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Witness:	Sarah Shenstone-Harris
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Sponsoring Party:	Sierra Club
Case No.:	EA-2022-0245
Date Testimony Prepared:	January 18, 2023

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

FILE NO. EA-2022-0245

APPLICATION OF UNION ELECTRIC COMPANY D/B/A AMEREN MISSOURI FOR A CERTIFICATE OF CONVENIENCE AND NECESSITY FOR A SOLAR FACILITY, APPROVAL OF A SUBSCRIPTION-BASED RENEWABLE ENERGY PROGRAM, AND AUTHORIZATION TO ESTABLISH TRACKING MECHANISM

SURREBUTTAL TESTIMONY
OF
SARAH SHENSTONE-HARRIS

ON BEHALF OF SIERRA CLUB

JANUARY 18, 2023

BEFORE THE
MISSOURI PUBLIC SERVICE COMMISSION

In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for Approval of a Subscription-Based Renewable Energy Program	)))))	No. EA-2022-0245

AFFIDAVIT

Pursuant to Missouri Public Service Commission requirements I, Sarah Shenstone-Harris, hereby state:

1. My name is Sarah Shenstone-Harris and I am a Senior Associate at Synapse Energy Economics, Inc. My business address is 485 Massachusetts Avenue, Suite 3, Cambridge, Massachusetts 02139.
2. Attached hereto and made part hereof for all purposes is my Direct Testimony on behalf of Sierra Club, including exhibits, which have been prepared in written form for introduction into evidence in the above-referenced docket.
3. I hereby swear and affirm that based upon my personal knowledge, the facts stated in the Direct Testimony are true. In addition, my judgement is based on my professional experience, and the opinions and conclusions stated in the testimony are true, valid, and accurate.

Under penalty of perjury, I declare that the preceding to be true and correct to the best of my knowledge and belief.

Date: January 18, 2023

Sarah Shenstone-Harris

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1. INTRODUCTION AND SUMMARY

Q Please state your name and occupation.

A My name is Sarah Shenstone-Harris. I am a Senior Associate at Synapse Energy Economics, Inc. ("Synapse"). My business address is 485 Massachusetts Avenue, Suite 3, Cambridge, Massachusetts 02139.

Q Please describe Synapse Energy Economics.

A Synapse is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, ratemaking and rate design, electric industry restructuring and market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Synapse's clients include state consumer advocates, public utilities commission staff, attorneys general, environmental organizations, federal government agencies, and utilities.

Q Please summarize your work experience and educational background.

A I provide research, analysis, and consulting services on various electricity-sector issues, including integrated resource planning and clean energy project evaluation. Prior to joining Synapse, I worked at Reading Municipal Light Department, one of Massachusetts's largest municipally owned utilities, as an Integrated Resource Analyst. I helped manage Reading Light's energy portfolio and secured reliable and cost-competitive long-term power contracts. I led the rate increase process and the design of new rate structures, such as a residential electric vehicle time-of-use rate. I was also involved in the administration and development of numerous energy efficiency and electrification programs,

including incentive programs for air-source heat pumps and electric vehicle chargers, among others.

I received a Master of Science in Environmental Sustainability from the University of Ottawa's Institute for the Environment, as well as a Bachelor of Science in Biology from Queen's University in Kingston, Ontario, Canada.

A copy of my current resume is attached as Exhibit SSH-1.

Q On whose behalf are you testifying in this case?

A I am testifying on behalf of Sierra Club.

Q Have you testified previously before the Missouri Public Service Commission ("Commission")?

A No.

Q What is the purpose of your testimony in this proceeding?

A The purpose of my testimony is to respond to the rebuttal testimony of Staff Witnesses Shawn E. Lange, J. Luebbert, Michael L. Stahlman, Brad J. Fortson, and Cedric E. Cunigan regarding the need for the Boomtown Solar project ("Boomtown"), its impact on ratepayers, and its impact on Ameren Missouri's ("Ameren" or "Company") system.

Q Please summarize the findings of your surrebuttal testimony.

First, I respond to Witness Lange's assertion that there is no need for Boomtown and his focus on firm capacity as the only basis for establishing need. I discuss how energy is a foundational component of electrical service.

Second, I address Witness Stahlman's incorrect assertion that solar will not displace existing fossil fuel resources in the Mid-Continent Independent System Operator ("MISO") grid. Boomtown generation will displace generation from other generators every day that it operates. Further, because those other generators are likely to be fossil fuel resources, this will both avoid fuel costs and reduce pollution.

Next, I refute Witness Luebbert's claims that Boomtown only definitively benefits shareholders, and I explain that Boomtown will also benefit ratepayers by reducing the risk associated with market exposure and fuel price volatility. I discuss the risk of inaction and examine the benefits to ratepayers of solar in reducing and avoiding Company spending on fuel costs, operation and maintenance (O&M) costs, and capital at its aging fossil plants. In this section, I also briefly discuss Witness Cunigan's comment that large C&I customers can install behind-the-meter solar instead.

Then, I respond to Witness Lange's concern about the operational risks from the growing penetration of renewables in MISO territory. I demonstrate that the risk from high renewable penetration is not an immediate issue, that it is being planned and prepared for by multiple stakeholders, and that it is not a reason to reject Boomtown. This project itself presents very small operational risk. I review the landscape of changing practices and procedures that are already reducing these potential or perceived risks to the MISO grid.

Lastly, I address Witness Fortson's concern about considering integrated resource plans (IRP) when evaluating a new solar resource. Although not perfect, IRPs are still an important part of the decision-making process.

Q Please summarize your recommendations.

A Based on my review of Ameren's application and Staff's rebuttal testimony, I recommend the following:

1. The Commission should grant Ameren a Certificate of Convenience and Necessity for the Boomtown Solar Project.
2. The Commission should find that need is not defined strictly by whether a resource meets the Company's firm capacity needs, but also by whether it can economically meet the Company's energy needs.
3. The Commission should also consider how a project will impact the Company's risk exposure, including to market energy and to volatile fossil fuel prices, and the benefit of diversifying its fleet away from heavy reliance on coal.

2. ENERGY IS A CUSTOMER 'NEED' UNDER COMMISSION STANDARDS; THE COMMISSION SHOULD REJECT STAFF'S NARROW INTERPRETATION OF "NEED" AS DEFINED ONLY BY FIRM CAPACITY.

Q Witness Lange asserts that there is no "need" for new resources until the capacity shortfall in winter 2026.[1] How do you respond?

A Witness Lange argues that Boomtown does not meet the Tartan Factor's first criterion of "a need for the service."[2] Witness Lange states that Ameren will only face a capacity shortfall in the winter of 2026, and in reference, Witnesses Luebbert[3] and Stahlman[4] make the argument that Boomtown is not particularly well suited to provide winter capacity. Witnesses Lange and Stahlman are not

[1] Rebuttal Testimony of Shawn E. Lange, pg. 7–8.

[2] Ibid.

[3] Rebuttal Testimony of J. Luebbert, pg. 16.

[4] Rebuttal Testimony of Michael L. Stahlman, pg. 6.

wrong about the projected timing of the capacity shortfall, and the match between solar and winter firm capacity needs. But Staff ignores several other important "need" considerations.

First, energy is a critical component of electricity service. Furthermore, there is a "need" to manage the costs and risks associated with meeting customers' long-term energy needs. "Need for the service" is not just based on meeting Ameren's firm capacity needs. Customers will always have a need for economic and reliably low-cost energy, and for resources that move Ameren's electricity system towards lower-risk energy resources.

Second, a resource does not have to meet every outstanding system need to satisfy the definition of "need." Witness Stahlman claims that Ameren needs to invest in firm and dispatchable resources, instead of solar. But investing in dispatchable resources and investing in low-cost, low-risk energy resources are not mutually exclusive. In fact, no single resource can address all system needs. Just because solar cannot meet all system winter firm capacity, voltage support, and dispatchable energy needs does not mean that it does not economically meet other critical system needs.

Third, stand-alone solar can provide capacity in the winter, even if it is less than a dispatchable fossil resource; and when battery storage is added in the future, the firm contribution of solar in the winter will increase. When the alternative is ramping up high-cost, aging peaker plants or buying high-cost energy from the market during a cold snap, even a small contribution from solar can be extremely valuable.

Q Staff Witness Luebbert argues that Boomtown does not promote the public interest.[5] How do you respond?

A Witness Luebbert discusses the interrelation of the two Tartan Factors of need and public interest.[6] Managing and minimizing risk is in the public interest, and Boomtown and other solar resources can help mitigate risk associated with operating an aging fleet with a heavy reliance on coal. Solar serves as a hedge against market energy and fossil fuel prices, which are increasingly volatile and costly. Solar plants require no fuel and minimal variable operations and maintenance; therefore, the cost of the project will be stable and locked in. This can be critical when unplanned maintenance or other types of outages occur at Ameren's existing resources, and replacement energy or fuel is costly. Approving the CCN for Boomtown would represent a no-regrets decision. These benefits and reduced risk on the part of ratepayers meet both the first and fifth of the Tartan Criteria: a need for service, and the service must promote the public interest.

I will discuss the risk mitigation value of solar in more detail in Section 4 below.

3. BOOMTOWN SOLAR WILL DISPLACE FOSSIL FUEL RESOURCES THROUGH MISO DISPATCH.

Q Witness Stahlman argues that Boomtown and other solar resources will not displace fossil fuels in the MISO regional grid.[7] How do you respond?

A I disagree with Witness Stalhman. Solar generation from the Boomtown project will displace fossil generation on the MISO grid. Since solar is a low marginal-cost resource, it displaces more expensive fossil fuel generation on the grid, which

[5] Rebuttal Testimony of J. Luebbert, pg. 13.

[6] Ibid.

[7] Rebuttal Testimony of Michael L. Stahlman, pg. 2–3.

ultimately drives down the cost of market energy used to meet the Company's energy needs.

Specifically, Ameren bids solar into the MISO market with a dispatch cost of zero. Since MISO's dispatch model is a least-cost economic-based algorithm, MISO will dispatch solar PV and all other zero marginal cost resources first. Those MWh added to the grid from solar will necessarily result in the reduction of MWh generated from the most expensive resources on the system. Those displaced MWh will generally come from expensive and aging oil, gas, and coal generators.

As more solar PV, and other zero marginal cost resources, are brought online in the MISO territory, these zero marginal cost resources will displace energy from the costliest fossil resources in MISO's resource stack, thereby reducing how much MISO economically commits and dispatches existing fossil resources into the market.

Additionally, solar PV can be deployed over wide geographic ranges to provide locational benefits that large, centralized plants cannot provide. This means that the availability of solar resources will not all be subject to the same local conditions, such as local weather patterns and clouds. Additionally, by distributing solar around the service territory, and not concentrating it all in one area, the Company can help address transmission and congestion issues.

Furthermore, battery storage deployment is expected to increase over the coming years. Deployment of battery storage alongside solar PV will enable solar-generated electricity to be dispatched at many more hours of the day. This in turn will allow solar PV to further displace fossil fuels during the costliest hours (not just the hours when the sun is shining) which will lower overall Company fuel costs and reduce pollution levels.

Q Witness Stahlman argues that a new solar plant will increase price volatility.[8] How do you respond?

A Price volatility is a normal part of real-time energy markets operations; locational marginal pricing (LMP) fluctuates with shifting demand, the dispatch of differently marginal cost resources, and congestion. Witness Stahlman is correct in that solar may impact hourly prices. When the supply of solar (with its low dispatch cost) decreases as the sun sets or clouds roll in, more expensive generators such as peaker plants are ramped up; this may result in higher hourly LMP for that moment in time. This phenomenon is no different than how energy markets currently and historically operate, with hourly fluctuations in prices due to changes in demand and supply. Importantly, as I will discuss below, solar facilities provide numerous benefits to ratepayers and in general should provide relative price stability compared to fuel-dependent resources.

Additionally, deployment of one solar project will not suddenly make LMPs volatile. When Ameren's system reaches a level of high penetration of solar PV on the grid it will have to address challenges through system planning, but that reason is insufficient to not deploy 150 MW of solar PV today.

4. THE BOOMTOWN SOLAR PROJECT PROVIDES BENEFITS TO RATEPAYERS.

Q Expert Witness Luebbert argues that the approval of Boomtown would saddle ratepayers with risk and limited benefit, while definitively benefiting shareholders.[9] How do you respond?

A I do not disagree with Witness Luebbert that shareholders will benefit if Boomtown is added to the rate base; it is true that putting any new project in rate

[8] Rebuttal Testimony of Michael L. Stahlman, pg. 4–6.

[9] Rebuttal Testimony of J. Luebbert, pg. 8.

base will provide a rate of return for shareholders. However, I disagree with Staff that Boomtown only provides limited benefits and will saddle ratepayers with risk. Implicit in Staff's testimony is the assumption that risk is inherently minimized by maintaining the status quo. But in today's market, there is a real risk of inaction for ratepayers. The energy industry is changing in the United States and across the world; and the status quo, which relies on aging fossil resources that run on costly and volatile fossil fuels, is not the lowest risk option.

Boomtown offers several important benefits for customers in mitigating risk and minimizing costs associated with the status quo. These benefits include (1) reducing operational costs associated with running aging fossil fuel resources, (2) hedging against price volatility of fossil fuel resources, (3) providing summer capacity, (4) avoiding reliability risks that water shortages pose, and (5) reducing the multiple risks from Ameren's current heavy reliance on coal generation. I will cover each of these five key benefits in the next six questions.

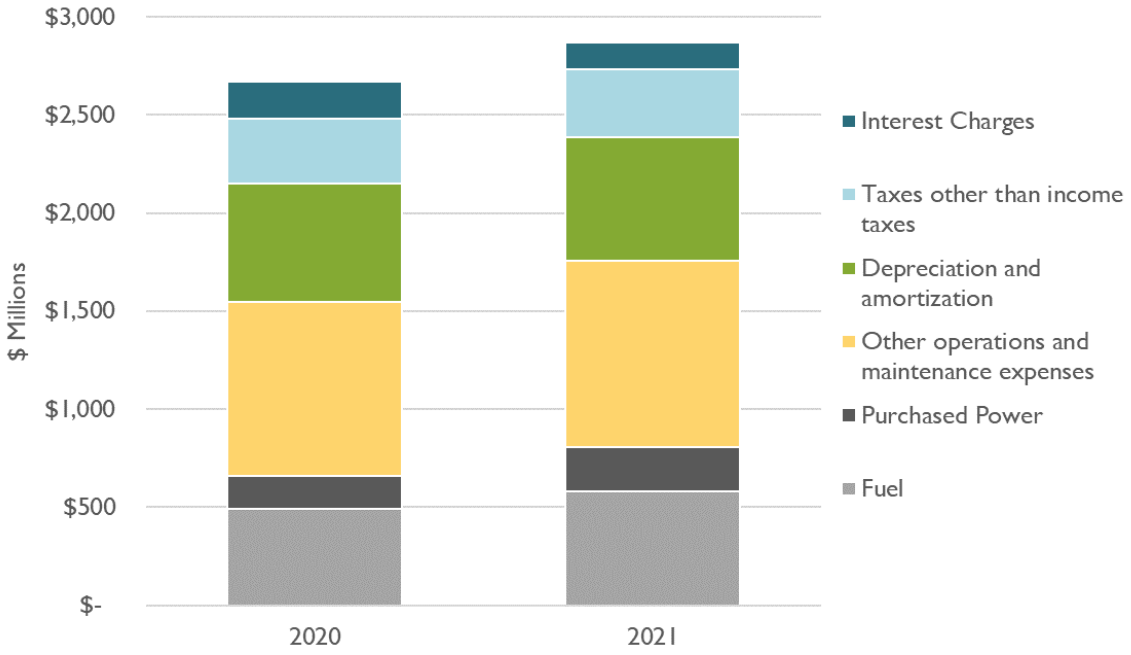
Q Please describe the ratepayer benefits solar provides in reducing system operating costs.

A Staff focuses on the capital cost of the proposed solar project but ignores the substantial other categories of costs Ameren incurs to operate its electricity system. The addition of Boomtown and other solar resources can reduce costs that Ameren incurs to meet system needs by avoiding fuel costs and variable O&M costs at fossil fuel generators. Additionally, solar can potentially reduce fixed O&M and sustaining capital expenditure costs for resources within the rate base.

Specifically, solar reduces the operational costs associated with running existing resources. These operational costs make up a significant part of Ameren spending, and are a major component of rates. As can be seen in Figure 1 below, Ameren spent 33 percent of its operating expenses on O&M in 2020 and 2021. Furthermore, as Ameren's existing coal fleet continues to age, total spending on

sustaining capital expenses is likely to increase with the need for additional refurbishments of aging equipment, replacement of older parts, etc. When considering solar, O&M and sustaining capital costs are relatively low. As more solar resources are added to Ameren's portfolio, its fixed O&M and sustaining capital spending will decline. This in turn will lower revenue requirements and reduce costs passed on to ratepayers.

Figure 1. 2020 and 2021 Ameren Missouri operating expenses



Source: Ameren Missouri's form 10-K, Income Statements. US Securities and Exchange Commission.

Q Please describe the ratepayer benefits from solar in mitigating the risk from volatile fossil fuel costs.

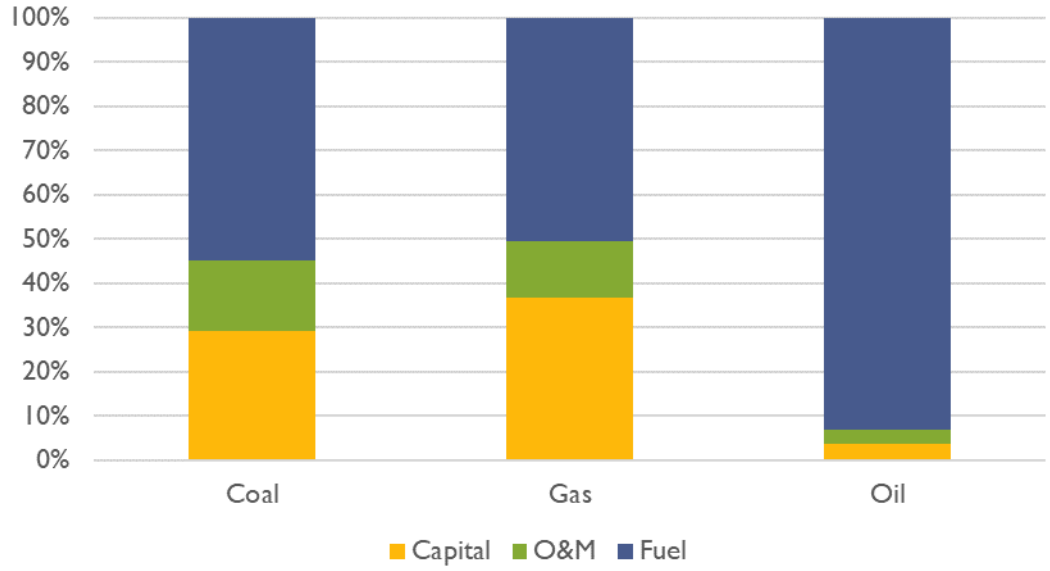
A Boomtown and other solar resources can protect ratepayers from the price volatility posed by reliance on fossil fuels and market energy. Fuel spending accounts for a substantial part of Ameren total operations spending. In 2020 and

2021, 18 percent and 20 percent of its operating expenses were for fuel purchases, respectively (Figure 1, above).

Once built, solar PV has no fuel costs, minimal variable operational costs, and limited long-term O&M and capital investment requirements. This means solar resources are insulated from volatile fuel and energy market prices. On the flip side, the cost associated with operating fossil generators are driven in large part by fuel prices. Consider the forward-going levelized cost of energy (LCOE) of Ameren's generation fleet, by generator type and cost component[10] (Figure 2). Fuel spending represents over 50 percent of the total levelized forward-going costs, demonstrating the vulnerability of Ameren's current resource portfolio to fuel price fluctuations. Should these costs increase, ratepayers will be saddled with paying the higher energy costs.

[10] Data from Table 4.2 of Ameren Missouri's 2020 Integrated Resources Plan, *available at* https://www.ameren.com/-/media/missouri-site/files/environment/irp/2020/ch4-existing-supply-side-resources.ashx.

Figure 2. Forward-going levelized cost of energy of Ameren Missouri's generation fleet, by resource type and cost component



Source: Table 4.2 of Ameren's 2020 Integrated Resource Plan.

Coal, natural gas, and oil prices are determined in large part by global markets and are influenced by numerous factors including rail and pipeline access, natural gas reserves in Europe, volume of exports and imports, extreme weather, etc. When fuel prices are high, ratepayers are on the hook to pay for high-cost electricity. Not only do high and volatile fuel prices influence Ameren Missouri's generation costs, but high prices also drive up LMP across the region, further driving up the cost of electricity for Ameren and its ratepayers. Utilities with renewable resources on their systems will have a buffer from these impacts; Utilities without renewables will bear the full burden of high fuel prices.

Q Please describe the ratepayer benefits from solar in terms of summer capacity.

A Both Ameren and MISO are traditionally summer-peaking. On hot summer afternoons, annual demand can peak, which can strain grid operations.

Conveniently, this is usually the time when solar resources are generating at their highest output. Boomtown will provide capacity value on peak summer days, contributing energy and capacity to the grid when its reliability is potentially most at risk. Annual peak demand is also when MISO will have to dispatch its most expensive resources; the marginal zero-cost energy of Boomtown and other solar resources can provide low-cost energy to the grid during times of peak demand and high costs.

Q Please describe the ratepayer benefits from solar in minimizing reliability risks posed by water shortages.

A Solar reduces the reliability risks posed by water shortages. Water is essential for cooling steam-fired generators, including coal plants and nuclear generators, which can cause problems during droughts and other extreme weather. The Missouri River Basin and Mississippi River Basin experienced a drought in 2022, and the Missouri River also experienced an ice blockage that impeded water flow during Winter Storm Elliot.[11,12, 13] The Ameren-owned Labadie Energy Center is located on the Missouri, while Ameren's Rush Island and Sioux Energy Centers are located on the Mississippi; all require water for cooling. In fact, the North American Electric Reliability Corporation (NERC) cited the ongoing Missouri River Basin drought as a reliability risk for thermal generators located along the

[11] National Integrated Drought Information System, Drought Status Update for the Missouri River Basin, (July 26, 2022), *available at* https://www.drought.gov/drought-status-updates/drought-status-update-missouri-river-basin-7-26-22.

[12] Rosenberg, J, "Drought conditions continue to pose shipping challenges on Mississippi River, officials hopeful for winter relief." Investigate Midwest, (December 1, 2022), *available at* https://investigatemidwest.org/2022/12/01/drought-conditions-continue-to-pose-shipping-challenges-on-mississippi-river-officials-hopeful-for-winter-relief/.

[13] Brown, C.J., "December 2022 Winter Storm Elliott," pg 7. Southwest Power Pool.

river,[14] and the Southwest Power Pool noted that ice on the Missouri River threatened 1000s of MWs of generation during Winter Storm Elliot[15] Should the duration and/or frequency of these extreme weather events intensify, they could pose serious reliability issues to Ameren. This is not just a hypothetical threat to coal-fired generators—Southwest Public Service Company in New Mexico has accelerated the retirement date of the Tolk Generating Station for the second time in five years due to water shortages. Solar does not rely on water for cooling and therefore is not vulnerable to this risk.

Q Please describe the ratepayer benefits from solar in terms of diversifying Ameren's generation portfolio and moving it away from heavy reliance on coal.

A The addition of Boomtown and other solar resources improves resource diversity, which in turn improves grid resiliency. A grid that is too heavily reliant on limited resource types can be disproportionally vulnerable to, for example, volatility in commodity markets, disruption in transportation and supply chains, or extreme weather events that specific resource types are less prepared to withstand.

Ameren is heavily dependent on coal generation today. As can be seen in Figure 3, coal was responsible for three-quarters of Ameren's generation in 2021,[16] and

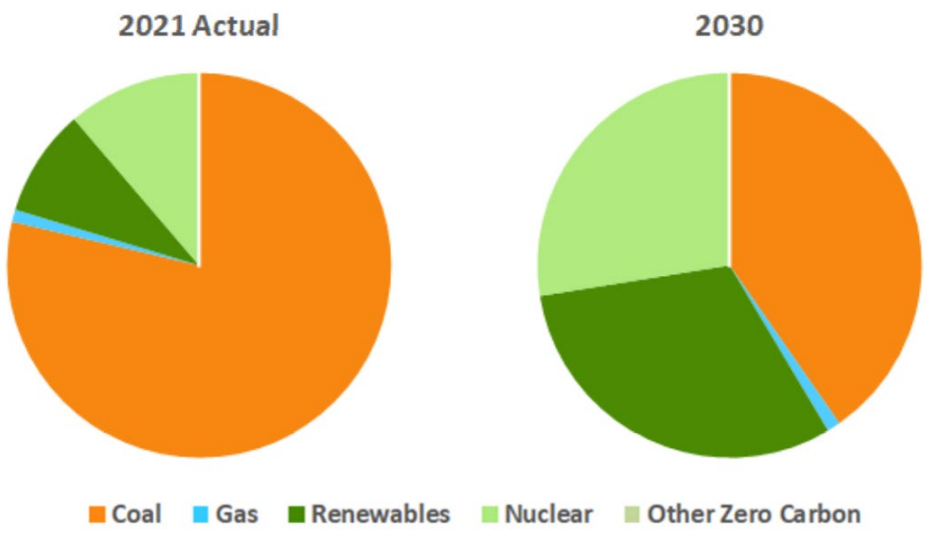
[14] North American Electric Reliability Corporation (NERC), 2022 Summer Reliability Assessment, pg 4, (May 2022), *available at* www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_SRA_2022.pdf

[15] Exhibit SSH-2, C.J. Brown, "December 2022 Winter Storm Elliott," pg 7, Southwest Power Pool.

[16] Figure 2, 2022 Change in Preferred Plan (Integrated Resource Plan), *available at* https://www.ameren.com/-/media/missouri-site/files/environment/irp/2022/preferred-plan.ashx. Nuclear percentage in 2021 reflects extended Callaway outage in 2021.

63 percent and 67 percent in 2019 and 2020, respectively.[17] Despite Labadie Energy Center being brought online in the 1970s, Ameren currently plans to operate this plant through the mid-2040s. Although Meramec Energy Center was closed at the end of 2022, Rush Island Energy Center is expected to be retired in 2025, and Sioux Energy Center retires in 2030, coal will still be a significant part of Ameren's resource mix throughout the decade and beyond (Figure 3).

Figure 3. Ameren Missouri's generation mix in 2021 and 2030



Source: Figure 2 of Ameren's 2022 Preferred Plan Update.

Q What are the specific risks posed to Ameren's ratepayers of continued reliance on coal?

A Unfortunately, there are numerous risks associated with coal, including the rising risk of environmental compliance, the risk of coal availability from mine supply

[17] FORM 10-K, pg. 19. US Securities and Exchange Commission. Ameren Corporation, Union Electric Company, Ameren Illinois Company, *available at* https://d18rn0p25nwr6d.cloudfront.net/CIK-0000100826/dba85030-9345-491b-890e-5044877fa117.pdf.

and transportation issues, and the increasing risk of forced outages, all of which could cause substantial reliability issues for Ameren.

Utilities around the country have experienced issues with their coal supplies over the last few years. For instance, the coal supplier for the San Juan Power Station in New Mexico was unable to supply the contracted amount of coal to the plant in 2022. As a result, the plant owners had to reduce how much they operated the plant.[18] Next door in Arizona, labor shortages in 2022 prevented Burlington Northern Santa Fe Railroad from delivering all the coal it was contracted to provide to Tucson Electric Power Company in 2022.[19] Similarly, the potential but avoided rail strike in fall of 2022 was a major threat to the coal industry. In fact, the coal industry is almost entirely dependent on railways, further exposing vulnerabilities of the coal supply chain.[20] If Ameren were to experience coal supply constraints as a result of transportation issues or coal mine supply, Ameren's ratepayers would be at risk of paying high prices for replacement market energy.

The risk of forced outages is also a concern, especially since all of Ameren's coal generators are over the age of 50 and nearing their end-of-life. As generators age, the likelihood and frequency of forces outages increases. For instance, CenterPoint's Culley Unit 3 was shut down unexpectedly for nearly six months due to a turbine failure. Not only did this put reliability at risk, but it has also led to a rate hike for CenterPoint customers to cover the cost of replacement market

[18] Direct Testimony of Devi Glick, pg 32. Docket No. E-01933A-22-0107. Arizona Corporation Commission (January 11, 2023).

[19] Direct Testimony of Devi Glick, pg 32. Docket No. E-01933A-22-0107. Arizona Corporation Commission, (January 11, 2023).

[20] Bittle, J., "Railroad strike threatens power in coal-dependent states," *Grist*, (September 14, 2022), *available at* https://grist.org/energy/railroad-strike-coal-power-shortage/.

energy that CenterPoint was forced to buy.[21] Similarly, as the generators continue to age, total spending on replacement parts and maintenance will continue to grow, increasing costs to Ameren and its ratepayers.

Lastly, as Ameren Witness Matt Michels has already discussed, the risk of costly environmental regulation for coal generators continues to increase for the generators that are not retired.[22] Witness Michels discussed Illinois' Climate and Equitable Jobs Act (CEJA), which imposed limits on Ameren's combustion turbine generators in Illinois, and the U.S. Environmental Protection Agency's (EPA) recently published proposed revisions for the Cross-State Air Pollution Rule. This EPA rule has the potential to limit coal generation during the summer months (to avoid ozone) or force Ameren to invest in expensive pollution control equipment. In addition to these, there are many other environmental rules and regulations that Congress is currently considering. These include, for instance, EPA's proposed decision for the reconsideration of national ambient air quality standards for particulate matter issues, EPA's plan to initiate rulemaking on greenhouse gas emission standards for existing power plants by April 2023, and its plans to implement Round II of the Regional Haze Rule. Each of these has the potential to require significant pollution control measures at Ameren's coal plans, which might include expensive pollution control technologies (or, if too expensive, forced early retirements of the plants). While these proposed changes are not certain, they demonstrate a growing trend towards greater and more costly environmental regulation of coal power plants.

[21] Schneider, K., "CenterPoint Energy request 3-month rate hike for 2023 following coal plant failure," *Indianapolis Star,* (November 25, 2022), *available at* https://www.indystar.com/story/news/2022/11/25/centerpoint-files-for-rate-hike-following-coal-plant-malfunction/69670232007/.

[22] Direct Testimony of Matt Michels, pg. 15.

If, or even when, any of these potential constraints on coal supply or coal generation materialize, Ameren would not be able to change course quickly. Purchasing replacement energy for over 60 percent of its portfolio would be very costly and would put reliability at risk. The addition of solar, on the other hand, would help mitigate many of these risks. If Ameren were to increase the diversity of its generation portfolio, it could limit risk for customers and improve the overall resiliency of the electricity grid.

Q What other resources have Ameren and Staff considered?

A Expert Witness Lange discusses Ameren's proposition of refurbishing two generators, Audrain and Peno Creek Energy Centers, to enable dual-fuel capabilities as a way of meeting winter 2026 capacity shortfalls.[23] However, as I have already laid out, this would only expose Ameren's customers to more risk. For instance, ratepayers would be exposed to the price volatility of oil and gas, as well as the risk of oil and gas constraints related to pipeline access and severe weather, among other factors. Although not coal, these two generators are still vulnerable to the risk of costly environmental regulation, such as Illinois's CEJA.[24] These generators would also have ongoing O&M costs, especially as dual-fuel generators, and would incur the refurbishment costs to upgrade these facilities for dual-fuel capabilities. Although no one resource can meet all needs, focusing on a diverse portfolio of resources and moving away from volatile and costly fossil fuels will ultimately benefit ratepayers.

[23] Rebuttal Testimony of Shawn E. Lange, pg. 9.

[24] CEJA referenced in Direct Testimony of Matt Michels, pg. 15, and Rebuttal Testimony of Shawn E. Lange, pg. 11.

Q Do the potential increasing cost of solar, tariff and import issues, and supply chain constraints pose added risk to Boomtown, and solar generally?

A I do not dispute that the costs of Boomtown and other solar projects could increase. However, the cost of most goods and services is also rising with inflationary pressures and our current economy. The issue is not limited to solar arrays and inverters; the same could be said about the cost of fossil-fuel-based generation, such as replacement parts for existing and aging resources, the cost of labor for plant refurbishment and maintenance, and many other Ameren costs.

I also do not dispute that tariff circumvention investigation issues and supply chain constraints could delay or cancel solar projects. However, even if a few solar projects are never built due to supply chain issues or otherwise, it does not mean that solar is not a valuable resource; solar still provides numerous benefits for ratepayers. The risk of delay or cancelation means that more solar should be added to the development pipeline sooner rather than later, as Ameren Witness Ajay K. Arora explains in his testimony.[25]

Q Staff Witness Cunigan argues that large customers can simply build their own behind-the-meter solar or procure energy through a purchased power agreement (PPA).[26] How do you respond?

A Very few customers have the resources and operational abilities to build a 150 MW solar project or be able to compete with utilities in securing a PPA from a solar plant owner. Furthermore, by reducing multiple reliability and cost risks, Boomtown will provide benefits for *all* ratepayers.

[25] Direct testimony of Ajay K. Arora, pg. 14–15.

[26] Rebuttal Testimony of Cedric E. Cunigan, pg. 5.

5. INCREASING RENEWABLE PENETRATION PROVIDES MORE BENEFITS THAN RISK

Q Staff Witness Lange raises concern about increasing penetration of renewables in the MISO grid,[27] referencing MISO's 2022 Regional Resource Assessment[28] and MISO's Renewable Integration Impact Assessment[29] (RIIA). Do you agree that the increasing penetration of renewables in MISO is a concern?

A Yes and no. The addition of more renewable energy will change how MISO operates the grid. However, the operational and reliability risks posed are manageable and already being closely analyzed and prepared for by MISO, Federal Energy Regulatory Commission (FERC), member states and utilities within MISO, and others. There are many changes occurring on the electric grid throughout North America to evolve system operations, build out infrastructure, and change market rules to better accommodate the expansion of renewables. And renewables will continue to come onto the grid in MISO territory regardless of whether Ameren installs Boomtown, whether Ameren installs all the solar outlined in its 2022 Preferred Plan Update, or whether the utility never builds or acquires anything further. Utilities in MISO already operate a substantial quantity of wind resources; wind generated 16 percent of energy in MISO in 2022.[30]

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[27] Rebuttal Testimony of Shawn E. Lange, pg. 10.

[28] MISO, Attachment SEL-2. 2022 Regional Resource Assessment, (November 2022).

[29] MISO, Renewable Integration Impact Assessment, (February 2021) (referenced in the Rebuttal Testimony of Shawn E. Lange).

[30] Using MISO real-time daily generation values for 2022, by resource type, *available at* https://www.misoenergy.org/markets-and-operations/real-time--market-data/market-reports/#nt=%2FMarketReportType%3ASummary%2FMarketReportName%3AHistorical%20Generation%20Fuel%20Mix%20(xlsx)&t=10&p=0&s=MarketReportPublished&sd=desc.

Further, MISO participants are certain to build a substantial quantity of solar resources in coming years.[31]

The potential risks posed by higher penetration of renewables should by no means be a reason for inaction (see Section 4 for my description of the risks of inaction). There is very little solar on the MISO system today; in 2022 solar generation accounted for only 1.2 percent of generation in MISO's territory.[32] The risks referenced in the report, such as the ability to manage the grid reliably, coordination among utilities, etc., are not major challenges currently. They may indeed be future challenges, but there is time to prepare and adapt. For instance, 50-percent renewable penetration, a threshold of concern highlighted in the RIIA report, will not be achieved overnight. Likewise, Ameren's net-zero goal for 2045 is 20 years away. Ameren has decades to learn, adapt, and prepare the system. In fact, Witness Lange correctly calls on Ameren to coordinate with MISO in the operation of solar,[33] and I do not disagree; building Boomtown will allow Ameren to improve coordination.

Q What changes and reforms specifically are underway to help with the expansion of renewables on the MISO grid?

A There are numerous changes underway to support this transition. Many of these focus on reducing barriers to expanding transmission capacity, including through

[31] MISO, MISO Futures Report, (December 2021), *available at* https://cdn.misoenergy.org/MISO%20Futures%20Report538224.pdf.

[32] Using MISO real-time daily generation values for 2022, by resource type, *available at* https://www.misoenergy.org/markets-and-operations/real-time--market-data/market-reports/#nt=%2FMarketReportType%3ASummary%2FMarketReportName%3AHistorical%20Generation%20Fuel%20Mix%20(xlsx)&t=10&p=0&s=MarketReportPublished&sd=desc.

[33] Rebuttal Testimony of Shawn E. Lange, pg. 10–11.

new streams of funding and policy reform. For instance, in December 2022, the U.S. Department of Energy (DOE) announced that it is considering providing a loan guarantee for the Grain Belt Express Transmission project, an 800-mile transmission line that would enable 5 GW of low-cost, renewable power to be transferred across the Midwest; the project includes the construction of interconnection facilities and 146 miles of high-voltage direct current (HVDC) transmission line in Missouri alone.[34] The DOE also recently launched the "Building a Better Grid Initiative" and allocated $12.5 billion for grid reliability improvements.[35] Beyond funding, FERC and others are proposing and establishing policy reforms to reduce barriers to transmission build-out and generator interconnection. For example, to support long-range transmission planning, FERC released a proposal in 2022 that would require public utility transmission providers to conduct long-term regional transmission planning and seeks the agreement of relevant state entities within the transmission planning region on cost allocation methodologies.[36] FERC is considering establishing a minimum requirement for interregional transfer capability.[37] FERC is also

[34] Federal Energy Regulatory Commission (FERC), "Notice of Intent to Prepare an Environmental Impact Statement for the Grain Belt Express Transmission Line Project, DOE/EIS-0554," (December 16, 2022), *available at* https://www.federalregister.gov/documents/2022/12/16/2022-27099/notice-of-intent-to-prepare-anenvironmental-impact-statement-for-the-grain-belt-express.

[35] S&P Global Market Intelligence, "As IRA drives renewables investment attention turns to transmission upgrades," (October 24, 2022), *available at* https://www.spglobal.com/marketintelligence/en/news-insights/research/as-ira-drives-renewables-investment-attention-turns-to-transmission-upgrades.

[36] FERC, "Building for the Future Through Electric Regional Transmission Planning and Cost Allocation and Generator Interconnection" (April 21, 2022) *available at* https://www.ferc.gov/media/rm21-17-000.

[37] FERC, "Establishing Interregional Transfer Capability Transmission Planning and Cost Allocation Requirements; Supplemental Notice of Staff-Led Workshop," (December 6, 2022) *available at* https://www.federalregister.gov/documents/2022/12/06/2022-

attempting to reform interconnection processes. For instance, through Docket RM 22-14-000, FERC proposes reforms to address interconnection queue backlogs and prevent undue discrimination of new technologies.[38] These new funding sources and policy reforms are all in response to changing system needs.

Boomtown is a very small project that only very minimally impacts MISO operations; rejecting the CCN for Boomtown will not help mitigate the risks of a changing electricity grid in MISO and North America as a whole. Instead, it will deny Ameren's customers the benefit of economic and low-risk solar energy.

Q What other issues do you have with Staff Witness Lange's concern about the forthcoming level of renewables in the MISO grid?

A Witness Lange's arguments about the risk to grid operations and reliability as a result of growing renewable energy adoption[39] contradict other Staff testimony. Witness Stahlman testifies that renewables will not impact MISO's economic dispatch and will not displace fossil fuel generation.[40] Yet, Witness Lange asserts that renewables will put MISO grid operations at risk. These two points are contradictory; MISO's grid operations cannot be impacted if renewables do not affect dispatch. Alternatively, dispatch must be impacted, and fossil-fuel-based generation will be replaced, if the grid begins to be operated differently.

26474/establishing-interregional-transfercapability-transmission-planning-and-cost-allocation.

[38] FERC, "Improvements to Generator Interconnection Procedures and Agreements," (June 16, 2022), *available at* https://www.ferc.gov/media/rm22-14-000.

[39] Rebuttal Testimony of Shawn E. Lange, pg. 10–11.

[40] Rebuttal Testimony of Michael L. Stahlman, pg. 2–3.

Q **Expert Witness Stahlman argues that Boomtown will be reaching the end of its life by 2045 when Ameren is trying to be carbon neutral, and therefore Boomtown will not be a part of their carbon neutrality; yet ratepayers will still incur the costs.[41] How do you respond?**

A First, I contest that Boomtown will be reaching the end of its life in 2045. Ameren Missouri states that Boomtown will be operating for 30 years,[42] to 2055. This is 10 years after the start of Ameren's goal of net neutral electricity generation. During the entire 30-year or longer lifetime of the project, Boomtown will generate energy that displaces fossil fuel generation and therefor will reduce carbon pollution for decades.

Second, as I have stated numerous times, ratepayers will not just pay for the cost of solar; they will also incur many benefits and avoid risks. During these decades, customers will, for example, benefit from relative energy price stability.

Third, as I have outlined above, the energy transition will not happen overnight. There will be decades of learning, management, planning, and adapting first. Grid management, asset portfolio management, and the energy transition are all iterative processes. The goal is not to suddenly be at net carbon neutrality, instead it is to reach that point year by year through a managed plan and adaptation.

Lastly, as I stated at the beginning of my surrebuttal testimony, no single resource will fit all of Ameren's needs, including the need to achieve net zero by 2045. For a reliable and affordable grid, Ameren and its ratepayers require a diverse portfolio of resources of multiple sizes, resource types, and locations.

[41] Rebuttal Testimony of Michael L. Stahlman, pg. 10–11.

[42] Direct Testimony of Scott Wibbenmeyer, pg. 7.

6. INTEGRATED RESOURCE PLANS (IRPS) ARE CRITICAL TO RESOURCE PLANNING AND DECISION-MAKING.

Q Expert Witness Fortson raises issue with using Ameren's 2020 Integrated Resource Plan and associated 2022 Preferred Plan Update for planning.[43] How do you respond?

A I disagree with Witness Fortson. IRPs provide important context to resource planning decisions; help Ameren to operate its resources most efficiently; and identify important short-, medium-, and long-terms needs. IRPs are critical in enabling Ameren to provide reliable and affordable electric service with minimal risk to ratepayers. If Witness Fortson or other stakeholders believe there are flaws in Ameren's IRP process, then Staff should push for improvements in how Ameren develops its IRPs.

No plan is perfect, and IRPs cannot predict the future. However, resource management is an iterative process and regularly updating plans is part of that process. Ameren should always be looking to improve the system by building lower-cost resources and retiring expensive and risk-intensive assets; IRPs can directly help address these goals. As Ameren clearly stated in its recent IRPs, solar will be part of its future resource mix. Ameren has no choice but to secure replacement resources; its existing coal-fired units are readily approaching their end-of-useful life and the risks of continuing to operate these generators and other fossil fuel plants are only mounting. For the many reasons I have already outlined, adding solar, in accordance with Ameren's 2020 IRP and 2022 Plan Update, mitigates risk and benefits ratepayers.

[43] Rebuttal Testimony of Brad J. Fortson, pg. 7–12.

Q **Does that conclude your testimony?**

A Yes, it does.

CERTIFICATE OF SERVICE

I, the undersigned, do hereby certify that on this 18th day of January, 2023, a true and correct copy of the above and foregoing Surrebuttal Testimony of Sarah Shenstone-Harris on Behalf of Sierra Club was served via email.

/s/ Bruce A. Morrison

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sshenstone-harris@synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. *Senior Associate*, October 2022 – Present.

- Provides research, analysis, and consulting services on various energy-sector issues, including integrated resource planning, rate design, electric vehicles and electrification, and clean energy

Reading Municipal Light Department (RMLD), Reading, MA. *Integrated Resource Analyst I,* January – September 2022; *Integrated Resource Specialist,* October 2020 – December 2021.

Integrated Resource Analyst I:

- Planned the Department's wholesale power supply strategy, including developing and running economic models to evaluate power supply decisions. Consistently working to achieve RMLD's goals of delivering reliable, low-cost, and emission-free power
- Led the rate increase process and the design of new rate structures, such as a residential electric vehicle time-of-use rate.
- Managed the retirement and sales of RMLD's Renewable Energy Certificates (RECs) and Emission-Free Certificates (EFECs) to ensure compliance with MA Climate Law and the achievement of RMLD's grid decarbonization goals, while keeping rates affordable for all classes
- Developed and maintained forecasting tools of retail load, energy purchases and hedging, power supply costs (energy, transmission, and capacity), and RECS/EFECs
- Prepared annual and monthly power supply budgets for energy, transmission, and capacity costs
- Adjusted monthly rates for all classes, based on expected costs and revenues
- Designed and implemented significant process improvements to track budgeted and actual costs, and manage the $65 million power supply budget

Integrated Resource Specialist:

- Administered, promoted, coordinated, and reported on utility energy efficiency and electrification programs, including Air Source Heat Pumps, Electric Vehicle Chargers, Commercial Lighting, Solar and Distributed Generation, Energy Audits, Appliance Rebates, and other energy management programs
- Designed and developed economic and analytical tools to help achieve RMLD's power supply and retail goals and objectives, such as a rate analysis models
- Developed and expanded utility load forecasts, to inform both power supply strategy and program management
- Implemented significant program process improvements, resulting in a >50% reduction in customer rebate application turnaround time

- Established systems to track program performance, including measure adoption, cost-effectiveness, energy savings, and environmental impacts
- Responsible for reporting to external agencies, such as the ISO-NE and US Energy Information Administration (EIA), as well as to board members and key stakeholders on all retail program activities
- Provided technical support to the Customer Service team, including administering training on new programs, a customer portal for rebate applications, and new program processes
- Coordinated with other RMLD departments, vendors, program partners, and other utilities to support RMLD programs and goals

ICLEI Canada – Local Governments for Sustainability, Toronto, Ontario, Canada. *Climate & Energy Planner Project Assistant*, October 2018 – March 2020; *Climate & Energy Project Assistant*, October 2017 – October 2018.

- Coordinated ICLEI's climate and energy consulting work for municipalities, including:
  - Stakeholder engagement (stakeholder identification, establishment of working groups, facilitating dialogue, collecting feedback and incorporating stakeholder input)
  - Identifying and developing programs and policies to improve environmental sustainability across multiple sectors (buildings, transportation, waste, land use, resource use, etc.)
  - Quantifying environmental and financial impacts of emission and energy reduction measures, identifying and collecting data sources, modelling energy and emissions with different policy options
  - Clearly and succinctly summarizing technical concepts to clients and stakeholders
  - Presenting recommendations and final plans to City Councils
- Coordinated and delivered capacity-building programs that support Canadian municipalities in greenhouse gas emissions mitigation activities and community energy planning
- Created resources and tools for climate action plan development and implementation (best practice guidelines, communication materials, emission measurement tools, decision-support tools, etc.)
- Developed and delivered workshops, webinars and training services to local governments participating in ICLEI programs and projects

Sustainable Development Technology Canada, Ottawa, Ontario, Canada. *Research and Technology Analyst* (8-month Co-op position), September 2016 – April 2017.

- Wrote and prepared briefing packages for the Board of Director's Investment Committee, detailing the technological, business, intellectual property, and financial merits of clean tech projects seeking funding
- Conducted research to assess and inform SDTC's clean tech investment priorities

EDUCATION

University of Ottawa, Ontario, Canada
Master of Science in Environmental Sustainability (focus on policy and economics), Institute of the Environment, 2017.
Masters Project: *Have we reached peak driving?: A 25-year decomposition of vehicle trends in Canada*

Queen's University, Kingston, Ontario, Canada
Bachelor of Science in Biology, 2013.
Graduated with Distinction and Dean's List Honors

PUBLICATIONS

Rivers, N., S. Shenstone-Harris, N. Young. 2017. *Using nudges to reduce waste? The case of Toronto's plastic bag levy*. Journal of Environmental Management, Volume 188. ISSN 0301-4797.ZURA Consulting,

ICLEI Canada and Wood PLC. 2021. *Town of Aurora (Ontario) Community Energy Plan*.

ICLEI Canada and Wood PLC. 2020. *Township of Huron-Kinloss (Ontario) Climate Change and Energy Plan*.

LURA Consulting and ICLEI Canada. 2019. *City of Kawartha Lakes (Ontario), Healthy Environment Plan.*

ICLEI Canada and the Federation of Canadian Municipalities. 2020. *Guidebook on Quantifying Greenhouse Gas Reductions at the Project Level.*

Shenstone-Harris, S., Cai, Y., and Dean, M. 2019. *On the Money: Financing Tools for Local Climate Action, 2019*. Prepared for Partners for Climate Protection.

ICLEI Canada and the Federation of Canadian Municipalities. 2018 and 2019. *Partners for Climate Protection National Measures Report 2018*, *Partners for Climate Protection National Measures Report 2019*.

Rivers, N., Shenstone-Harris, S., Young, N. 2017. *Using nudges to reduce waste? The Case of Toronto's plastic bag levy.* Journal of Environmental Management 188: 153-162.

Resume updated October 2022

SPP Southwest Power Pool

Working together to responsibly and economically keep the lights on today and in the future.

DECEMBER 2022 WINTER STORM ELLIOTT

C.J. BROWN

DIRECTOR, SYSTEM OPERATIONS

2022 WINTER STORM GRID EMERGENCY

TIMELINE OF OPERATIONAL COMMUNICATIONS: DEC. 19-26, 2022

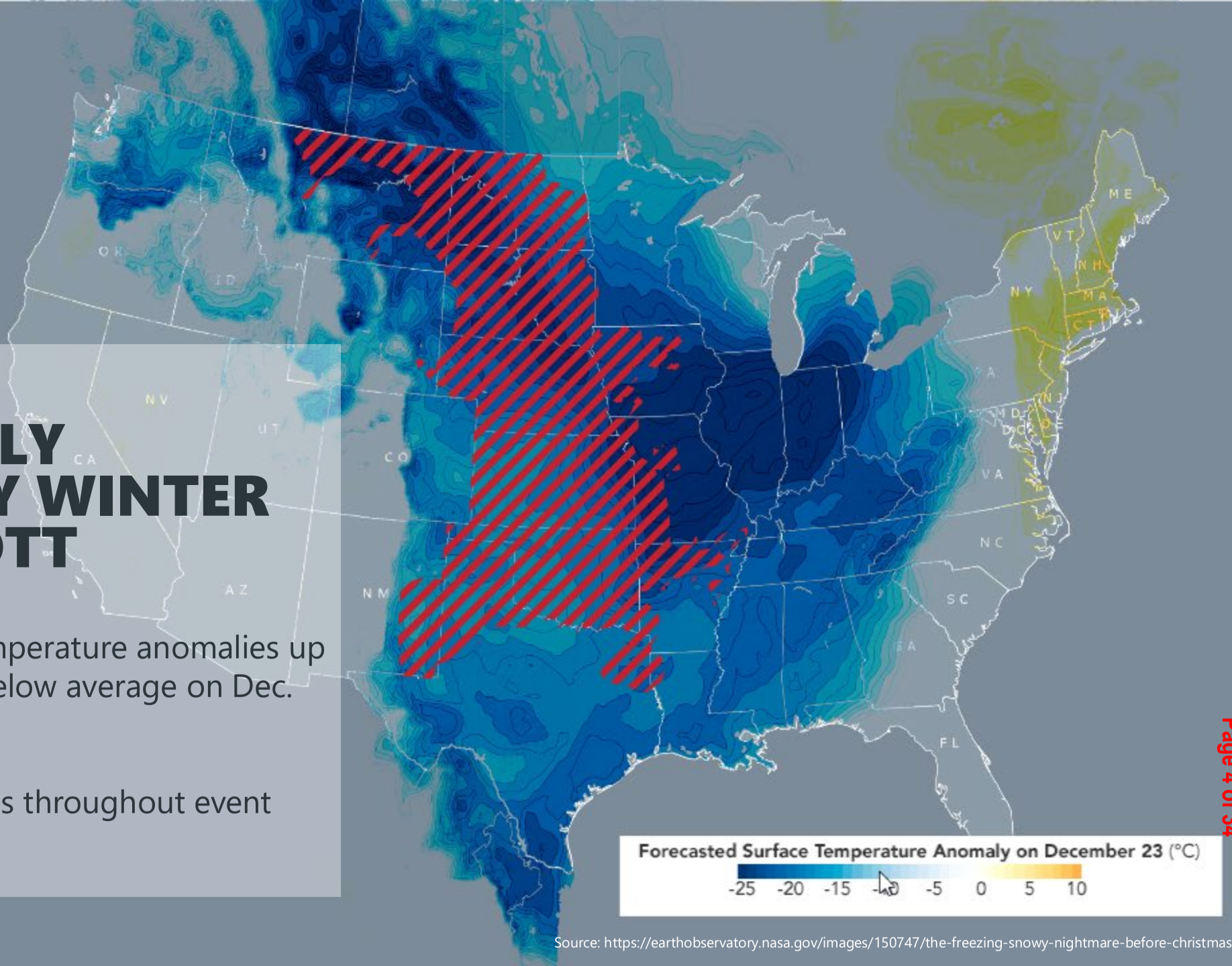
Fri. 12/16 to Mon. 12/19	Tue. 12/20	Wed. 12/21	Thu. 12/22	Fri. 12/23	Sat. 12/24	Sun. 12/25	Mon. 12/26
Fri. 12/16: Internal communication with operations notes upcoming cold weather. Operations monitoring conditions with no identified needs for resource alerts at that date. --- **Mon. 12/19, 13:54** SPP operations issues a **Cold Weather Advisory** to begin on 12/21/22 at 20:00. --- **Mon. 12/19, 14:30** SPP Communications sends Grid Notice email to all subscribers regarding the upcoming Weather Advisory	**17:57** SPP BA issues a **Resource Advisory** *(supersedes Weather Advisory)* effective 12/23 00:00 through 12/25 00:00 --- **18:01** SPP BA **moves up start** of **Resource Advisory** to 12/22 00:00	**10:00** SPP Comms. sends Grid Notice of upcoming Resource Advisory	**Resource Advisory** in effect	**Resource Advisory** in effect **08:27** **EEA1** declared **10:00** End of EEA **11:00** **Conservative Operations** declared, anticipated end 12/25 00:00 **17:20** **EEA1** declared **20:20** End of EEA. Conservative Operations Continues	**Conservative Operations** in effect **08:29** SPP **extends anticipated end of Conservative Operations** through 12/25 12:00	**Conservative Operations** in effect **12:00** Conservative Operations ends but **Resource Advisory** in effect until midnight	**Weather Advisory** in effect **10:00** SPP returns to **Normal Operations**

Time blocks are not to scale

SPP REGION SIGNIFICANTLY IMPACTED BY WINTER STORM ELLIOTT

Experienced surface temperature anomalies up to 25 degrees Celsius below average on Dec. 23, 2023.

Extreme wind chill values throughout event



Source: https://earthobservatory.nasa.gov/images/150747/the-freezing-snowy-nightmare-before-christmas

DRIVERS OF ENERGY EMERGENCY ALERTS

1. Generation unavailability
   - Lack of fuel supply
   - Extreme cold weather-related outages
2. Record winter energy consumption
   - New record set 12/22/22 @ 18:27: 47,157 MW

ADVANCE PREPARATIONS

- **Alerted** operators as conditions changed
- **Provided** advance notification to members committee
- **Communicated** with Operating Reliability Working Group and provided public notifications as system conditions changed
- **Committed** gas generation early to help fuel procurement

OTHER NOTABLE CHALLENGES

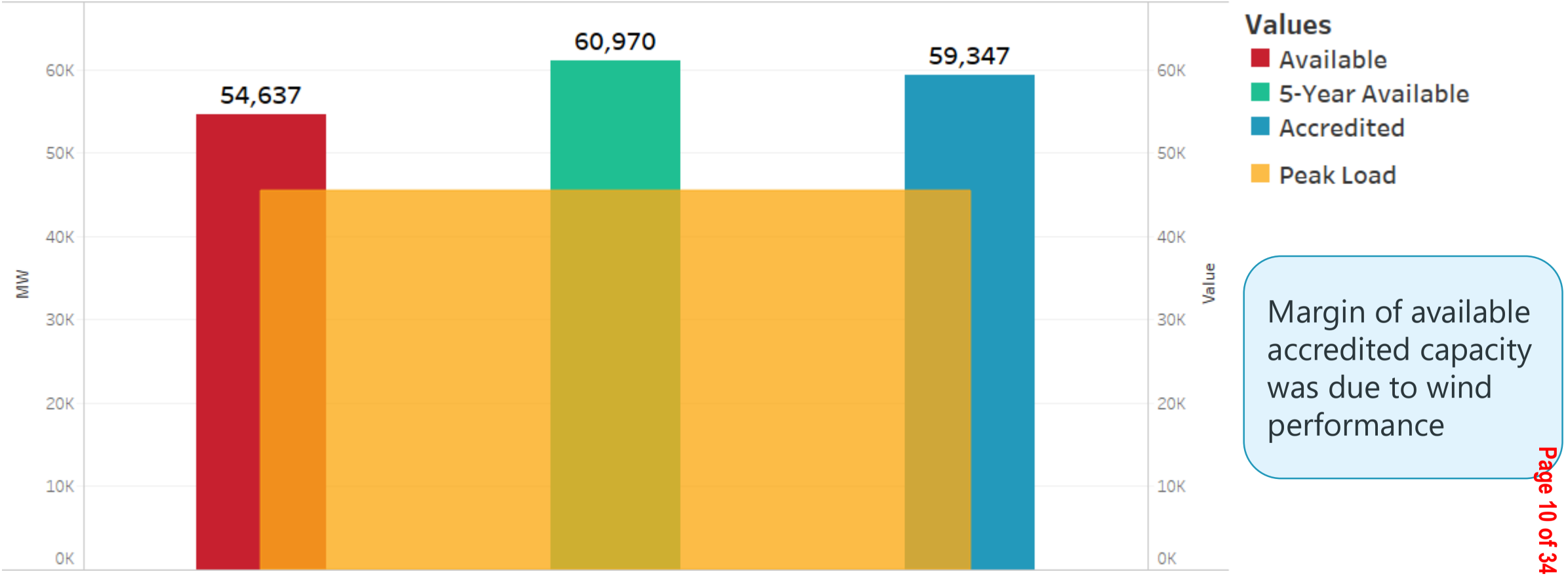
- **Dec. 20:** SPP began receiving natural gas notifications that flexibility and other non-firm usage of pipelines would be greatly limited through Dec. 28
- **Dec. 23:**
  - SPP Chenal facility transformer malfunctioned and operated on backup generators during the event
  - SPP Chenal data center cooling system was inoperable due to low temperatures for 6 hours until system bypass was put in place
- **Dec. 23 & 24:** Missouri river developed ice block preventing river flow and threatened 1000s of MWs of generation

OPERATIONAL DATA

KEY POINTS FOR ELLIOTT & URI COMPARISON

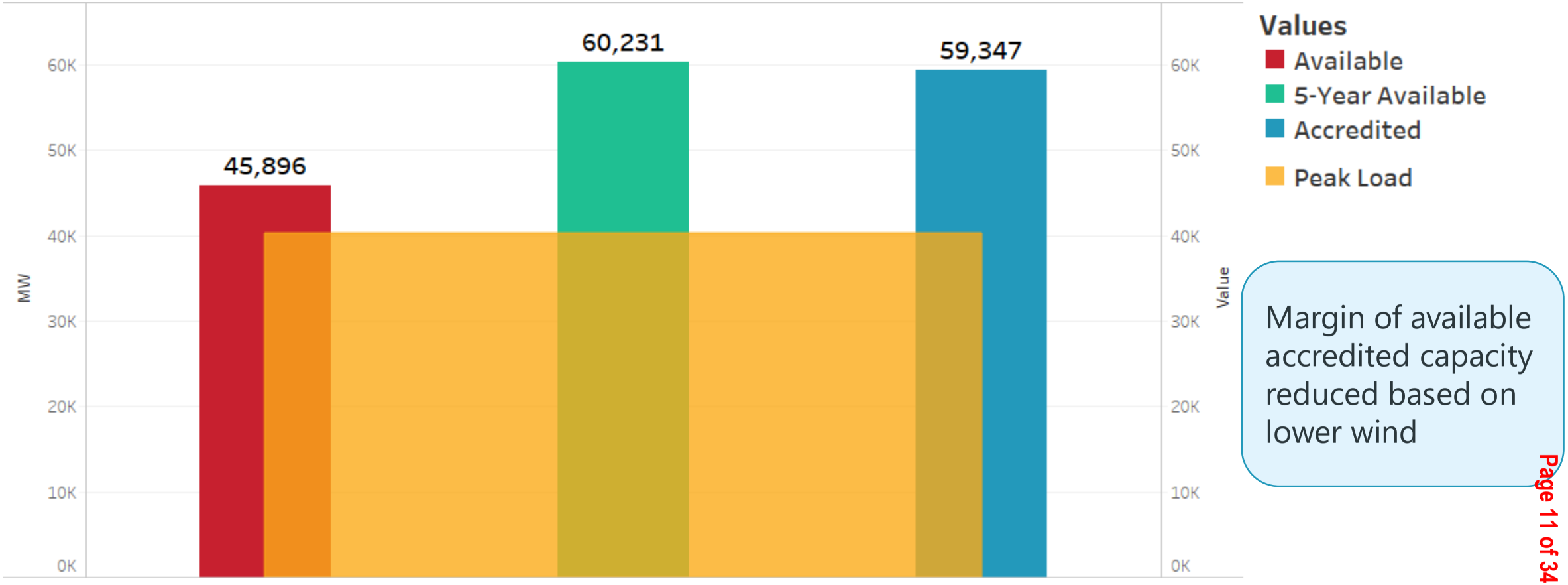
- For SPP, Elliott was not as severe as winter storm Uri (Feb. 2021)
- Fewer gas and wind outages in Elliott than Uri
- Coal outages and derates were worse in Elliott
- While there was no BA directed load shed in Elliott, there was BA load shed potential

TOTAL ACCREDITED CAPACITY BREAKDOWN VS. LOAD
12/23/2022 06:00
ELLIOTT



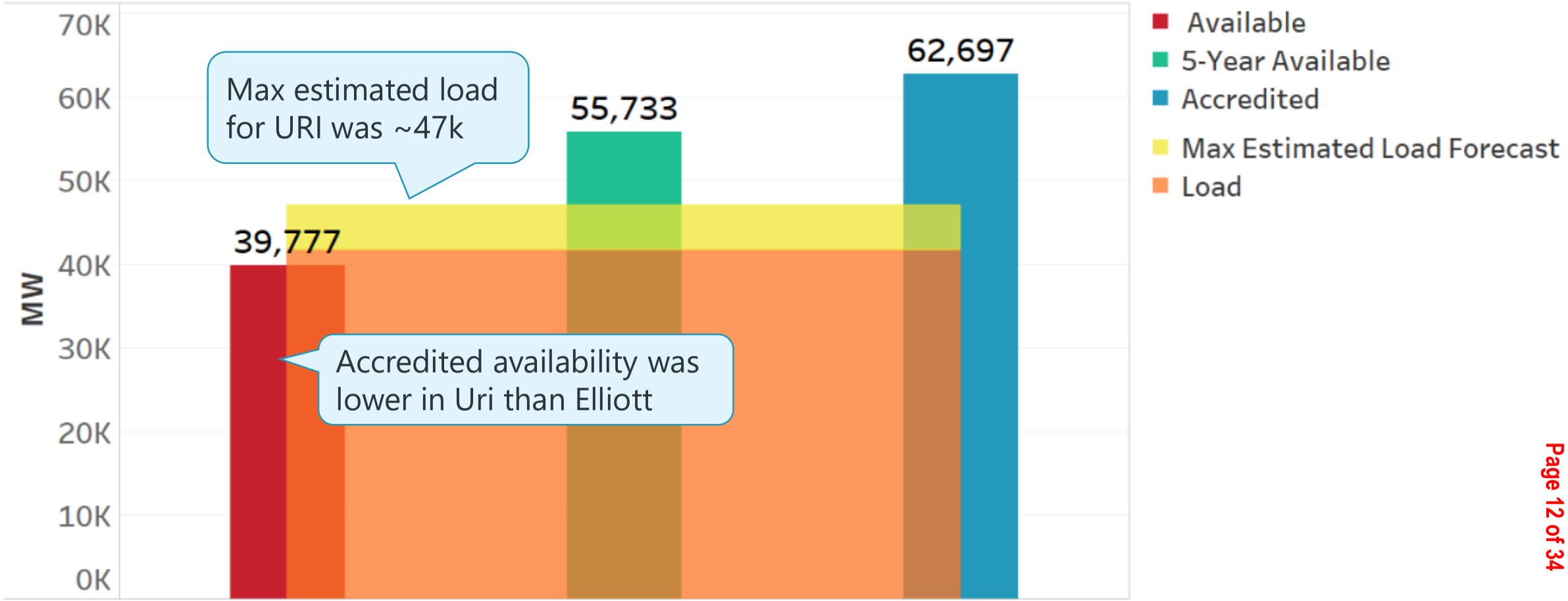
Margin of available accredited capacity was due to wind performance

TOTAL ACCREDITED CAPACITY BREAKDOWN VS. LOAD
12/24/2022 06:00
ELLIOTT

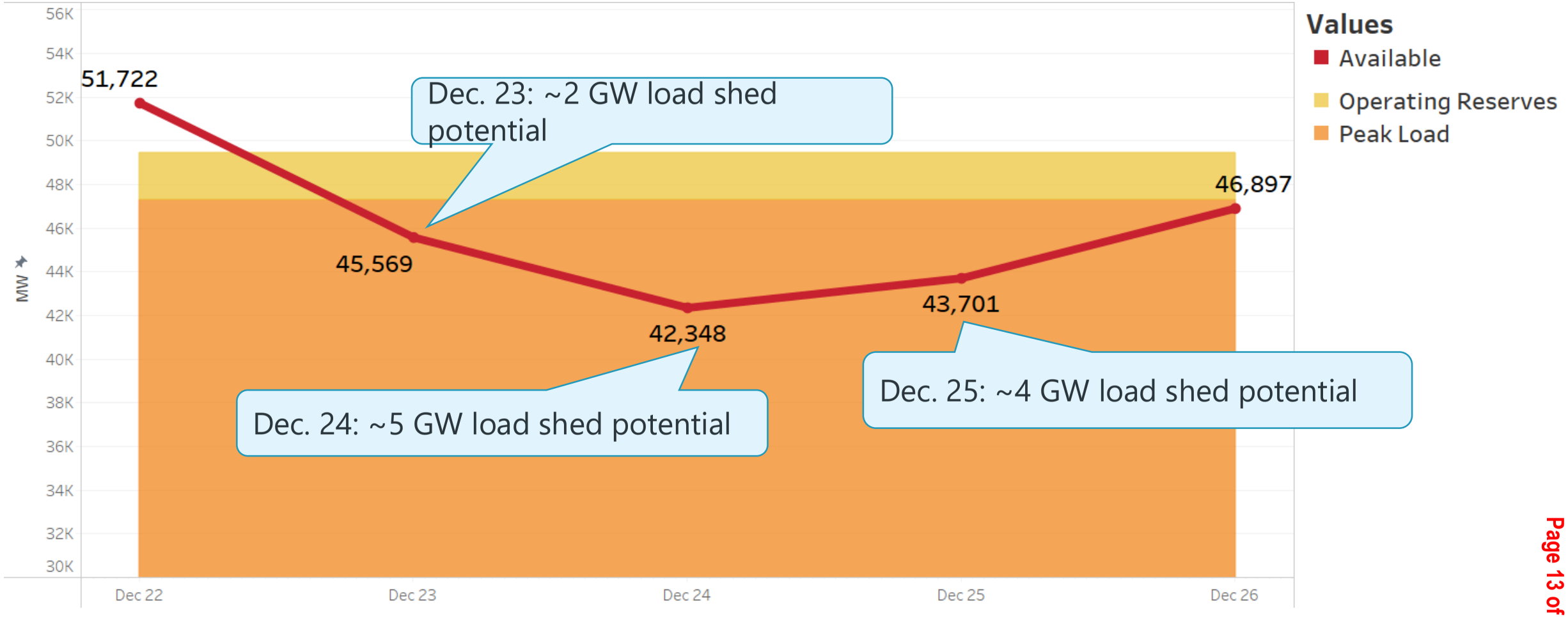


Margin of available accredited capacity reduced based on lower wind

TOTAL ACCREDITED CAPACITY BREAKDOWN VS. LOAD
URI

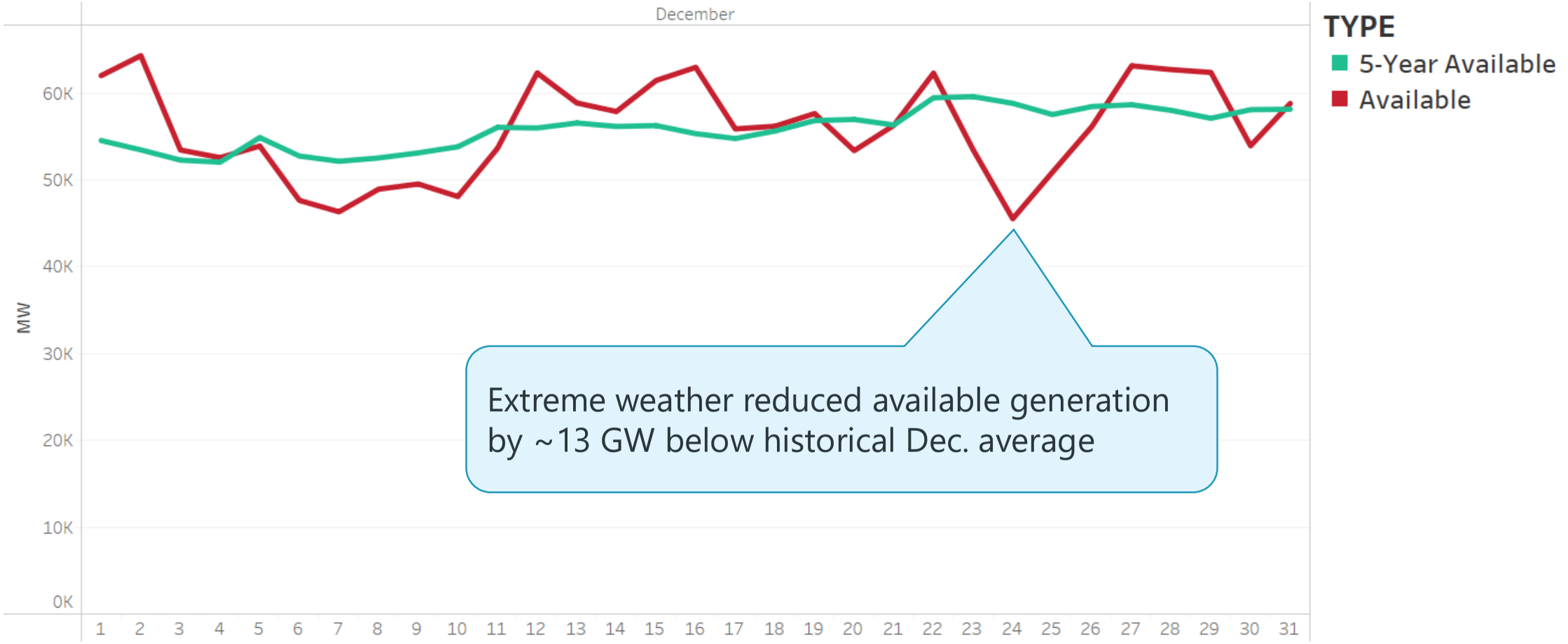


PEAK OBLIGATION VS. DAILY ACCREDITED AVAILABLE CAPACITY ELLIOTT



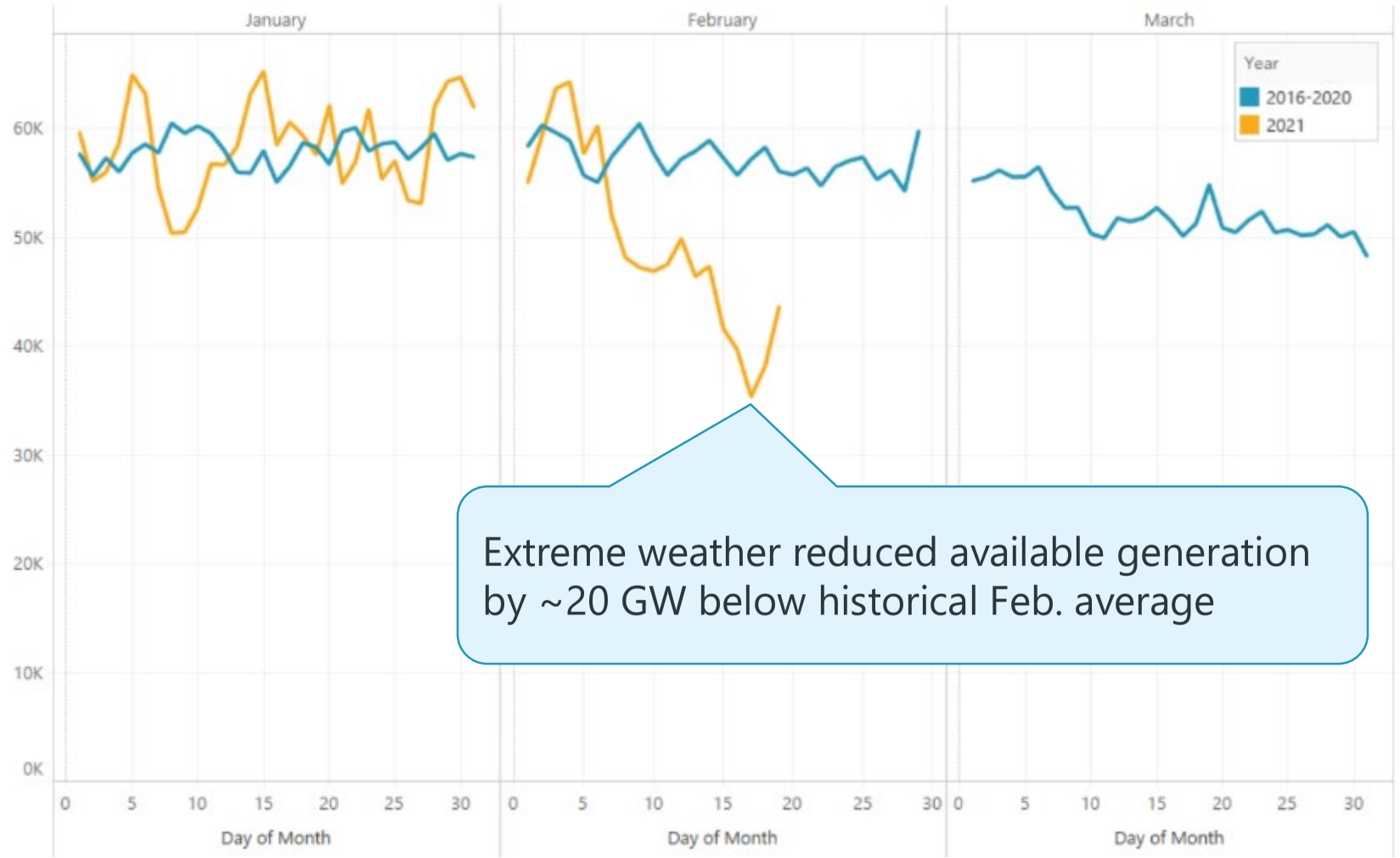
**This compares the maximum obligation during the time frame (Load + Operating Reserves) to the accredited availability on that day.

AVAILABLE GENERATION IN SPP MARKET
ELLIOTT

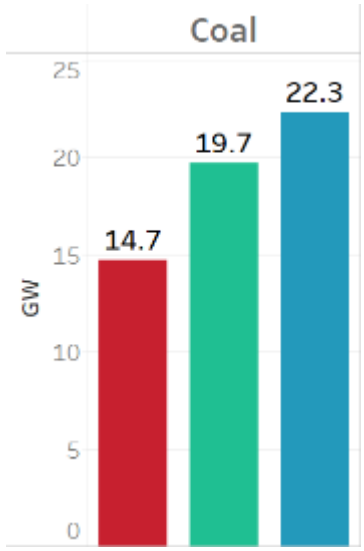


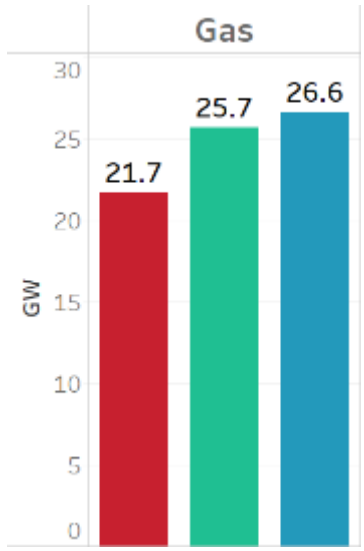
AVAILABLE GENERATION IN SPP MARKET

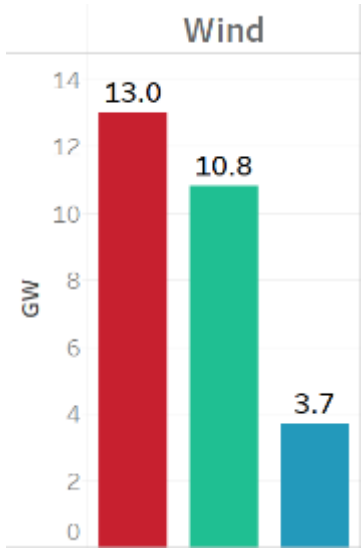
URI

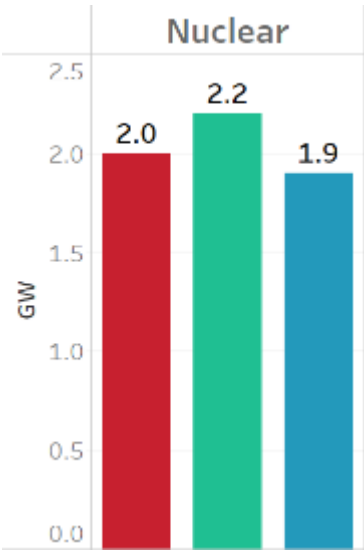


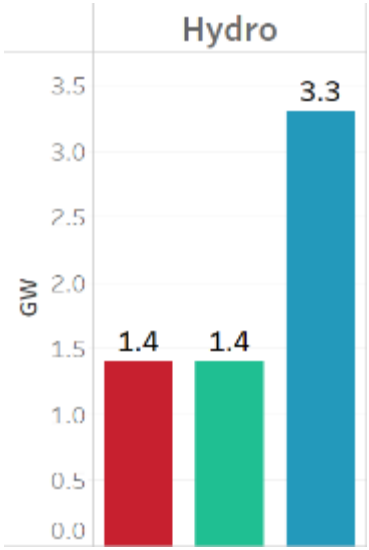
FUEL TYPE CAPACITY BREAKDOWN
12/23/2022 06:00 ELLIOTT

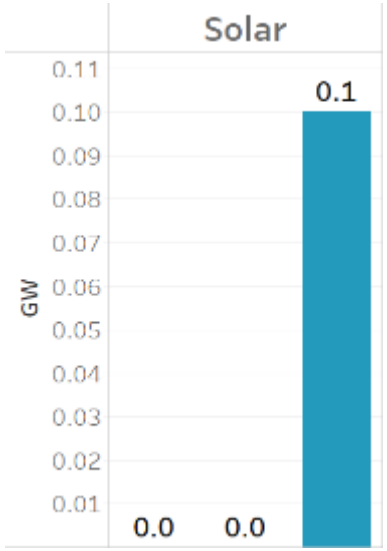


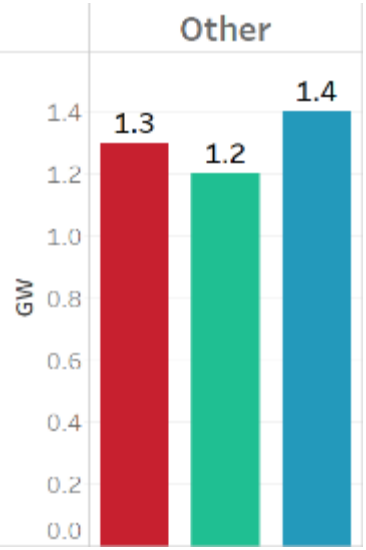


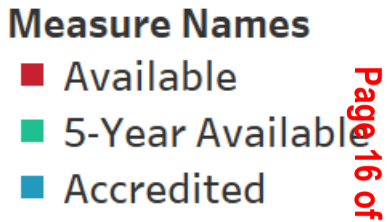




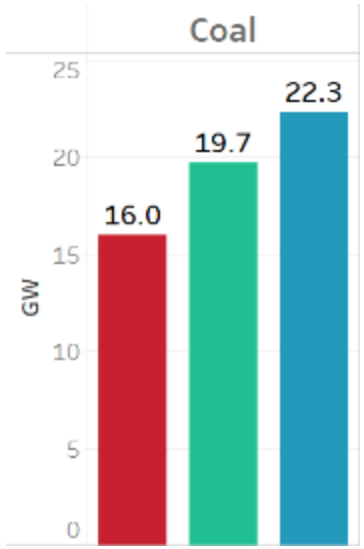


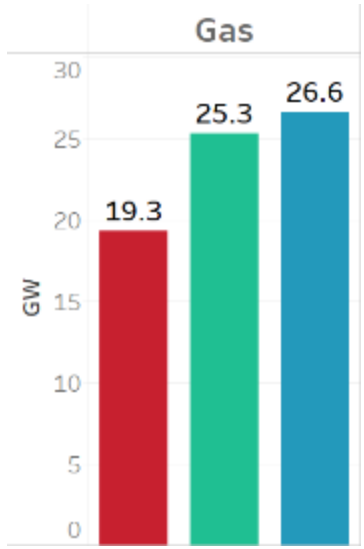


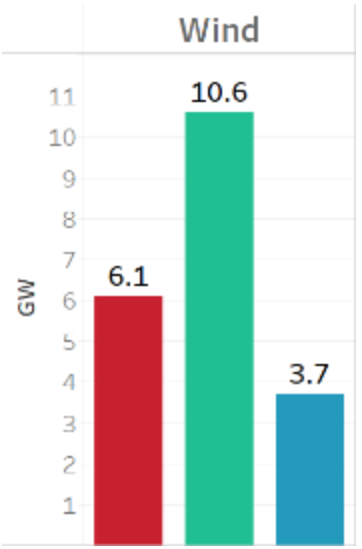


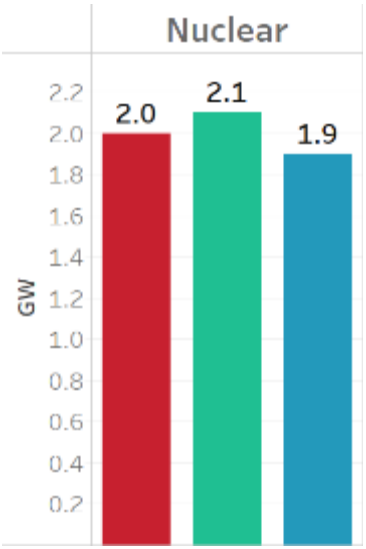


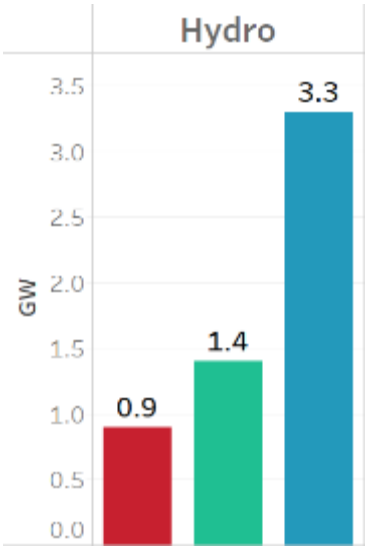
FUEL TYPE CAPACITY BREAKDOWN
12/24/2022 06:00 ELLIOTT

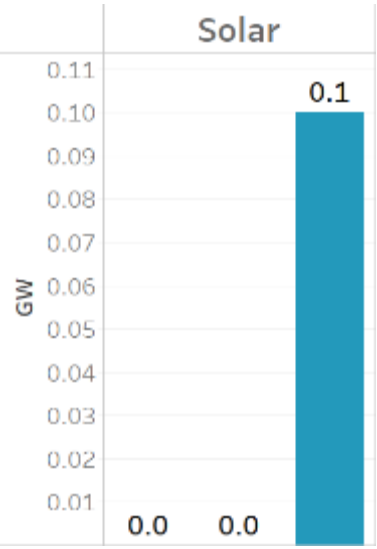


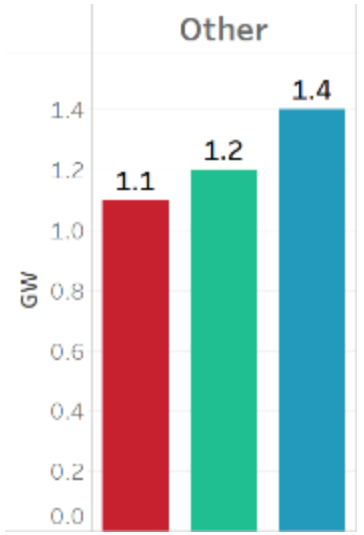


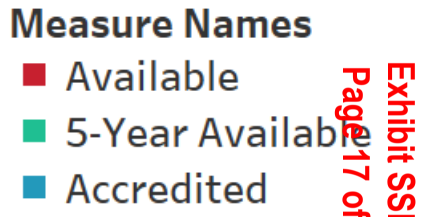




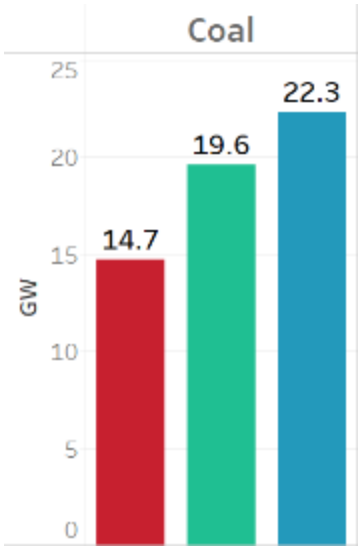


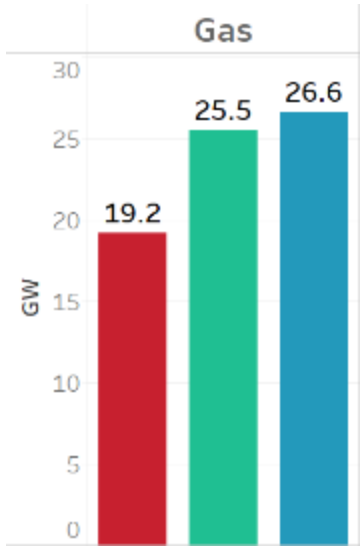


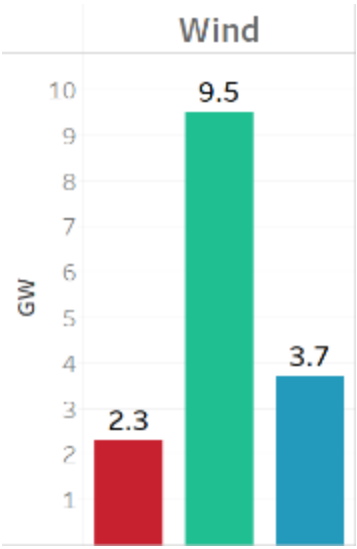


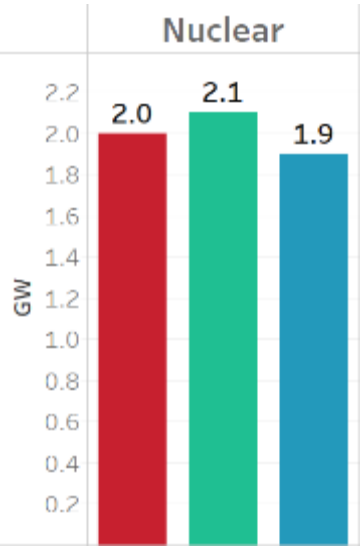


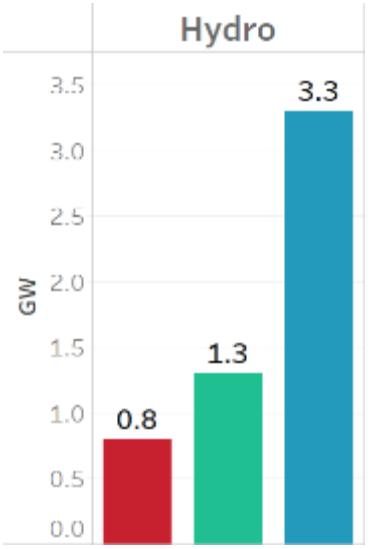
FUEL TYPE CAPACITY BREAKDOWN
12/22-12/24 ELLIOTT (MINIMUM AVAILABLE)

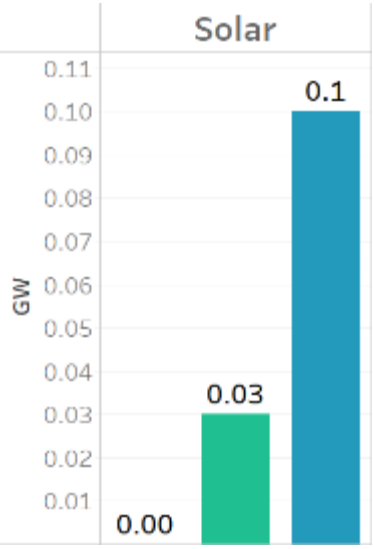


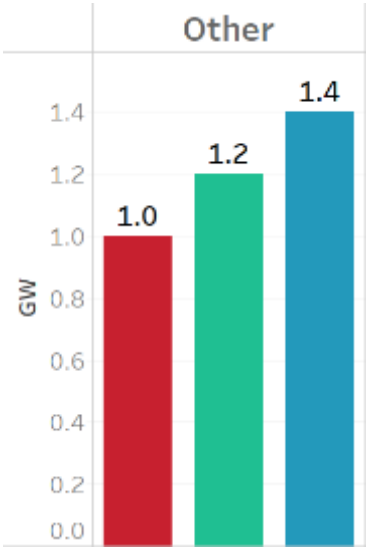


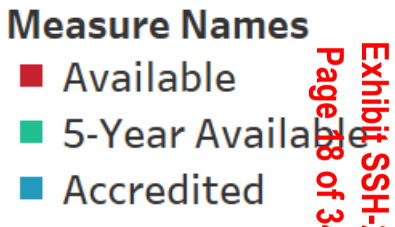








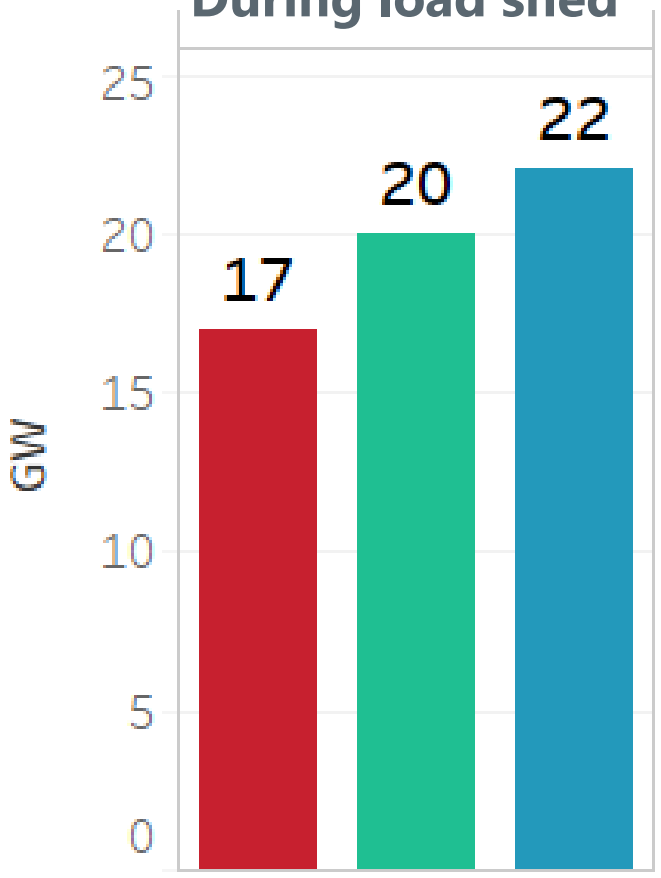




URI VS ELLIOTT COAL AVAILABILITY

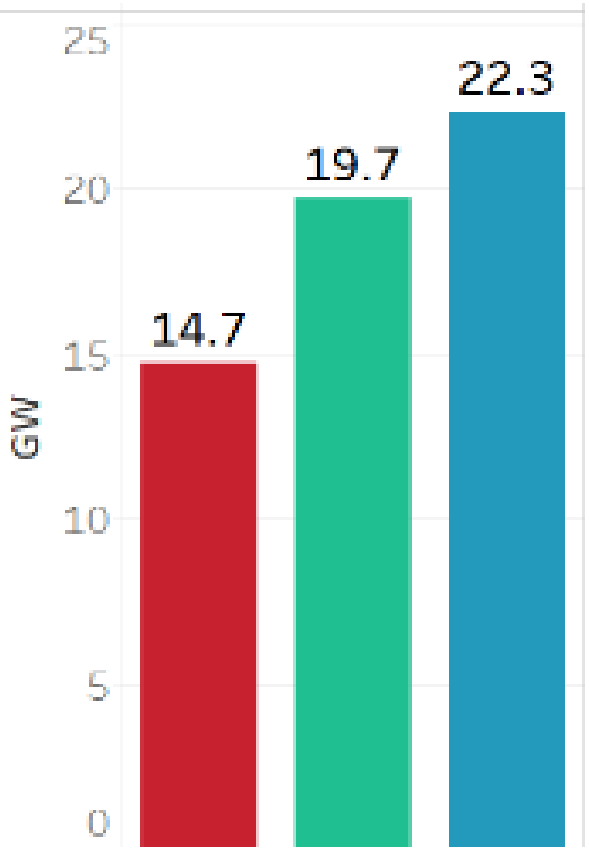
Uri

During load shed



Elliott

Average throughout event



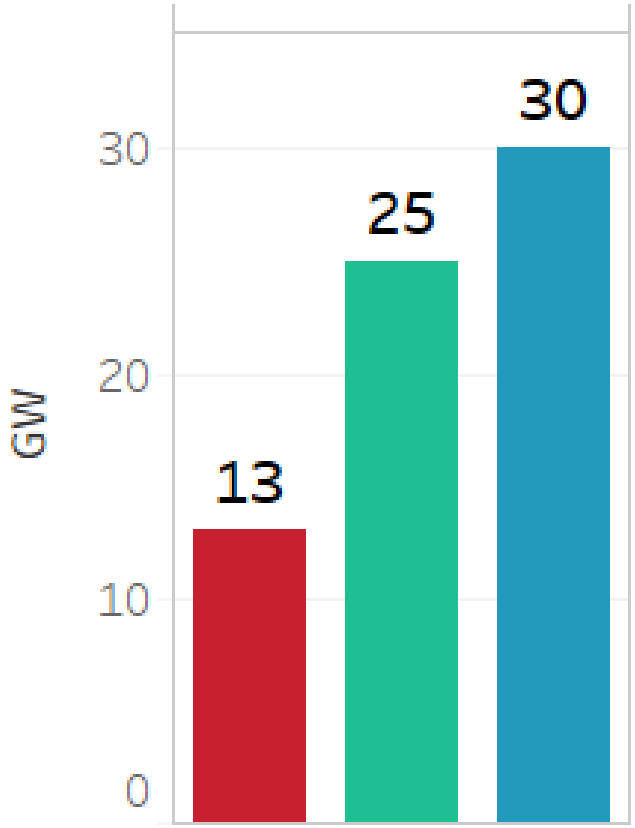
During Elliott, accredited coal performed below Uri levels by ~2.3GW

Available
5-Year Available
Accredited

URI VS ELLIOTT GAS AVAILABILITY

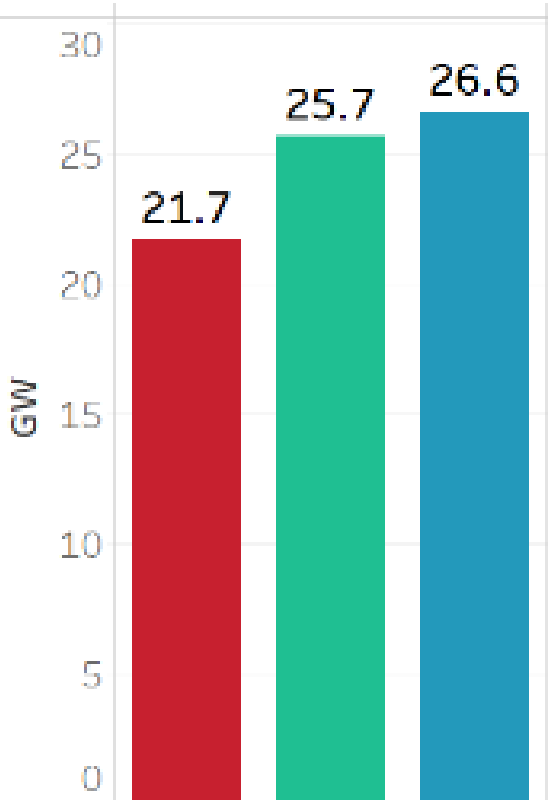
Uri

During load shed



Elliott

Average throughout event



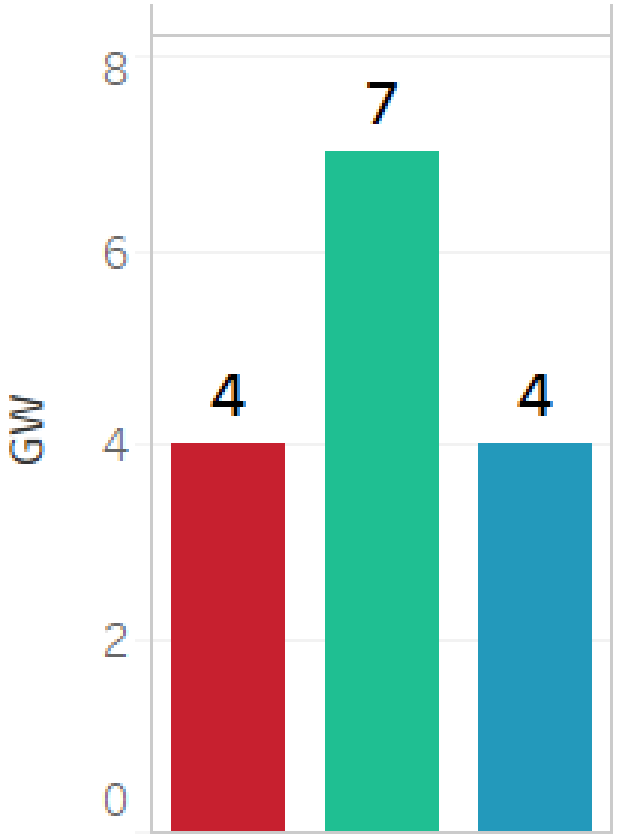
During Elliott, accredited gas performed above Uri levels by ~8.7 GW

- Available
- 5-Year Available
- Accredited

URI VS ELLIOTT WIND AVAILABILITY

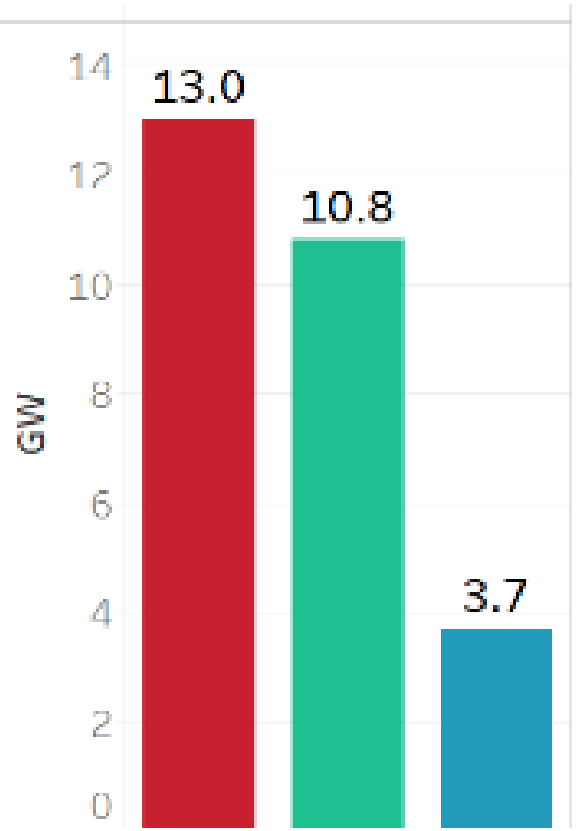
Uri

During load shed



Elliott

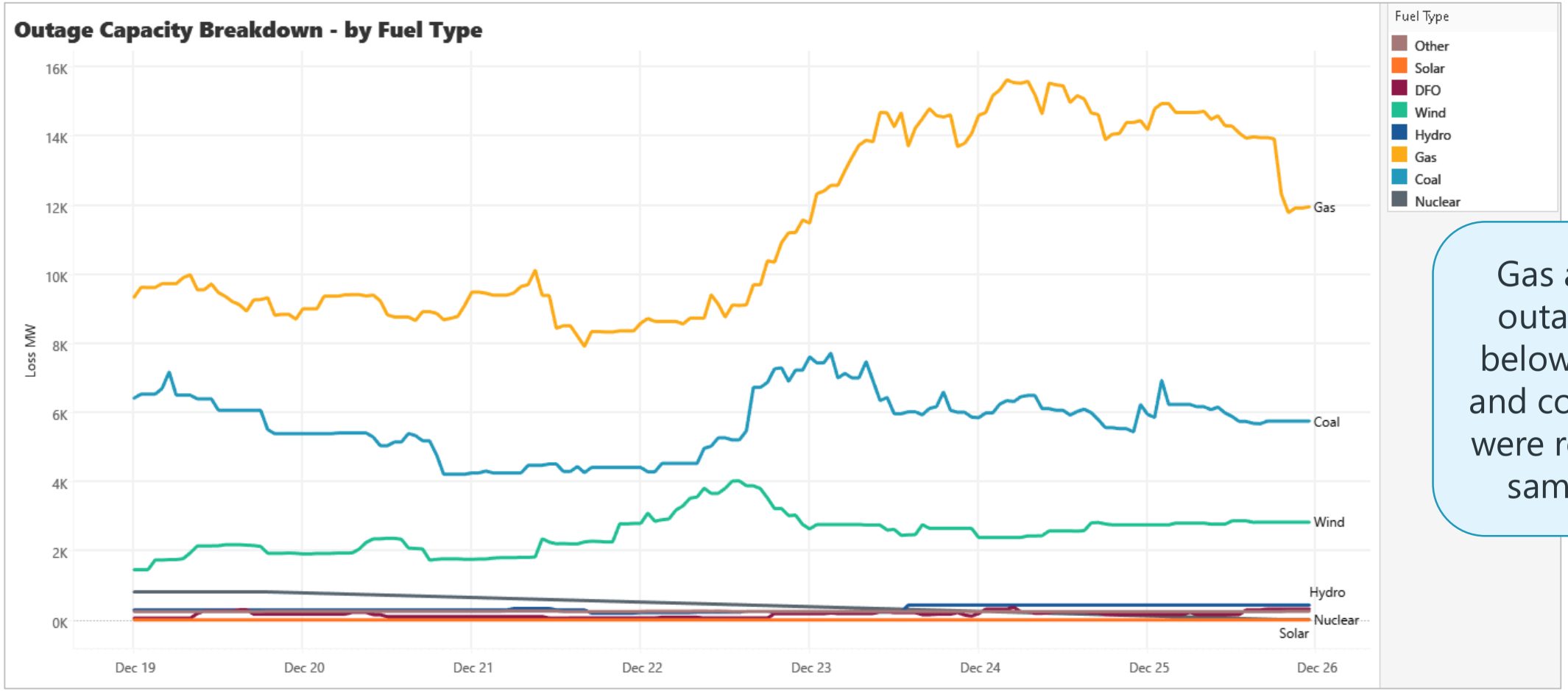
Average throughout event



During Elliott, accredited wind performed above Uri levels by ~9 GW

- Available
- 5-Year Available
- Accredited

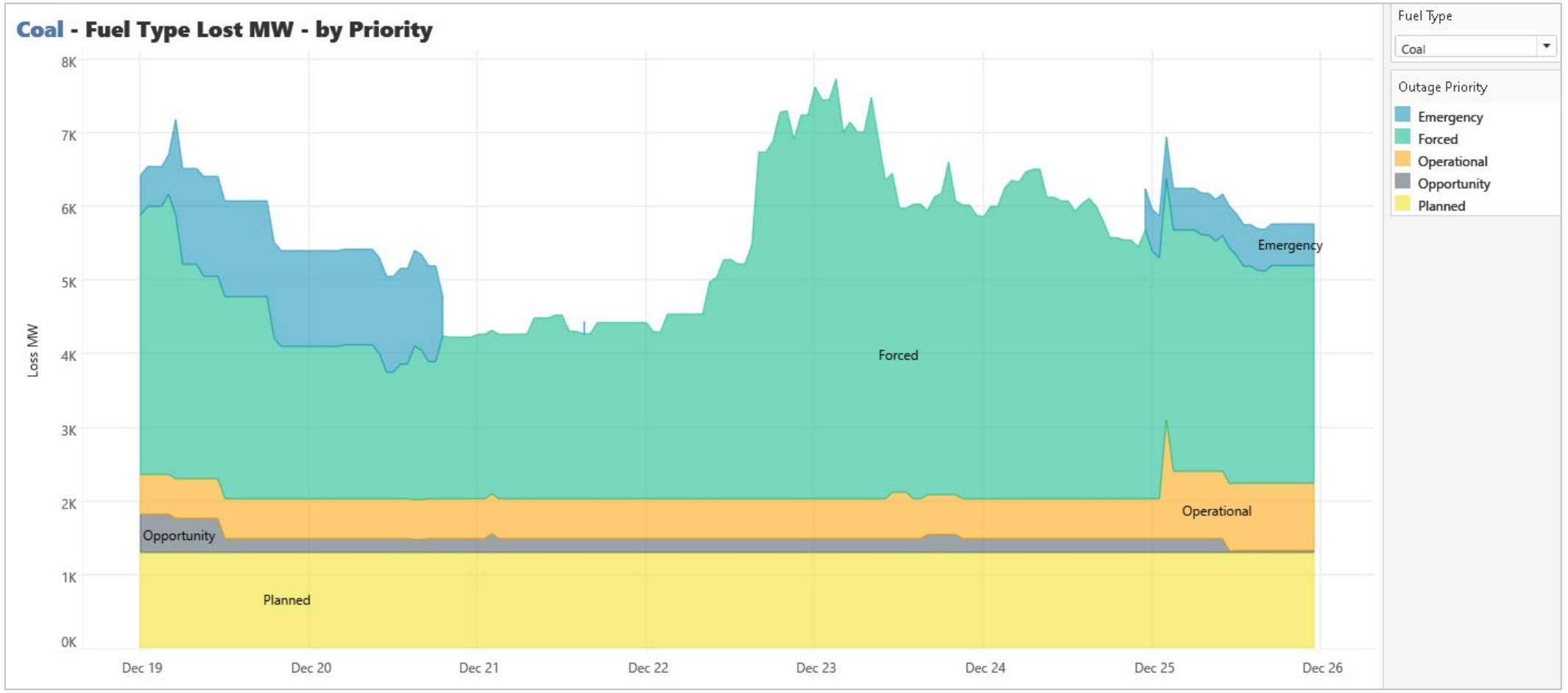
GENERATING CAPACITY OUTAGES ELLIOTT



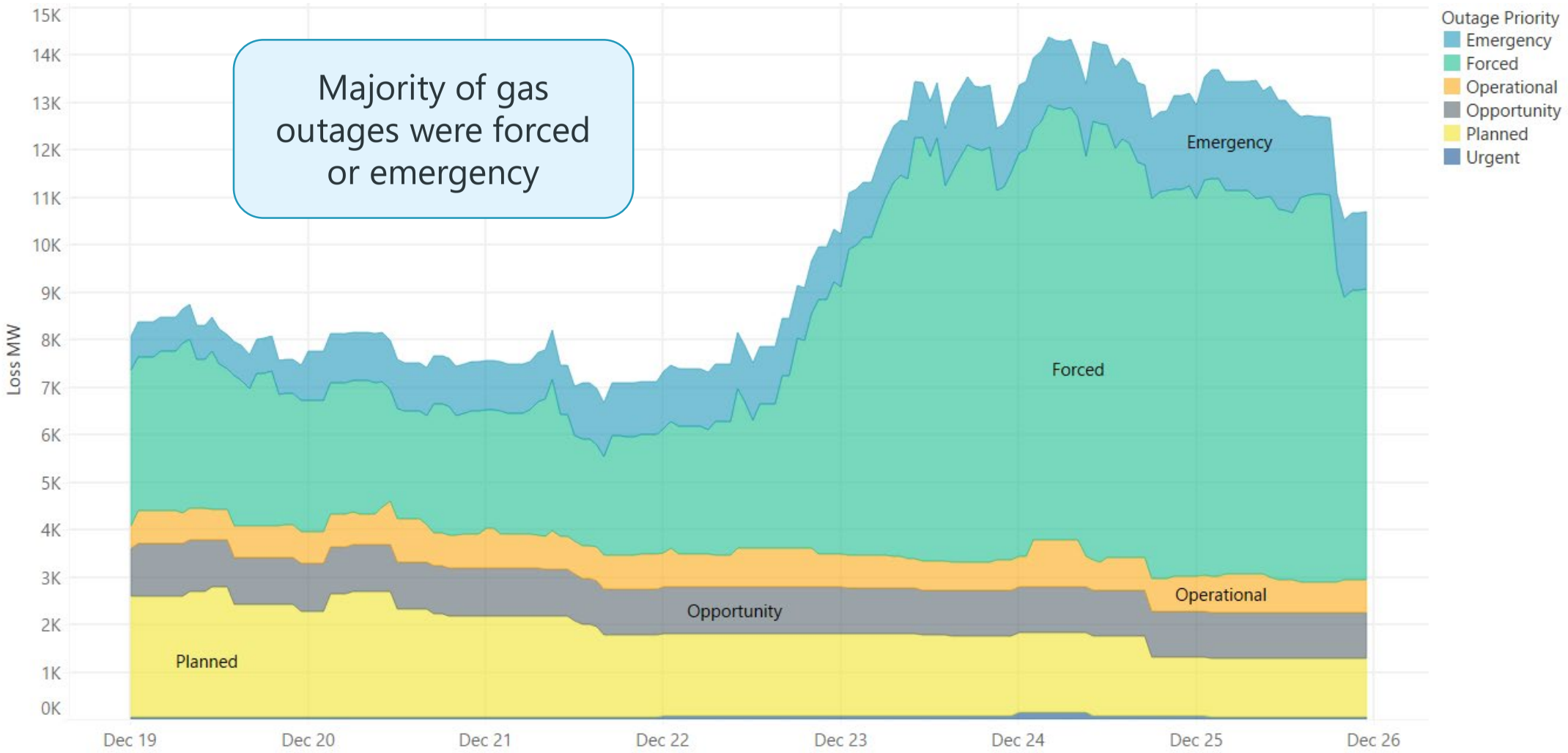
Gas and wind outages were below Uri levels and coal outages were roughly the same as URI

COAL BY PRIORITY ELLIOTT

Majority of coal outages were forced or emergency

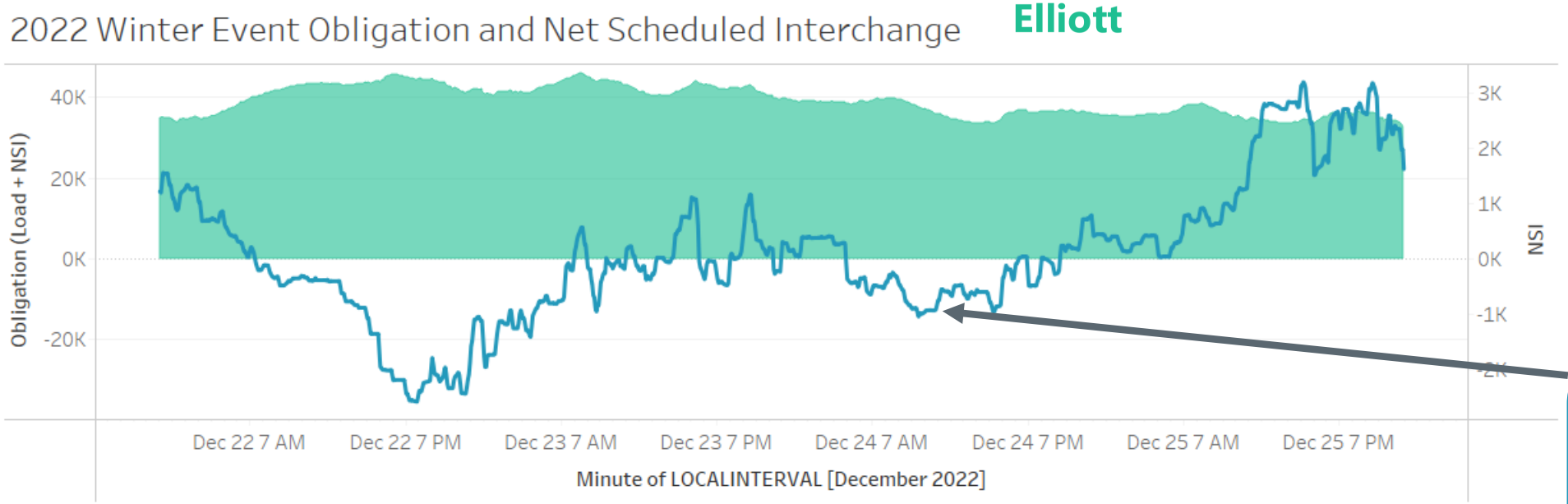


GAS BY PRIORITY ELLIOTT



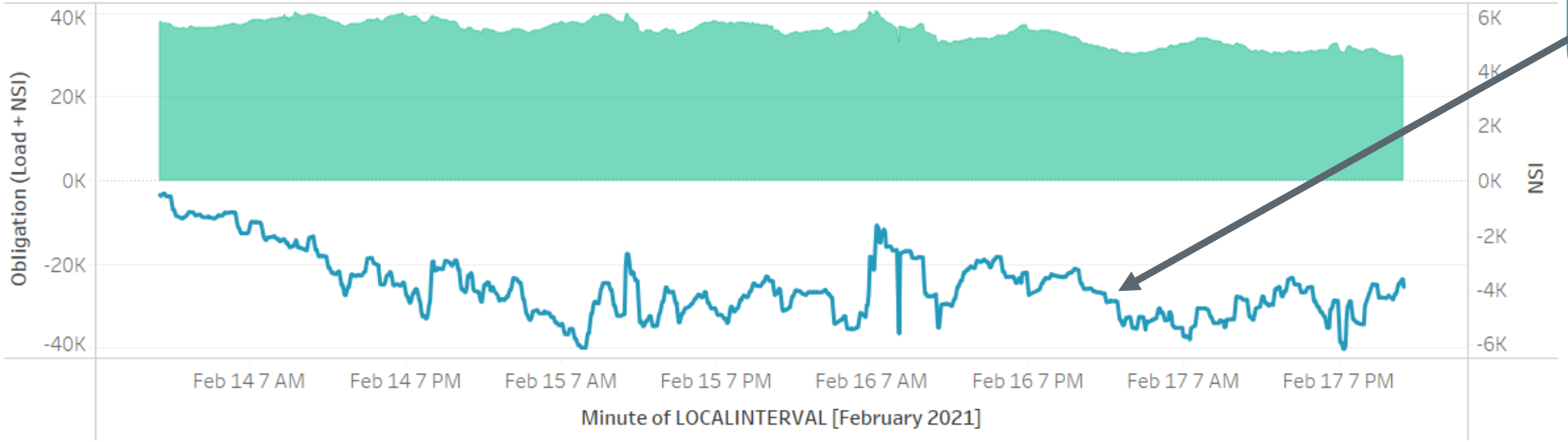
2022 Winter Event Obligation and Net Scheduled Interchange

Elliott



2021 Winter Event Obligation and Net Scheduled Interchange

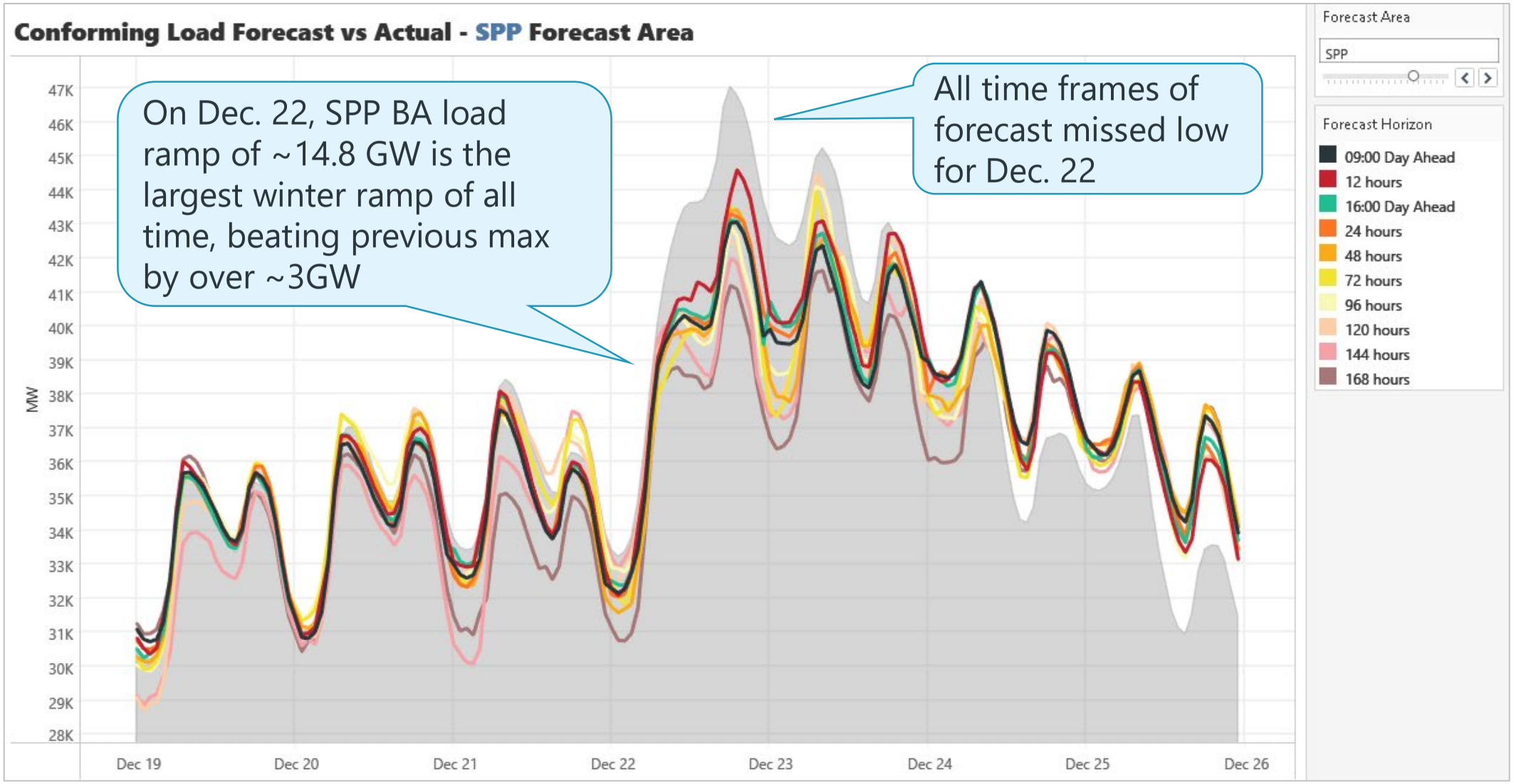
Uri



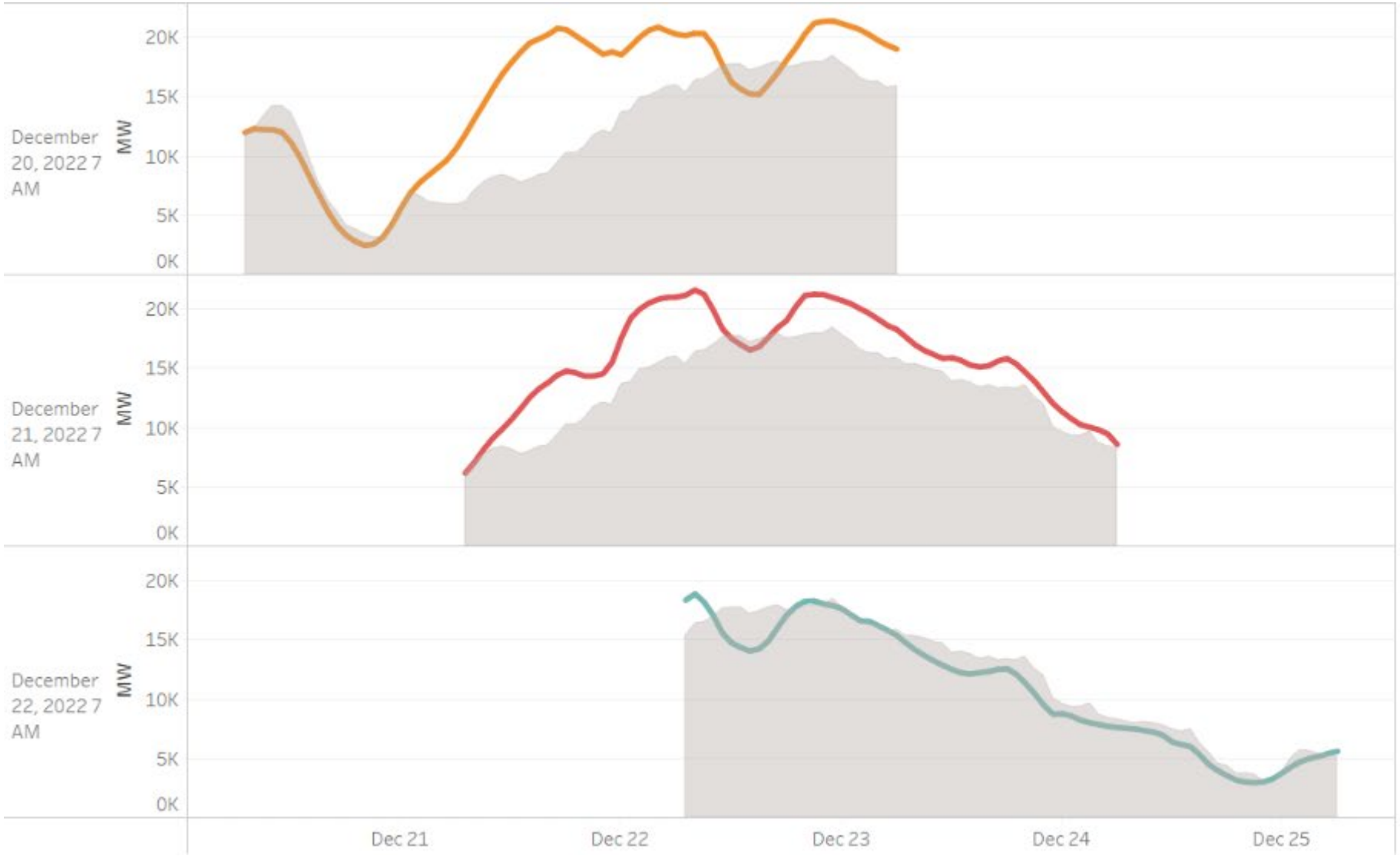
SPP imports were well below Uri levels during Elliott & SPP was exporting for much of the event

FORECAST

SPP LOAD FORECAST ELLIOTT



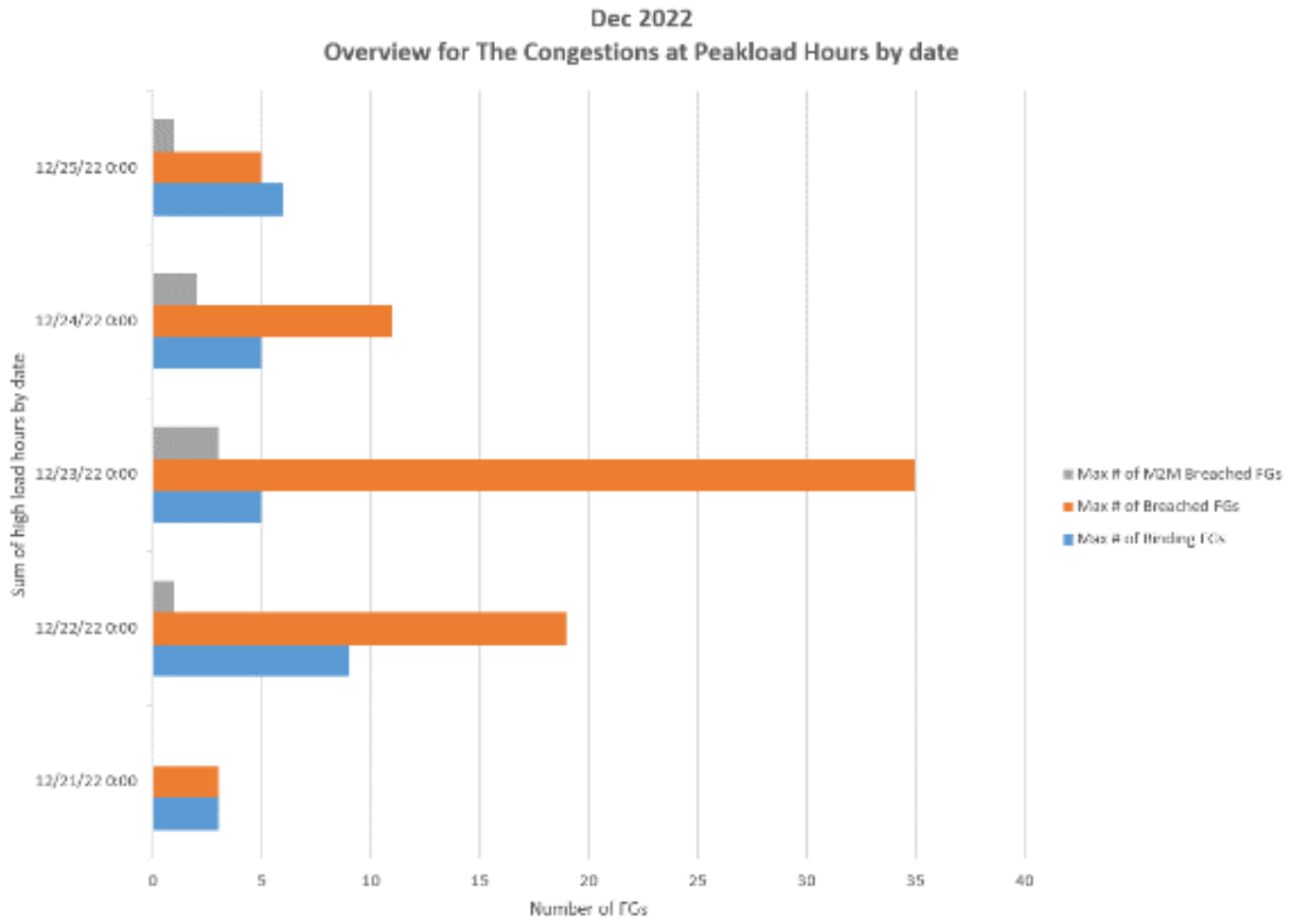
WIND FORECAST (COLD WEATHER/ICING) VS. ACTUAL ELLIOTT



"Icing" wind forecast performed very well for the event

SYSTEM CONGESTION

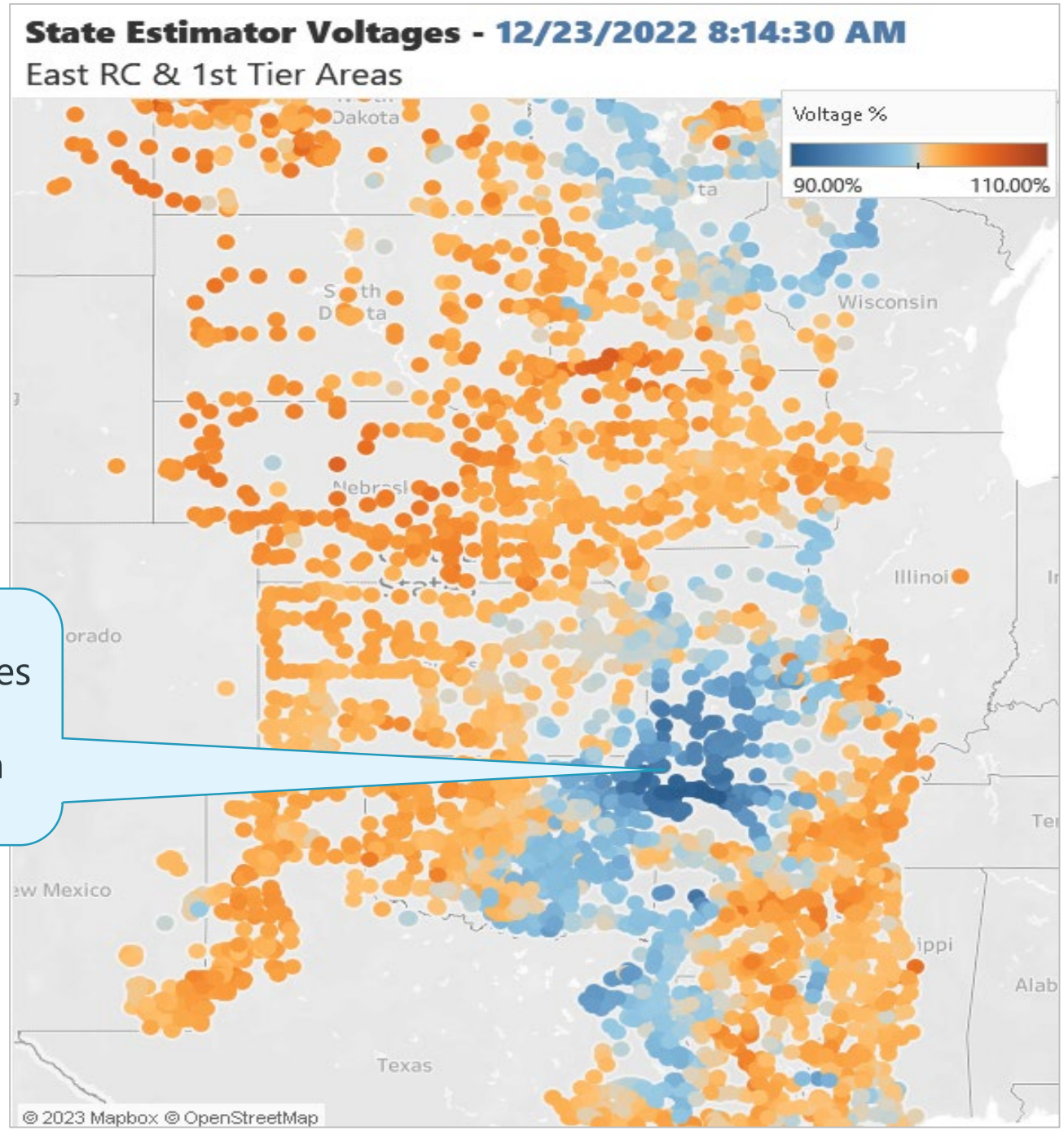
OVERVIEW FOR THE CONGESTIONS AT PEAK LOAD



- **Elliott**: Max of 35 breached flowgates, w/50-60 actively managed by Reliability Coordinator and Markets
- **Uri:** Max of 28 breached flowgates, w/50-60 actively managed by Reliability Coordinator and Markets

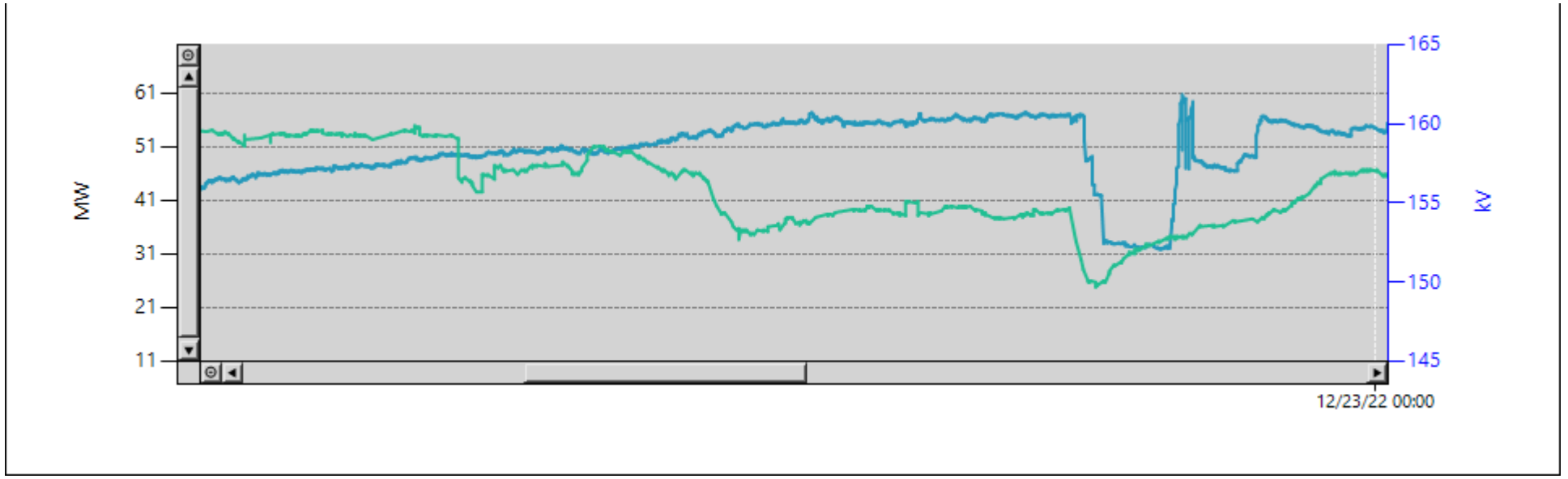
SPP VOLTAGE HEAT MAP
ELLIOTT

SW Missouri/NW Arkansas experienced extremely low voltages caused by resource trips, lack of deliverability and parallel system flows



TOP-DIRECTED LOAD SHED

- Low voltages ultimately resulted in TOP-directed load shed
  - EDE shed appx 25 MW on 12/22 from 21:00 to 21:15 primarily due to the lack of ability to deliver available native resources



NEXT STEPS

Complete post event review and gather lessons learned

Participate as requested in FERC/NERC/MRO inquiry

Continue to support resource adequacy efforts

- IRATF
- SAWG
- RSC

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