available at this time.

- **12/24/2022 10:00**: Non-Firm energy exports resumed.

- **12/24/2022 15:00**: All exports were reloaded.

- **12/24/2022 17:30**: DOE 202(c) Order received and implemented effective immediately through 12:00 on 12/26/2022.

- **12/24/2022 18:15**: PJM ended Voltage Reduction Warning and Reduction of Non-Critical Plant Load.

- **12/24/2022 18:34**: PJM ended the Voltage Reduction Alert.

- **12/24/2022 22:00**: All pre-emergency and emergency procedures cancelled. PJM returned to EEA0. Performance Assessment Intervals end.

- **12/24/2022 22:38**: PJM issued a Maximum Generation Emergency/Load Management Alert for 12/25/2022.

    - The purpose of the Maximum Generation Emergency Action is to increase the PJM generation above the maximum economic level. It is implemented whenever generation is needed that is greater than the highest incremental cost level.

    - PJM issued this Maximum Generation Emergency/Load Management Alert due to uncertainties regarding whether 12/25/2022 would match the unprecedentedly high load conditions of 12/23 and 12/24/2022.

- **12/25/2022 11:10**: PJM issued a Cold Weather Alert from 07:00 through 23:00 on 12/26/2022 for the Western Region Zones only.

    - Because PJM issued a Cold Weather Alert, generation plants in the affected region were required to: review fuel supply/delivery schedules in anticipation of greater-than-normal operation of units, monitor and report projected fuel limitations to the PJM operator and update the unit Max Run field in Markets Gateway if less than 24 hours of run-time is remaining and contact PJM Dispatch if it is anticipated that spot market gas is unavailable, resulting in unavailability of bid-in generation.

- **12/25/2022 22:00**: The Maximum Generation Emergency and Load Management Alert declared at 22:38 on 12/24/2022 ended, and PJM returned to EEA0. PJM's calls for conservation also end at this time.

    - The purpose of the Maximum Generation Emergency Action is to increase the PJM generation above the maximum economic level. It is implemented whenever generation is needed that is greater than the highest incremental cost level.

- **12/26/2022 23:00**: Cold Weather Alert for Western Regions Zones ended.

Attachment B

Affidavit of Michael E. Bryson
on Behalf of PJM Interconnection, L.L.C.

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Calpine Corporation,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-66-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |
| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

**AFFIDAVIT OF MICHAEL E. BRYSON**
**ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1. My name is Michael E. Bryson. My business address is 2750 Monroe Blvd., Audubon, Pennsylvania, 19403. I am the Senior Vice President of Operations for PJM Interconnection, L.L.C. (PJM).

2. I am submitting this affidavit on behalf of PJM in support of PJM's Answers to the Complaints filed by the Calpine Corporation and Invenergy Nelson LLC in the captioned proceedings. I have reviewed these Complaints and aver that the statements, analyses, and conclusions I present in my May 26, 2023 affidavit submitted on behalf of PJM in support of PJM's Answers to the Complaints filed by the ComEd Zone Generators and the Coalition of PJM Capacity Resources in Docket Nos. EL23-54 and EL23-55, which I include as Exhibit 1 to this affidavit, apply equally to the issues raised in the captioned Complaints of Calpine Corporation and Invenergy Nelson LLC.

3. This concludes my affidavit.

# Exhibit 1

## Affidavit of Michael E. Bryson
## on behalf of PJM Interconnection, L.L.C.

## Submitted in Docket Nos. EL23-54 and EL23-55
## on May 26, 2023

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| **Essential Power OPP, LLC, *et al.*,** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-53-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Aurora Generation, LLC, *et al.*,** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-54-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Coalition of PJM Capacity Resources** | ) | |
| **Complainant** | ) | |
| **v.** | ) | **Docket No. EL23-55-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |

**AFFIDAVIT OF MICHAEL E. BRYSON**
**ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

## A. Introduction

1. My name is Michael E. Bryson. My business address is 2750 Monroe Blvd., Audubon, Pennsylvania, 19403. I am the Senior Vice President of Operations for PJM Interconnection, L.L.C. (PJM). I am submitting this affidavit on behalf of PJM in support of PJM's Answers to the Complaints filed by the CZG and the Coalition of PJM Capacity Resources in the captioned proceedings.

2. I earned a Bachelor of Science in general engineering from the United States Military Academy at West Point, New York, focusing on computer science and electrical engineering, and have a Master of Business Administration from Saint Joseph's University in Philadelphia. I earned a graduate certificate in power engineering from the Worcester Polytechnic Institute.

3. Prior to my current position at PJM, I have held the positions of Executive Director of System Operations, General Manager of Dispatch Operations, and manager of the Transmission Department for the System Operations Division. I am the current chair of the Independent System Operator and Regional Transmission Organization Operating Committee. I also serve on the boards of directors of PJM Technologies, Inc., and PJM Repository Information Services, Inc. I previously served on the boards of directors of the ReliabilityFirst Corporation and Consortium for Electric Reliability Technology Solutions.

4. I am responsible for PJM's Operations Division, overseeing transmission operations for real-time systems. These operations include scheduling, transmission dispatch, generation dispatch, reliability coordination, training, and all engineering analysis required to run the system and support the critical energy management systems.

5. The purpose of my declaration is to address claims that PJM acted improperly during Winter Storm Elliott by exporting power to other Balancing Areas during periods in which PJM had declared Pre-Emergency Load Management Reduction Actions and Emergency Actions, including Maximum Generation Emergency and Emergency Load Management Reduction Actions. The CZG Complainants[1] allege that the Performance Assessment Intervals (PAIs) triggered by PJM's Emergency Actions were invalid, and requests that the Commission "eliminate the penalties assessed to the [CZG Complainants]," because, in their view, PJM's Emergency Actions during Winter Storm Elliott did not comply with the Tariff, Operating Agreement, or Manual 13.[2] Specifically, the CZG Complainants assert that "[1] PJM failed to curtail all non-firm exports before taking Emergency Actions, and [2] PJM incorrectly used Load Management/Demand Response to facilitate aid to adjacent control areas that triggered PAIs, in direct violation of its Tariff, Operating Agreement, and Manual 13."[3] The CZG Complainants assert that "there was no emergency in the ComEd region and therefore no need for Complainants' generation facilities,"[4] then go on to make the extraordinary claim that their failure to perform should be excused because "bringing more capacity online would have made system conditions worse."[5] Further, the CZG Complainants say that PJM was not permitted to assist other Balancing Authorities after PJM dispatched Load Management Reduction Actions.[6] The Coalition more or less repeats these arguments as relates to PJM's exports.[7] The Nautilus Entities take a slightly different approach and argue that curtailing all Non-Firm exports and issuing an EEA1 is just one of four prerequisites that Manual 13 requires before PJM may take Emergency

[1] For clarity, this affidavit will refer to the "ComEd Zone Complainants," the "Coalition," and the Nautilus Entities when referencing arguments unique to those parties. Likewise, when the parties present the same or similar claims, I will refer to the "Complainants."

[2] Complaint of ComEd Zone Generators (ComEd Zone Complaint) at 3.

[3] *Id.* at 3-4.

[4] *Id.* at 4.

[5] *Id.* at 5; *accord id.* ("Clearly, the generation should not have been dispatched as it would have made the situation worse, and clearly emergency demand response was not only unnecessary, but it, too, was making things worse in the ComEd zone.").

[6] *See, e.g.*, *id*. at 40; *id.*, Test. of Dr. Paul Sotkiewicz, Ph.D., Ex. CZG-0004, at P 97.

[7] *See* Complaint of the Coalition of PJM Capacity Resources (Coalition Complaint), at 25-26.

Actions.[8] They further contend that PJM's continuing exports to adjacent Balancing Areas is evidence that they were not "needed" to address the emergency, and thus cannot be liable for Non-Performance Charges.[9]

6. All of these claims are wrong. Complainants' assertions misstate the terms of the controlling documents, misrepresent or misunderstand the relevant facts, and ignore mutual assistance policies established by this Commission and the North American Electric Reliability Corporation (NERC). Specifically, Complainants misread the Tariff, Operating Agreement, and Manual 13[10] to impose irrational and counter-productive constraints on emergency operations that are entirely alien to my understanding of those documents and contrary to the manner in which our operators are trained to respond in emergency conditions. On the contrary, PJM acted properly and fully in compliance with its obligations to support neighboring Balancing Authorities in crisis by allowing the non-firm exports to those Balancing Authorities after PJM initiated Pre-Emergency Load Management Reduction Actions and Emergency Actions. Also, because PJM did not initiate Load Management procedures for the purpose of assisting other regions, PJM was not constrained from providing exports to regions experiencing or attempting to avoid capacity deficient conditions. Further, the CZG Complainants' claim that there was no emergency in the ComEd Zone or elsewhere in PJM to justify Emergency Actions is absurd on its face, as is their claim that bringing the Complainants' 6,552 MW of non-performing capacity resources on line would have exacerbated the emergency.[11]

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[8] Complaint of the Nautilus Entities (Nautilus Complaint) at 19.

[9] *Id.* at 32.

[10] PJM Manual 13: Emergency Operations (Nov. 3, 2022), https://www.pjm.com/-/media/documents/manuals/archive/m13/m13v86-emergency-operations-11-03-2022.ashx. References to all PJM Manuals herein are to the versions in effect during Winter Storm Elliott.

[11] As Mr. McGlynn explains in his affidavit:

- For the snapshot of the system as of 4:45 on December 24th, PJM could have reliably accommodated a net 5,845 MW from the ComEd generators;
- For the snapshot of the system as of 10:54 on December 24th, PJM could have reliably accommodated a net 5,055 MW from the ComEd generators; and
- For the snapshot of the system as of 16:03 on December 24th, PJM could have reliably accommodated a net 5,001 MW from the ComEd generators. Notably for the analysis run at 16:03, this energy is in addition to the net 540 MW of energy being produced at this time from five units, at Aurora and Elwood, included in the two prior analyses, that had not been operating earlier in the day.

McGlynn Aff. at P 24.

## B. PJM Is Obligated To Provide Assistance to Other Regions And Is Entitled To Receive Assistance From Other Regions During Emergency Conditions

7. The Eastern Interconnection is one of the largest fully integrated transmission systems in the world. One of the advantages of its large scope is to provide enhanced reliability to all of the Balancing Areas that comprise it. In addition to the reliability benefits associated with having multiple redundant paths for power flows from generators to loads, there are also significant reliability benefits associated with diversity of load, generation, and geography. The benefit of geographic diversity is that over a large region such as the Eastern Interconnection, one region may not be as severely impacted by an event as an adjoining region. For example, one part of the Eastern Interconnection may be experiencing an extreme weather event when another potion of the Eastern Interconnection may be relatively less affected by the event. The Commission illustrated this point when commenting on the impacts of Winter Storm Uri in February 2021:

> ERCOT faced the greatest challenge [in Winter Storm Uri] due to the magnitude of unplanned generating unit outages in its area, coupled with its limited ability to import power to help offset generation shortfalls. . . . In contrast to ERCOT, some regions, such as MISO and SPP, had the ability to import power from the east, where weather conditions were less severe, to make up for a large portion of their generation shortfalls during the event. For example, PJM was exporting an unprecedented amount of electricity into MISO and SPP, reaching over 15,700 MW of interregional transfers on February 15, 2021.[12]

It would waste the Eastern Interconnection's capabilities to accept Complainants' artificial, needlessly formalistic, and counter-productive constraints on providing mutual assistance. Further, accepting Complainants' arguments would be inconsistent with the Commission's policies as embodied in the quoted passage.

8. NERC also has rules governing mutual assistance. PJM has NERC obligations as a Reliability Coordinator and as a Balancing Area that require PJM to provide assistance to other regions, particularly when PJM can do so without shedding load within its own footprint. Attachment 1 to NERC Standard EOP-011-1,[13] Section 2.3 provides: "During EEA 2, Reliability Coordinators and energy deficient Balancing Authorities have the following responsibilities: Other Reliability Coordinators of Balancing Authorities with available resources shall coordinate, as appropriate, with the Reliability Coordinator that has an energy deficient Balancing Authority." NERC Standard IRO-014-3 R7 likewise provides: "Each Reliability Coordinator shall assist Reliability Coordinators, if requested and able, provided that the requesting Reliability Coordinator has implemented its

[12] *Transmission Sys. Plan. Performance Requirements for Extreme Weather*, 179 FERC ¶ 61,195 at P 32 (2022) (footnotes omitted).

[13] NERC Standard EOP-011-1 was in effect during Winter Storm Elliott. NERC Standard EOP-011-2 superseded that standard on April 1, 2023.

emergency procedures, unless such actions cannot be physically implemented or would violate safety, equipment, regulatory, or statutory requirements."[14] Other Reliability Coordinators and Balancing Areas have reciprocal obligations to PJM under these same rules and, for that reason, PJM not only provided emergency energy to other Balancing Authorities during capacity shortages, but also received assistance from the Northeast Power Coordinating Council (NPCC) during the Winter Storm Elliott emergency.[15]

9. The Tariff and Operating Agreement also incorporate mutual assistance principles. They state that PJM "shall . . . [a]dminister . . . agreements for the transfer of energy in conditions constituting an Emergency in the PJM Region or in an interconnected Control Area, and the mutual provision of other support in such Emergency conditions with other interconnected Control Areas . . . ."[16] Further, PJM "shall . . . [c]oordinate the curtailment or shedding of load, or other measures appropriate to alleviate an Emergency, in order to preserve reliability in accordance with NERC, or Applicable Regional Entity principles, guidelines and standards, and to ensure the operation of the PJM Region in accordance with Good Utility Practice and this Agreement."[17]

10. PJM also has agreements with other regions that flesh out procedures to provide assistance during emergencies and potential emergencies. PJM has such agreements with Duke Energy Progress, LLC (Duke),[18] Midcontinent Independent System Operator (MISO),

[14] NERC Standard IRO-014-3, Coordination Among Reliability Coordinators, R7.

[15] Net Scheduled Imports to PJM were in excess of 2,000 MW/hr for most of the cold weather period and reached as high as 4,000 MW/hr.

[16] PJM Open Access Transmission Tariff (Tariff), Attach. K-App'x, § 1.6.2(vi); *see also id.*§ 1.7.11 ("The Office of the Interconnection, with the assistance of the Members' dispatchers as it may request, shall be responsible for monitoring the operation of the PJM Region, for declaring the existence of an Emergency, and for directing the operations of Market Participants as necessary to manage, alleviate or end an Emergency. . . . Actions by the Office of the Interconnection and the Market Participants shall be carried out in accordance with this Agreement, the NERC Operating Policies, Applicable Regional Entity reliability principles and standards, Good Utility Practice, and the PJM Manuals.").

[17] *Id.* § 1.6.2(vi).

[18] Amended and Restated Joint Operating Agreement Among and Between PJM Interconnection, L.L.C., and Duke Energy Progress, LLC (July 22, 2019) (PJM-Duke JOA), https://www.pjm.com/directory/merged-tariffs/progress-joa.pdf.

Inc,[19] Tennessee Valley Authority (TVA),[20] New York Independent System Operator, Inc. (NYISO),[21] and VACAR South Reliability Coordinator.[22] For example, the PJM-MISO JOA provides:

> In the event an emergency condition is declared in accordance with a Party's published operating protocols, the Parties agree to provide emergency assistance to each other and to facilitate obtaining emergency assistance from a third party. The Parties will coordinate respective actions to provide immediate relief until the declaring Party eliminates the declaration of emergency. The Parties will notify each other of emergency maintenance and forced outages that would have a significant impact on the other Party as soon as possible after the conditions are known. The Parties will evaluate the impact of emergency and forced outages on the Parties' systems and coordinate to develop remedial steps as necessary or appropriate. If the emergency response allows for coordinating with the other Party before action must be taken, the normal RTO to RTO request for action will be followed. The Parties will conduct joint annual emergency drills and will ensure that all operating staff are trained and certified, if required, and will practice the joint emergency drills that include criteria for declaring an emergency, prioritized action plans, staffing and responsibilities, and communications.[23]

As is typical in agreements of this type, the general goal is to coordinate operations during emergencies to alleviate the emergency condition. As Manual 37 states, "PJM directs actions to provide emergency assistance to all Reliability Coordination neighbors, during

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[19] Joint Operating Agreement Between the Midcontinent System Operator, Inc. and PJM Interconnection, L.L.C. (Dec. 11, 2008) (PJM-MISO JOA), https://www.pjm.com/directory/merged-tariffs/miso-joa.pdf.

[20] Joint Reliability Coordination Agreement Among and Between PJM Interconnection, L.L.C., and Tennessee Valley Authority (Oct. 15, 2014) (PJM-TVA JOA), https://www.pjm.com/-/media/documents/agreements/joint-reliabilityagreement-jrca-pjm-tva.ashx.

[21] Joint Operating Agreement Among and Between New York Independent System Operator Inc. and PJM Interconnection, L.L.C. (Sept. 16, 2019) (PJM-NYISO JOA), https://pjm.com/~/media/documents/agreements/nyiso-joa.ashx.

[22] PJM-VACAR South Amended Adjacent Reliability Coordinator Coordination Agreement (Mar. 7, 2018) (PJM-VACAR JOA), https://www.pjm.com/-/media/documents/agreements/executed-pjm-vacar-rc-agreement.ashx. The VACAR South RC Area includes the territories of the following companies: Cube Hydro Carolinas, LLC, Duke Energy Carolinas, LLC, Duke Energy Progress, LLC, Dominion Energy South Carolina, Inc. and the South Carolina Public Service Authority.

[23] PJM-MISO JOA, § 8.1.1.

declared emergencies, which is required to mitigate the operational concern to the extent that the same entities are taking in kind steps and the assistance would be effective."[24]

11. Mutual assistance concepts are also recognized in PJM Manual 13. One important provision concerns exports from PJM to other Balancing Authorities when PJM has declared a Maximum Generation Emergency. Section 2.3.2 includes among the steps taken by PJM in a Maximum Generation Emergency Action:

- PJM Dispatch determines the feasibility [of] recalling off-system capacity sales that are recallable (network resources).
    - PJM Dispatch will determine any limiting transmission constraints internal to PJM that would impact the ability to cut transactions to a specific interface.
    - PJM Dispatch will identify off-system capacity sales associated with the identified interfaces.
    - PJM Dispatch will contact the sink Balancing Authority to determine the impact of transaction curtailment.
- If the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed then PJM will not curtail the transactions unless it would prevent load shedding within PJM.[25]

This provision supplements the Operating Agreement and Tariff concerning PJM's obligations to provide mutual assistance by explaining the level of priority that off-system capacity sales will receive during a capacity emergency even while PJM itself is in near deficit conditions.

12. In addition, Manual 13 provides that:

> When adjacent Balancing Areas are deficient in generation and are requesting assistance from the PJM RTO, actions are taken, provided the adjacent Balancing Area has taken the same actions requested of PJM [including] as required, increased generation, including Maximum Emergency generation (with the exception of fuel limited and environmentally restricted capacity).[26]

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[24] Manual 37: Reliability Coordination (Mar. 22, 2023), Attach. A (PJM Reliability Plan, § 1.1, https://www.pjm.com/-/media/documents/manuals/m37.ashx.

[25] PJM Manual 13, § 2.3.2 (Step 4A – Maximum Generation Emergency Action) at 32; *accord id.* § 5.2 (Transmission Security Emergency Procedures) (Step 4A) at 93 (same).

[26] *Id.* § 2.5 at 51.

This provision allows PJM to initiate actions, including Emergency Actions, for the purpose of providing assistance to another Balancing Area provided that, when it does so, it must specifically indicate that the action is being done to support that region.[27]

### C. Nothing in Manual 13 or NERC Standard EOP-011-2 Prevents PJM From Taking Actions that Trigger a Performance Assessment Interval While Making Non-Firm Exports

13. One of Complainants' central contentions is that PJM must curtail all non-firm exports as a "prerequisite" of calling a Maximum Generation Emergency Action or a Pre-Emergency or Emergency Load Management Reduction Action.[28] In support, they reference Manual 13 and NERC Standard EOP-011-1.[29] In fact, neither Manual 13 nor NERC Standard EOP-011-1 imposes such an obligation.

14. Manual 13, like all manuals, is supplementary to the Tariff and Operating Agreement. As discussed by Mr. McGlynn in his Affidavit,[30] PJM has broad authority under the Tariff and Operating Agreement to declare emergencies and decide what steps to take to avoid, mitigate, or shorten emergencies. Nothing in the PJM Manuals could limit the ability of the PJM Operators to address emergency conditions under the discretionary authority conferred in the Tariff and Operating Agreement.[31] In this case, however, there is no inconsistency to address because Manual 13 does not specify a requirement to curtail non-

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[27] *Id.* ("PJM Dispatch prefaces these procedures [when initiated to provide assistance to other regions] by the words 'due to PJM providing emergency assistance to an adjacent Control Area(s), PJM is issuing an (appropriate alert or action message.)'").

[28] CZG Complaint at 21-22 ("The evidence introduced by Dr. Harvey and Dr. Sotkiewicz demonstrates that th[e] prerequisite [of curtailing all non-firm exports] was not met, as PJM failed to curtail non-firm exports prior to taking Emergency Actions. In fact, during many of the PAIs, PJM was a net exporter of electricity including energy supported by Non-Firm transmission as shown by Dr. Sotkiewicz."); Coalition Complaint at 27-28 ("PJM's Tariff mandates the curtailment of these reservation exports *prior to* entering into the Maximum Generation Emergency Action, which PJM failed to do." (emphasis in original)); Nautilus Complaint at 19-20 (referring to PJM's "obligation to curtail all non-Firm exports prior to declaring a Maximum Generation Emergency Action").

[29] *See* CZG Complaint at 21; *id.*, Sotkiewicz Aff., CZG-0004, at P 4; Coalition Complaint at 26-27; Nautilus Complaint at 19.

[30] McGlynn Aff. at P 20.

[31] The ComEd Zone and Coalition Complainants argue that their respective misinterpretations of Manual 13 were incorporated into the PJM Tariff and Operating Agreement. However, I will note that if Complainants' arguments were to be accepted, *i.e.*, that Manual 13 is removes all operator discretion regarding actions during emergencies, then Manual 13 procedures it would simply overwrite and nullify other PJM documents, NERC rules, Reliability First principles, and long-standing practices regarding mutual assistance.

firm exports—or any other preliminary step—as a "prerequisite" to instituting either a Maximum Generation Emergency Action or a Pre-Emergency/Emergency Load Management Reduction Action. Manual 13 specifies that "[d]ue to system conditions and the time required to obtain results, PJM dispatchers may find it necessary to vary the order of application [of actions] to achieve the best overall system reliability."[32] Manual 13 further states, repeatedly, that "[a] NERC EEA2[33] is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, interruption of non-firm load in accordance with applicable contracts, demand side management/active load management, *or* utility load conservation measures."[34] Thus, PJM Manual 13 does not mandate that Maximum Generation Emergency Action or a Pre-Emergency/Emergency Load Management Reduction Action may be taken only when all non-firm exports are curtailed.

15. Complainants' argument is also inconsistent with other provisions of Manual 13. As noted above, Section 2.3.2 of Manual 13 has a specific procedure for determining whether to cut transactions to other Balancing Areas if PJM has declared a Maximum Emergency Action. This provision gives such transactions, when made known to PJM, a priority almost as high as native load stating that "[i]f the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed then PJM will not curtail the transactions unless it would prevent load shedding within PJM."[35] Clearly, given this directive, there cannot be a mandatory requirement that PJM must cut all non-firm exports before taking an Emergency Action.

16. Complainants' reliance on NERC Standard EOP-011-1 is also misplaced. While NERC Standard EOP-011-1 states that curtailing "[n]on-firm wholesale energy sales (other than those that are recallable to meet reserve requirements)" may be a typical step before

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[32] Manual 13, § 2.3.2 at 28.

[33] EEA2 is a NERC procedure in which, *inter alia*, "[l]oad management procedures [are] in effect" and "[a]n energy deficient Balancing Authority has implemented its Operating Plan(s) to mitigate Emergencies." NERC Standard EOP-011-1, Attach. 1: Emergency Operations, § B(2). Nothing in NERC Standard EOP-110-1, Attach. 1, § B(2) references an expectation that the Balancing Authority will have curtailed non-firm exports before issuing the alert.

[34] Manual 13, § 2.3.2 (Step 2 - Emergency Load Management Reduction Action) at 30; *id*. (Step 7 - Deploy All Resources) at 37; *id*. (Step 9 - Voltage Reduction Action) at 40; *id*. § 2.5 (Transmission Security Emergency Procedures) (Step 2 - Emergency Load Management Reduction Action) at 90; *id*. (Step 7 - Deploy All Resources) at 98; *id*. (Step 9 - Voltage Reduction Action) at 100 (emphasis added); *see also id.* § 2.3.2 (Step 2 - Emergency Load Management Reduction Action) (Note 4, EEA Levels) at 30 (stating that a NEARC EEA2 "may be issued," rather than "is issued"); *id*. § 2.5 (Transmission Security Emergency Procedures) (Note 4, EEA Levels) at 91 (same).

[35] *Id.*

declaring an EEA1 alert,[36] the standard also specifies that "[t]he Reliability Coordinator may declare whatever alert level is necessary, and need not proceed through the alerts sequentially."[37] Therefore, declaring an EEA1 alert is not a prerequisite for declaring an EEA2 event such as the Maximum Generation Emergency Actions or the Pre-Emergency Load Management Reduction Actions that triggered PAIs during Winter Storm Elliott.

17. In addition to Complainants' failure to acknowledge that NERC Standard EOP-011-1 and Manual 13 give operators the discretion to skip or reorder steps to avoid or address emergency conditions, Complainants also wrongly treat a provision intended to be guidance as a mandate. I interpret the reference to curtailing non-firm load prior to declaring an EEA1 alert in Attachment 1, NERC Standard EOP-011-1, to mean that non-firm load should be curtailed when the operators have a reasonable expectation that doing so will address the emergency or potential emergency. Complainants' insistence that it is a strict rule regardless of its impact is unreasonable. In the situation faced by the PJM operators during Winter Storm Elliott, curtailing all non-firm exports for the entirety of the PAIs would not have alleviated the need for the Maximum Generation Emergency Actions or the Pre-Emergency/Emergency Load Management Reduction Actions taken by the PJM operators. Further, PJM operators also had to consider PJM's obligations to provide assistance to other regions and, in the circumstances present during Winter Storm Elliott, the non-firm deliveries were helping to alleviate reliability challenges being experienced in other regions. I will discuss both of these points in greater detail below.

### D. Acceptance of Complainants' Assertion That Initiating Pre-Emergency Load Management Reduction Action Requires Curtailment of Non-Firm Exports Would Nullify the Flexibility Granted to PJM to Utilize This Tool

18. Acceptance of Complainants' contention that Manual 13 requires the prior curtailment of all non-firm exports before calling for a Pre-Emergency Load Management Reduction Action[38] would nullify the flexibility expressly granted to PJM under its Tariff to utilize this tool. The Tariff states that, "PJM will initiate a pre-emergency event *prior to* the declaration of a Maximum Generation Emergency or an emergency event *when*

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[36] NERC Standard EOP-011-1, Attach. 1, § B(1).

[37] *Id.* § B.

[38] *See* CZG Complaint at 4 ("Manual 13 requires PJM to curtail all non-firm exports before taking . . . Emergency Actions, including both Pre-Emergency and Emergency Load Management Reduction Actions . . . ." (alteration in original)); *id.* at 29 ("For the avoidance of doubt, these Emergency Actions include Pre-Emergency Load Management Reduction Actions—i.e., Manual 13 requires PJM to curtail all non-Firm exports before taking Pre-Emergency Load Management Reduction Actions." (alteration in original)); CZG Complaint, Sotkievicz Aff. at P 90 ("Prior to initiating an Emergency Action such as call for Pre-Emergency . . . Load Management . . . PJM is required by Manual 13; . . to curtail all Non-Firm exports of energy."), Coalition Complaint at 25 ("PJM must curtail non-firm exports before taking capacity-related Emergency Actions."); Nautilus Complaint at 19.

*practicable*. A pre-emergency event is implemented when economic resources are not adequate to serve load and maintain reserves or maintain system reliability, and prior to proceeding into *emergency procedures*."[39] Further, as the Commission stated in its order approving the Pre-Emergency Load Management Reduction Program, "it is reasonable for PJM to seek some added flexibility to dispatch these resources in response to system conditions, *without* the added step of declaring a system emergency."[40] Complainants' contention that there is a rigid prerequisite surrounding the use of this program is completely at odds with both the Tariff and the Commission's findings. Further, Manual 13 refers to the potential step of curtailing non-firm exports only in connection with "emergency procedures"[41] which, in the Tariff passage quoted above, comes *after* PJM has initiated "a pre-emergency event."

## E. PJM Acted Properly During Winter Storm Elliott By Allowing Non-Firm Exports Following PJM's Declaration of Maximum Generation Emergency Actions and the Pre-Emergency and Emergency Load Management Reduction Actions

19. During Winter Storm Elliott, PJM acted consistently with its obligations by allowing non-firm transactions during periods in which Maximum Generation Emergency Actions and the Pre-Emergency and Emergency Load Management Reduction Actions were in effect. As I discussed above, PJM is obligated to provide assistance to other Balancing Areas when it can do so and when those regions are facing emergencies or potential emergency conditions.[42] During Winter Storm Elliott, PJM operators sought to help adjacent Balancing Areas to the extent feasible without shedding load in PJM. As I will detail below, PJM operators were successful in their efforts as PJM avoided load shedding and the assistance that PJM provided to other regions enabled them either to avoid or mitigate shedding their customers' load. Finally, while I disagree with the CZG Zone Complainants' claim that the reliability issues facing the ComEd Zone can be evaluated separately from the rest of PJM under the facts here, I will show that, accepting this premise, there was no impediment to the initiation of Pre-Emergency and Emergency Actions in the ComEd Zone even under Complainants' erroneous Tariff interpretation.

### 1. Curtailing All Non-Firm Exports Would Not Have Enabled PJM To Avoid Taking Pre-Emergency and Emergency Actions

Curtailing all non-firm transactions would not have alleviated the conditions that compelled the decision of the PJM operators to take Emergency Actions. As explained in greater detail in Mr. McGlynn's Affidavit, one of the reasons why the PJM operators took these steps related to the uncertainty of the load forecast—both in terms of the weather

[39] Tariff, Attach. K App., § 8.5 (emphasis added).

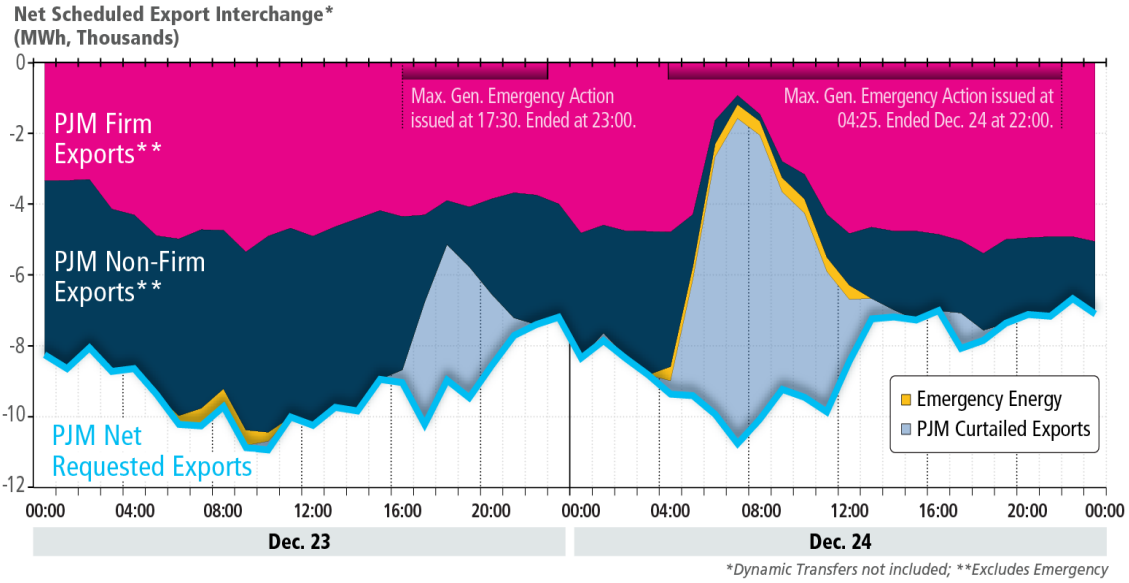
[40] *PJM Interconnection, L.L.C.*, 147 FERC ¶ 61,103 at P 38 (2014) (emphasis added).

[41] The term "emergency procedures" is sometimes capitalized in Manual 13 and sometimes in lower case. *See e.g.*, Manual 13, § 2.3 at 28.

[42] *See supra* at P 8.

forecast and uncertainty regarding how loads would respond to the weather conditions.[43] The most important reason, however, was the spectacular failure of generators to be available consistent with PJM's expectations of them as Capacity Resources subject to Capacity Performance obligations. As discussed by Mr. Pilong in his affidavit, "because of the poor generator performance, PJM was facing approximately 57,000 MW of generator unavailability for the morning peak on December 24."[44] Not only did many generators fail to produce power as expected but they also failed in many cases even to update their parameters so that operators had the information they needed to make the most effective dispatch decisions. In fact, about 24% of the PJM generation fleet was not available which actually was worse than PJM experienced during the 2014 Polar Vortex that was the precipitating event for adopting the Capacity Performance construct. Based upon these general considerations alone—the uncertainty of the load forecast and the shockingly poor performance of generators—the operators were justified in taking Emergency Actions instead of risking that PJM could avoid load-shedding by curtailing non-firm exports.

20. The operators' decisions to initiate Emergency Actions, moreover, are validated by the supply/demand conditions that were present. The graph below depicts the levels of exports from PJM during Winter Storm Elliott:




21. Comparing the values in this graph to the supply/demand conditions that PJM actually experienced confirms that PJM could not have met system demand only by cutting non-firm exports. On December 23, 2022, at 17:30, PJM issued a Pre-Emergency Load Management Reduction Action for the 30 minute and 60 minute Demand Resources that resulted in load reductions of about 1,100 MW. At the same time, PJM operators also

[43] McGlynn Aff. at P 56.

[44] Pilong Aff. at P 26.

issued a Maximum Generation Emergency Action that resulted in an average of 2,372 MW of additional generation.[45] In total, these actions had about 3,472 MW of impact. In comparison, for hour 18:00 non-firm exports were 1,241MW and for hour 19:00 non-firm exports were 1,683 MWs. Accordingly, even if the operators had cut all non-firm exports there would have been a deficit of at least 1,789 MW needed to satisfy PJM load and firm exports. Pre-Emergency and Emergency Actions thus would have been necessary to satisfy capacity needs even if all non-firm exports had been cut.

22. The situation for December 24, 2022 is similar. At 04:20 on December 24, 2022, PJM issued a Pre-Emergency Load Management Reduction Action and an Emergency Load Management Reduction Action that covered all Demand Resources and resulted in about 2,400 MW of load reduction. And at 04:28, PJM issued a Maximum Generation Emergency Action that it resulted in an average of about 2,879 MW in additional generation.[46] In total, these actions had 5,279 MW of impact. In comparison, for hour 05:00, non-firm exports were 1,820 MW falling to a low of 591 MW in hour 8:00 and increasing to a maximum level of 2,359 MW in hour 19:00 before the PAIs ended at 22:00. Accordingly, even if the operators had cut all non-firm exports there would have been a deficit between about 4,688 MW and 2,920 MW during this period needed to satisfy PJM load and firm exports. Pre-Emergency and Emergency Actions thus would have been necessary even if all non-firm exports had been cut.

23. These graphs also show that PJM prioritized meeting its own load by cutting exports—both firm and non-firm—when necessary. The graph shows a significant number of hours in which the assistance requested by other regions was not supplied. This correlates to the periods when PJM needed most of its generation for internal loads notwithstanding that during some these times other regions were seeking emergency supplies.

24. The Complainants also fail to acknowledge that PJM's operators were simultaneously considering PJM's potential needs over multiple time frames.[47] The ComEd Zone Complainants focus on the period after 06:00 on December 24, 2022, claiming that "there was no emergency in ComEd Zone beginning at least as of 06:00 on December 24 and thereafter"[48] and asserting that there was "excess generation" in the ComEd Zone.[49] Likewise, the Coalition faults PJM for issuing Maximum Generation Emergency Actions across the entire RTO and failing to distinguish generators in less-affected areas.[50] The

[45] This is hourly total MW operating above Ecomax for the Maximum Generation Emergency period.

[46] This is hourly total MW operating above Ecomax for the Maximum Generation period.

[47] *See, e.g.*,Pilong Aff. at 21-22, 29.

[48] CZG Complaint at 34 (quoting Test. of Dr. Scott Harvey, Ex. CZG-0001, at P 70).

[49] *Id.* at 35.

[50] Coalition Complaint at 37.

Nautilus Entities argue that the OPP and Rock Springs units were not needed between 12:00 and 24:00 on December 24, citing PJM's exports as evidence for that claim. [51]But looking at the totality of the circumstances, PJM's operators acted consistently with Good Utility Practice in retaining the Pre-Emergency Load Management Reductions and Maximum Emergency generation based on the information they had at the time. PJM operators had to continue to assume that more generation in the ComEd Zone and the entire PJM footprint would continue to experience outages for the rest of the weekend.

25. An overriding concern of the operators during December 24, 2022, given what had happened over the previous day and in the morning, was whether PJM could meet the evening peak in the RTO. PJM's ability to allow some non-firm exports to flow during the time leading up to the evening peak was not indicative as to whether PJM could meet the evening peak without Emergency Actions even if all non-firm exports were curtailed. PJM was reasonably concerned that loads might be as high or higher as the earlier peaks experienced on December 23 and 24.[52] Keeping both the Maximum Generation Emergency Actions and Pre-Emergency/Emergency Load Management Reduction Actions in effect throughout the day on December 24, 2022 were reasonable measures to address this possibility.

26. In particular, operators were concerned that if the Maximum Generation Emergency Action and the Pre-Emergency/Emergency Load Management Reduction Action were rescinded and PJM attempted to reinstate them in the face of a high evening peak on December 24, there could be a significantly lower response rate. If allowed to go offline, some generators might not restart due to the cold weather conditions or units running on gas might resell their gas supply. In addition, if Demand Resources were released and allowed to resume normal power consumption, PJM operators were concerned that they would not be willing and able to redeploy if called again prior to the evening peak. The fact that the evening peak came in at a relatively lower level does not undermine the validity of the operators' decisions under the Good Utility Practice standard based on the information they had when those decisions were made.

27. The validity of the PJM operators' decision to continue with Pre-Emergency/Emergency Load Management Reduction Actions and the Maximum Generation Emergency Action until PJM experienced the evening peak becomes even more plain when taking into account the operators' understanding regarding Demand Resources during the event. When the PJM operators called for Pre-Emergency Load Management Reduction Actions for the 30 minute and 60 minute participants on December 23, 2022, load reductions of about 4,300 MW were expected based on the estimates provided by the Curtailment Service Providers (CSPs). And, when PJM called for Pre-Emergency Load Management Reduction Actions and Emergency Load Management Reduction Actions for all participants, PJM expected load reduction of about 7,400 MWs based on the estimates provided by the CSPs. Until PJM received the data to determine actual load management response weeks later,

[51] Nautilus Complaint at 51-52.

[52] McGlynn Aff. at PP 56-57.

operators reasonably assumed that the actual reductions would be in line with the CSP estimates. Accordingly, when the operators decided to retain pre-emergency and Emergency Actions until the evening peak on December 24, the data they possessed indicated that the unrestricted peaks on the evening of December 23 and the morning of December 24 would have been approximately 139,300[53] MW and 137,400 MW,[54] respectively. The *perceived* impact of load management therefore was considerably greater than the actual impact of load management based on performance data, so the *perceived* risk of meeting the evening peak on December 24, 2022 was elevated even beyond what an *ex post* analysis of the actual supply/demand balance shows.

**2. PJM's Decision To Permit Non-Firm Power to Flow When There Was Sufficient Generation to Meet That Demand Was Not Only Reasonable, But Was Also Necessary For PJM to Fulfill Its Obligations To Assist Adjoining Balancing Areas**

28. Complainants provide no justification or rationale for their claim that Manual 13 and NERC rules prohibit PJM from employing Emergency Actions unless non-firm exports have been cut to zero. In fact, accepting the Complainants' interpretation would lead to inefficient outcomes and could adversely affect reliability. Essentially, Complainants' argue that if two adjoining Balancing Areas are experiencing a capacity shortage and, after taking Emergency Actions under their respective tariffs, one of the Balancing Areas has sufficient capacity to provide non-firm service requested by the other Balancing Area to assist in meeting load, then the Balancing Area with the available capacity must turn down the request for help or, alternatively, must end its own emergency declaration. As I indicated earlier, the only sensible reading of Manual 13 and NERC Standard EOP-011-1 is that a Balancing Authority experiencing or approaching a capacity shortage emergency should curtail non-firm exports to the extent that doing so will help alleviate the emergency. However, after the Balancing Authority takes Emergency Action and has the capacity to provide non-firm service requested by another Balancing Authority to avoid shedding load, it would be inefficient and undermine reliability in the Eastern Interconnection to impose an arbitrary restriction preventing it from doing so. But that is exactly what Complainants claim is the rule.

29. In the situation posited here, the Balancing Authority with the extra capacity took the Emergency Action to meet the needs of its own system and thereby *incidentally* created capacity capable of serving load in another Balancing Authority. This was the situation faced by PJM during Winter Storm Elliott, in particular on December 24, 2022, after the morning peak. PJM took Pre-Emergency and Emergency Actions to meet its own needs, which created more capacity than it needed on a minute-by-minute basis, and it supplied

[53] Actual peak of about 135,000 MW plus expected :Load Management response of 4,300 MW.

[54] Actual peak of about 130,000 MW plus expected Load Management response of 7,400 MW.

some of that capacity to other areas that needed it through non-firm exports (as well as firm exports and emergency sales).

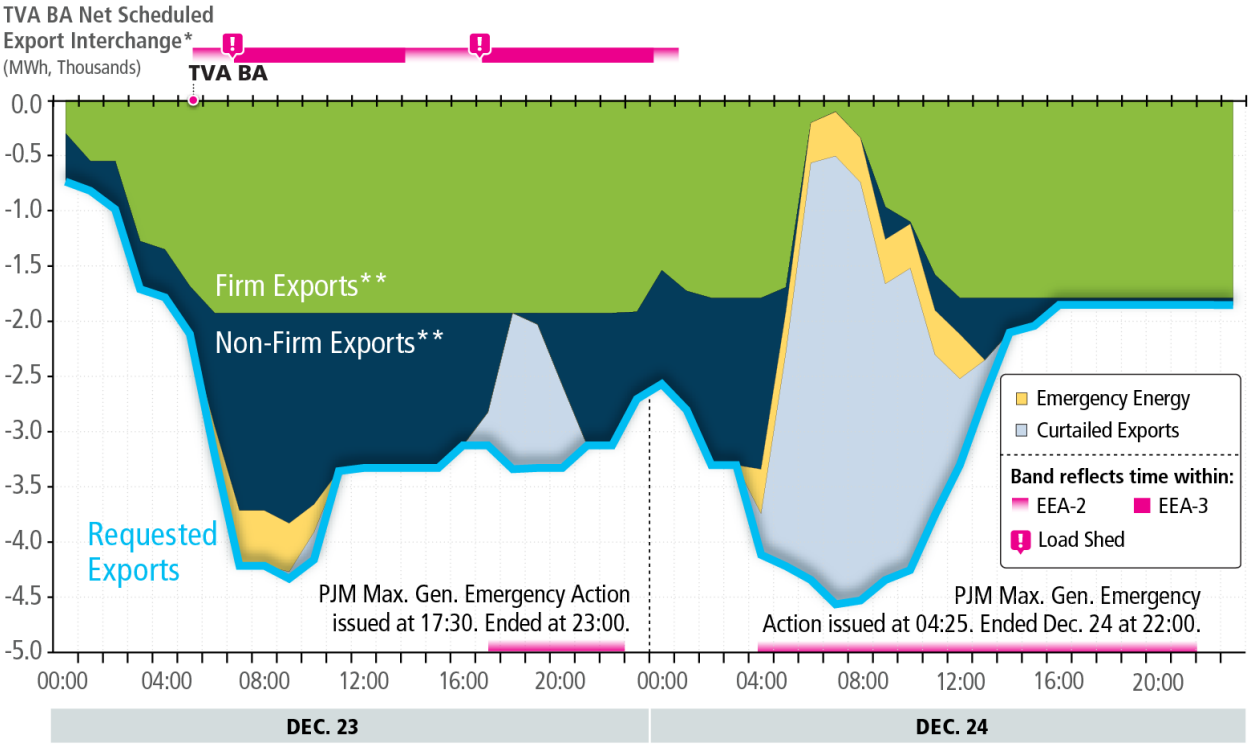
30. PJM's purpose in initiating and maintaining Pre-Emergency Emergency Actions on December 24, 2022, through the evening peak was not directed towards providing non-firm exports. But once PJM had sufficient capacity to provide assistance to other Balancing Areas, it was obligated to do so. As I noted above, NERC Standard IRO-014-3 R7 provides that "[e]ach Reliability Coordinator shall assist Reliability Coordinators, if requested and able . . . .[55] PJM met this obligation, in part, when it was "requested and able" to make non-firm exports to other Reliability Coordinators such as VACAR and TVA. Further, as also noted above, Manual 13 specifically contemplates that "[i]f the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed then PJM will not curtail the transactions unless it would prevent load shedding within PJM."[56] As shown below, this was exactly the situation presented to the PJM operators. With this in mind, Dr. Sotkiewicz's, as well as the CZG Zone Complainants and the Coalition, assertion that "[i]f PJM felt comfortable enough to allow Non-Firm exports of energy, the logical implication is that there really was no Emergency Condition"[57] is a complete misunderstanding of PJM's obligations under Manual 13 and distorts the logic undergirding Section 2.3.2.

31. The non-firm exports supplied to TVA provided assistance during periods when TVA was in a capacity deficient condition. The graph below shows the non-firm exports made to TVA:

[55] NERC Standard IRO-014-3 R7.

[56] Manual 13, § 2.3.2.

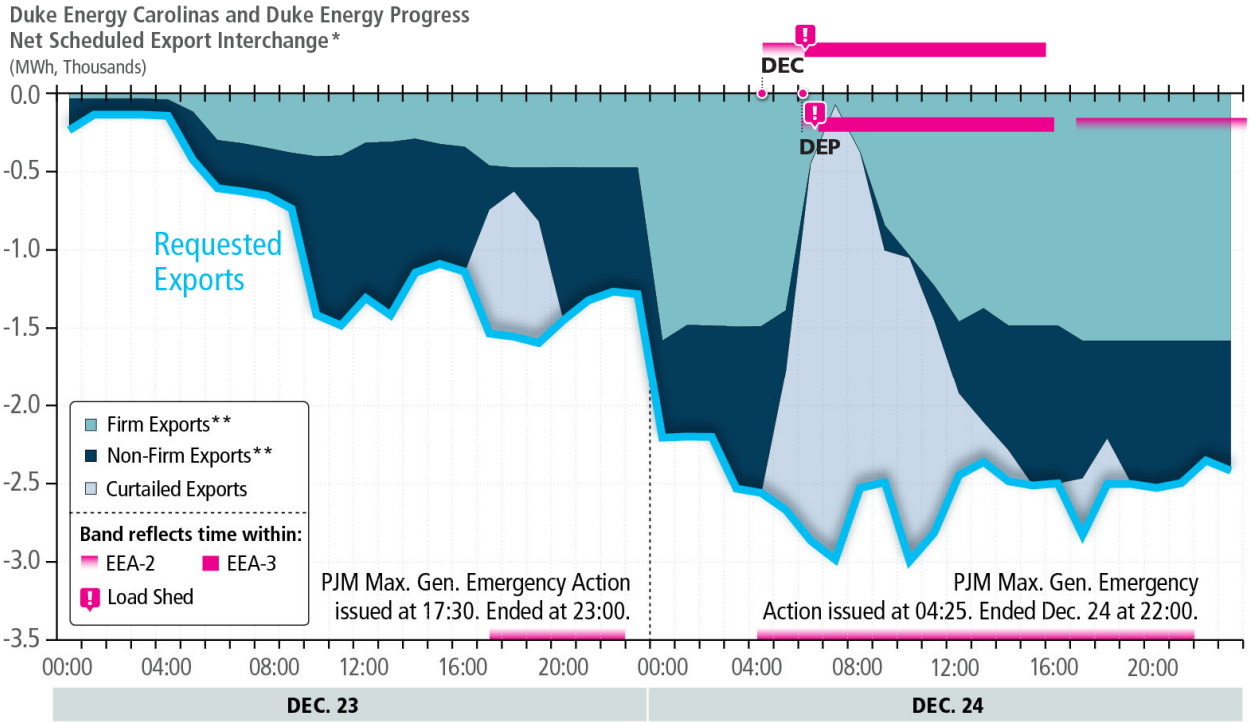
[57] CZG Complaint, Sotkiewicz Aff., Ex. CZG-0004, at P 96; Coalition Complaint, Sotkiewicz Aff., Attach. 4, at P 130.




*Dynamic Transfers not included; **Excludes Emergency

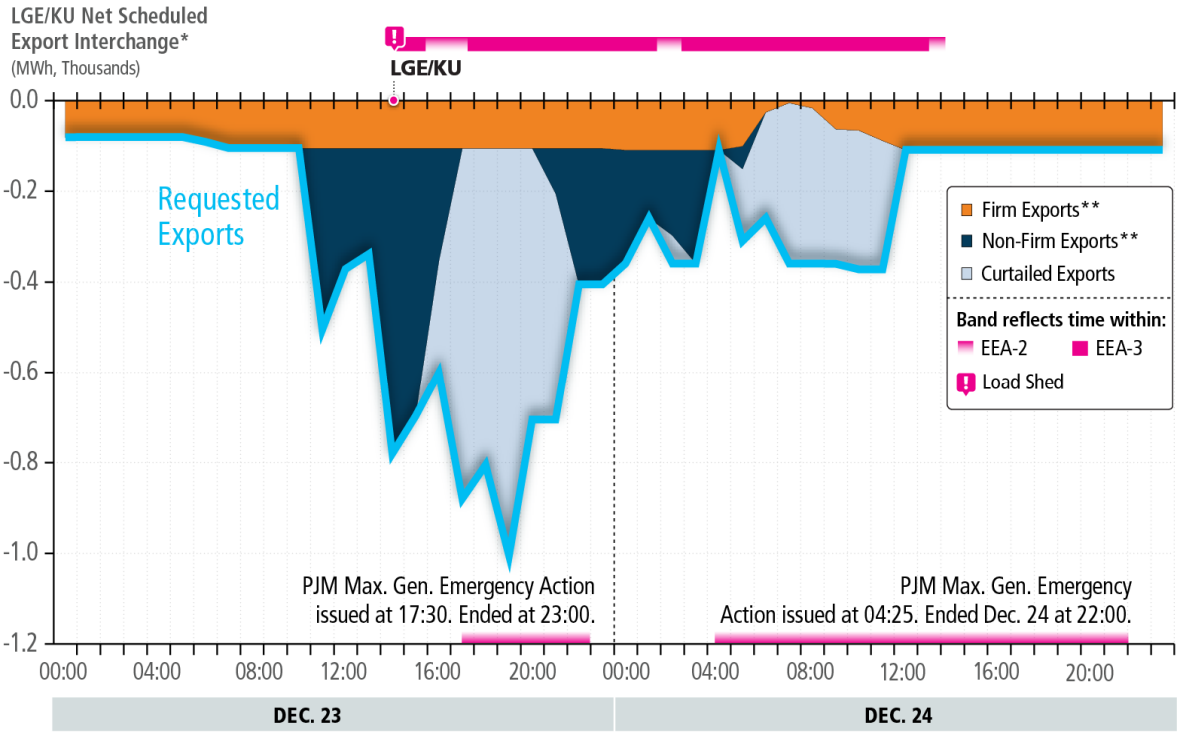
As can be seen by the chart, PJM was able to assist TVA by providing non-firm expoerts during times that the TVA system was shedding load. Had PJM not done so, it is likely that TVA would have been required to engage in additional load shedding than actually occurred.

32. Similarly, the non-firm exports supplied to Duke Carolinas and Duke Energy Progress provided assistance to those systems when they were experiencing capacity deficient conditions as shown in the chart below:




As depicted above, PJM was also able to provide assistance by making non-firm exports to Duke Carolinas and Duke-Energy Progress when they were shedding load. Again, if PJM had not provided this assistance, in all likelihood Duke Carolinas and Duke Energy Progress would also have had to engage in more load shedding.

33. Finally, Louisville Gas and Electric Company and Kentucky Utilities Company (LGE/KU) also received non-firm exports when they were experiencing capacity deficit conditions as shown in the chart below:




*Dynamic Transfers not included; **Excludes Emergency

Once again, PJM made non-firm deliveries to LGE/KU when the region was shedding load. Had PJM not made these exports, additional load shedding would likely have been needed.

## F. PJM Acted Properly By Providing Assistance to Adjoining Balancing Areas After It Initiated Load Management Actions

34. The CZG Complainants and the Coalition assert that PJM violated a provision in Section 2.5 of Manual 13 that prevents PJM from calling Load Management Actions for the purpose of providing assistance to another region. According to these Complainants, this violation occurred because PJM made non-firm exports after it implemented Load Managements Actions. The factual support for their claims consists of pointing to timelines for December 23, 2022 and December 24, 2022 showing that non-firm exports occurred after the Load Management events began. The CZG Complainants' and the Coalition's argument is a gross misreading of Manual 13 that is inconsistent with the text of the manual and which, if accepted, would prevent PJM from providing *any* assistance to other Balancing Areas during virtually any capacity shortage event that PJM might ever experience.

35. The obvious purpose of Section 2.5 of Manual 13 is to prohibit PJM from initiating Load Management *for the purpose* of providing assistance to another region. Section 2.5 provides: "When adjacent Balancing Areas are deficient in generation and are requesting assistance from the PJM RTO, actions are taken, provided the adjacent Balancing Area has

taken the same actions requested of PJM."[58] Subject to certain restrictions, actions may include "Maximum Emergency generation [and] a 5% Voltage Reduction to provide the required assistance . . . ." To be clear, this provision assumes that PJM is not itself experiencing an emergency condition when it is invoked. As stated in Manual 13, "PJM Dispatch prefaces these procedures [steps taken to assist other Balancing Areas under this provision] by the words 'due to PJM providing emergency assistance to an adjacent Control Area(s), PJM is issuing an (appropriate alert or action message).'"[59] The events that occurred during Winter Storm Elliott therefore do not fall within the scope of this section of Manual 13.

36. PJM *itself* needed Load Management Actions to meet its own needs. During Winter Storm Elliott, PJM never initiated a Load Management Action for the purpose of providing assistance to another region. Even assuming that Load Management might have had the incidental effect of facilitating some non-firm exports when PJM was experiencing emergency conditions, the Manual 13 guidance not to initiate Load Management Actions *for the purpose* of assisting other regions simply does not apply.

37. In fact, accepting the CZG Complainants' and the Coalition's interpretation, PJM could never provide emergency assistance of any sort to another Balancing Area if it previously called for Load Management Actions. There is nothing in Section 2.5 of Manual 13 that would limit the (claimed) prohibition of providing assistance to other regions after initiating Load Management Actions to non-firm exports. The sentence cited by these Complainants states: "PJM load management programs are not to be used to provide assistance to adjacent Balancing Areas."[60] If the CZG Complainants' and the Coalition's reading is correct, this limitation would mean that PJM could not provide firm exports or even emergency sales to another Balancing Area experiencing a capacity shortfall after PJM initiated a Load Management Action. The only time PJM could assist another region in any respect would be if no Load Management Actions were taken. Given that PJM would be expected to call for Load Management Action during any capacity shortage (including during pre-emergency conditions) PJM would be side-lined in virtually any wide-area capacity event that included its territory. Such an interpretation of this manual provision would be irrational.

## G. Complainants' Arguments That PJM Failed to Properly Maintain Reserves in Certain Control Areas Do Not Support their Claims

38. The CZG Complainants and Coalition contend that PJM failed to properly maintain reserve levels and claim that PJM should have curtailed both non-firm and firm exports to do so. According to Dr. Sotkiewicz, PJM violated the Tariff and Operating Agreement because "PJM allowed reserve levels to fall below their requirements RTO-wide and within the

[58] Manual 13, § 2.5.

[59] *Id.* (emphasis omitted).

[60] *Id.*

Mid-Atlantic-Dominion ('MAD') reserve sub-zone frequently while supporting exports."[61] Specifically, Complainants cite the language of Tariff, Attachment K–Appendix Section 1.10.6 (c) and Operating Agreement Schedule 1, Section 1.10.6(c), which both state that "[t]he Office of the Interconnection shall curtail deliveries to an External Market Buyer if necessary to maintain appropriate reserve levels for a Control Zone as defined in the PJM Manuals, or to avoid shedding load in such Control Zone."[62] The CZG Complainants claim that "because the OA trumps the manuals,"[63] the admonition to "curtail deliveries to an External Market Buyer if necessary to maintain appropriate reserve levels" prevents PJM from relying upon Manual 13, Sections 2.3.2 and 2.5, which both prevent PJM from cutting external sales "[i]f the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed . . . unless it would prevent load shedding within PJM."[64] But even if Dr. Sotkiewicz's analysis were correct (and I do not concede that it is), it fails to help Complainants' basic thesis that PJM's pre-emergency and Emergency Actions were not justified. Further, the Complainants' asserted dichotomy between the Operating Agreement, Tariff, and Manual 13 is invalid. Complainants badly misread each of those provisions, which do not conflict.

39. As an initial matter, I disagree with Dr. Sotkiewicz's statement that PJM "allow[ed] reserves to go short increasing the likelihood of a loss of load event in PJM." [65] PJM had options to address a large contingency occurring at times when level of reserves fell below the desired levels. PJM had the option to take a Voltage Reduction Action which would have made 1,701.7 MW of reserves available to PJM.[66] At least 1,239.1 MW are available in 10 minutes or less, some of which are available in as little as 2 minutes.[67] Also, a Voltage Reduction Action for the Mid-Atlantic-Dominion subzone would have made 1239.1 MW available in 10 minutes or less. These quantities are similar in terms of their operational characteristics to Synchronized Reserves since their sources are currently operating resources synchronized to the system. Further, because this was a capacity shortage emergency and PJM had called a Maximum Generation Action, it had the ability to recall all PJM Capacity Resources being used to serve loads outside of PJM regardless of the type

[61] CZG Complaint, Sotkiewicz Aff., Ex. CZG-0004, at P 100; Coalition Complaint, Sotkiewicz Aff., Attach. 4, at P 131 & n.93.

[62] CZG Zone Complaint at 19 & n.57 (quoting and citing the Tariff and OA); Coalition Complaint at 25, 32.

[63] CZG Complaint at 30.

[64] *Id.* at 30 (quoting Manual 13, § 2.3.2 at 32); Manual 13, § 2.5 at 92.

[65] CGZ Complaint, Sotkiewicz Aff., Ex. CZG-Ex-004, at P 117.

[66] *See* Manual 13 § 2.3.2 (Step 9 (Real-time)" Voltage Reduction Action at 39, *id*. at 26-27 (tables describing available amounts).

[67] *Id.* at 26-27 (tables describing available amounts).

of transmission service, *i.e.*, non-firm or firm, being used.[68] Most of the exports are related to PJM Capacity Resources and thus could have been recalled by PJM if needed to serve its own customers' requirements.

40. Dr. Sotkiewicz claims that all or most exports should have been curtailed at various times on December 23 and December 24, 2022, but he nowhere explains how much curtailment was necessary, so the impact of taking this extraordinary step contrary to Manual 13 cannot be determined. Even more importantly, Dr. Sotkiewicz does not even claim that if PJM had curtailed non-firm and firm exports, PJM would not have needed either Pre-Emergency Load Reduction Actions or Emergency Actions. As I have explained already, the PJM's operators' reasons for taking Pre-Emergency and Emergency Actions related mainly to uncertainty in the load forecast and the surprisingly poor overall performance of generation. Further, as I have also explained, an important reason for extending pre-emergency and emergency procedures after the morning peak ended on December 24, was the PJM operators' concern about meeting the evening peak. Even if PJM should have curtailed external exports to maintain RTO Primary Reserves during certain times between 02:00 and 06:00 on December 24, 2022 (which I do not concede is correct), that would not have addressed the valid concerns the operators had about meeting the evening peak. In fact, about half the identified period on December 24, 2022, falls outside of the times that PJM took pre-emergency and Emergency Actions. The main focus of this portion of Dr. Sotkiewicz's affidavit is the claim that "PJM's failure to curtail exports to maintain reserves in accordance with the Tariff led to reserve shortages and higher reserve prices than needed to be the case."[69] But the ComEd Zone Complainants and Coalition are seeking to avoid Non-Performance Charges; they do not seek redress for cost impacts associated with PJM's alleged violation of the requirement to maintain reserves.

41. The CZG Complainants' assertion that Dr. Sotkiewicz's affidavit sets up a conflict between a controlling tariff provision and an inferior manual provision is also misleading. PJM's Tariff and Operating Agreement both provide for "the mutual provision of . . . support in . . . Emergency conditions with other interconnected Control Areas" and require PJM to "[c]oordinate the curtailment or shedding of load, or other measures appropriate to alleviate an Emergency."[70] The Manual 13 guideline is an implementation detail for the

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[68] *See PJM Interconnection, L.L.C.*, 84 FERC ¶ 61,224 at 62,081 (1998) ("PJM explains that the curtailment provisions [i.e., those proposed for Operating Agreement Section 1.11.3A Maximum Generation Emergency] relate to generation curtailments, not transmission curtailments. [PJM's] right to call upon the output of Capacity Resources is already a requirement applicable to the owners of Capacity Resources (i.e., they are permitted to make only nonfirm, recallable sales from Capacity Resources) . . . ., and that this provision merely clarifies that fact. We find that PJM's explanation adequately addresses Cargill-Alliant's concerns and agree that the curtailment terms at issue here relate to generation sales, not transmission service, and simply clarify the existing arrangement.").

[69] CZG Complaint, Sotkiewicz Aff., Ex. CZG-0004, at P 109.

[70] Tariff § 1.6.2.

performance of PJM's obligations under the Tariff and Operating Agreement. Assuming a conflict between PJM's Tariff/Operating Agreement duties to sustain internal reserves and its Tariff/Operating Agreement commitment to provide assistance to prevent load shed in another area, the task faced by the PJM operators would be to balance, the achievement of these two goals when feasible and consistent with the Good Utility Practice Standard. Specifically, under the facts here, the PJM operators would need to balance the the reserves violations the CZG Zone Complainants and Coalition allege occurred against the load shedding damage that cutting firm transactions to other regions would have caused or failed to mitigate. This is very different than the analysis framed by these Complainants. Even accepting the CZG Complainants' and Coalition's claim that the reserves shortages occurred, opting instead to prevent or mitigate load shedding in neighboring regions during an extreme cold weather event would been the most reasonable choice.

42. This concludes my affidavit.

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| **Essential Power OPP, LLC, *et al.*** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-53-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Aurora Generation, LLC, *et al.*** | ) | |
| **Complainants** | ) | |
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| **Respondent** | ) | |
| | ) | |
| **Coalition of PJM Capacity Resources** | ) | |
| **Complainant** | ) | |
| **v.** | ) | **Docket No. EL23-55-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |

## VERIFICATION

I, **Michael E. Bryson**, state, under penalty of perjury, that I am the Michael E. Bryson referred to in the foregoing document entitled "Affidavit of Michael E. Bryson on Behalf of PJM Interconnection, L.L.C.," that I have read the same and am familiar with the contents thereof, and that the facts set forth therein are true and correct to the best of my knowledge, information, and belief.

*/s/ Michael E. Bryson*
Michael E. Bryson

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Calpine Corporation,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-66-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |
| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

## VERIFICATION

I, **Michael E. Bryson**, pursuant to 28 U.S.C. § 1746, state, under penalty of perjury, that I am the Michael E. Bryson referred to in the foregoing document entitled "Affidavit of Michael E. Bryson on Behalf of PJM Interconnection, L.L.C.," that I have read the same and am familiar with the contents thereof, and that the facts set forth therein are true and correct to the best of my knowledge, information, and belief.

DocuSigned by:
Michael E. Bryson
9FA6D57CE407438...

Michael E. Bryson

Attachment C

Affidavit of Steven T. Naumann, P.E.
on Behalf of PJM Interconnection, L.L.C.

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Calpine Corporation,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-66-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |
| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

**AFFIDAVIT OF STEVEN T. NAUMANN, P.E.**
**ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1. My name is Steven T. Naumann. My business address is 8210 Tripp Avenue, Skokie, Illinois 60076. I am a self-employed consultant, with over 40 years of experience in planning, operations, reliability and regulatory aspects of electric power systems.

2. I am submitting this affidavit on behalf of PJM in support of PJM's Answers to the Complaints filed by the Calpine Corporation and Invenergy Nelson LLC in the captioned proceedings. I have reviewed these Complaints and aver that the statements, analyses, and conclusions I present in my May 26, 2023 affidavit submitted on behalf of PJM in support of PJM's Answers to the complaints filed in Docket Nos. EL23-53, EL23-54, and EL23-55, which I include as Exhibit 1 to this affidavit, apply equally to the issues raised in the captioned Complaints of Calpine Corporation and Invenergy Nelson LLC.

3. This concludes my affidavit.

# Exhibit 1

## Affidavit of Steven T. Naumann
## on behalf of PJM Interconnection, L.L.C.

## Submitted in Docket Nos. EL23-53, EL23-54 and EL23-55
## on May 26, 2023

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| **Essential Power OPP, LLC, *et al.*,** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-53-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Aurora Generation, LLC, *et al.*,** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-54-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Coalition of PJM Capacity Resources** | ) | |
| **Complainant** | ) | |
| **v.** | ) | **Docket No. EL23-55-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |

**AFFIDAVIT OF STEVEN T. NAUMANN, P.E.**
**ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1. My name is Steven T. Naumann. My business address is 8210 Tripp Avenue, Skokie, Illinois 60076. I am a self-employed consultant. In 2019, I retired from Exelon Corporation (Exelon) where I served as Vice President, Transmission and NERC Policy for Exelon Business Services Company. In that role, I provided the electric delivery utilities owned by Exelon advice and guidance on regulatory questions relating to system planning, design, operation, and reliability, and rates, terms, and conditions of service that are subject to federal regulation or that concern boundaries and classifications of assets, services, and authority between federal and state jurisdiction. I also provided advice and guidance on reliability and security policy to Exelon Generation, then the generation subsidiary of Exelon.

2. I have over 40 years of experience in planning, operations, reliability and regulatory aspects of electric power systems. I was part of the Exelon executive team leading the integration of Commonwealth Edison Company (ComEd) into PJM. My knowledge of transmission and generation issues in PJM, particularly in the ComEd Zone, is directly relevant to the arguments advanced by the ComEd Zone Generators in this proceeding.

3. I am licensed in Illinois, both as a Professional Engineer and as an attorney, although I do not practice law. I hold a Bachelor of Science degree in Electric Power Engineering and a Master of Engineering degree in Electric Power Engineering, both from Rensselaer Polytechnic Institute in New York, as well as a Juris Doctor from Chicago-Kent College

of Law. My biographical summary, attached as Exhibit PJM-007.1, provides more detail on my qualifications, my publications, and my previous testimony.

4. I am submitting this Affidavit in support of PJM Interconnection, L.L.C. (PJM) in response to the complaints filed in the above captioned proceedings.

**Conclusions**

5. PJM's primary responsibility is to manage the assets that it operates in a reliable and safe manner. This responsibility is above all others. PJM's mission statement declares that its "primary task" is "to ensure the safety, reliability, and security of the bulk electric power system."[1] As PJM's President and CEO has stated, "[k]eeping the power flowing and the grid reliable is the core mission for PJM and our member companies."[2]

6. Based on over 40 years of experience, the primary responsibility of all entities that plan and operate the electric power grid is to keep the lights on. This task may be challenging when system operators face severe conditions, especially where decisions need to be made within a short period of time and circumstances are rapidly changing. It should be no surprise that operators may take actions in real-time to address difficult problems that others may question after the fact as being overly conservative or uneconomic. At such times, delaying actions can result in unnecessary loss of load. Furthermore, it is important for operators to be proactive—i.e., stay ahead of potential problems, not reactive after problems occur—to ensure reliability, especially during periods of severe stress.

7. Winter Storm Elliott was an unusually severe winter storm that struck the PJM Region between December 23 and December 24, 2022. The storm presented extraordinary reliability challenges by causing an extremely rapid drop in temperatures coincident with unexpectedly record-breaking high loads for the Christmas holiday.[3] It had a major impact not just on PJM but on much of the rest of the Eastern Interconnection. There have been a number of large-scale disturbances that have resulted in wide-area loss of load dating back to the Northeast Blackout of 1965.[4] One of the more remarkable features of PJM's

[1] PJM, *About PJM: Who We Are*, https://pjm.com/about-pjm.

[2] *PJM 2021 Annual Report, Operations* (June 2022), https://services.pjm.com/annualreport2021/operations/. PJM's emphasis on reliability has remained unchanged for the past two decades. For example, in April 2004, the Exelon executive team met with the PJM executive team to finalize the steps of PJM integrating ComEd into PJM on May 1, 2004. At that meeting, I recall that Exelon's then-CEO, John Rowe, asked PJM's then-CEO, Phil Harris, to promise not to go forward with the integration if there was anything not yet completed that would threaten reliability. Mr. Harris, of course, reassured the Exelon team that PJM would ensure reliable operations before completing the switchover.

[3] *See* PJM, *Winter Storm Elliott Info*, https://www.pjm.com/markets-and-operations/winter-storm-elliott (collecting PJM's public statements addressing Winter Storm Elliott's impact on PJM's operations and markets).

[4] *See* FERC and NERC, Regional Entity Staff Report, The February 2021 Cold Weather Outages in Texas and the South Central United States 47-50 (Nov. 2021) (February 2021 Cold

performance during Winter Storm Elliott is that PJM, unlike its neighboring Balancing Authorities, was able to navigate Winter Storm Elliott without forcing customers to shed load.[5]

8. While each operating situation is different and the information that operators have to make decisions varies, it is important to put the performance of PJM during Winter Storm Elliott in context of severe cold weather events over the past decade.[6] Following the February 2011 cold weather event in ERCOT and the Southwest, the FERC-NERC Staff Report made 26 recommendations for the electric system including the need for generator winterization.[7] Next was the 2014 Polar Vortex, after which NERC made a number of recommendations, generator winterization again among them.[8] In January 2018, similar high outage rates occurred during the extreme cold in the South Central United States, including MISO and TVA, which connect to PJM.[9] A more recent incident is the situation in Texas during Winter Storm Uri, in February 2021, when ERCOT was forced to shed over 10,000 MW of load in less than an hour to avoid a blackout of the entire ERCOT

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Weather Report) (describing previous cold weather events), https://www.nerc.com/news/Pages/Final-Report-on-February-2021-Freeze-Underscores-Winterization-Recommendations.aspx; FERC and NERC Staff Report, Arizona-Southern California Outages on September 8, 2011 (Apr. 2012), https://www.nerc.com/pa/rrm/ea/Pages/September-2011-Southwest-Blackout-Event.aspx; U.S.-Canada Power System Outage Task Force, Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations § 7 at 103-07 (Apr. 2004) (describing seven large-scale disturbances), https://www.energy.gov/oe/articles/blackout-2003-final-report-august-14-2003-blackout-united-states-and-canada-causes-and.

[5] *See infra* P 23 & notes 47-51 (detailing emergency actions and substantial forced load shedding in PJM's neighboring Balancing Authorities on December 23 and December 24 as documented by NERC, the Department of Energy, and the Reliability Coordinator Information System).

[6] Other types of historical weather events also highlight the risk of operators waiting too long to take emergency actions and how dramatic such actions may need to be in a crisis. A particularly noteworthy example occurred in July 1977, when the New York electric grid suffered transmission line outages due to lightning from thunderstorms north of New York City, which was importing power. After a number of outages, the Consolidated Edison operators delayed shedding load, and, after separating from the rest of the Eastern Interconnection, nearly the entire city suffered a blackout. *See, e.g.*, Victor K. McElheny, *Improbable Strikes by Lightning Tripped Its System, Con Ed Says*, N.Y. TIMES (July 15, 1977).

[7] *See* FERC and NERC, Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011, 197-212 (Aug. 2011), https://www.nerc.com/pa/rrm/ea/Pages/February-2011-Southwest-Cold-Weather-Event.aspx.

[8] *See* NERC, Polar Vortex Review 19-20 (Sept. 2014), https://nerc.com/pa/rrm/january%202014%20polar%20vortex%20review/polar_vortex_review_29_sept_2014_final.pdf.

[9] *See* FERC and NERC, Staff Report, The South Central United States Cold Weather Bulk Electric System Event of January 17, 2018 (July 2019), https://www.nerc.com/pa/rrm/ea/Documents/South_Central_Cold_Weather_Event_FERC-NERC-Report_20190718.pdf.

system.[10] ERCOT came within minutes of a full blackout due to a combination of generator outages and high load.[11]

9. These events prompted regulators and public utilities, including PJM, to develop guidelines to avoid or mitigate cold weather emergencies. Starting in 2012, NERC issued three versions of winter preparedness guidelines culminating in a comprehensive guideline in 2020[12] and Level 2 Alerts providing recommendations to industry prior to the 2021-2022 and 2022-2023 winter seasons.[13] After a decade of alerts, guidelines, training, and lessons learned, PJM's generator owners and operators were well aware of the need to winterize their assets and that extreme cold was going to be more common than previously thought. In fact, the Commission recently pointed this out stating "we also emphasize that industry has been aware of and alerted to the need to prepare their generating units for cold weather since at least 2011."[14] And PJM's generators certainly were aware that FERC had approved modifications to three NERC reliability standards, even though those standards would not be effective until April 1, 2023.[15]

10. Nevertheless, many generators failed to perform once again when Winter Storm Elliott struck PJM on December 23-24. They failed despite mandatory reliability standards that were just over the horizon, numerous examples of cold weather events where large amounts of natural gas-fired generation were unavailable, and a wide array of alerts, reports, lessons learned, guidelines and training in which generators were told repeatedly what they needed to do to operate during extreme cold.

11. For example, NERC's Generating Unit Winter Weather Readiness Guideline lists 16 "typical problem areas," that may result in operational issues due to cold and/or freezing

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[10] *See* February 2021 Cold Weather Report, Fig. 73, at 137.

[11] *See id*. at 47-50.

[12] *See* NERC, Reliability Guideline, Generating Unit Winter Weather Readiness – Current Industry Practices – Version 3 (Dec. 15, 2020) (Generating Unit Winter Weather Readiness), https://www.nerc.com/comm/RSTCReliabilityGuidelines/Reliability_Guideline_Generating_Unit_Winter_Weather_Readiness_v3_Final.pdf.

[13] *See* Recommendation to Industry, Cold Weather Preparations for Extreme Weather Events – II (Sept. 12, 2022), https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC%20Alert%20R-2022-09-12-01%20Cold%20Weather%20Events%20II.pdf; Recommendation to Industry, Cold Weather Preparations for Extreme Weather Events (Aug. 18, 2021), https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC%20Alert%20R-2021-08-18-01%20Extreme%20Cold%20Weather%20Events.pdf.

[14] *See N. Am. Elec. Reliability Corp*., 182 FERC ¶ 61,094 at P 88 (2023) (approving Extreme Cold Weather Reliability Standards).

[15] *See N. Am. Elec. Reliability Corp*., 176 FERC ¶ 61,119 (2021) (approving Cold Weather Reliability Standards); Recommendation to Industry, Cold Weather Preparations for Extreme Weather Events – II at 1 ("The Cold Weather Reliability Standard becomes enforceable on April 1, 2023") (in red and bold in original).

weather.[16] In turn, PJM has documented a Cold Weather Preparation Guideline and Checklist that includes a detailed list of typical problem areas for generators to include in their winterization plans.[17]

- Personnel Preparation
- Staffing
- Equipment Preparation
- Maintain Substation Equipment
- Fuel and Environmental Preparation

Under equipment protection, PJM has listed 33 detailed, albeit not exclusive actions, including:

- Review cold weather scenarios affecting equipment taking into account the effects of precipitation and wind
- Consider pre-warming, operating at full speed no load, early start-up, and/or putting on turning gear scheduled units prior to a forecasted severe winter weather event
- Prepare units that have been off line for lengthy periods of time for start-up and operation during severe winter weather events

To refer to the events of Winter Storm Elliott as *déjà vu* all over again would be an understatement.[18]

12. With this history in mind, Winter Storm Elliott presented PJM operators with extremely high rates of generator outages and derates related to extreme cold weather and fuel supply problems—problems that the training, guidelines, and most importantly, the Capacity Performance market-based framework[19] were supposed to solve. PJM operators had to deal with these facts and could not assume that, if the next generator(s) tripped, sufficient generation would be able to come on line at the times needed to stabilize the system with enough energy plus reserves. The risk was too high.

13. The seriousness of generation failures during a decade of cold weather events and lack of preparedness, has led NERC to issue an unprecedented level 3 alert "to target a critical risk,

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[16] *See* Generating Unit Winter Weather Readiness, at 3-5.

[17] *See* PJM Manual 14D: Generator Operational Guidelines, Attach. N: Cold Weather Preparation Guideline and Checklist, at 148-54 (Rev. 62, Dec. 21, 2022).

[18] Yogi Berra purportedly made this statement following back-to-back home runs by Mickey Mantle and Roger Maris in 1961.

[19] *See PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208 (Capacity Performance Order), *order on reh'g & compliance*, 155 FERC ¶ 61,157 (Capacity Performance Rehearing and Compliance Order), *pet'n for rev. denied sub nom. Advanced Energy Mgmt. All. v. FERC*, 860 F.3d 656 (D.C. Cir. 2017).

cold weather preparations for extreme weather events to reliability."[20] Of the eight Essential Actions, six require responses by Generator Owners. These actions include (1) calculating the Extreme Cold Weather Temperature (ECWT), as defined in the Alert and in new standard EOP-12-1, for each plant; (2) identifying the cold weather preparedness plan the critical components and freeze protection measures to be implemented for the next winter season; (3) identifying which units are capable of operating at the ECWT, which units require additional freeze protection and which can be implemented prior to next winter; (4) identifying units that experienced a Generator Cold Weather Event during the 2022-2023 winter and (a) identify the cause; (b) determine applicability to similar units; (c) determine corrective actions that can be implemented prior to next winter; and (d) identify temporary operating limitations; and (5) providing information to the relevant Reliability Coordinators, Balancing Authorities and Transmission Operators. [21] While I am not implying that the PJM generators should have been in compliance with Reliability Standard EOP-012-1, which the Commission did not approve until after the events of Winter Storm Elliott,[22] generators certainly were aware of the requirements prior to the start of the 2022-2023 winter season.

14. The ComEd Zone Generators contend that PJM was required to curtail all non-firm exports prior to initiating capacity-related emergency procedures.[23] The Coalition of PJM Capacity Resources (Coalition) makes this same argument. [24] This is a faulty interpretation of the PJM OATT and PJM Manual 13. The ComEd Zone Generators and the Coalition are arguing that PJM has no flexibility in the steps it takes before a Performance Assessment Interval (PAI) is triggered. In the first instance, both Complainants come to this conclusion by misreading the PJM OATT and PJM Manual 13. While the ComEd Zone Generators correctly cite the definition of Emergency Action, which encompasses "*any* emergency action for locational or system-wide capacity shortages,"[25] the ComEd Zone Generators go on to argue that, because "PJM did not take *all* steps before taking Emergency Actions that triggered the PAIs," the penalties should not have been triggered.[26] For example, the

[20] NERC Board of Trustees Agenda, Agenda Item 6b (Mar. 11, 2023).

[21] NERC, Essential Actions to Industry, Cold Weather Preparations for Extreme Weather Events III (May 15, 2023), https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/Level%203%20Alert%20Essential%20Actions%20to%20Industry%20Cold%20Weather%20Preparations%20for%20Extreme%20Weather%20Events%20III.pdf.

[22] *See N. Am. Elec. Reliability Corp*., 182 FERC ¶ 61,094. A number of the Complainants voted against approval of EOP-12-1. *See* Ballot Name: 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination EOP-012-1, https://sbs.nerc.net/BallotResults/Index/649.

[23] Complaint of ComEd Zone Generators at 21-22, Docket No. EL23-54 (Apr. 4, 2023).

[24] Complaint of the Coalition of PJM Capacity Resources (Coalition Complaint) at 27-33, Docket No. EL23-55 (filed Apr. 4, 2023).

[25] Complaint of ComEd Zone Generators at 18, Docket No. EL23-54 (Apr. 4, 2023) (citing PJM OATT, § 1, Definitions, Definitions E – F) (emphasis added).

[26] Complaint of ComEd Zone Generators at 19 (emphasis added).

ComEd Zone Generators, the Coalition and the Nautilus Entities argue that Section 2.3.2 of PJM Manual 13 *requires* that "prior to entering into capacity related Emergency Procedures, PJM *must* 'curtail all non-Firm exports.'"[27] The Coalition repeats this argument and also claims, erroneously, that Section 2.3.2 requires PJM to issue an Energy Emergency Alert Level 1 (EEA 1).[28] But Section 2.3.2 says no such thing.

15. Inventing a requirement to take *all* steps prior to taking Emergency Actions is contrary to the express language of Section 2.3.2 of PJM Manual 13. First, Section 2.3.2 explicitly states, "[d]ue to system conditions and the time required to obtain results, PJM dispatchers may find it necessary to vary the order of application to achieve the best overall system reliability."[29] Section 2.3.2 goes on to state that the actions taken prior to entering into capacity related emergency procedures are "the most probable sequence" and, depending on the severity of the capacity deficiency, "it is unlikely that some Steps would be implemented."[30] Moreover, as I explain below, such a reading is inconsistent with the flexibility that PJM operators must have to deal with emergencies, especially those faced by PJM during Winter Storm Elliott.

16. The operators have to make decisions based on current conditions, expected conditions, and the uncertainty of various elements of the system with an eye to preventing loss of load. They must have flexibility. For example, given the quickly changing weather and the large amount of gas-fired generation then unavailable, inaccurate and untimely information provided by generators, the fact that neighboring regions did not have excess capacity to supply to PJM if additional PJM generation tripped, and the uncertainty of the level of load, maintaining non-firm exports when PJM had additional resources to do so must be considered Good Utility Practice.[31] If some generators that were delivering energy had tripped or were forced to derate, or load unexpectedly increased, PJM could then

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[27] Complaint of ComEd Zone Generators at 21 (underlining in original, italics added); *see also* Complaint of Coalition Complaint at 25, 27, Docket No. EL23-55 (filed Apr. 4, 2023); Complaint of Nautilus Entities at 42, 56 and Affidavit of Christopher H. Jordan at P 42, Docket No. EL23-53 (filed Mar. 31, 2023).

[28] Coalition Complaint at 25, 27.

[29] PJM Manual 13, § 2.3.2, at 28.

[30] *Id*.

[31] The "Good Utility Practice" standard has been in place for decades and applies to all FERC-jurisdictional transmission providers. The PJM OATT includes the standard definition of "Good Utility Practice" as "any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, *in the exercise of reasonable judgment in light of the facts known at the time the decision was made*, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather is intended to include acceptable practices, methods, or acts generally accepted in the region; including those practices required by Federal Power Act section 215(a)(4)." PJM OATT, § 1, Definitions, Definitions G – H (emphasis added).

interrupt non-firm exports and utilize the energy from the remaining generators that are on-line to maintain service to PJM load.[32] Similarly, PJM operators had to consider the probability that generators would not start when called upon or that start-up would be delayed. This concern was not theoretical. When PJM called for resources to support the peak the morning of December 24, approximately 6,000 MW of steam generation did not come on-line at the expected time to support the load.[33] Furthermore, PJM found numerous instances of generators either not providing accurate data on availability or not updating data. PJM only found out about generators inability to run, to start when needed, or derates when PJM called on those generators to operate. This lack of accurate information increased the difficulty for PJM to serve the load.[34] PJM was in a position of having to make critical operating decisions but could not trust the information provided by many generators. Having generation running and synchronized, as well as additional generation available for such contingencies is, by definition, Good Utility Practice.

17. The conditions in ERCOT during Winter Storm Uri are an example of what can happen under similar extreme cold conditions. During a three-hour period, the load in ERCOT increased and over 6,000 MW of generation was lost.[35] As stated in the February 2021 Cold Weather Report, "[d]ue to the unrelenting generating unit losses during this period, the actions ERCOT BA operators took to restore Physical Responsive Capability and maintain normal frequency (initially, calling on demand response, then ordering small blocks of firm load shed) could not keep up, and frequency continued to drop. ERCOT BA operators were forced to shed larger blocks of firm load, and within minutes of one another, to restore frequency."[36] PJM operators could not allow a similar situation to occur. They had to be proactive, not reactive.

18. Dr. Sotkiewicz's analogy to the airline safety instruction concerning putting on your mask before helping others is incorrect.[37] PJM operators did, in fact, keep the PJM system reliable and helped keep their neighbors reliable. Furthermore, to the extent reserve levels

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[32] As it turns out, the concerns of PJM operators were well founded. Between the evening of Friday, December 23, when 34,500 MW of generation were forced out, and the morning of Saturday, December 24, another 12,500 MW of generation were forced off line. Other generation issues raised the total amount of "missing" generation to 57,000 MW on the morning of December 24. *See* PJM, Winter Storm Elliott, Frequently Asked Question 3 (updated Apr. 12, 2023), https://www.pjm.com/-/media/markets-ops/winter-storm-elliott/faq-winter-storm-elliott.ashx.

[33] PJM Presentation to Market Implementation Committee "Winter Storm Elliott" at 12 (Jan. 11, 2023), https://www.pjm.com/-/media/committees-groups/committees/mic/2023/20230111/item-0x---winter-storm-elliott-overview.ashx; Christopher Pilong Aff., Ex. PJM-004 at PP 26.

[34] Pilong Aff. at PP 47-65.

[35] *See* February 2021 Cold Weather Report, Figs. 69-70, at 130-31.

[36] *Id*. at 133.

[37] Sotkiewicz Aff., Ex. CZG-0004, at PP 123-24; Coalition Complaint, Attach. 4, Aff. of Paul M. Sotkiewicz, Ph.D, at P 152.

in PJM were below what Dr. Sotkiewicz believes were required, PJM temporarily shared the oxygen in their masks with their neighbors when it was safe to do so, rather than allowing them to pass out.

19. Dr. Sotkiewicz's argument that PJM violated its tariff and NERC Standards by continuing with non-firm exports during Emergency Actions is incorrect for several reasons.

20. First, Dr. Sotkiewicz repeats the mistaken interpretation that section 2.3.2 of Manual 13 *requires* PJM to curtail *all* non-firm energy exports prior to initiating Emergency Action.[38] As I stated above,[39] this interpretation is incorrect.

21. Second, Dr. Sotkiewicz, in support of the ComEd Zone Generators, takes a similar inflexible reading of the PJM Operating Agreement and Tariff sections that state PJM "shall curtail deliveries to an External Market Buyer if necessary to maintain appropriate reserve levels."[40] The Coalition makes this same argument.[41] Again, Dr. Sotkiewicz and the Coalition assume that the term "appropriate reserve levels" leaves no room for PJM to assist its neighbors when it can while retaining the ability to recall non-firm transactions when necessary. In fact, PJM Manual 13 contemplates this situation stating that "[i]f the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed then PJM will not curtail the transactions unless it would prevent load shedding within PJM."[42]

22. Third, Dr. Sotkiewicz's claim that while PJM can "come to the aid of neighboring control areas [sic]" PJM put its system "in a jeopardized reliability situation . . . by extending PAIs through December 24"[43] ignores PJM's obligations to support other Reliability Coordinators. The Coalition goes further and contends that "PJM was *obligated, then, not to assist other zones* after it entered into its own emergency."[44] Complainants' arguments disregard Requirement R7 of NERC Reliability Standard IRO-014-3, which states that "[e]ach Reliability Coordinator *shall* assist Reliability Coordinators, if requested and able,

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[38] *Id*. at P 122. Dr. Sotkiewicz, in support of the Coalition goes further and claims that Section 2.3.2 of PJM Manual 13 "mandated" that PJM curtail all non-firm exports and "reasonably allowed" PJM to recall daily firm exports. *See* Coalition Complaint, Attach. 4: Sotkiewicz Aff., at P 72.

[39] *See supra* PP 15.

[40] Sotkiewicz Aff., Ex. CZG-0004, at P 100 (citing parallel provisions in PJM OATT, Attach. K – App'x § 1.10.6(c) and PJM Operating Agreement, Schedule 1, § 1.10.6(c)).

[41] Coalition Complaint at 32-33.

[42] Manual 13, § 2.3.2 at p. 32.

[43] Sotkiewicz Aff., Ex. CZG-0004, at P 99. Although Manual 13 uses the term "control areas," I assume Dr. Sotkiewicz is referring to neighboring Reliability Coordinators or possibly Reliability Balancing Authorities as NERC has assigned functions formerly performed by control area functions to specific registered entities to whom the standards are applicable.

[44] Coalition Complaint at 32 (italics added).

provided that the requesting Reliability Coordinator has implemented its emergency procedures, unless such actions cannot be physically implemented or would violate safety, equipment, regulatory, or statutory requirements."[45] This is exactly what PJM did – assisted TVA (the Reliability Coordinator for TVA and LGE/KU) and VACAR-South (the Reliability Coordinator for Duke Progress and Duke Carolinas).

23. There is no question that these neighboring systems were implementing emergency steps, up to and including firm load interruptions under Energy Emergency Alert Level 3 (EEA 3),[46] and that PJM was able to assist. These EEA 3 actions and load-shedding are well-documented by NERC,[47] the Department of Energy,[48] and the Reliability Coordinator Information System (RCIS).[49]

Emergency Energy Alerts Level 3[50]

[45] NERC Standard IRO-014-3 – Coordination Among Reliability Coordinators (2015).

[46] NERC defines EEA 3 to mean that "Firm Load Interruption is imminent or in progress." NERC, Attachment 1-EOP-011-1 (Energy Emergency Alerts) at 12, https://www.nerc.com/pa/Stand/Reliability%20Standards/EOP-011-1.pdf.

[47] *See* NERC, Winter Storm Elliott: Bulk Power System Awareness Observations, at 5-8 (Mar. 22, 2023) (listing preparatory actions, EEA 3 actions, and load shed quantities in neighboring Balancing Authorities), https://www.nerc.com/comm/RSTC/AgendaHighlightsandMinutes/RSTC_Meeting_Materials_Package_March_22_2023.pdf.

[48] U.S. Dep't of Energy, OE-417 Electric Emergency and Disturbance Report – Calendar Year 2022, at 37 (showing SERC (Tennessee) shedding 100 MW or more of firm load on Dec. 23 and SERC (South Carolina and North Carolina) shedding 1,960 MW of firm load on Dec. 24), https://www.oe.netl.doe.gov/download.aspx?type=OE417PDF&ID=83.

[49] *See* PJM, RCIS-EEA 12/20/2022 00:00 – 12/26/2022 00:00. Specifically, PJM's neighboring Reliability Coordinators—including TVA and VACAR South—declared EEA3 and lower levels of system emergencies during Winter Storm Elliott. Specifically, TVA declared EEA-3 for the TVA BA at 06:15 on 12/23; and for the LGE/KU BA at 1456 on 12/23. The TVA BA went down and then back to EEA3 at 17:21 on 12/23. Similarly, VACAR South declared EEA-3 for Dominion South Carolina at 05:59 on 12/24, for Duke Energy Carolinas at 06:17 on 12/24, for Duke Energy Progress at 06:40 on 12/24, and for South Carolina Public Service Authority at 07:20 on 12/24.

[50] NERC, Winter Storm Elliott, *supra* note 47, at 7.

| Reliability Coordinator | Balancing Authority | Fri | Sat | Sun |
|---|---|---|---|---|
| Tennessee Valley Authority | TVA BA | ● | ● | |
| Tennessee Valley Authority | LG&E/KU | ● | ● | |
| VACAR South | Duke Energy Carolinas | | ● | |
| VACAR South | Duke Energy Progress | | ● | |
| VACAR South | Dominion South Carolina | | ● | |
| VACAR South | Santee Cooper | | ● | ● |

24. NERC summarized the load loss as follows:[51]

| Friday, December 23 | | |
|---|---|---|
| 06:12 | TVA BA | 1,270 |
| 09:31 | Memphis Light Gas and Water* | 200 |
| 16:18 | TVA BA | 3,200 |
| 14:36 | LG&E/KU | 350 |
| **Saturday, December 24** | | |
| 06:10 | Duke Energy Carolina | 1,000 |
| 06:15 | Dominion South Carolina | 86.3 |
| 06:35 | Duke Energy Progress | 961 |
| **Total (all reports) load shed** | | **7,067.3 MW** |

* TVA BA is the Balancing Authority for MLGW.

25. Had PJM not provided assistance, PJM's neighboring Reliability Coordinators would have been required to shed additional firm load with possible devastating consequences. For example, between around 16:11 on December 23, TVA told PJM dispatchers several times that if PJM were to curtail roughly 2,500 MW of exports, "that would put [TVA] back into an EEA3, essentially shedding loads"[52] and that doing so would "put the bulk electric grid at risk."[53] Later, around 17:11, TVA, when discussing curtailing those transactions, told PJM "we're trying to keep people alive over here."[54] For PJM not to provide assistance when it was able would have been a violation of Requirement R7 which documents one of the most important obligations of operating entities in an interconnection – to assist others

[51] *Id.* at 8 (showing over 5,000 MW of load shed in the TVA BA and LG&E/KU BA on December 23 and over 2,000 MW of load shed in the Duke Carolina, Duke Progress and Dominion Carolina BAs on December 24).

[52] Transcript, Tennessee Valley Authority Call to PJM (Dec. 23, 2022) (on file with author) P 0206 at 13-14.

[53] *Id*. P 0208 at 11-12.

[54] *Id.* p. 74 at l-2.

when they are able to without endangering their own reliability. The Violation Severity Level of not complying with Requirement R7 is "Severe." Unlike most other NERC Standards, there are no lesser degrees of non-compliance. The standard is clear – help your neighbors if you can without endangering your system.

26. As FERC reiterated when it approved the first version of IRO-014, one of the purposes of this standard is to "preserve the reliability benefits of interconnected operation."[55] In spite of Dr. Sotkiewicz's assertions, it is clear to me that PJM operated in accordance with Good Utility Practice while maintaining the reliability of the PJM system under very stressful conditions.

27. The Coalition claims that NERC Reliability Standard EOP-011-2 [sic] and PJM Manual 13 require PJM to issue an EEA1 "before Emergency Actions are taken."[56] But this ignores the express language of Attachment 1 – EOP-011-1 which explicitly states "The Reliability Coordinator may declare whatever alert level is necessary, and need not proceed through the alerts sequentially."[57]

28. The Coalition also makes an amorphous claim that PJM violated Requirement R1 of NERC Reliability Standard IRO-001-4 which states that "[e]ach Reliability Coordinator shall act to address the reliability of its Reliability Coordinator Area." It argues that "PJM had an obligation to use its position to operate a reliable grid. It did not."[58] In spite of the fact that unlike many of its neighbors, PJM did not shed load,[59] the Coalition bases its conclusion on *post hoc* conclusions as to actions that PJM should have taken, such as scheduling long-lead generation further in advance.[60] Similarly, the Coalition's claims that "PJM "inserted uncertainty into a situation when certainty was needed" and "gave incomplete or inaccurate guidance to the available resources" including exactly whether, when and for how long generators would be needed.[61] But, as stated in more detail in P 29 below, Complainants' arguments in each case are made after the fact, knowing all the events that have transpired, rather than looking at the decision PJM made in real-time faced with many uncertainties. PJM was facing uncertainties about available generation as generators were failing before the operators eyes in spite of over 10 years of notice concerning winter weather readiness and uncertainty as to load levels in the face of "a

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[55] *Mandatory Reliability Standards for the Bulk-Power System*, 118 FERC ¶ 61,218 at P 993 (2007).

[56] Coalition Complaint at 38-39. EOP-011-1 was in effect during Winter Storm Elliott. The current version, EOP-011-2, did not become effective until April 1, 2023. If EOP-011-2 had been in effect at the time of Winter Storm Elliott, the registered entities comprising the Coalition would have been subject to Requirements R7 and R8 concerning cold weather preparedness.

[57] *See* Attachment 1 – EOP-011-1, Emergency Energy Alerts, § B.

[58] Coalition Complaint at 39.

[59] *See supra* P 7.

[60] Coalition Complaint at 39-40.

[61] *Id*. at 41-42.

historic extratropical cyclone [that] created winter storm conditions including blizzards, high winds, snowfall, and record cold temperatures.[62] The Coalition's claim that PJM operators should have had perfect foresight simply cannot be squared with the standard of Good Utility Practice which makes clear that actions are judged "*in light of the facts known at the time the decision was made*."[63]

29. The ComEd Zone Generators argue that PJM did not operate in a reasonable manner based on their own *post hoc* economic analysis months after Winter Storm Elliott has passed.[64] The essence of their argument is that, because not enough bad things actually happened, the actions of PJM's operators to be prepared for foreseeable contingencies were not only wrong, but also a violation of PJM's tariffs and manuals.[65] Complainants' approach in each case is fundamentally misguided. This type of *post hoc* economic analyses and other varieties of "Monday morning quarterbacking" are irrelevant to the question of whether operators acted reasonably and in accordance with Good Utility practice with the knowledge they had at the time they had to make decisions. While post event analyses are useful to better understand the event, and can be used to improve rules and processes *going forward*, they cannot upset real-time decisions.[66]

30. The ComEd Zone Generators contend that PJM should not have taken Emergency Actions in the ComEd Zone because there was no capacity deficiency within the ComEd Zone.[67] The Coalition makes a similar argument that (1) because PJM Manual 13 *allows* PJM to target Emergency Actions to specific zones; and (2) because "PJM had never issued an RTO-wide PAI in the history of its emergency procedures," PJM's decision to implement Emergency Actions for the entire RTO were "unprecedented and unreasonable."[68] The

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[62] *See* NERC, Winter Storm Elliott: Bulk Power System Awareness Observations, at 3.

[63] *See supra* note 31.

[64] Complaint of ComEd Zone Generators at 19; Harvey Aff., Ex. CZG-0001, at P 78.

[65] For an extreme example based on after-the-fact simulations, the NTSB determined that US Air 1549 could have returned to LaGuardia following the loss of both engines if the aircraft had "been turned toward the airport immediately after the bird strike." However, the National Transportation Safety Board also found that "[t]he immediate turn did not reflect real-world considerations." *See* NTSB, Accident Report NTSB/AAR-10/03, Loss of Thrust in Both Engines After Encountering a Flock of Birds and Subsequent Ditching on the Hudson River, US Airway Flight 1549, § 2.3.2, at 89 (May 4, 2010).

[66] Good Utility Practice is analogous to the Commission's prudence standard, which rejects the type of *post hoc* analysis pushed by the ComEd Zone Generators here. *See, e.g.*, *Big Sandy Peaker Plant, LLC. v. PJM Interconnection, L.L.C.*, 154 FERC ¶ 61,216 at P 50 (2016); *PPL EnergyPlus, LLC v. PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,338 at P 33 (2006); *see also Midcontinent Indep. Sys. Operator, Inc.*, 144 FERC ¶ 61,129 at P 37 (2018).

[67] Complaint of ComEd Zone Generators at 31 (citing Harvey Aff., Ex. CZG-0001, at P 65). The Coalition makes a similar, albeit more generic argument, focusing on Virginia versus Ohio and Kentucky. Coalition Complaint at 35-37.

[68] Coalition Complaint at 35.

Coalition further argues that PJM (1) did not distinguish temperature differences between zones covering Ohio and Kentucky from Virginia;[69] and (2) did not provide adequate justification for its "economically inefficient decision to apply the Emergency Action orders to the entire RTO."[70] Nautilus Entities focus on conditions at specific times in Maryland and New Jersey, where its generators are located.[71]

31. These arguments are deeply flawed. During Winter Storm Elliott, PJM faced unprecedented operating conditions in the form of rapidly failing generators, inaccurate and untimely information from generators, fuel supply problems, increasing load, and continuing uncertainty. It is absurd to suggest that because PJM had not issued an RTO-wide PAI in the past, it was unreasonable to do so under the conditions presented in Winter Storm Elliott. Moreover, Dr. Harvey's own testimony concedes that prior to PJM Capacity Performance rules, PJM did, in fact, declare RTO-wide capacity emergencies.[72] PJM operators are not handcuffed by the past, but must address the system conditions they actually face. Nor must PJM operate in a Balkanized manner where PJM must not consider generation available in some specific areas (Illinois, Virginia, Maryland and New Jersey). The opposite is true. PJM operates as a centrally dispatched Balancing Area that dispatches its aggregate generation resources to serve the aggregate load in the RTO. PJM has an obligation to ensure the reliability of each of its control zones and its entire system.[73] Because PJM *may* limit Emergency Actions to specific zones does not mean that under every and all conditions PJM *must* tie its hands and take risks to the reliability of the rest of PJM.

32. As I noted above, PJM Manual 13 section 2.3.2 states, "[d]ue to system conditions and the time required to obtain results, PJM dispatchers may find it necessary to vary the order of application *to achieve the best overall system reliability*."[74] This is consistent with Good Utility Practice and the need for system operators to maintain flexibility to address emergencies in real-time. PJM operators needed to make decisions in real-time to ensure that the load was served in the entire RTO. Because of the large increase in failures of (mostly) gas-fired generation, PJM operators needed to ensure that all generation, other than those on approved planned and maintenance outages, were available on-line or at least available to run when needed. The fact that specific zones were not at some point short of generation did not relieve PJM operators from acting in the best interest of the entire RTO, as is their obligation. Recall that between the evening of December 23 and the morning of

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[69] *Id*. at 35-36.

[70] *Id.* at 37.

[71] Complaint of Nautilus Entities at 43-44.

[72] PJM declared an Emergency Generation Action during the 2014 Polar Vortex. *See* Ex. CZG-0003, Tbl. C-10, at 6-7; Harvey Aff., Ex. CZG-0001, at PP 92-93 ("[B]efore the establishment of PJM's capacity performance rules [emergency declarations] were also *generally* limited to a subset of PJM zones.") (emphasis added).

[73] *See* McGlynn Aff., Ex. PJM-005.

[74] PJM Manual 13, § 2.3.2, at 28 (emphasis added).

December 24, PJM had seen a significant increase in unavailable generation. One just has to look at how quickly the situation deteriorated in ERCOT during Winter Storm Uri to understand PJM's need to continue emergency conditions RTO-wide until PJM had assurance that the emergency had passed.

33. In effect, the ComEd Zone Generators are saying that PJM should have rolled the dice, wagering that generation from their units would not be needed for the duration of the emergency because the Complainants' *post hoc* analysis suggests those units were not arguably needed to supply load to the ComEd Zone. The key flaw in this approach is that it treats the successful performance by *other* generators as a given; however, the PJM operators had no such luxury when they were managing the emergency in real time. Had events transpired differently, and one or more units had tripped, the consequences would have fallen on PJM's customers.[75] Once again, Good Utility Practice, especially during extremely stressed conditions, requires maximum flexibility on the part of system operators.

34. The ComEd Zone Generators assert that because transmission was constrained east of the ComEd Zone, bringing the ComEd Zone Generators' resources on line could not have helped to increase the supply of energy available to other PJM zones in the east. As discussed below, they are incorrect. Moreover, the *post hoc* argument by Dr. Harvey[76] presents an incomplete and misleading view of the operating situation. First, even if transmission was constrained east of ComEd at particular times, PJM operators had to be prepared to have sufficient generation available in other time periods and also in the event of foreseeable contingencies that would have required increases in generation in the ComEd Zone.[77] For example, Dr. Harvey is literally correct when he states that "from the standpoint of transmission flows from ComEd to eastern PJM, a load reduction in [the] ComEd [zone] has the same effect on net exports from the zone as an increase in ComEd [zone] generation output."[78] But PJM operators had to be concerned about the converse situation—an unexpected increase in load in the ComEd Zone, which, to use Dr. Harvey's language, would have the same effect on net exports from the ComEd Zone as a decrease in generation in the ComEd Zone, which would relieve the constraints. Second, PJM system operators had to be concerned that more generation, possibly even large nuclear units, would trip, causing the same impact.[79] The fact that those contingencies were

[75] *See* Bryson Aff., Ex. PJM-006 at P 24.

[76] *See* Harvey Aff., Ex. CZG-0001, at P 65.

[77] *See* Bryson Aff., at P 38 (PJM operators need to consider future time frames).

[78] Harvey Aff., at P 64.

[79] All nuclear units in the ComEd Zone operated at full output during Winter Storm Elliott. *See*, U.S. Nuclear Regulatory Commission, Power Reactor Status Report for 2022 (specifically for the Braidwood, Byron, Dresden, LaSalle and Quad Cities units on December 23, 24 and 25), https://www.nrc.gov/reading-rm/doc-collections/event-status/reactor-status/2022/index.html. However, PJM operators had seen that at 2:22 am on December 24 a large nuclear unit had tripped in Eastern PJM. *See* U.S. Nuclear Regulatory Commission, Event Notification Report for Dec. 27, 2022 (Event No. 56286 showing Salem Unit 2 tripped at 02:22 EST on Dec. 24, 2022),

avoided does not mean that PJM operators should not have had more generation available to deal with severe and changing conditions.

35. Third, ComEd Zone Generators ignore the fact that, had their units been available, PJM could have increased the generators on-line within the ComEd Zone. Doing so would have given PJM more assurance of avoiding start-up risk that it had already encountered.[80] Finally, had as much as 5,000 MW of generation in the ComEd Zone been available, PJM could, at various times, have utilized that generation to address the needs within PJM and could have redispatched generation within the ComEd Zone to relieve transmission constraints.[81]

36. I would make a final point in response to an argument made in a related Winter Storm Elliott complaint proceeding that I think is relevant here. Mr. Berardesco, on behalf of Lee County Generating Station, LLC, in Docket No. EL23-57-000, contends that PJM's Operating Instruction for Lee County to enter into a forced outage was inconsistent with NERC's definition. While Mr. Berardesco correctly states NERC's definition of Forced Outage in NERC's Glossary of Terms Used in NERC Reliability Standards,[82] he never explains why this definition applies to anything other than reliability standards. As the title of the Glossary explicitly states, these terms are for use in NERC Reliability Standards, not anything else.[83] However, PJM has not incorporated the NERC definition of Forced Outage as part of its Capacity Performance mechanism.

37. This concludes my affidavit.

38. I hereby certify under penalty of perjury that the foregoing statements are true and correct to the best of my knowledge, information, and belief:

Executed on: May 26, 2023

*/s/ Steven T. Naumann*
Steven T. Naumann

https://www.nrc.gov/reading-rm/doc-collections/event-status/event/2022/20221227en.html. As I stated in P 33, while the *post hoc* analysis by the ComEd Zone Generators had the luxury of knowing that these units performed, PJM operators could not make that assumption in real-time.

[80] *See supra*, note 32; Bryson Aff. at P 27.

[81] *See* McGlynn Aff. at PP 69-72. While the analysis detailed by Mr. McGlynn was performed after Winter Storm Elliott, it simply confirms the obvious – that having the additional generation within the ComEd Zone would have provided PJM operators with additional flexibility to mitigate transmission constraints and provide energy to PJM zones to the east.

[82] *See* Declaration of Charles A. Berardesco on Behalf of Lee County Generating Station, LLC at P 4, Docket No. EL23-57 (filed Apr. 5, 2023).

[83] Following immediately after the document title, NERC states "[t]his Glossary lists each term that was defined in one or more of NERC's continental-wide or Regional Reliability Standard."

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Calpine Corporation,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-66-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |
| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

## VERIFICATION

I, **Steven T. Naumann**, pursuant to 28 U.S.C. § 1746, state, under penalty of perjury, that I am the Steven T. Naumann referred to in the foregoing document entitled "Affidavit of Steven T. Naumann on Behalf of PJM Interconnection, L.L.C.," that I have read the same and am familiar with the contents thereof, and that the facts set forth therein are true and correct to the best of my knowledge, information, and belief.

DocuSigned by:
Steven T. Naumann
04280FEFEC21424...

Steven T. Naumann

# Exhibit PJM-007.1

# Curriculum Vitae of Steven T. Naumann

**Steven T. Naumann**

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Skokie, IL 60076
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708.404.6829

Mr. Naumann is a self-employed consultant. Until his retirement at the end of February 2019, Mr. Naumann served as Vice President, Transmission and NERC Policy for Exelon Business Services Company. In that role, he provided to the electric delivery utilities owned by Exelon Corporation advice and guidance on regulatory issues relating to system planning, design, operation, reliability and resiliency, as well as rates, terms, and conditions of service that are subject to federal regulation or that concern boundaries and classifications of assets, services, and authority between the Federal Energy Regulatory Commission and state regulators.

## EDUCATION

Chicago-Kent College of Law
Chicago, IL
J.D. 1988

Rensselaer Polytechnic Institute
Troy, NY
M. Engineering, Electric Power Engineering, 1972
B.S., Electric Power Engineering, 1971

## PROFESSIONAL REGISTRATION

Registered Professional Engineer – Illinois
Admitted to Illinois Bar

## WORK EXPERIENCE

Sept. 2019 – April 2023: Protect Our Power, Chief Technical Advisor

2003 – 2019 Exelon Corporation: Vice President

March 2012 – February 2019: Vice President, Transmission and NERC Policy. Responsible for developing policy for Exelon on transmission pricing, cost allocation, and high-level transmission planning policy nationwide. Directed the development of policy issues involving NERC. Executive interface with EEI, NERC and DOE on transmission policy, reliability and security issues. Testified at FERC, DOE and the Illinois Commerce Commission on transmission, reliability and security issues.

February 2003 – March 2012: Vice President, Wholesale Market Development. Executive responsibilities for development of markets nationwide, senior interface with NERC and was one of a team of Exelon executives involved in development of RTO policy, including the integration of ComEd into the PJM, completed in May 2004. Directed the development of Exelon policy on numerous market issues related to PJM, MISO, and the Southwest Power Pool, and in other areas of the country. These issues included questions of capacity requirements, generation retirements, station power, ancillary services markets, reliability must run rules, reactive power compensation, transmission cost allocation and general market structure and development.

2003 – 2019: Representative to Outside Organizations.

- Chairman and Vice Chairman of the NERC Member Representatives Committee ("MRC")
- Vice Chairman of the MAIN Board of Directors
- Interim Board of Directors of ReliabilityFirst Corporation
- Senior Executive Working Group supporting the ESCC

- NERC Stakeholders Committee and NERC MRC representing investor-owned utilities
- EEI Reliability Executive Advisory Committee
- EEI Energy Delivery Public Policy Executive Advisory Committee

1975 – 2003 Commonwealth Edison Company: Various engineering, management and executive positions: Commonwealth Edison Company

October 1999 – February 2003: Vice President, Transmission Services. Executive responsibility for transmission service provided by ComEd, including the interconnection of new generation to the ComEd transmission system, and executive responsibilities for ISO and later regional transmission organization ("RTO") development.

January 1996 – October 1999: Director of T&D Regulatory Services. Directed the work of the T&D Regulatory Services Department which included the preparation and filing of tariffs and service agreements with FERC, administering those tariffs, and providing cost justifications where required. Responsible for administering ComEd's Open Access Transmission Tariff ("OATT") and for determining the propriety of rate discounts for transmission services and interpreting the tariff.

Served as a member of the NERC Interconnected Operations Services Working Group that issued a report in March 1997 providing additional technical information on ancillary services and other services needed for reliability of the interconnected system. Member of the Commercial Practices Working Group that provided an industry forum to discuss and resolve business practice issues related to the operation of bulk power electric systems in

North America. MAIN representative on the Interim Market Interface Committee, and the investor-owned utilities representative on the Market Interface Committee.

January 1995 – December 1995: Director of Market Analysis, Wholesale Marketing Department. Directed market analyses in support of ComEd's wholesale sales. Also served as a representative on the Real-Time Information Networks "What" Group, that provided information and a report to FERC on what information should be posted on the electronic information-sharing system that became known as the OASIS.

1993 – December 1994: Director, Interconnection Planning Section. Supervised the engineers performing interconnection studies, including the ComEd portion of MAIN studies, analysis of the transmission system in response to requests for bulk power sales, purchases and wheeling, and analysis of impacts of parallel flows on ComEd's transmission system. Served as the representative of the Northern Illinois subregion of MAIN to the MAIN Transmission Task Force Steering Committee. This Committee was responsible for directing MAIN regional and interregional studies, reviewing such studies, and recommending approval of such studies to the MAIN Engineering Committee. Served as Chairman of the MAIN Transmission Assessment Studies Group, responsible for conducting seasonal transmission assessment studies; Chairman of the MAIN Future Systems Studies Group, responsible for conducting future interchange and extreme disturbance studies; and the MAIN-ECAR-TVA Coordination and Data Exchange Committee, responsible for devising procedures for exchanging information on transfers and identifying actions to take during transmission system emergencies.

1990 – 1993: Head of Technical Studies Section. Directed engineers performing dynamic and transient analyses, as well as interconnection planning studies, including ComEd's participation in MAIN studies.

1988 – 1990: Research Engineer on the staff of the Vice President of Engineering, which included managing DOE research contracts and managing company patent program.

September 1980 – 1988: Assistant head of Technical Studies. Directed junior engineers and performed dynamic and transient analyses of the ComEd system and surrounding systems as well as reactive or voltage planning of the ComEd transmission system.

September 1978 – August 1980: Assigned to the Mid-America Interconnected Network ("MAIN"), formerly one of the regional reliability councils of NERC. Responsible for interconnection and extreme disturbance studies performed by MAIN, as well as monitoring of interconnected operations. Supervised the MAIN Coordination Center, including all engineering and operations functions.

December 1975 – August 1978: Engineer in Technical Studies Section of the System Planning Department. Performed stability, dynamic, transient switching, and other detailed studies of the ComEd transmission system. Staff assistant to Vice President of Engineering.

July 1975 – December 1975: Engineer assigned to a six-month "Graduate Development Program." Rotating engineering assignments including transmission, distribution, generation and testing.

1971 – 1975 1 Lt/2 Lt, United States Air Force

June 1972 – June 1975: Base Electrical Engineer, 64 Civil Engineering Squadron/3500 Air Base Group, Reese AFB, TX. Responsible for all base electrical design and construction.

September 1971 – June 1972: Assigned as graduate student

**Other Experience**

Chicago-Kent College of Law Board of Advisors 2009-2020

**Testimony**

## Before Congress

Senate Committee on Homeland Security & Governmental Affairs, "Protecting Cyberspace as a National Asset: Comprehensive Legislation for the 21st Century," June 15, 2010

House Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology, Committee on Homeland Security, "Securing the Modern Electric Grid from Physical and Cyber Attacks," July 21, 2009

House Subcommittee on Energy and Air Quality, Committee on Energy and Commerce, "Protecting the Electric Grid from Cyber-Security Threats," Sept. 11, 2008

## Before the Illinois Supreme Court

*Illinois Landowners Alliance, NFP, et al., v. Illinois Commerce Commission*, Docket Nos. 121302, 121304, 121305, 121308 cons. (Affidavit, May 3, 2017)

## Before the Federal Energy Regulatory Commission

*Commonwealth Edison Co.*, Docket No. ER19-1478 (Testimony filed March 29, 2019)

*Delaware Public Service Commission and Maryland Public Service Commission v. PJM Interconnection, L.L.C.*, Docket No. EL15-95 (Sept. 17, 2018) (Affidavit)

*Reliability Technical Conference*, Docket No. AD18-11 (July 31, 2018) (Comments)

*PJM Interconnection, L.L.C.*, Docket No. ER17-1420 (Affidavit, August 25, 2017)

*PJM Interconnection, L.L.C.*, Docket No. ER17-718, *et al* (Staff Workshop June 13, 2017)

*Review of Generator Interconnection Agreements and Procedures*, Docket No. RM16-12; *American Wind Energy Association*, RM15-21 (Technical Conference, May 13, 2016)

*PJM Interconnection, L.L.C.*, Docket No. ER15-1344; *Potomac Electric Power Co.*, Docket No. ER15-1387 (Technical Conference, Nov. 12, 2015)

*Northern Indiana Public Service Co. v. Midcontinent Independent System Operator, Inc. and PJM Interconnection, L.L.C.*, Docket No. EL13-88-000 (Technical Conference, June 15, 2015)

*Reliability Technical Conference*, Docket No. AD14-9 (June 10, 2014) (Prepared Remarks)

*Duquesne Light Co. and PJM Interconnection, L.L.C.*, Docket No. ER13-90-002 (Declaration, Second Declaration)

*Staff Technical Conference on Geomagnetic Disturbances to the Bulk-Power System*, Docket No. AD12-13 (Technical Conference, April 30, 2012) (Prepared Remarks)

*Reliability Monitoring, Enforcement and Compliance Issues*, Docket No. AD11-1 (Technical Conference, Nov. 18, 2010) (Prepared Remarks)

*PJM Interconnection L.L.C.*, Docket No. EL05-121-006 (Direct and Reply Affidavits)

*Midwest Independent Transmission System Operator, Inc.*, Docket No. ER08-637-000, ER08-637-001, ER08-637-004, ER08-637-005 (Technical Conference on Market Coordination Service)

*PJM Interconnection, L.L.C.*, Docket Nos. ER06-456-006, ER06-954-002, ER06-1271-001, ER07-424-000, EL07-57-000 (Cross Answering Testimony)

*OATT Reform Technical Conference*, Docket Nos. RM05-17-000, RM05-25-000 (Oct. 12, 2006)

*PJM Interconnection, L.L.C.*, Docket Nos. ER05-1410-000, EL05-148-000 (Technical Conference on RPM, June 8, 2006)

*Midwest Independent Transmission System Operator, Inc.*, Docket Nos. ER05-6, EL04-135, EL02-111, EL03-212 (Answering Testimony)

*PJM Interconnection L.L.C.*, Docket No. EL05-121-000 (Direct and Cross-Answering Testimony)

*Joint Boards on Security Constrained Economic Dispatch*, Docket No. AD05-13-000 (PJM/MISO, Nov. 21, 2005)

*The New PJM Companies*, Docket No. ER03-262-009 (Direct and Rebuttal Testimony)

*Midwest Generation EME, LLC*, Docket Nos. ER04-190-000, EL04-22-000 (Affidavit)

*Electricity Market Design and Structure*, Docket No. RM01-12-000, *RTO Markets and Design: Optional RTO Markets* (Oct. 15, 2001), *Transmission Rights and Financial Rights* (Feb. 5, 2002)

*Commonwealth Edison Co. and PECO Energy Company*, Docket No. EC00-26-000 (Direct Testimony)

*Commonwealth Edison Company*, Docket No. ER01-2992-000 (Direct Testimony)
*American Electric Power Co. and Central and South West Corp.*, Docket Nos. EC98-40-000, ER98-2770-000 and ER98-2786-000 (withdrawn)

*Inquiry Concerning the Commission's Policy on Independent System Operators*, Docket Nos. PL98-5-000 (Apr. 16, 1998); PL98-5-004 (June 4, 1998)

*Midwest Independent Transmission System Operator, Inc.*, Docket Nos. ER98-1438-000, EC98-24-000 (Direct and Rebuttal Testimony)

*IES Utilities, Inc.*, Docket Nos. EC96-13-000, ER96-1236-000, and ER96-2560-000 (Answering and Rebuttal Testimony)

*Promoting Wholesale Competition Through Open Access, Non-discriminatory Transmission Services by Public Utilities*, Ancillary Services Technical Conference (Oct. 26, 1995)(Obligation to Offer and Obligation to Take Ancillary Services)

*Commonwealth Edison Company*, Docket Nos. ER93-777-000, ER95-1545-000, ER95-1539-000, and ER95-371-000.

**Before the U.S. Department of Energy**

DOE Workshop on Electric Transmission Development and Siting Issues (Nov. 15, 2018)

Pre-Congestion Study Regional Workshops for the 2009 National Electric Congestion Study (Sept. 17, 2008), transcript at http://www.congestion09.anl.gov/documents/docs/Transcript_Pre_2009_Congestion_Study_Chicago.pdf

**Before the Illinois Commerce Commission**

*NextEra Energy Transmission MidAtlantic, LLC*, Docket No. 18-0843 (Direct Testimony and Rebuttal Testimony)(filed but not admitted into evidence – application withdrawn with prejudice)

*Commonwealth Edison Co., Petition Concerning the Implementation of a Demonstration Distribution Microgrid* (Docket No. 17-0331)(Rebuttal and Surrebuttal)

*Commonwealth Edison Co., Application for a Certificate of Public Convenience and Necessity, pursuant to Section 8-406.1 of the Illinois Public Utilities Act, and an Order pursuant to Section 8-503 of Illinois Public Utilities Act, to Construct, Operate and Maintain a new 345 kilovolt transmission line in Ogle, DeKalb, Kane and DuPage Counties, Illinois*, (Docket No. 13-0657) (Direct, Rebuttal, Surrebuttal; Surrebuttal on Reopening; Direct, Supplemental Direct and Rebuttal on Rehearing)

*Rock Island Clean Line LLC*, Docket No. 12-0560 (Direct, Cross-Rebuttal and Rebuttal testimony)

*Commonwealth Edison Company, Application for an amendment to a Certificate of Public Convenience and Necessity granted in ICC Docket Nos. 89-0215 and 92-0185, authorizing and directing the Petitioner to construct, operate and maintain two 345,000-volt underground electric transmission lines in Cook County, Illinois* (Docket No. 11-0692)(Surrebuttal Testimony)

*Illinois Power Agency, Petition for Approval of the 220 ILCS 5/16-111.5(d) Procurement Plan*, Docket No. 11-0660 (Verification)

*Commonwealth Edison Company, Petition for Approval of Initial Procurement Plan*, Docket No. 07-0528 (Affidavit)

*Investigation of Rider CPP of Commonwealth Edison Company, and Rider MV of Central Illinois Light Company d/b/a AmerenCILCO, of Central Illinois Public Service Company d/b/a AmerenCIPS, and of Illinois Power Company d/b/a AmerenIP, pursuant to Commission Orders regarding the Illinois Auction*, Docket No. 06-0800 (Rebuttal Testimony)

*Commonwealth Edison Company, Proposed tariffs filed pursuant to Article IX of the Public Utilities Act defining a competitive supply procurement process and, pursuant to Section 16-112(a) of the Act, establishing a market value methodology to be effective post-2006; providing for Power Purchase Options and for recovery of transmission charges post-2006; and enabling subsequent restructuring of rates and unbundling of prices for bundled service pursuant to Sections 16-109A and 16-111(a) of the Act*, Docket No. 05-0159 (Direct, Rebuttal and Surrebuttal Testimony)

Electric Policy Meeting, *FERC's Standard Market Design Hearing* (Oct. 15, 2002)

*Commonwealth Edison Company, Petition for approval of delivery services tariffs and tariff revisions and residential delivery services implementation plan, and for approval of certain other amendments and additions to its rates, terms, and conditions*, Docket No. 01-0423 (Rebuttal and Surrebuttal Testimony)

*Commonwealth Edison Company, Petition for expedited approval of implementation of a market-based alternative tariff, to become effective on or before May 1, 2000, pursuant to Article IX and Section 16-112 of the Public Utilities Act*, Docket No. 00-0259 (Rebuttal Testimony)

*South Beloit Water, Gas & Electric Company, Delivery Services Implementation Plan submitted pursuant to Section 16-105 of the Illinois Public Utilities Act*, Docket Nos. 99-0124, 99-0125, 99-0132, 99-0133 (Direct Testimony)

*Commonwealth Edison Company, Petition for approval of delivery services tariffs and delivery services implementation plan, and for approval of certain other amendments and additions to its rates, terms, and conditions*, Docket No. 99-0117 (Direct, Rebuttal and Surrebuttal Testimony)

*Commonwealth Edison Company, Petition for Order Concerning Delineation of Transmission and Local Distribution Facilities*, Docket No. 98-0894 (Direct and Rebuttal Testimony)

*Central Illinois Light Company, Central Illinois Public Service Company, Commonwealth Edison Company, Illinois Power Company, and Union Electric Company*, Docket No. 98-0818 (Prepared Testimony)

*Commonwealth Edison Company, Application of Commonwealth Edison Company, for a Certificate of Public Convenience and Necessity, under Section 8-406 of the Illinois Public Utilities Act to construct, operate and maintain a new electric transmission line in Will County, Illinois* Docket No. 98-0745 (Rebuttal Testimony)

Docket No. 98-0649 (ARES Certification): *Investigation concerning certain tariff provisions proposed under Section 16-108 of the Public Utilities Act and related issues*, Docket No. 98-0680 (Rebuttal Testimony)

Docket No. 95-0314/0338: *Rulemaking proceeding to implement Section 16-119A(a) of the Public Utilities Act regarding standards of conduct and Rulemaking proceeding to implement Section 16-119A(b) of the Public Utilities Act regarding functional separation between generation services and delivery services of Illinois electric utilities*, Docket Nos. 98-0147/0148

**Before the Public Service Commission of Wisconsin**

Docket Nos. 6630-UM-100, 4420-UM-101 (Primergy Merger)

**Other**

Illinois Pollution Control Board, *In Re Matter of: Natural Gas-Fired, Peak-Load Electrical Power Generating Facilities (Peaker Plants)*, Docket No. R01-10 (Aug. 16, 2000)

Zoning Board of Appeals of McHenry Co. (Special Use Permit re: Reliant IPP)

**Publications and Presentations**

The Threat to the Electric Grid of Drones Must Be Analyzed and Action Taken Now, Protect Our Power (Jan. 10, 2023).

We must act now to protect the electric grid from drones, The Hill (Jan. 10, 2023).

Will There be Sufficient Blackstart Resources to Recover from a Major Electric Outage? FERC Needs to Get the Facts, Protect Our Power (Jan. 4, 2022).

Design Basis Threat Development is Key to Proper "Blackstart" Grid Capability, Protect Our Power (Nov. 4, 2021).

"Black Start" Capability is Critical to a Resilient Electric Grid, Protect Our Power (Aug. 9, 2021).

Electricity Dialogue at Northwestern University, Session Three – Energy Infrastructure: Making Sure We Have What We Need When and Where We Need it to Assure Reliability, Security and Resiliency (24/7/365)(May 2, 2017).

Chicago Bar Association, Energy, Telecommunications and Water Committee, *Competition in Developing Transmission* (Apr. 20, 2017).

North American Electric Reliability Corporation 2017 Reliability Leadership Summit, Panel 2 - Identification and Mitigation of Significant Risks to Reliability: Resiliency and Security (March 21, 2017).

ABA Section of Environment, Energy, and Resources, Cybersecurity Summit, Response and Recovery Scenarios for Energy and Water Sectors (May 18, 2015), http://shop.americanbar.org/ebus/ABAEventsCalendar/SessionDetail.aspx?productId=188816475&MtgId=188481263.

Naumann, S.T., *Physical and Cyber Security in Today's Utility Industry*, Presented at Energy Bar Association, Midwest Energy Conference (March 31, 2015). Available at http://www.eba-net.org/sites/default/files/2015%20Midwest%20Energy%20Conference%20Handouts_0.pdf.

Naumann, S.T., *Cyber-Security vs. Physical Security, High Voltage vs. Low Voltage: Which Should Be A Priority?*, Presented at the Harvard Electricity Policy Group (June 13, 2014). Available at https://hepg.hks.harvard.edu/files/hepg/files/naumann_hepg_06132014.pdf?m=1528297918

Naumann, S.T., *Electric Transmission Development and Cost Allocation*, Presented at Energy Bar Association, Midwest Energy Conference (March 5, 2013)

Naumann, S.T., *How Much Electricity Infrastructure and Reliability Should We Be Investing In?*, Presented at the Harvard Electricity Policy Group (December 7, 2012). Available at https://hepg.hks.harvard.edu/files/hepg/files/naumann_hepg_12072012_1.pdf?m=1529958366

Naumann, S.T., *Order No. 1000, View from Western PJM*, Presented at the Organization of PJM States Annual Meeting (Oct. 5, 2011). Available at http://www.opsi.us/meetings/2011/oct5oct6/Oct5-800am-Naumann.pdf.

Naumann, S.T., *NERC, Reliability Enforcement*, Presented at the Skadden Sixth Annual Enforcement and Compliance Conference (Feb. 2, 2011)

Naumann, S.T., *Reliability Moving Forward, Perspective View on Where We Go From Here*, Presented at the Energy Bar Association, Reliability Primer for Lawyers and Energy Professionals (April 28, 2010)

Naumann, S.T., *NERC, Thoughts on the Previous Year*, Presented at the Skadden 5th Annual Enforcement and Compliance Conference (Feb. 2, 2010)

Naumann, S.T., *Enforcement of Reliability Standards*, Presented at the AGA/EEI Chief Audit Executives' Conference (June 22, 2009). Available at http://www.aga.org/NR/rdonlyres/B9BE1BBD-0787-4802-946C-4D491E886546/0/0907NAUMANN.PPT

Naumann, S.T., *Formulating and Enforcing Reliability Standards*, Presented at the Harvard Electricity Policy Group (March 12, 2009). Available at https://hepg.hks.harvard.edu/files/hepg/files/steve_naumann_marh09.pdf?m=1523368156

Naumann, S.T., *Enforcement of Reliability Standards*, Presented at the Skadden Fourth Annual Enforcement and Compliance Conference (Feb. 3, 2010)

Naumann, S.T., *Mandatory Reliability Standards, Is the Grid More Reliable?*, Presented at Energy Bar Association, Midwest Energy Conference (March 6, 2008)

Naumann, S.T., *New Mandatory Reliability Standards*, Presented at the Skadden 3rd Annual Enforcement and Compliance Conference (Jan. 22, 2010)

Naumann, S.T., *Electric Reliability Standards (Enforcement and Compliance)*, Presented at the Energy Bar Association, Sixty-First Annual Meeting (April 25, 2007).

Naumann, S.T., *Transmission Expansion, Boom or Bust*, Presented at Energy Bar Association, Midwest Energy Conference (March 7, 2007).

Naumann, S.T., *Planning and Siting Under Various Transmission Business Models*, Presented at the National Commission on Energy Policy (July 18, 2006). Available at http://www.energycommission.org/files/contentFiles/21_Naumann_-_Business_Models_Exelon_44c1254e9b090.ppt

Naumann, S.T., *Pricing for Reactive Power*, Presented at IEEE/PES Transmission and Distribution Conference (May 23, 2006).

Naumann, S.T., *Active Markets and Reactive Policies: Requirements Rules, Incentives and Business Models for Reactive Power*, Presented at the Harvard Electricity Policy Group (December 2, 2004). Available at https://hepg.hks.harvard.edu/files/hepg/files/naumann.act_.mkts_.1204.pdf?m=1523367962

Naumann, S.T., *Commercial Incentives and Reliability Rules*, Presented at the Harvard Electricity Policy Group (June 3, 2004).

Naumann, S.T., *Too Little Money*, Presented at the Harvard Electricity Policy Group (May 21, 2003). Available at https://hepg.hks.harvard.edu/files/hepg/files/naumann_too.little.money_5-21-03.pdf?m=1523369204

Naumann, S.T., *Wholesale Market Platform*, Presented at IEEE T&D Conference (Sept. 8, 2003), Available at http://www.ieee.org/portal/cms_docs_pes/pes/subpages/meetings-folder/td_dallas2003/naumannpresentation.ppt

Naumann, S.T., *Restoring Transmission Investment*, Presented at IEEE/PES Transmission and Distribution Conference (Oct. 31, 2001)

Naumann, S.T., *Supporting Markets Through Regional Institutions: The Midwest ISO*, Presented at the Harvard Electricity Policy Group (November 20, 1998)

Wang, C., White, R.L., Illian, H.F., and Naumann, S.T., *Emergency Redispatch to Relieve Other Control Area Constraints*, 60 Proceedings of the American Power Conference (1998).

Naumann, S.T., *The Impact of FERC Order 888 and 889 on Transmission Providers*, Presented at the 1997 American Power Conference.

Paserba, Larsen, Lauby, Leonard, Naumann, Miller and Sener, *Feasibility Study for A Distribution-Level STATCON*, IEEE FACTS Applications 96-TP-116 8-22 (1996).

McCoy, P.D., Naumann, S.T., Terhune, H.L., *Curtailments and Priorities Under Open Access*, Presented at EPRI Conference The Future of Power Delivery: The 4Rs: Research, Reliability, Reputation and Regional Transmission Groups (April 10, 1996).

Shanahan, P.J., and Naumann, S.T., *Evaluation of Simultaneous Transfer Capabilities*, 57 Proceedings of the American Power Conference 1463 (1995).

Naumann, S.T., *Assessment of Transfer Capability*, 56 Proceedings of the American Power Conference 289 (1994).

Paserba, Leonard, Miller, Naumann, Lauby and Sener, *Coordination Of A Distribution Level Continuously Controlled Compensation Device With Existing Substation Equipment For Long Term Var Management*, 9 IEEE Transactions On Power Delivery 1034 (April 1994).

Naumann, S.T., *Assessment of Transfer Capability*, Presented at Transmission Access and Pricing: Policy and Practice in Illinois, August 24, 1993.

Carlson, McGarrah, Naumann and Shah, *Voltage Stability Analysis As Part of An Interchange Capability Study*, 55 Proceedings of the American Power Conference 1196 (1993).

Larsen, Leonard, Miller, Othman, Paserba and Naumann, *Application Studies for a Distribution STATCON on Commonwealth Edison's Power System*, Proceedings: FACTS Conference 2, EPRI Report No. TR-101784, 2.3-1 (1992).

Pinnello, Naumann and Rehor, *An Analysis of Spontaneous Oscillations On A Large Power System*, 46 Proceedings of the American Power Conference 422 (1984).

Pinnello and Naumann, *Review of an Underfrequency Protection Scheme Using a Large Transient Stability Program*, 45 Proceedings of the American Power Conference 599 (1983).

Van Ness, Brasch, Landgren and Naumann, *Analytical Investigation of Dynamic Instability at Powerton Station*, 99 IEEE Transactions on Power Apparatus & Systems 1386 (July/August 1980).

Naumann, Landgren, Jovanovich, Larson and Swann, *Underexcited Operation and Stability Tests at the Powerton Station*, 41 Proceedings of the American Power Conference (1979).

Naumann, S.T., *Know Your Electric Bill and Save Money*, AF Civil Engr. 16-25-27 (Feb. 1975).

Attachment D

Affidavit of Joseph Mulhern
on Behalf of PJM Interconnection, L.L.C.

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

**AFFIDAVIT OF JOSEPH MULHERN**
**ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1. My name is Joseph Mulhern. My business address is 2750 Monroe Blvd., Audubon, Pennsylvania, 19403. I currently serve as Lead Engineer, Market Coordination for PJM Interconnection, L.L.C. (PJM).

2. I am submitting this affidavit on behalf of PJM in support of PJM's Answers to the Complaint filed by Invenergy Nelson LLC in the captioned proceeding. I have reviewed this Complaints and aver that the statements, analyses, and conclusions I present in my May 26, 2023 affidavit submitted on behalf of PJM in support of PJM's Answers to the complaints filed in Docket Nos. EL23-53, EL23-54, and EL23-55, which I include as Exhibit 1 to this affidavit, apply equally to the issues raised in the captioned Complaint of Invenergy Nelson LLC.

3. This concludes my affidavit.

# Exhibit 1

## Affidavit of Joseph Mulhern
## on behalf of PJM Interconnection, L.L.C.

## Submitted in Docket Nos. EL23-53, EL23-54 and EL23-55
## on May 26, 2023

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| **Essential Power OPP, LLC, *et al.*** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-53-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Aurora Generation, LLC, *et al.*** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-54-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Coalition of PJM Capacity Resources** | ) | |
| **Complainant** | ) | |
| **v.** | ) | **Docket No. EL23-55-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |

**AFFIDAVIT OF JOSEPH MULHERN**
**ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1. My name is Joseph Mulhern. My business address is 2750 Monroe Blvd., Audubon, Pennsylvania, 19403. I currently serve as Lead Engineer, Market Coordination for PJM Interconnection, L.L.C. (PJM). I am submitting this affidavit to support PJM's separate Answers to the complaints filed by the "Nautilus Entities,"[1] the "ComEd Zone Generators,"[2] and the Coalition of PJM Capacity Resources[3] that are being filed today in

[1] The Nautilus Entities are Essential Power OPP, LLC (OPP), Essential Power Rock Springs, LLC, and Lakewood Cogeneration, L.P..

[2] The ComEd Zone Generators are Aurora Generation, LLC, Elwood Energy, LLC, Jackson Generation, LLC, Lee County Generating Station LLC, Lincoln Generating Facility, LSP University Park, Rockford Power, LLC, Rockford Power II, LLC, and University Park Energy, LLC.

[3] The members of the Coalition of PJM Capacity Resources are: Ad Hoc Committee of Certain Noteholders of Talen Energy Corp.; Clean Energy Future – Lordstown, LLC Competitive Power Ventures Holdings, LP; Hickory Run Energy, LLC; Lanyard Power Holdings, LLC; Lightstone Marketing LLC; Orion Power Holdings, LLC; Parkway Generation Operating LLC; Brunner Island, LLC, H.A. Wagner LLC, Montour, LLC, Camden Plant Holding, L.L.C., MC Project Company LLC; Talen Energy Marketing, LLC; Red Oak Power, LLC; and South Field Energy LLC.

the captioned proceedings. For ease of reference, I will use the term "Complainants" when referring to all three groups of complainants.

2. As part of my current work for PJM I am focused on facilitating accurate load forecasting by configuring and training models, optimizing input data, assessing performance, and communicating load forecast information to PJM dispatchers. My work also involves improving load, wind, and solar forecast accuracy and facilitating the successful integration of renewables by enhancing the use of forecast data, evolving business rules, and educating stakeholders.

3. Starting in 2010 I have held positions at PJM as a Senior Engineer I and II, Generation, Engineer II, Outage Analysis Technologies, and Engineer I, Operations Planning. My work in these roles has often involved load forecasting issues. As an Engineer I and II, I was responsible for performing transmission outage analysis studies, in which I used load forecast data to model the system. As an Engineer II through Senior Engineer II, I served as project manager for an extensive capital project to refresh PJM's seven forecast applications that manage the complex flow of data for load, weather, wind, solar, and interchange forecasting. My hands-on load forecasting experience began in 2020 when assessing COVID-19 impacts on load, and expanded to include providing daily advice to Dispatch. During this time, I designed multiple tools to assess load and weather forecast error, and was instrumental in creating PJM's load forecasts for Christmas Eve and Christmas in 2021 and Thanksgiving in 2022, all of which performed far better than the default model (by 39%, 72%, and 69%, respectively).

4. I have a Master's Degree in Business Administration—Strategic Management from Villanova University and a Master of Engineering—Energy Systems Engineering from Lehigh University. I also have a Bachelor of Science in physics from Villanova University.

5. I was directly involved in preparing, and subsequently reviewing, the PJM load forecasts for December 23 and 24, 2022, i.e., the two days at issue in this proceeding, which are commonly known as Winter Storm Elliott.[4]

6. The purpose of this affidavit is to show that Complainants' various claims that PJM's load forecasts for December 23 and 24 were "inaccurate" or otherwise materially flawed are wrong. Complainants' mischaracterizations of the quality of PJM's forecasts reflect, at best, serious misunderstandings of load forecasting and the difficulty of anticipating conditions as exceptional as those that existed during Winter Storm Elliott.

7. I take issue with any notion that PJM "failed" at forecasting for December 23 and December 24, 2022. As I will explain, PJM's load forecasts for the relevant days proved to be less accurate than normal for a variety of reasons. That does not change the conclusion that PJM's forecasts were reasonable given the information available to PJM at the time that they were made. It is simply not correct to assert that PJM "failed" to fulfill

[4] *See* https://www.pjm.com/markets-and-operations/winter-storm-elliott (collecting PJM's public statements addressing Winter Storm Elliott's impact on PJM's operations and markets).

its load forecasting responsibilities in connection with Winter Storm Elliott. PJM used its state-of-the art load forecasting model and followed good forecasting practices.

8. I also think that it would be a serious mistake to conclude that the forecasts for December 23 and 24 indicate that there is some material defect in PJM's load forecasting overall. On the contrary, the weather and load conditions on December 23 and 24 could not have reasonably been anticipated because, by every objective measure, those conditions were extremely abnormal.

## A. Introduction

9. Like other Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs), PJM produces a load forecast for each of its transmission zones for the next several days. Load forecasting attempts to determine how much electricity demand there will be using weather forecast data and historical observations of load and weather. Uncertainty is inherent in any forecast. This is especially true of load forecasting because of its dependence on weather forecasts, which are famously uncertain, and on unpredictable human behavior patterns.

10. PJM uses sophisticated software, combined with informed human review and frequent human intervention, to forecast load as accurately as is practicable notwithstanding the innate fallibility of any human attempt to predict the future. PJM also reviews forecast performance on a daily basis, analyzes days with significant error, and actively participates in load forecasting working groups with other ISOs and RTOs.

11. PJM diligently maintains high quality forecast systems and produces well-developed forecasts. PJM continuously strives to meet a specified accuracy threshold. PJM reviews this load forecasting metric and performance with market participants on a monthly basis.

12. While the results of the load forecasting process can provide insight into how much generation might be required on a future day, the load forecast is not all that PJM uses to make generation commitments. Reserves, operator-entered case adjustments, and additional capacity commitments are used to account for uncertainty.

## B. How PJM Load Forecasts Are Created

13. PJM's hourly load forecast covers the remainder of the current day as well as the next six days. The forecasting process begins with the hourly retrieval of weather forecast data from three separate private weather companies. PJM uses three reputable vendors, because of the strong benefits doing so has for reliability and accuracy. Using multiple vendors promotes redundancy in the event of failure of one or two vendors, and by averaging the vendor forecasts together, it allows for any significant error from any one vendor's forecast to be moderated by the other forecasts. PJM operations staff pay close attention to weather vendor performance, and use a daily report to monitor and compare performance on a daily

basis. Output of this report is used to inform decisions about how much weight is given to each weather vendor in the averaging process.

14. After the vendor forecasts are combined for 28 designated weather stations in the PJM footprint, the resultant forecasts become inputs into another weighted average calculation that determines a singular weather forecast value for each hour in 10 forecast zones for each hour.

15. The zonal weather forecast dataset is then used as input into the load forecast. For this, PJM uses a load forecasting algorithm that is widely used in the industry. The system runs on in-house computers and produces a series of outputs for each transmission zone for each hour in the outlook timeframe (remainder of current day plus next six days). There are multiple outputs because the system runs a wide suite of models, including the following:

- Models created by the algorithms designer are combined into an ensemble, where models with better recent performance are weighted higher, which then becomes PJM's default forecast before any manual adjustments are applied:
    - A neural network model that uses temperature as an input.
    - A neural network model that uses temperature as an input and is optimized for sudden changes in temperature.
    - A pattern matching algorithm that creates a load forecast by applying a weighted average to days with similar weather that occurred in the past.
- Models created internally by PJM:
    - A neural network model that uses effective temperature (which accounts for wind speed) as an input.
        - In the summer months, this model uses temperature humidity index instead of effective temperature.
    - A neural network that replaces recent historical load and weather data with forecasted values.

16. Output from all of these models are visualized in an in-house tool called LoadCast. LoadCast is prominently displayed in the control room on the desktop of the operator responsible for making manual adjustments to the published forecast, and also used extensively by support engineers who provide advice on how to make these manual adjustments.

17. The LoadCast tool also offers the ability to manually create a load forecast by plotting individual historical days with similar temperature profiles. This mimics a legacy load forecasting approach and provides a useful sanity check to verify the output of the models.

18. PJM uses multiple tools to visualize weather data. A custom in-house weather dashboard presents temperature, effective temperature, wind speed, cloud cover, and other parameters for weather stations and forecast zones for the current day and next six days. The dashboard features charts that compare vendor forecasts and show the 24 hour change in temperature; and daily written reports describing forecasted weather conditions in each of

three major zones in PJM. A dashboard with maps of the United States and parts of Canada shows real-time temperature, radar, dew point, and infrared and forecasted temperature deviations from normal for the current day and next 14 days. A custom Dispatch interactive mapping tool shows weather radar and satellite; temperature, wind speed, dew point, and relative humidity observations; local storm reports; National Weather Service bulletins; and a variety of severe conditions.

## C. How PJM Optimizes Accuracy in Load Forecasting

19. PJM Operations staff closely monitor load forecast accuracy and model performance. A company forecast metric requires that 91% of days in the calendar year have a daily average load forecast error of less than 3%. The following table summarizes compliance with that goal. Forecast accuracy in 2021 and 2022 surpassed the three preceding years, and accuracy in 2023 is 97.16% as of May 22, 2023, which is better than the past five years.

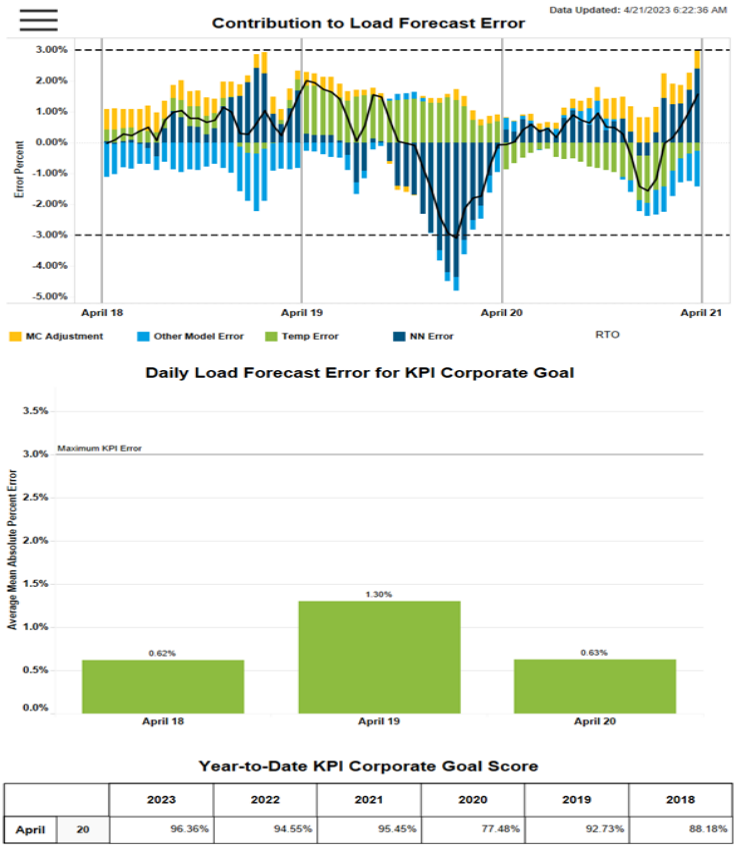
**Table 1: Percentages of Days with Load Forecast Error Under 3%**

| | |
|---|---|
| 2023 | N/A |
| 2022 | 91.51% |
| 2021 | 92.60% |
| 2020 | 85.52% |
| 2019 | 90.36% |
| 2018 | 91.23% |

20. Each morning, PJM operations staff and leadership review a report of forecast performance from the previous day. The report contains the day's load forecast score and a chart that depicts the contributions to load forecast error from weather forecast error, model error, and human adjustments. These contributions are quantified by running a backcast algorithm and computing the difference between various outputs. This information allows control room staff to observe trends, such as under- or over-forecasting that repeats at certain times of day, and correct for them in future forecasts.

21. Figure 1 below presents an example of a recent daily report addressing load forecasting errors.

**Figure 1: Sample Load Forecast Error Report**




## D. "Training" the PJM Load Forecasting Model

22. PJM Operations staff trains the neural network models on three years of historical load and weather data. A three year term is the industry standard for model training. It appropriately balances having enough historical data to adequately capture the way load responds to a variety of weather conditions and not including obsolete data that does not reflect the current load/weather relationship. The latter concern has become more pronounced in recent years as COVID-19, energy efficiency, and increased behind-the-meter solar and data center load have all contributed to reshaping the load profile. The models then continue to learn and adapt from new data that comes in after the end of the training period.

23. The current training period spans from July 2019 to June 2022. That period went into effect in August 2022 after weeks of testing.

## E. Winter Storm Elliot and PJM's Load Forecasts

24. Winter Storm Elliott was an unusually severe winter storm that struck the PJM Region between December 23 and December 24, 2022. Winter Storm Elliott presented

extraordinary reliability challenges by causing an extremely rapid drop in temperatures at a time of record-breaking high loads for the Christmas holiday. Winter Storm Elliott had a major, and in many ways unanticipated, impact not just on PJM but on much of the rest of the Eastern Interconnection. Thus, I think that it is a mistake to suggest that Winter Storm Elliott was a routine storm that "played out as forecast."[5]

25. Two factors beyond what PJM normally encounters were the largest contributors to the greater-than-normal difference between PJM's load forecasts and actual load during Winter Storm Elliott.

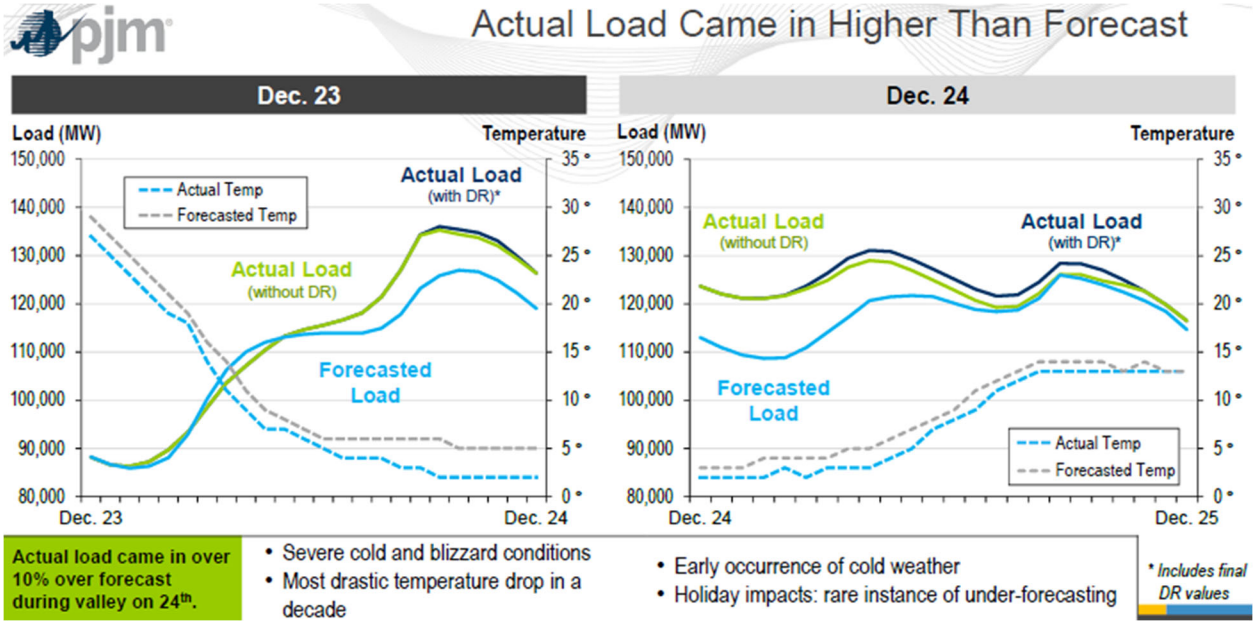
26. First, the proximity to the Christmas holiday, and ongoing changes in patterns of human behavior during holiday periods, meant that PJM's load forecasting model faced an unusual challenge. In particular, load has traditionally been over-forecasted by models in the days leading up to Christmas. As discussed below, PJM realized that Winter Storm Elliott could deviate from historic trends and established a higher-than-usual load forecast for early Winter. But actual load unexpectedly came in much higher than even PJM's atypically high projection.

27. Second, the extreme weather associated with Winter Storm Elliott's movement into and across the PJM region was outside the bounds of anything the model had seen before in its training data. Not only were the temperatures colder than any in the model's history for the time of year, but the rate of the temperature decrease, an abrupt 29° F in just 12 hours, was faster than for any cold weather event for more than a decade (which encompasses the entire model training history of PJM's current suite of forecasting tools). In some parts of PJM, the highest temperatures on December 24 were the coldest in recorded history for that date.

28. As shown below in Figure 2, actual loads in PJM were higher than forecast, with the evening peak on December 23 and morning peak on December 24 both underestimated by approximately 7%.

[5] *See, e.g.*, Complaint of The Coalition of PJM Capacity Resources (Coalition Complaint) at 8, Docket No. EL23-55 (filed Apr. 4, 2023).

**Figure 2: 12/23-24 Actual Load vs. Load Forecast**

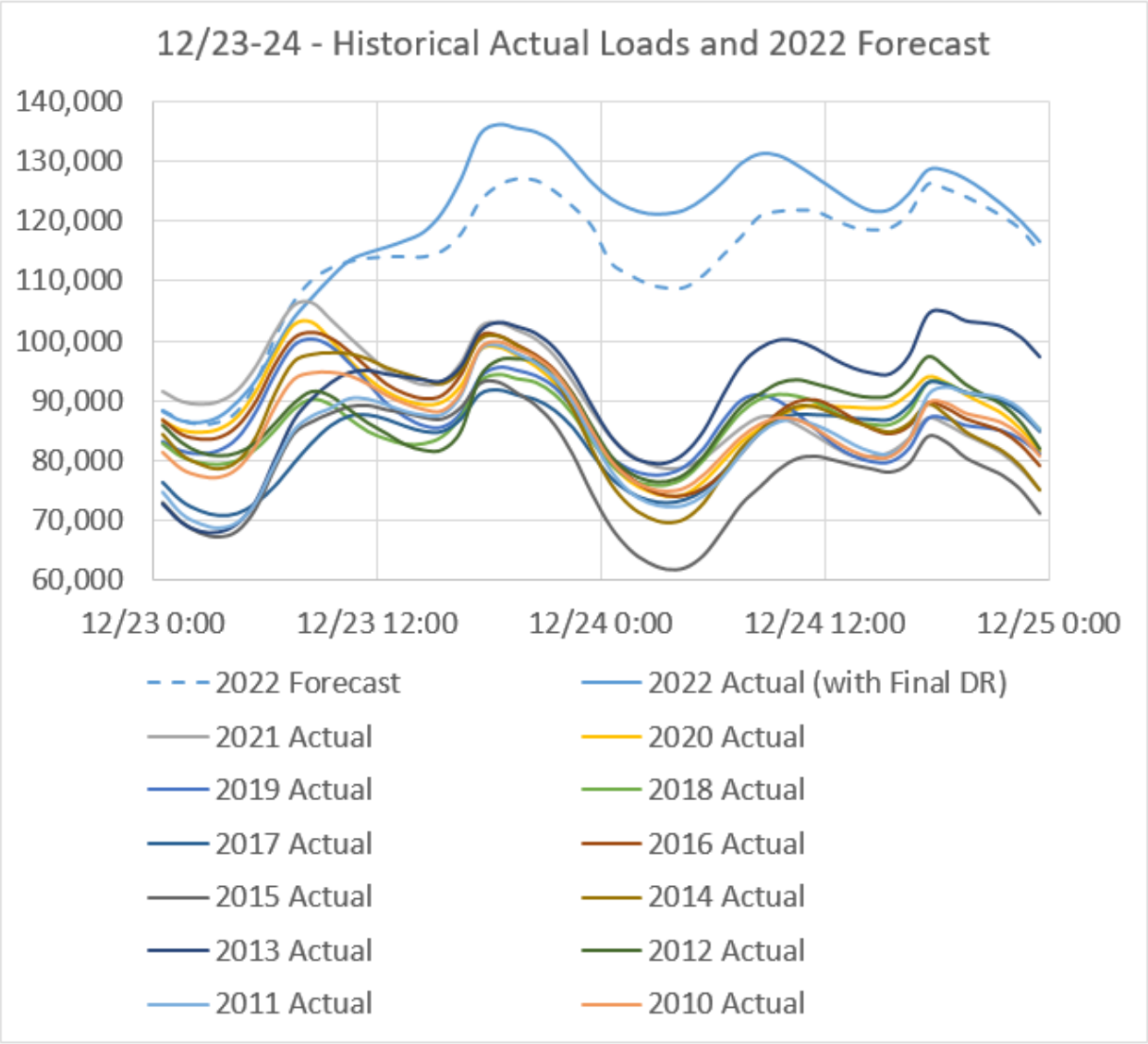



29. PJM's peak forecasted load for 18:00 on December 23 was 126,968 MW. PJM called over 155,750 MW into the operating capacity for the day. PJM reasonably believed that it was guarding against potential uncertainty as further described in Mr. McGlynn's affidavit.

30. PJM's peak forecasted load for 18:00 on December 24 was 126,007 MW.

31. These peak forecasts are both over 20,000 MW higher than peak loads observed on these days in the last 13 years. As a whole, PJM's load forecasts correctly predicted very high load levels for both days, but did not capture the full magnitude of how unprecedented actual load would prove to be. The difference is captured by Figure 3 below.

**Figure 3: Historical Actual Loads and Forecast for December 23 and 24**




32. As Figure 3(a) demonstrates, the 2022 holiday weekend load during Winter Storm Elliott was an extreme outlier in both magnitude and timing. The actual hourly load was 136,010 MW on December 23 (hour ending 19:00) and 131,113 MW on December 24 (hour ending 09:00). Load also stayed unusually high overnight from December 23 to December 24. The "Christmas Eve Valley" in the early morning hours on December 24 was 40,000 MW higher than the next highest over the last decade. In fact, the load "valley" on December 24 was 15,000 MW higher than any peak load on that date in a decade. Figure 3(b) in turn shows PJM's December 1 – January 15 Loads since 2012.

**Figure 3(a): 2022 Holiday Weekend Load**

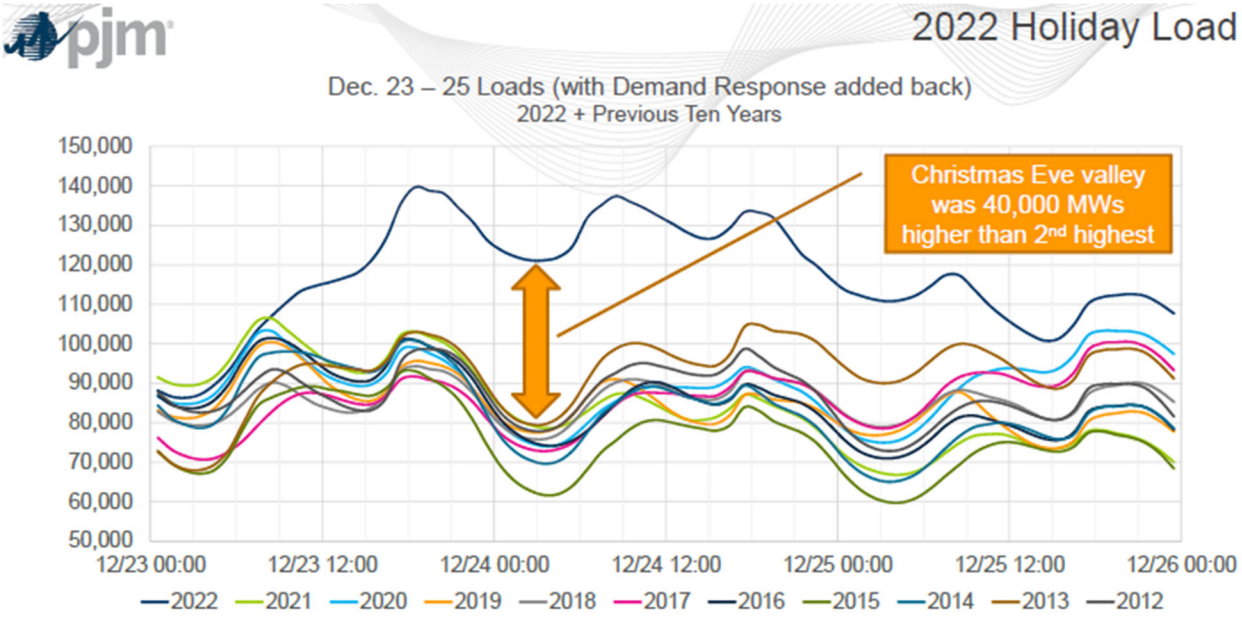
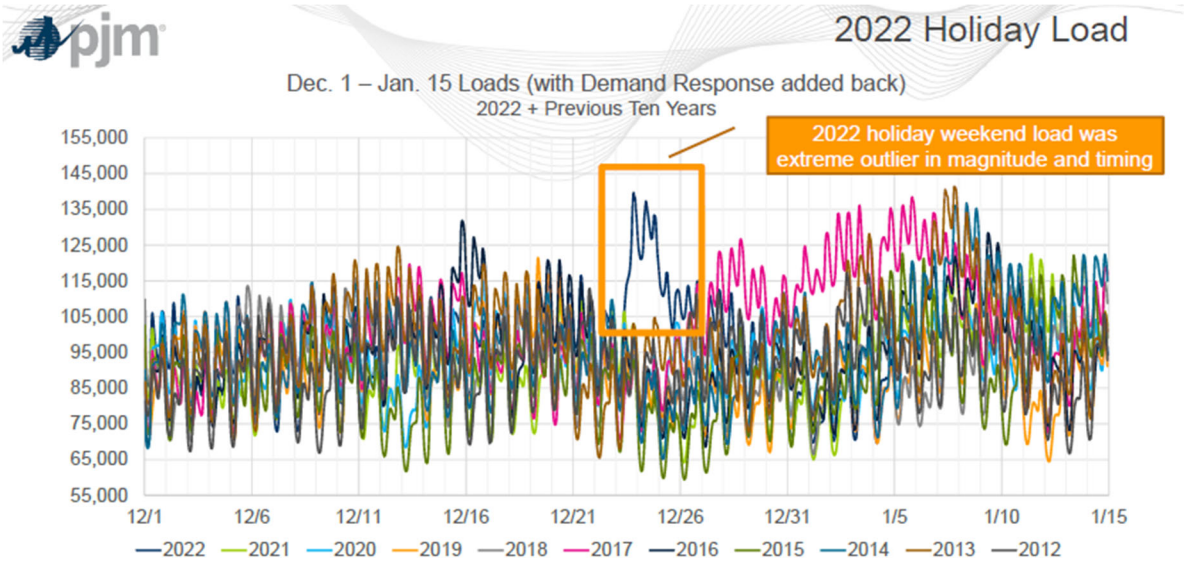



**Figure 3(b): 2022 December 1 – January 15 Loads, 2012-2022**



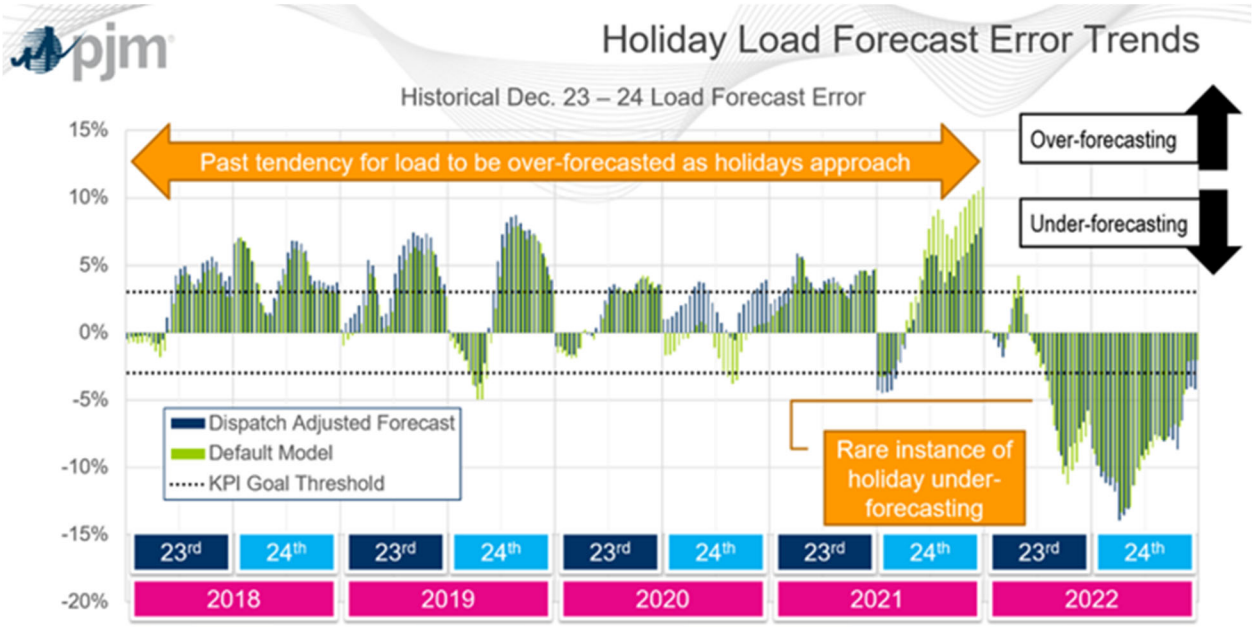

33. The load forecast for December 24 was off by less than 2% at the evening peak. But the morning peak that day was under-forecasted—partially due to a temperature forecast error, such cold temperatures (and sudden temperature drops) not existing for the early winter timeframe in the model's history, and potentially other reasons.

34. December 24 has historically been one of the most difficult days of the year to forecast even with normal seasonal weather because of the Christmas Eve holiday. The holiday's impact on human behavior is hard to anticipate and directly relevant historical data is

relatively scant because load on weekends differs greatly from weekdays and the last time that December 24 fell on a Saturday was 2016.

35. Figure 4 below illustrates the pattern of Christmas holiday load forecasting error over the last five years. In particular, it shows how the under-forecast for Winter Storm Elliott was a departure from usual holiday period over-forecasts.

**Figure 4: Holiday Load Forecasting Error Trends**

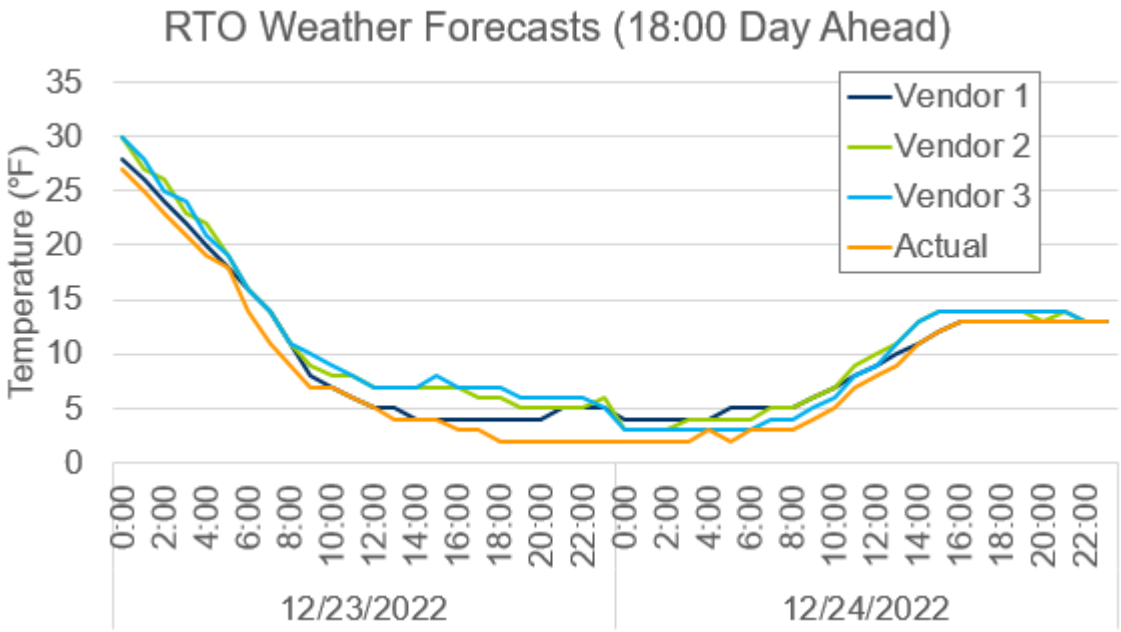



36. On December 23, actual temperatures were materially colder than predicted by PJM or any of its vendors. During the second half of the day, the RTO average was 4 degrees colder than the 18:00 day ahead forecast, with the most severe over-forecasting in the central and northeastern part of the footprint, where several cities came in 6 or more degrees colder for at least two hours (Erie, PA; Harrisburg, PA; Morgantown, WV; Pittsburgh, PA; Bowling Green, KY; Newark, NJ; Williamsport, PA; Johnstown, PA).

37. Temperatures were 1-3 degrees colder than PJM's most conservative vendor forecast for all but two hours from 00:00 on December 23 through 13:00 on December 24. There were three consecutive hours of a three-degree temperature forecast error from late on December 23, leading to a significant valley load forecast error. A three-degree error would be expected to have a material impact on load because load is very sensitive to temperature forecast at the tail ends of the distribution.

38. Figure 5 below captures the temperature forecast error for 18:00 on December 23-24.

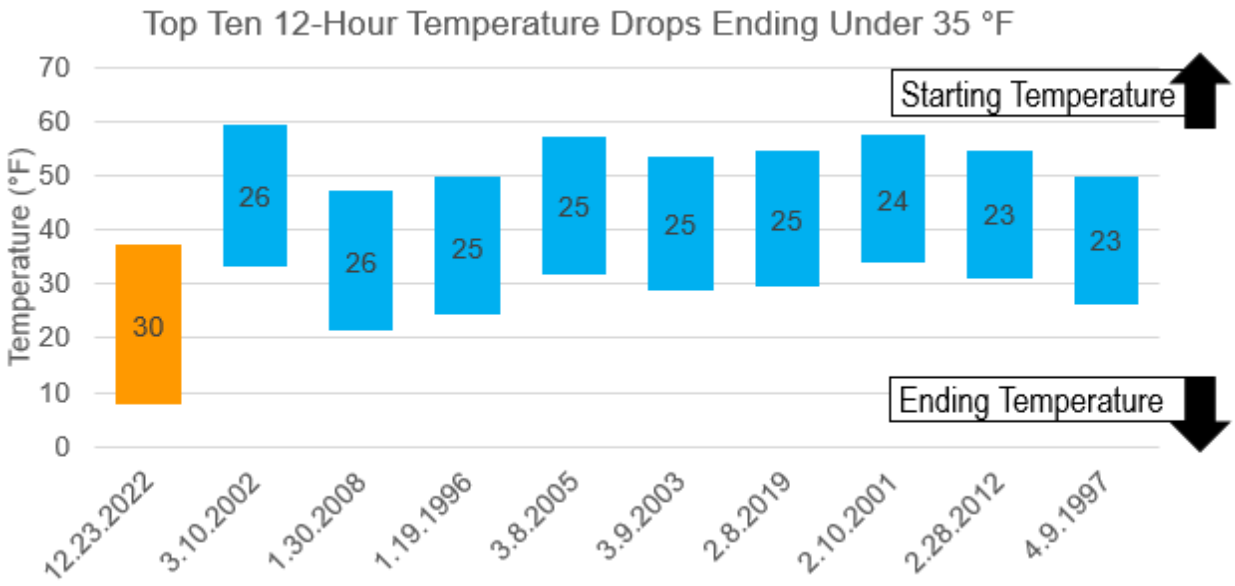
**Figure 5: Forecast Error for December 23 – 24, 18:00**




39. The rapidity of the temperature drop associated with Winter Storm Elliott was at least as significant as its magnitude. The twenty-nine-degree temperature drop that occurred on December 23 was the most significant temperature decrease over a 12-hour period that ended below 15°F dating back to at least 1996 and was seven degrees (i.e., 30%) greater than the temperature drop during the Polar Vortex in 2014.

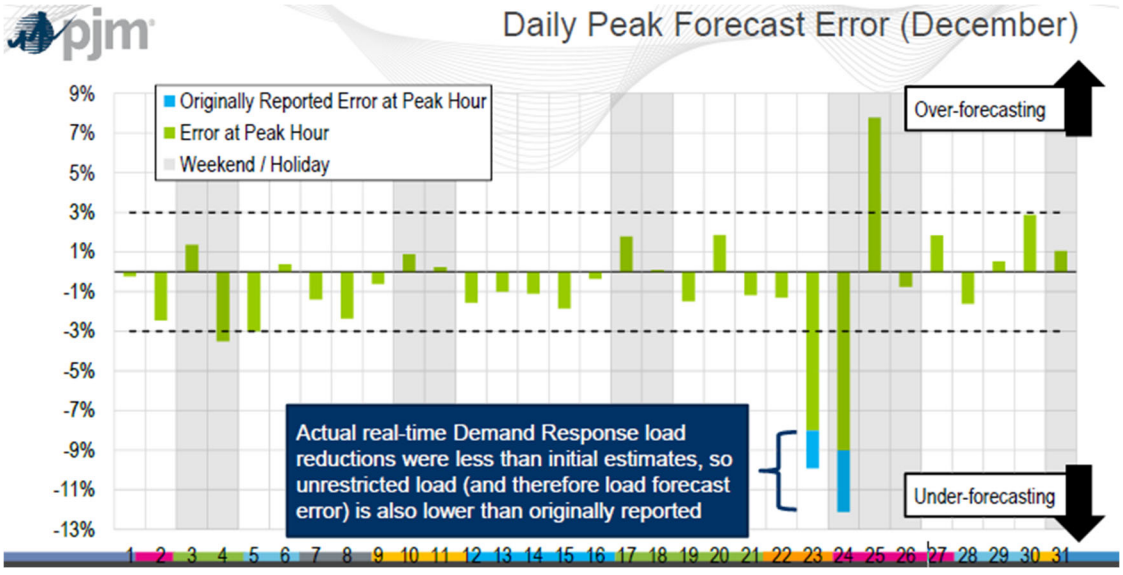
40. Figure 6 below depicts the speed and significance of the temperature drop on December 23 compared to other drastic temperature drops since 1996.

**Figure 6: Most Significant Temperature Drops Since 2014**




41. In short, and as shown by Figure 7, below, exceptional weather and load conditions during Winter Storm Elliot were the principal causes of PJM's under-forecasting. The fact that PJM's load and temperature forecasts were at their normal levels of accuracy before Winter Storm Elliott, and returned to those levels afterwards, reinforces this conclusion.

**Figure 7: December Daily Peak Forecast Error**




42. Given all of these considerations, I do not think it is accurate to suggest that PJM's load forecasts were unreasonable in light of the available weather forecasts or for any other

reason.[6] It is overly simplistic to suggest that PJM should have been able to predict record-breaking high holiday loads without reference to the aforementioned difficulties of predicting Christmas Eve loads or the fact that forecasts have traditionally over-estimated loads at that time of year.[7]

## F. PJM's Neighbors Experienced Comparable Forecasting Difficulties During Winter Storm Elliott

43. As PJM's separate Answers to the Complainants each discuss in detail,[8] PJM was not the only region to encounter load forecasting challenges due to Winter Storm Elliott. The Tennessee Valley Authority, the VACAR portion of the SERC Reliability Corporation, Midcontinent Independent System Operator, Southwest Power Pool, Duke Energy, and Louisville Gas & Electric/Kentucky Utilities all under-forecasted Winter Storm Elliot loads to an extent comparable to PJM. In my view, the fact that neighboring regions produced similar under-forecasts when confronting the same set of exceptional circumstances demonstrates that PJM's forecasts were reasonable given the information available at the time. The similarity in forecasting results also confirms my view that Winter Storm Elliott did not expose some unknown defect in PJM's load forecasting procedures.

44. At the end of the day, PJM goes to great lengths to make its load forecasts as accurate as possible. But forecasting is an inherently uncertain activity. Forecasts will inevitably sometimes be off by a greater-than-usual amount. In my view, it was clearly the confluence of exceptional circumstances related to Winter Storm Elliott that caused PJM's larger-than-normal under-forecasts for December 23 and 24. And as further described in Mr. McGlynn's affidavit, given the unusual weather and forecast uncertainty, operating plans reflected the potential for higher than normal forecast error.

45. This concludes my affidavit.

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[6] *See, e.g.*, Coalition Complaint at 11-12; Attach. 4: Aff. of Paul M. Sotkiewicz, at PP 11-26.

[7] *See, e.g.*, Coalition Complaint at 12 ("PJM projected temperatures for December 23 and 24 that were likely to be similar to previous winter weather events in its region, which should have been an indication to PJM that load forecasts should also be comparable."); Sockiewicz Aff. at P 23 ("The apparent lack of situational awareness on the part of PJM's on-duty operations staff regarding the mismatch between the weather and load forecast is incomprehensible given the available weather and load history.").

[8] *See* Section II.C of each PJM Answer in the captioned proceedings.

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| **Essential Power OPP, LLC, *et al.*** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-53-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Aurora Generation, LLC, *et al.*** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-54-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Coalition of PJM Capacity Resources** | ) | |
| **Complainant** | ) | |
| **v.** | ) | **Docket No. EL23-55-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |

## VERIFICATION

I, **Joseph Mulhern**, state, under penalty of perjury, that I am the Joseph Mulhern referred to in the foregoing document entitled "Affidavit of Joseph Mulhern on Behalf of PJM Interconnection, L.L.C.," that I have read the same and am familiar with the contents thereof, and that the facts set forth therein are true and correct to the best of my knowledge, information, and belief.

*/s/ Joseph Mulhern*
Joseph Mulhern

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

## VERIFICATION

I, **Joseph Mulhern**, pursuant to 28 U.S.C. § 1746, state, under penalty of perjury, that I am the Joseph Mulhern referred to in the foregoing document entitled "Affidavit of Joseph Mulhern on Behalf of PJM Interconnection, L.L.C.," that I have read the same and am familiar with the contents thereof, and that the facts set forth therein are true and correct to the best of my knowledge, information, and belief.

DocuSigned by:
Joseph Mulhern
9B71654952B443F...

Joseph Mulhern

Attachment E

Affidavit of Paul F. McGlynn
on Behalf of PJM Interconnection, L.L.C.

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

**AFFIDAVIT OF PAUL F. MCGLYNN**
**ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1. My name is Paul F. McGlynn. My business address is 2750 Monroe Blvd., Audubon, Pennsylvania, 19403. I currently serve as Executive Director System Operations for PJM Interconnection, L.L.C. (PJM).

2. I am submitting this affidavit on behalf of PJM in support of PJM's Answers to the Complaint filed by Invenergy Nelson LLC in the captioned proceeding. I have reviewed this Complaints and aver that the statements, analyses, and conclusions I present in my May 26, 2023 affidavit submitted on behalf of PJM in support of PJM's Answers to the complaints filed in Docket Nos. EL23-53, EL23-54, and EL23-55, which I include as Exhibit 1 to this affidavit, apply equally to the issues raised in the captioned Complaint of Invenergy Nelson LLC.

3. This concludes my affidavit.

# Exhibit 1

## Affidavit of Paul F. McGlynn
## on behalf of PJM Interconnection, L.L.C.

## Submitted in Docket Nos. EL23-53, EL23-54 and EL23-55
## on May 26, 2023

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| **Essential Power OPP, LLC et al** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-53-000** |
| **PJM Interconnection, L.L.C.** | ) | |
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| **Coalition of PJM Capacity Resources** | ) | |
| **Complainant** | ) | |
| **v.** | ) | **Docket No. EL23-55-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |

**AFFIDAVIT OF PAUL F. MCGLYNN**
**ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1. My name is Paul F. McGlynn. My business address is 2750 Monroe Blvd., Audubon, Pennsylvania, 19403. I currently serve as Executive Director System Operations for PJM Interconnection, L.L.C. (PJM). I am submitting this Affidavit to support PJM's separate answers to the complaints in the above-captioned proceedings that are being filed today. For ease of reference, I refer to the three groups of generators that have filed the above-captioned complaints collectively as "the Complainants."[1]

2. I have been employed by PJM since 2007. As part of my current work for PJM, I am responsible for managing the System Operation Division to ensure the secure, reliable, economic and coordinated operation of the PJM Interconnection system. In this role I direct and oversee all System Operation Division activities for the efficient and reliable operation and coordination of the PJM bulk power system including load forecasting, scheduling and dispatch of generating units, coordinating generating unit and transmission outages, scheduling power interchange transactions with neighboring systems and monitoring and control of the loading and voltages of the system within established reliability standards.

[1] For clarity, this affidavit will refer to the "CZG Complainants," the "Coalition", and the "Nautilus Entities" when referencing arguments unique to those parties.

3. Prior to assuming my position in System Operation, I was the senior director of System Planning for PJM Interconnection. In that role I was responsible for the development of the PJM Regional Transmission Expansion Plan (RTEP) including transmission planning, interregional planning and the analytic activities in support of the interconnection process. My responsibilities included assessing long-term transmission system adequacy and reliability, and recommending bulk transmission system expansions and enhancement options.

4. Prior to joining PJM, I was employed by PECO Energy, a subsidiary of Exelon Corporation, for 21 years where I began working as an Engineer in the Electrical Engineering Division. I was promoted to Manager of Engineering in Transmission and Substations in 1995. I transferred to System Operations in the Operations Planning Department in 1998. I was promoted to Shift Manager in System Operations in 1999 and to Manager in Operation Planning in 2001. I became Manager in Transmission control in 2003.

5. At PECO, I was responsible for engineering and designing transmission and substation equipment, including protective relay systems; providing engineering and technical support for PECO's transmission and substation organization; short-term transmission system planning studies, developing operating procedures and preparing and presenting training courses; directing the real-time operation of the Transmission System; short-term transmission planning, outage coordination, dispatcher training, procedure development and real-time control room support; and managing the real-time personnel and activities of the transmission control center.

6. I am a licensed Professional Engineer in the Commonwealth of Pennsylvania. I hold a Bachelor of Science degree in Electrical Engineering from the Pennsylvania State University and a Master of Science degree in Electrical Engineering from Drexel University.

7. I was directly involved in overseeing, and subsequently reviewing, PJM's operational decisions during "Winter Storm Elliott."[2] That storm precipitated a major reliability emergency both in PJM and other portions of the Eastern Interconnection on December 23 and 24, 2022.

8. The purpose of this Affidavit is to explain how PJM's actions in response to Winter Storm Elliott were consistent with the PJM Open Access Transmission Tariff (Tariff), Operating

[2] "Winter Storm Elliott" was an unusually severe winter storm that struck the PJM Region between December 23 and December 24, 2022. Winter Storm Elliott presented extraordinary reliability challenges by causing an extremely rapid drop in temperatures at a time of record-breaking high loads for the Christmas holiday. It had a major, and in many ways unanticipated, impact not just on PJM but on much of the rest of the Eastern Interconnection. See https://www.pjm.com/markets-and-operations/winter-storm-elliott (collecting PJM's public statements addressing Winter Storm Elliott's impact on PJM's operations and markets).

Agreement (OA),[3] PJM Manual 13: Emergency Operations (Manual 13)[4] and all other applicable requirements. These authorities all provide PJM with broad operational flexibility to preserve reliability within PJM, and to assist neighboring systems, in emergencies. All of PJM's efforts were reasonable attempts to contend with the confluence of unexpected and unprecedented abnormal events during Winter Storm Elliott, including the poor communications and performance by Capacity Resources.

### A. PJM's Actions Successfully Met the Serious Challenges Presented by Winter Storm Elliott

9. At a time when millions of Americans in the PJM Region were preparing for the Christmas holiday, PJM recognized the impending reliability threat posed by Winter Storm Elliott. As discussed in the Bielak Affidavit, PJM initiated extensive preparatory efforts that were a call to action to PJM's generation fleet. PJM's Load Forecasts for December 23 anticipated that the coming storm could bring significant temperature drops and anticipated high loads. Operators scheduled conservatively, making a conscious decision to carry a large amount of additional capacity going into the December 23 operating day. But these efforts were insufficient because many Capacity Resources, including Complainants, unexpectedly failed to perform when they were most needed to support reliable system operations.

10. In the face of widespread and unacceptable non-performance by generators, PJM staff spent the days leading up to Christmas working tirelessly to keep the lights on. PJM operators repeatedly had to make difficult reliability decisions in real-time while in the midst of unprecedented circumstances and significant uncertainties that were exacerbated by generator failures. There was a very real risk on both December 23 and December 24 that PJM would be forced to shed load to avoid widespread outages. Winter Storm Uri is a recent reminder of how devasting the human and economic consequences of load shedding in freezing winter conditions can be.

11. PJM has included a timeline of the various actions that it took before, during and after Winter Storm Elliott. The timeline is included as Exhibit 1 to PJM's answers to the above captioned proceedings. The timeline is accurate to the best of my knowledge.

12. The PJM actions referenced in the timeline include issuing: (i) Cold Weather Advisories and Cold Weather Alerts; (ii) NERC Emergency Alerts Level 1 (EEA1) and 2 (EEA2), including Pre-Emergency Load Management Reduction Actions, Emergency Load Management Reduction Actions, loading Maximum Emergency Generation and Maximum Emergency Generation Alerts/Load Management Alerts; (iii) issuing Voltage Reduction Alerts and Voltage Reduction Warnings; and (iv) making public appeals for conservation. PJM also received requests for assistance from neighboring systems that were also experiencing capacity emergencies and had reached NERC level EEA3, i.e., load shedding.

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[4] PJM Manual 13: Emergency Operations (Manual 13). See https://www.pjm.com/~/media/documents/manuals/m13.ashx.

These terms are all described in Manual 13 and in NERC documents. But for ease of reference, they are collected in Exhibit 1 to PJM's Answer in the captioned proceeding.

13. PJM is traditionally a net exporter of energy. But at times during Winter Storm Elliott, PJM determined that it must recall non-firm exports to neighboring systems that were themselves shedding, or on the brink of shedding, load in order to manage the risk of load shedding in PJM. At other times, on December 24, PJM itself received assistance in the form of imports from the Northeast Power Coordinating Council (NPCC).

14. Because of its actions, PJM was able to keep the lights on notwithstanding the incredibly challenging system conditions. PJM did not shed a single megawatt of load on December 23 and December 24. Consistent with Good Utility Practice, NERC reliability standards, and other legal obligations, PJM also continued to serve a critical role in supporting the reliability needs of its neighbors, despite having to recall exports to neighboring Balancing Authorities at times.

### B. PJM Complied with the Tariff, OA, and Manual 13 Throughout Winter Storm Elliott

15. PJM must comply with the Tariff, OA (as informed by the PJM Manuals), mandatory NERC and regional reliability standards, and the dictates of the Good Utility Practice standard. All PJM dispatch staff are NERC-certified system operators and receive extensive training throughout the year on the reliable operation of the Bulk Electric System including, but not limited to, emergency procedures.

16. The Tariff, OA, NERC standards, and the implementing PJM Manuals ultimately exist to protect reliability. PJM's foremost obligation as a FERC-regulated Transmission Provider, as well as a registered NERC Reliability Coordinator, Balancing Authority, and Transmission Operator, is to maintain reliability.

17. PJM, like other entities with comparable reliability responsibilities, must be allowed flexibility to make operational decisions based on the information available to them in real-time. Dispatchers have to think in terms of multiple time frames simultaneously, e.g., very short time intervals, such as almost minute-by-minute, longer times frames such as hour-by-hour, and still longer time frames spanning 24 hours or longer.

18. I am familiar, as are the collective PJM Dispatch staff, with the provisions of the Tariff, OA, and Manual 13 (and other PJM Manuals) that delineate PJM's emergency reliability authority and procedures as well as the related NERC reliability standards. It is well understood by PJM's operators, but still should be noted given the position taken by Complainants in the above-caption proceedings, that these authorities all clearly provide PJM with flexibility to address emergencies. They leave PJM with broad flexibility to act as needed. They do not establish absolute prohibitions on actions that operators may take beyond making the avoidance of load shedding the operators' paramount objective.

19. Section 1.7.11 of the OA makes PJM responsible "for declaring the existence of an Emergency, and for directing the operations of Market Participants as necessary to manage, alleviate or end an Emergency," and further clearly states that a PJM "declaration that an

Emergency exists or is likely to exist . . . shall be binding on all Market Participants" until PJM "announces that the actual or threatened Emergency no longer exists." Section 1.7.15 instructs that "[c]onsistent with Good Utility Practice, [PJM] shall be authorized to direct or coordinate corrective action, whether or not specified in the PJM Manuals, as necessary to alleviate unusual conditions that threaten the integrity or reliability of the PJM Region, or the regional power system."

20. Manual 13 is PJM's emergency operations manual. Section 1.1 of Manual 13 emphasizes that "[t]he policy of PJM is to maintain, at all times, the integrity of the PJM RTO transmission systems and the Eastern Interconnection and to give maximum reasonable assistance to adjacent systems when a disturbance that is external to the PJM RTO occurs." Section 2 gives PJM dispatchers, "the flexibility of implementing the emergency procedures in whatever order is required to ensure overall system reliability" including "the flexibility to exit the emergency procedures in a different order than they are implemented when conditions necessitate." Section 2.3.2 of Manual 13 reiterates that "[d]ue to system conditions and the time required to obtain results, PJM dispatchers may find it necessary to vary the order of application [of various measures including recalling non-capacity backed off-system sales and load relief measures] to achieve the best overall system reliability." Section 2.3.2 also expressly notes that, "[t]he Real-Time Emergency Procedures section [i.e., section 2.3.2 itself] combines Warnings and Actions in their most probable sequence based on notification requirements during extreme peak conditions. Depending on the severity of the capacity deficiency, it is unlikely that some Steps would be implemented."

21. To be clear, Manual 13 addresses five different types of emergencies. PJM experienced a "capacity emergency" during Winter Storm Elliott. Capacity emergencies are the subject of section 2 of Manual 13. The circumstances of Winter Storm Elliott did not give rise to a circumstance where warnings/actions were warranted on a Control Zone or a subset of a Control Zone basis. As discussed *infra*, the performance of the ComEd generators would have significantly mitigated (if not eliminated) the emergency conditions in the PJM Region during the storm. I also note that section 2.2 of Manual 13 indicates that, "PJM issues capacity emergencies across the entire PJM RTO." Load Dump Warnings/Actions were not necessary during Winter Storm Elliott.

22. In addition, NERC reliability standard IRO-014-3 R7 specifies that, "[e]ach Reliability Coordinator shall assist Reliability Coordinators, if requested and able, provided that the requesting Reliability Coordinator has implemented its emergency procedures, unless such actions cannot be physically implemented or would violate safety, equipment, regulatory, or statutory requirements." This NERC requirement is addressed in more detail in the Bryson and Naumann Affidavits. I will say here, however, that IRO-014-3 R7 reinforces the PJM-specific authorities noted above, which also make helping neighboring systems in duress a very high priority. PJM's operators are well-aware of this requirement, which is grounded in the utility industry's long tradition of providing mutual assistance when facing emergencies.

23. I am also familiar with the well-established concept of "Good Utility Practice," which is expressly referenced in some of the PJM sources that I quote above and is also generally applicable to virtually all of PJM's operational actions under the Tariff.

24. The Tariff defines "Good Utility Practice" as "any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition." The definition also notes that "Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather is intended to include acceptable practices, methods, or acts generally accepted in the region." My understanding is that this is identical to the definition used in other regions under FERC's *pro forma* Open Access Transmission Tariff.

25. PJM exercised reasonable judgment in light of the facts known at the time of its Emergency Actions during Winter Storm Elliott. PJM's decisions accomplished the "desired result" under the Good Utility Practice standard of the reliable operation of the bulk electric system and avoiding load shedding in PJM while providing as much help as practicable to neighboring systems in duress. My understanding is that the Good Utility Practice Standard did not require PJM to use the "optimum practice, method, or act to the exclusion of all others" and that reasonably-based decisions made by the operators will be viewed as consistent with this standard. Hindsight is always 20/20. But even if there were some theoretical optimal approach that could have been used, that would not change the determination that the Good Utility Practice standard was met.

26. The fact that Emergency Actions triggered Non-Performance Charges is something that PJM operators understood. Operators also know that under the Capacity Performance construct, generators are responsible for winter preparedness (including fuel supply) and excuses for non-performance by Capacity Resources are extremely limited. Going into Winter Storm Elliott operators expected that Capacity Resources would be available consistent with the performance incentives incorporated into the Capacity Performance construct.

27. I have reviewed all three complaints, including the assertions that PJM violated Manual 13. The Complainants' claims are not valid. They second-guess real-time operational decisions with the benefit of 20/20 hindsight. They are also based on economic arguments that operators were not, and should not have been, considering even if the information underlying those arguments had been readily available to them in real-time.

28. PJM's operators fully satisfied their compliance obligations in advance of and for the entire duration of Winter Storm Elliott. If the Complainants' restrictive and unrealistic interpretations of Manual 13 was adopted, it would have an adverse impact on the reliability of bulk electric system and would seriously inhibit PJM operators' ability to keep the lights on.

### C. PJM's Actions During Winter Storm Elliott Were Reasonable and Justified in Light of the Information that Was Available to PJM Operators at the Time that They Were Making Decisions

29. This section of my Affidavit briefly discusses the actions that PJM took in connection with Winter Storm Elliott and the reasons why they were taken.[5]

#### 1. December 23

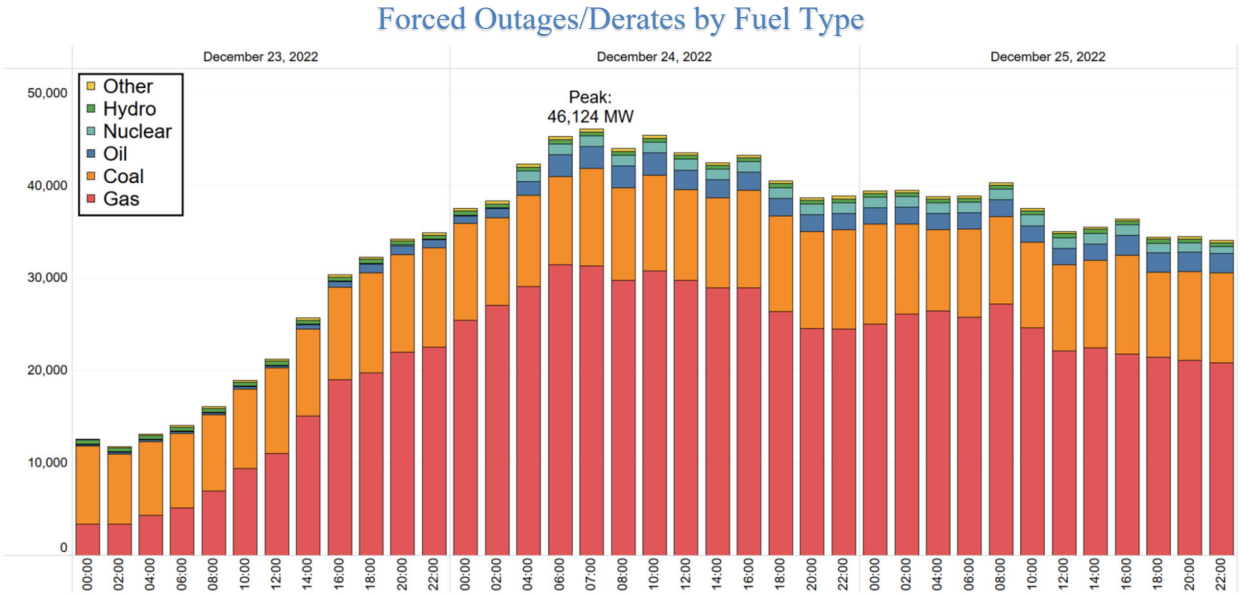
30. PJM put generators on notice through Cold Weather Advisories and Cold Weather Alerts of the need for heightened readiness as Winter Storm Elliott approached. As noted in Exhibit 1 to PJM's Answer, these advisories and alerts were issued between 9:00 on December 20 and 17:30 on December 22. These communications are discussed in more detail in the Bielak Affidavit. .

31. PJM entered the December 23 operating day in the reasonable belief, based on Markets Gateway and eDart data, that it had a substantial cushion for meeting load even taking account of potential variations in the peak load and expected higher-than-normal generation outages due to the cold weather. As explained in the Pilong Affidavit, "PJM entered the operating day on December 23, 2022 with the understanding that it had a total of approximately 158,000 MW of available generation to meet a forecasted load of 127, 000 MW."

32. Starting approximately 3:00 in the morning on December 23, generation forced outages/derates increased substantially. This happened at the same time as PJM load was increasing. PJM struggled to meet the consistently growing load inside PJM with the rapidly diminishing fleet of available generation. It also became apparent that many generators were not updating their offer parameters in Market Gateway or their status in eDart in a timely manner. On many occasions, PJM only learned of generators that were not able to operate after the operators called them to come on line. In some instances, the dispatch agent told the PJM dispatcher that the unit could not start during the same phone call requesting that unit to start. The operators thus could not rely upon what they were seeing on their screens.

**33.** The chart below shows the steadily rising levels of forced outages that PJM experienced through December 23. As depicted there, gas fired generators represent the largest segment of units experiencing higher outage rates. As discussed in the Pilong Affidavit, lack of natural gas as fuel was a growing problem.

[5] I note that there is no basis for Dr. Scott Harvey's assertion in the complaint proceeding brought by the CZG Complainants that PJM took actions because it had an ulterior motive such as a desire "to go short on PJM reserves relative to the reliability requirement in order to export more power to adjacent balancing areas." Harvey Aff. at n. 70.




The increase in load occurring at the same time as the performance of the generation fleet deteriorated caused the operational situation to become increasingly dire during the afternoon of December 23. Eventually, there were about 34,500 MW of forced outages at peak load of 135,000 MW on December 23.

34. PJM experienced two spinning reserves events on December 23 to address a low Area Control Error (ACE). These events are indicative of the stress that was being placed on the system at this time. ACE is a measure of how well the Balancing Authority is matching generation to the load. If load and generation are perfectly balanced, then ACE is zero. When a generator within a Balancing Authority trips off-line the ACE goes negative.[6] PJM experienced these events because load was increasing as generators tripped or failed to start. The December 23 spinning reserve events are depicted on the chart below in which PJM deployed Synchronized Reserves[7] to recover the ACE:

[6] NERC Standard BAL-002, Disturbance Control Performance, requires PJM, in its role as a registered NERC Balancing Authority, to ensure that is able to utilize its contingency reserve to balance resources and demand, and to return Interconnection frequency to within defined limits following a Reportable Disturbance. NERC defines a Reportable Disturbance as any event that causes an ACE change greater than or equal to 80 percent of a Balancing Authority's or reserve sharing group's most severe contingency.

[7] PJM defines "Synchronized Reserves" as "the reserve capability of generation resources that can be converted fully into energy or Demand Resources whose demand can be reduced within ten minutes from the request of the [PJM] dispatcher, and is provided by equipment that is electrically synchronized to the Transmission System." OA, §1 – Definitions. "Synchronized Reserves" are supplied from both 10-minute synchronized generating resources (i.e., the Spinning Reserves referenced above) and 10-minute demand-side response resources. *See* Manual 13, §1 at 15.

| Event Start (EST) | Event End (EST) | Duration | Zone | Reason | PAI in effect |
|---|---|---|---|---|---|
| 12/23/22 10:14 | 12/23/22 10:25 | 00:11:07 | RTO | Low ACE | No |
| 12/23/22 16:17 | 12/23/22 18:09 | 01:51:29 | RTO | Low ACE | Yes (1730-1809) |

Spinning reserve events to recover ACE do not occur often. To have one last the duration of the second event is very rare and is indicative of the extreme difficulties the system was facing as it headed into the December 23 evening peak. In fact, during my entire career in system operations, I have never before encountered an instance in which a spinning reserve event was needed for almost two hours.

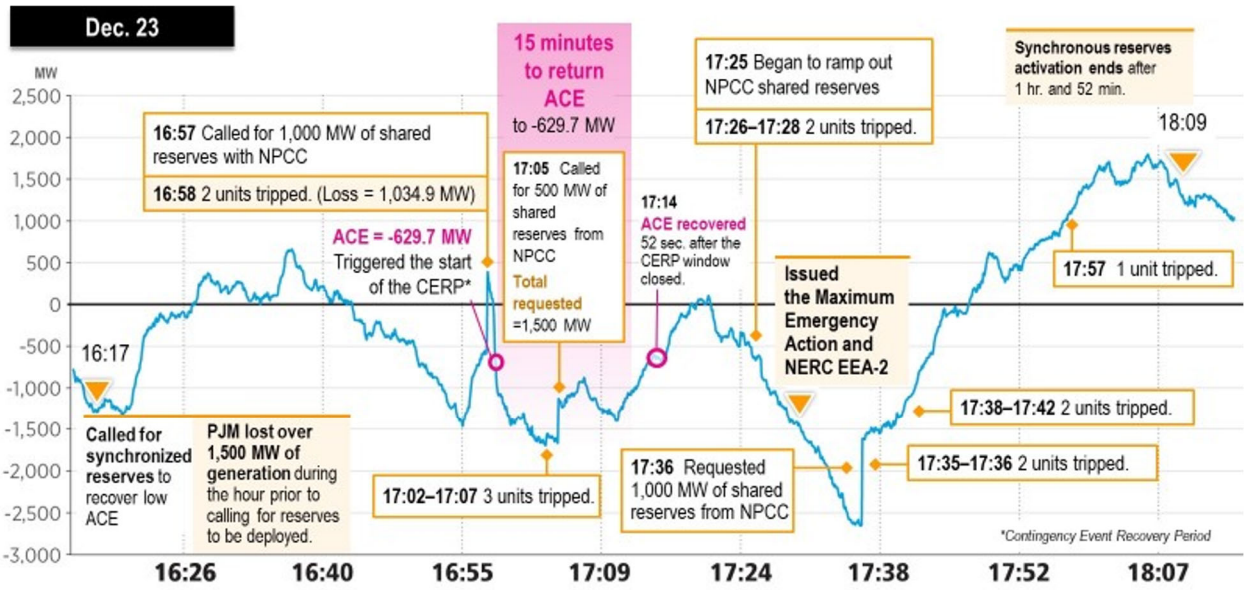
35. In addition, responses by Synchronized Reserves to Winter Storm Elliott was generally poor. The chart below captures the performance of Synchronized Reserves on December 23.

Assigned Reserve Performance

| Event Start | Event End | Synch Reserve Assignment (MW) | Synch Reserve Response (units with assignment) (MW) | Shortfall to Assignment (MW) | Response to Assignment (%) |
|---|---|---|---|---|---|
| 12/23/22 10:14 | 12/23/22 10:25 | 1,791 | 1,547 | 244 | 86.4% |
| 12/23/22 16:17 | 12/23/22 18:09 | 1,846 | 945 | 901 | 51.2% |

The performance of the Synchronized Reserve Units is yet another indication of the problems that generators were encountering.

36. The chart below depicts the level of the ACE along with specific events and actions that affected it. As the chart illustrates, while PJM acted to recover the ACE as load grew, trips by multiple generators worked against those efforts. Notably, PJM ACE was dangerously low at nearly -3000 MW at a time when load was still continuing to increase. It was not until the impact of the Pre-Emergency Load Management Action and the Maximum Emergency Generation Action (that I describe below) were felt, that ACE truly recovered.



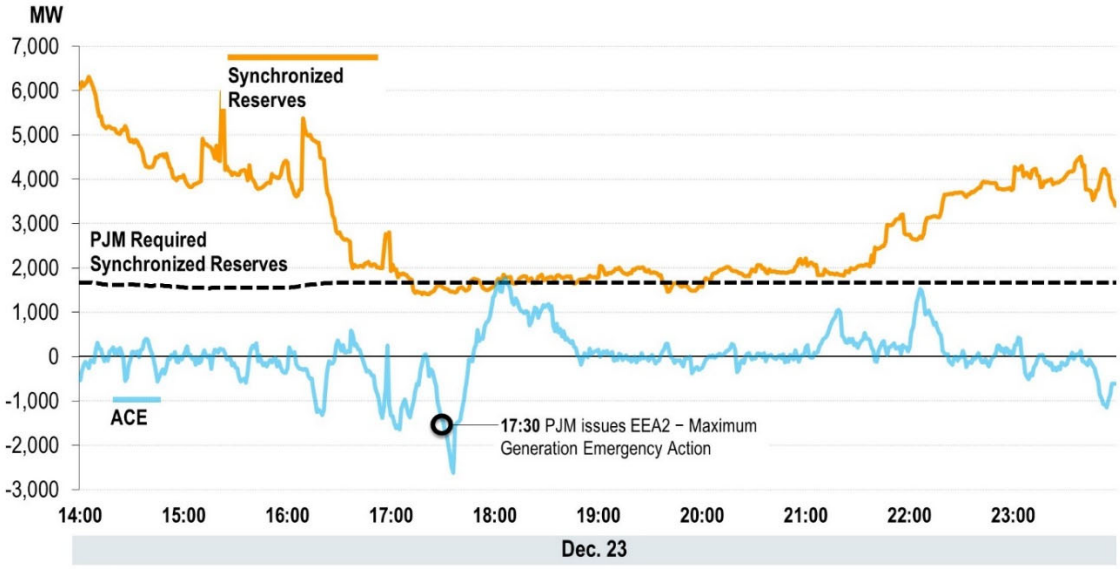

37. Given the on-going poor performance by Capacity Resources being observed in real-time, the remaining reserves available, the increasing load and the declining ACE, PJM dispatchers needed to take immediate action to address the situation. At 17:30, PJM issued a Maximum Emergency Generation Action, a Pre-Emergency Load Management Reduction Action[8] and issued a NERC EEA2. It was apparent that reducing off-system energy interchange alone would not be able to be implemented quickly enough and, in any event, would not be adequate to address the situation. Additional relief through emergency procedures was required. Consistent with section 2.2 of Manual 13, the Pre-Emergency Load Management Reduction Action, the Maximum Generation Action and the EEA2 encompassed the entire PJM footprint.

38. As discussed in the Bryson Affidavit, the action at 17:30 was validated by the supply/demand conditions that were present at that time. Mr. Bryson shows that cutting non-firm exports alone would not have been sufficient to preserve reliability.

**39.** The Emergency Action's impact on ACE can also be seen in the chart below. In particular, it depicts the difficult conditions facing PJM's operators between 14:00 and the end of the day on December 23. It clearly shows how available spinning reserves on the system were being depleted, how the PJM ACE was becoming progressively harder to control, and how spinning reserves dipped below the normal target level before PJM issued its EEA2. While PJM was taking actions to recover the ACE as load grew, the tripping of multiple

[8] PJM has three Load Management products: a thirty minute product, a sixty minute product and a 120 minute product. PJM requested the 30 minute and 60 minute Load Management product to be implemented. The 120 minute Load Management product was not requested as it would not have been effective until after the evening peak on December 23.

generators worked against those efforts. It was not until the impact of the Pre-Emergency Load Management Action and the Maximum Emergency Generation Action were felt, that ACE truly recovered.[9]




40. System conditions stabilized sufficiently by 22:00 so that PJM ended the EEA2 at that time. Both the Pre-Emergency Load Management Action and Maximum Emergency Generation Actions were cancelled and the PAIs were no longer triggered.

41. At 23:00 on December 23, PJM issued a Maximum Generation Alert/Load Management Alert and an EEA1 effective at 0:00 on December 24. PJM took this action in light of both forecasted conditions for the next day and the enormous uncertainty resulting from unprecedented system conditions that had emerged on December 23. Moreover, neighboring systems continued to face reliability challenges on the evening of December 23. For example, TVA was back in an EEA3 that evening and stayed at that level through 12:11:56 on December 24. MISO declared an EEA 2 at 18:00. The VACAR South Reliability Coordinator issued an EEA1 for DEC beginning at 20:25.

42. Simply stated, PJM had to account for the prospect that very challenging conditions would continue on December 24. As far as PJM could tell given the information available on December 23, it was very possible that historically high load levels could recur again on December 24. The poor operating performance, as well as lack of transparency, by many Capacity Resources on December 23 was a major factor weighing on the PJM operators. They were concerned that PJM might have to reach deep into its emergency procedures in order to serve load on December 24.

[9] It should be noted that PJM is a centrally dispatch single Balancing Area. PJM tracks ACE and manages the system to comply with ACE requirements for the entire PJM region. PJM does not track separate ACE values for portions of the PJM footprint, such as the ComEd Zone. PJM dispatches all resources in the RTO to serve all load in the RTO.

### 2. December 24

43. Generator outage levels in PJM continued to increase early on December 24. At 08:00, over 24% of the PJM fleet (approximately 46,000 MW) was experiencing a forced outage, which is higher than the 22% level that PJM experienced during the Polar Vortex in 2014. After 08:00, outage levels gradually decreased. but approximately 35,000 MW of generation was still experiencing a forced outage at 22:00 on December 24 which was still a very high forced outage rate of approximately 20%.

44. In addition, approximately 6,000 MW of steam generation was called but was not online as expected for the morning peak on December 24. Ultimately, over 16,000 MWs of generation that was committed in the Day-ahead Market failed to perform.[10] Further, high generator outage rates had limited PJM's ability to replenish pond levels for pumped storage hydro prior to the morning peak on December 24. Taken together, because of the poor generator performance, PJM was facing approximately 57,000 MW of generator unavailability for the morning peak on December 24.

45. Meanwhile, outside of PJM neighboring systems continued to face load shedding and to need assistance during the morning of December 24. VACAR South issued EEA3s for Dominion South Carolina at 05:59 on 12/24, for Duke Energy Carolinas at 06:17 on 12/24, for Duke Energy Progress at 06:40 on 12/24, and for South Carolina Public Service Authority at 07:20 on 12/24. For example, TVA shed as much as 3,200 MW on the morning of December 24. If PJM had provided less assistance than it did, the levels of load shed within that Balancing Area undoubtedly would have been higher.

46. On December 24, PJM again called for Synchronized Reserves to contend with low ACE in two cases and the loss of a unit in another case. Again, these events were unusual in terms of frequency and duration, with the third event lasting more than one hour, indicating that the PJM system was under stress. Also, as was the case the day before, the response by generators was disappointing and, unfortunately, confirmed the observations and concerns of the PJM operators regarding generation performance and how well generators would address future system threats that might arise.

47. The charts below encapsulate the disappointing results of PJM's Synchronized Reserves deployments on the morning of December 24.

[10] *Id.* at P 24.

| Event Start (EST) | Event End (EST) | Duration | Zone | Reason | PAI in effect |
|---|---|---|---|---|---|
| 12/24/22 0:05 | 12/24/22 0:30 | 00:25:43 | RTO | Low ACE | No |
| 12/24/22 2:23 | 12/24/22 2:54 | 00:30:35 | RTO | Unit Trip | No |
| 12/24/22 4:23 | 12/24/22 5:51 | 01:27:32 | RTO | Low ACE | Yes (0425—0127) |

| Event Start | Event End | Synch Reserve Assignment (MW) | Synch Reserve Response (units with assignment) (MW) | Shortfall to Assignment (MW) | Response to Assignment (%) |
|---|---|---|---|---|---|
| 12/24/22 0:05 | 12/24/22 0:30 | 1,767 | 930 | 837 | 52.6% |
| 12/24/22 2:23 | 12/24/22 2:54 | 1,665 | 535 | 1,130 | 32.1% |
| 12/24/22 4:23 | 12/24/22 5:51 | 1,007 | 169 | 838 | 16.8% |

As can be seen from the chart, the response for the Synchronized Reserves event beginning at 4:23 was especially poor with only a 16.8% response rate.

48. At 04:00 on December 24, PJM issued a call for conservation to last until 10:00 on December 25. PJM decided that this could be a useful measure on the evening of December 23 because it was apparent then that generator outages were climbing, were likely to increase further overnight, and that it could be challenging to meet the peaks on Saturday morning and Saturday evening. The call was distributed through the media and through direct communications with Transmission Owners and state regulators. PJM believes that responses to its call for conservation helped to reduce load beginning at about 07:15.[11]

49. PJM also recalled exports, with those actions peaking at 07:00 when PJM became a net importer. High PJM system costs incentivized interchange into PJM at the same time that the non-firm transactions were recalled. Had PJM's net interchange not become positive, PJM would likely have been required to take more drastic measures such as a Voltage

[11] *See* PJM FAQs at 19.

Reduction Action and a Manual Load Dump Warning to prepare for the possibility of shedding load if conditions continued to deteriorate.

50. At 04:20, PJM issued an EEA2 – Pre-Emergency Load Management Reduction Alert and an Emergency Load Management Reduction Action. In this instance, PJM requested all three Load Management products (i.e., 30 minute, 60 minute and 120 minute). This was promptly followed at 04:28 by the issuance of an EEA2 Maximum Generation Emergency Action. Load Management went into effect at 06:00.[12] Again, consistent with section 2.2 of Manual 13, these actions encompassed the entire PJM footprint. The Bryson Affidavit confirms that these actions would have been needed even if PJM cut all non-firm exports.

51. At 04:52, PJM issued a Voltage Reduction Alert, followed at 07:15 by a Voltage Reduction Warning and Reduction of Non-Critical Plant Load. PJM took these steps to give regional stakeholders notice that PJM might be forced to take drastic measures short of load shedding to address reliability problems that could emerge later in the day. Underscoring the challenges faced by the system during this time frame, PJM convened a Systems Operations Subcommittee call with the transmission owners at 7:30, at which time it advised the transmission owners to prepare for a Voltage Reduction Action and to be sure to have their load shed plans in place.

52. PJM also publicly encouraged Market Participants to submit bids to sell emergency energy into PJM at 06:17. This action reflects PJM's all-out effort to secure as many resources as possible given the performance failures of December 23.

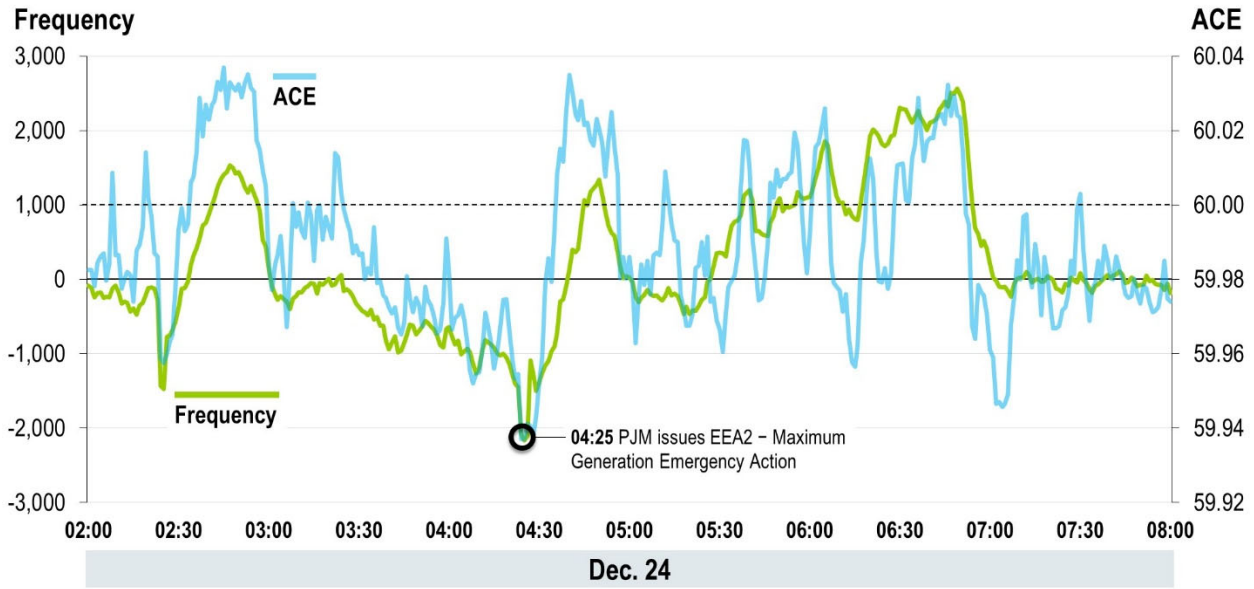
53. Around 06:30, PJM began receiving reports that generators were having to limit their output due to federal government environmental restrictions. PJM promptly sought relief and, at 17:30, PJM secured an order from the Department of Energy under section 202(c) of the Federal Power Act confirming that an emergency existed in PJM until Monday, December 26 at 12:00 and lifting certain emission restrictions for its duration.[13] The DOE order was received at 17:45 on Christmas Eve and immediately implemented.

54. The chart below illustrates the ACE and Frequency on the morning of December 24 from 02:00-08:00. Both values were sliding steadily notwithstanding that PJM deployed Synchronized Reserves between 4:23 and 5:31. Further, loads were growing over this period and, as it will be recalled from the earlier discussion, PJM was faced with approximately 57,000 MW of generator unavailability for the morning peak on

[12] This the earliest time of day that Load Management can be implemented.

[13] U.S. Dep't Energy, *Federal Power Act Section 202(c): PJM December 2022*, DOE Order No. 202-22-4, at 1 (Dec. 24, 2022) ("[A]n emergency exists in the electricity grid operated by PJM Interconnection, LLC (PJM) due to a shortage of electric energy, a shortage of facilities for the generation of electric energy, and other causes, and … issuance of this Order will meet the emergency and serve the public interest."), https://www.energy.gov/ceser/federal-power-act-section-202c-pjm-december-2022.

December 24. ACE and frequency began to recover after PJM entered into in EEA2 by loading Max Emergency generation and calling for Load Management to be implemented.




55. At 10:00, PJM began to restore exports to support neighbors. PJM held Load Management in anticipation of the potential for continuing generator outages which had been on an upward trajectory throughout the morning, and out of concern for being able to serve the load during the evening peak. In addition, retaining Load Management enabled PJM to allow pumped storage units that had been unable to run overnight to replenish their reservoirs so that they would be available for the evening peak. Based on the estimates supplied by the Curtailment Service Providers that administer the Load Management programs, the observed load was thought to be about 7,400 MW below what the levels that would have been experienced without Load Management. An increase in load of 7,400 MW would have posed a significant challenge for the system especially during peaks.

56. System conditions gradually began to improve during the day on December 24. But PJM operators had no guarantee in real-time that these positive trends would continue coupled with the fact noted above that Load Management was believed to be providing about 7,400 MW in load reduction. Uncertainties remained about the load forecast and whether PJM would experience another anomalously high peak in the evening. Just as important, generator outages remained at a high levels and many gas-fired generators were still having problems obtaining gas supplies even late in the day. PJM operators exercised their discretion to decide when and how to exit from emergency procedures to assure that reliability was maintained.

57. I agree with the observation made by Mr. Bryson that "[a]n overriding concern of PJM's operators during December 24, 2022, given what had happened on December 23 and early on December 24, was whether PJM could meet the evening peak for its footprint." PJM's ability to allow some non-firm exports to flow during the time leading up to the evening peak was not indicative of whether PJM could meet the December 24 evening peak without Emergency Actions even if all non-firm exports were recalled. Given the unprecedented

pre-holiday loads throughout December 23, PJM was reasonably concerned that loads might be as high or higher for the December 24 evening peak as those earlier peaks. And it was clear that many gas-fired generators did not have firm gas supplies and would be expected to have difficulty obtaining short-term gas supplies. Keeping both the Maximum Generation Emergency Actions and Pre-Emergency/Emergency Load Management Reduction Actions in effect throughout the day on December 24 were reasonable measures for addressing these risks.

58. Only after it became apparent that the dire conditions of December 23 and early on December 24 had not materialized by the evening of December 24 did PJM undo its pre-emergency and emergency steps for December 24. PJM ended the Voltage Reduction Warning and Reduction of Non-Critical Plant Load at 18:15 and the Voltage Reduction Alert at 18:34. PJM ended the Maximum Generation Emergency Actions and Pre-Emergency/Emergency Load Management Reduction Actions and returned to EEA0 at 22:00.

59. At 22:38 on December 24, PJM issued an EEA1 Maximum Generation Emergency/Load Management Alert for December 25. Like PJM's other actions on December 24, this was a prudent precautionary measure. Just as PJM could not have been sure if the unprecedentedly high holiday load conditions on December 23 would recur on December 24, it had to consider the possibility that December 25 might be another historically anomalous day. PJM had barely avoided load shedding and its potentially disastrous consequences on December 23, and the PJM system also strained to meet load on the morning of December 24. It was naturally and reasonably cautious for PJM not to simply assume that everything would be back to normal on December 25.

### 3. December 25

60. The Exhibit 1 timeline notes that at 11:10 on December 25, PJM issued a Cold Weather Alert from 07:00 through 23:00 on December 26 for PJM's Western Region Zones[14] only. This Cold Weather Alert ended as scheduled.

61. The Maximum Generation Emergency and Load Management Alert declared in the evening of December 24 also ended as scheduled at 22:00 on December 25 when PJM returned to EEA0. Similarly, PJM's call for conservation from December 24 expired as scheduled on December 25.

62. No PAIs were triggered on December 25. Accordingly, no Non-Performance Charges were assessed for that date.

63. In short, in my opinion, PJM's operational and reliability decisions fully complied with all applicable Tariff, OA, Manual 13, NERC requirements and other reliability requirements throughout Winter Storm Elliott. I believe that PJM's decisions were all reasonable and justified given the severity of the emergency, the information available at the time, and the need for PJM to be cautious to safeguard against load shedding within its footprint. I

[14] https://emergencyprocedures.pjm.com/ep/pages/regions.jsf

therefore cannot imagine how the propriety of PJM's Emergency Actions could reasonably be challenged as a justification for excusing any of the Complainants' generators from Non-Performance Charges.

### D. Had the ComEd Generators Been Available, Their Output Could have Served the Rest of PJM

64. I disagree with the CZG Generators' contention supported by their witness Dr. Harvey that "there was persistent transmission congestion that did not allow resources in ComEd to increase output to serve the rest of PJM . . . . because the transmission lines from ComEd to the rest of PJM were constrained."[15] As I'll describe further below the CZG Complainants try to use LMP information to obfuscate the fact that their resources were not on and operating. The resources were not on because they failed to make adequate preparations to be available during extreme cold weather conditions and could not perform when needed.

65. The CZG generators try to develop an argument that the ComEd Zone had more generation than load during Winter Storm Elliott which somehow relieves them of their obligation to perform as Capacity Resources. PJM is a centrally dispatched balancing area. PJM does not dispatch the system based on individual transmission owner zones. ComEd and other transmission zones had more on-line generation than load during Winter Storm Elliott and other transmission zones had less on-line generation than load. That is completely irrelevant in PJM which is a centrally dispatched single balancing area. As I'll describe below, PJM uses all resources within PJM, regardless of the transmission zone in which they are located to serve the load within PJM.

66. First, Dr. Harvey concedes that "[t]he PJM FTR model is not a good model for estimating the impact of ComEd generation on PJM constraints[.]"[16] I agree. He relies upon a third-party's (Cambridge Energy Solutions) calculation of shift factors using the PJM Financial Transmission Rights (FTR) network model.[17] . Dr. Harvey correctly recognizes that this model "may be somewhat different from those in PJM's market model" and operations models.[18] In fact, the FTR model does not account for the real time outages and topology changes that existed during Winter Storm Elliott. The FTR model also does not consider external factors that would impact interregional congestion patterns. Dr. Harvey's flawed use of the FTR model and conclusion that the system was too constrained to utilize resources within the ComEd Zone based on that flawed data is incorrect.

67. Second, Dr. Harvey's selection of cherry-picked data lead to a biased and invalid conclusion. It is not uncommon for there to be constraints on the PJM system. Constraints on the system are managed by changing or adjusting the topology of the system and by

[15] CZG Complaint at 32-33

[16] Harvey Aff. at 104.

[17] *See* i*d*. at P 66

[18] Harvey Aff. at P 104..

adjusting the output of generation resources. The CZG Complainants suggest that PJM was not utilizing their resources due to the constraints on the system and as such they should be excused from PAI penalties. That is not correct. PJM was not utilizing the CZG Complainants' generator resources because they were not available. In fact, the constraints that we had on the system in the ComEd Zone in particular were due in large part to generators that had failed to start, tripped off-line or were otherwise not available during Winter Storm Elliott. Generation resources are used to manage constraints by lowering generators that aggravate a constraint and increasing the output of generators that help to relieve the flow on a constrained facility. As previously noted, many generators in the ComEd Zone including the CZG Complainant's generating resources failed to operate during Winter Storm Elliott. Had those resources been available, they would have helped to address the PJM-wide capacity emergency and they would have also helped to reduce the constraints in the ComEd Zone.

68. Although unnecessary to justify PJM's actions during Winter Storm Elliott, PJM has performed an engineering analysis using the real time Energy Management System (EMS) data from Winter Storm Elliott reflecting the system topology during the operating days. For three different representative times on the December 24 operating day, PJM's analysis utilized a real time snapshot of the system configuration which included all real time congestion, limits, flows, and topology.

69. The Elwood, Jackson Combined Cycle, Lee County, Lincoln, Aurora, University Park and Rockford facilities (6,552 MW) failed to perform at various times during Winter Storm Elliott, with most of the units having failed to perform at all. However, in PJM's after-the-fact analysis we assumed that they did operate. PJM's analysis found that on December 24, PJM's system would have reliably accommodated thousands of MW of energy from the CZG Complainants' generators had they performed, including the resources at Elwood, Jackson Combined Cycle, Lee County, Lincoln, Aurora, University Park and Rockford. As described above, the output of generating resources were adjusted to address constraints. As further described below, PJM's analysis showed that over 5,000 MW of additional resources, if available, could have been turned on to address the capacity emergency. Additional generation re-dispatch or other operating procedures may have been utilized during the event to further increase the output of these capacity resources. In summary, PJM's studies showed:

- For the snapshot of the system as of 4:45 on December 24, PJM could have reliably accommodated a net 5,845 MW from the ComEd generators;

- For the snapshot of the system as of 10:54 on December 24, PJM could have reliably accommodated a net 5,055 MW from the ComEd generators; and

- For the snapshot of the system as of 16:03 on December 24, PJM could have reliably accommodated a net 5,001 MW from the ComEd generators. Notably for the analysis run at 16:03, this energy is in addition to the net 540 MW of energy being produced at this time from five units, at Aurora and Elwood, included in the two prior analyses, that had not been operating earlier in the day.

70. It is critical to remember that the CZG Complainants' generating units were either on unplanned outages and not available, or were called on by PJM to operate but failed to do so, and later entered an unplanned outage. Had these generators performed, their output would have reduced the congestion in the ComEd Zone because a number of these generators that failed to perform would have provided counterflows on the constrained facilities. Thus, had PJM been able to bring those generators into operation, it would have significantly reduced the flows on many of the constrained facilities.

71. Further, had PJM been able to dispatch those units on, it likely would have reduced the interchange from MISO. This would have further reduced the flows on many of the constrained facilities.

72. It is my opinion that if the CZG Complainants' generating units had produced net outputs determined from the studies, not to mention outputs from the numerous other generators around PJM that failed to perform, this production would have significantly mitigated the capacity deficiency PJM was experiencing. It could have mitigated (if not eliminated) the need for many if not all of the Emergency Actions PJM implemented, and it would have reduced (if not eliminated) the risk of extensive PAIs.

73. Finally, in claiming that their generations could not have been dispatched (which PJM's studies show is untrue), the CZG Complainants ignore the fact that system conditions during the evening peak on December 24 would have been different if the anomalous peak load levels that occurred for the evening peak on December 23 and the morning peak on December 24 had happened again. Had the higher peak occurred, having the CZG Complainants' generators available could have been even more critical to the reliability of the PJM system.

### E. PJM Did Not Violate Requirements R5 and R3 of COM—002-4 Concerning Three-Part Communications

74. The Coalition claims that PJM violated Requirements R5 and R3 of COM—002-4. They assert that PJM's instructions were not clear, but they have presented no evidence to support that allegation.[19] In addition, PJM followed all communication protocol requirements as set forth in PJM Manual 1, Section 4.5.3 Definitions, when issuing Operating Instructions per COM-002-4 R5 and other applicable NERC rules.

75. To the extent that the Coalition is claiming that discussion between PJM operators and generation dispatchers are a "command" requiring three-part communication, they are incorrect. As noted in PJM Manual 1, a discussion of general information and of potential options or alternatives to resolve Bulk Electric System operating concerns is not a command and is not considered an "Operating Instruction." Additional examples not considered to be Operating Instructions per PJM Manual 1 include confirming ratings or power flows, discussions of operational options, and discussions of generator status or

[19] Coalition Complaint at 30.

availability. The examples presented in the complaint concerned generator schedules and options of schedules, and as such, were not Operating Instructions.

### F. Complainants' Arguments That PJM Acted Improperly Because it Failed to Properly Maintain Reserves in Certain Control Areas Does not Withstand Analysis

76. The CZG Complainants and Coalition contend that PJM failed to properly maintain reserve levels and claim that PJM should have curtailed both non-firm and firm exports to do so. According to Dr. Sotkiewicz, PJM violated the Tariff and Operating Agreement because "PJM allowed reserve levels fall below their requirements RTO-wide and within the Mid-Atlantic-Dominion ('MAD') reserve sub-zone frequently while supporting exports."[20] Specifically, Complainants cite the language of Tariff, Attachment K–Appendix Section 1.10.6 (c) and Operating Agreement Schedule 1, Section 1.10.6(c), which both state that "[t]he Office of the Interconnection shall curtail deliveries to an External Market Buyer if necessary to maintain appropriate reserve levels for a Control Zone as defined in the PJM Manuals, or to avoid shedding load in such Control Zone." The CZG Complainants claim that "because the OA trumps the manuals," the admonition to "curtail deliveries to an External Market Buyer if necessary to maintain appropriate reserve levels" prevents PJM from relying upon Manual 13, Sections 2.3.2 and 2.5, which both prevent PJM from cutting external sales "[i]f the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed . . . unless it would prevent load shedding within PJM."[21]

77. I disagree with Dr. Sotkiewicz's statement that PJM "allow[ed] reserves to go short increasing the likelihood of a loss of load event in PJM." PJM had options to address a large contingency occurring at times when level of reserves fell below the desired levels. PJM had the option to take a Voltage Reduction Action which would have made 1,701.7 MW of reserves available to PJM. At least 1,239.1 MW are available in 10 minutes or less, some of which are available in as little as 2 minutes. Also, a Voltage Reduction Action for the Mid-Atlantic-Dominion subzone would have made 1239.1 MW available in 10 minutes or less. These quantities are similar in terms of their operational characteristics to Synchronized Reserves since their source is currently operating resources synchronized to the system. Further, because this was a capacity shortage emergency and PJM had called a Maximum Generation Action, it had the ability to recall all PJM Capacity Resources being used to serve loads outside of PJM regardless of the type of transmission service, i.e., non-firm or firm, being used. Most of the exports are related to PJM Capacity Resources and thus could have been recalled by PJM if needed to serve its own customers' requirements.

78. Also, it is worthwhile to consider the requirements of the corresponding NERC standard to place this claimed transgression into perspective. "BAL-002-003—Disturbance Control Standard – Contingency Reserve for Recovery from a Balancing Contingency Event"

[20] CZG Complaint, Sotkiewicz Aff. at P 100.

[21] *Id.* at 30.

addresses, among other things, how long a Balancing Authority should take to restore reserves that have been deployed. Rule R3 provides:

> Each Responsible Entity, following a Reportable Balancing Contingency Event, shall restore its Contingency Reserve to at least its Most Severe Single Contingency, before the end of the Contingency Reserve Restoration Period, but any Balancing Contingency Event that occurs before the end of a Contingency Reserve Restoration Period resets the beginning of the Contingency Event Recovery Period. *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*

For the purposes of this provision, the "Contingency Reserve Restoration Period" is defined as "[a] period not exceeding 90 minutes following the end of the Contingency Event Recovery Period," and the "Contingency Event Recovery Period" is defined as "[a] period that begins at the time that the resource output begins to decline within the first one minute interval of a Reportable Balancing Contingency Event, and extends for fifteen minutes thereafter." The trip of a generating unit qualifies as a "Reportable Balancing Contingency Event."

Breaking this provision down, a Balancing Authority is supposed to restore reserves within 105 minutes[22] of the triggering event but that period resets itself every time that another triggering event occurs. As I noted above, PJM experienced a large number of generator trips throughout the entire Winter Storm Elliott event. Although PJM's practice is to restore reserve levels as quickly as possible, under the NERC standard, PJM had 105 minutes from each of those to restore reserves. For example in the context of the periods in which Dr. Sotkiewicz claims PJM was not compliant with reserves requirements, PJM would have had 105 minutes to recover its reserves but, since additional Balancing Continency Events, *i.e.*, generator trips[23] were occurring, this period was reset over and

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[22] This is the sum of the 90 minute "Contingency Reserve Restoration Period" and the 15 minute "Contingency Event Recovery Period."

[23] The definition of a Balancing Contingency Event is as follow:

> Any single event described in Subsections (A), (B), or (C) below, or any series of such otherwise single events, with each separated from the next by one minute or less. A. Sudden loss of generation: a. Due to i. *unit tripping*, or ii. loss of generator Facility resulting in isolation of the generator from the Bulk Electric System or from the responsible entity's System, or iii. sudden unplanned outage of transmission Facility; b. And, that causes an unexpected change to the responsible entity's ACE; B. Sudden loss of an Import, due to forced outage of transmission equipment that causes an unexpected imbalance between generation and Demand on the Interconnection. C. Sudden restoration of a Demand that was used as a resource that causes an unexpected change to the responsible entity's ACE.

(emphasis added).

over. Accordingly, PJM was compliant with this standard even accepting Dr. Sotkiewicz's claims that reserves fell below target levels.

79. This concludes my Affidavit.

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| **Essential Power OPP, LLC, *et al.*** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-53-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Aurora Generation, LLC, *et al.*** | ) | |
| **Complainants** | ) | |
| **v.** | ) | **Docket No. EL23-54-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |
| | ) | |
| **Coalition of PJM Capacity Resources** | ) | |
| **Complainant** | ) | |
| **v.** | ) | **Docket No. EL23-55-000** |
| **PJM Interconnection, L.L.C.** | ) | |
| **Respondent** | ) | |

## VERIFICATION

I, **Paul F. McGlynn**, state, under penalty of perjury, that I am the Paul F. McGlynn referred to in the foregoing document entitled "Affidavit of Paul F. McGlynn on Behalf of PJM Interconnection, L.L.C.," that I have read the same and am familiar with the contents thereof, and that the facts set forth therein are true and correct to the best of my knowledge, information, and belief.

*/s/ Paul F. McGlynn*
Paul F. McGlynn

**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Invenergy Nelson LLC,<br>Complainant, | ) | |
| v. | ) | Docket No. EL23-67-000 |
| PJM Interconnection, L.L.C.,<br>Respondent. | ) | |

## VERIFICATION

I, **Paul F. McGlynn**, pursuant to 28 U.S.C. § 1746, state, under penalty of perjury, that I am the Paul F. McGlynn referred to in the foregoing document entitled "Affidavit of Paul F. McGlynn on Behalf of PJM Interconnection, L.L.C.," that I have read the same and am familiar with the contents thereof, and that the facts set forth therein are true and correct to the best of my knowledge, information, and belief.

DocuSigned by:
Paul McGlynn
0A23DB3297264C0...

Paul F. McGlynn

## CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Washington, D.C., this 9th day of June 2023.

/s/ *Wendy B. Warren*
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