MISSOURI PUBLIC SERVICE COMMISSION
FINANCIAL AND BUSINESS ANALYSIS
AND INDUSTRY ANALYSIS DIVISIONS
AND REGULATORY ANALYSIS DEPARTMENT REPORT

IN THE MATTER OF THE CAUSE OF THE FEBRUARY 2021
COLD WEATHER EVENT AND ITS IMPACT ON
UNION ELECTRIC COMPANY, INC.
D/B/A AMEREN MISSOURI

FILE NO. GO-2021-0362

APRIL 30, 2021

IN THE MATTER OF THE CAUSE OF THE FEBRUARY 2021 COLD WEATHER EVENT AND ITS IMPACT ON UNION ELECTRIC COMPANY, INC. D/B/A AMEREN MISSOURI FILE NO. GO-2021-0362

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IN THE MATTER OF THE CAUSE OF THE FEBRUARY 2021 COLD WEATHER EVENT AND ITS IMPACT ON UNION ELECTRIC COMPANY, INC. D/B/A AMEREN MISSOURI FILE NO. GO-2021-0362

I. Introduction

On February 24, 2021, the Missouri Public Service Commission ("Commission") issued an *Order Directing Staff to Investigate and Submit Report* ("Investigation Order") noting, "Much of the Midwest, including Missouri, experienced unseasonably cold temperatures in February 2021. Such temperatures resulted in rolling electrical blackouts and extreme natural gas price spikes in Missouri."

In its Investigation Order, the Commission directed its Regulatory Analysis and Customer Experience Departments, with assistance from its Industry Analysis and Financial Analysis Divisions, to investigate Missouri's electric and natural gas utilities' preparation for and response to Missouri's February 2021 extreme cold ("Cold Weather Event") and to report their findings to the Commission in no later than April 22, 2021.

On April 15, 2021, Staff filed a motion requesting the Commission open 10 additional files, one for each investor-owned electric and natural gas utility and to issue protective orders in each file to address confidentiality issues. On April 21, 2021, the Commission issued a Protective Order and Notice that Additional Files Have Been Opened as more specifically outlined below.

On April 21, 2021, Staff filed a motion asking for additional time, until April 30, 2021, to file its report. The Commission granted Staff's motion on April 22, 2021.

The Commission, in its Investigation Order, further directed that,

> Such a report should summarize analysis performed by the RTOs, market monitors, FERC, NERC, or any other relevant body. The report should also include

information from the utilities as to their response measures, impacts on customers, and lessons learned going forward.

This Report provides the analysis and observations of members of the Industry Analysis and Financial Analysis Divisions, including the Customer Experience Department, ("Staff") and the Regulatory Analysis Department, and provides some recommendations Staff identified during its investigation to date. Staff also identified areas requiring additional analysis, and will provide additional information in this docket or in other dockets as appropriate. Regularly used terms and definitions are included in Appendix A, Appendix of Acronyms and Key Terms.

During its investigation, Staff received Highly Confidential, Confidential, and public responses to its requests for information. The public information is provided in this Report. The company-specific information, including Highly Confidential and Confidential material, will be filed in the following docket assigned to that utility.

i. EO-2021-0358: Union Electric Co., Inc. d/b/a Ameren Missouri (Electric)
ii. EO-2021-0359: Evergy Missouri West, Inc.
iii. EO-2021-0360: Evergy Missouri Metro, Inc.
iv. EO-2021-0361: The Empire District Electric Co. d/b/a Liberty
v. GO-2021-0362: Union Electric Co., Inc. d/b/a Ameren Missouri (Gas)
vi. GO-2021-0363: Spire Missouri, Inc. d/b/a Spire Missouri West
vii. GO-2021-0364: Spire Missouri, Inc. d/b/a Spire Missouri East
viii. GO-2021-0365: The Empire District Gas Co., d/b/a/ Liberty
ix. GO-2021-0366: Liberty Utilities (Midstates Natural Gas) Corp. d/b/a Liberty
x. GO-2021-0367: Summit Natural Gas of Missouri, Inc.

Contributor: Natelle Dietrich

II. Summary of February 2021 Cold Weather Event

From all indications, planning for the Cold Weather Event began as early as Monday, February 1, 2021, with Staff receiving the first calls related to the event starting February 13, 2021. As part of monitoring and planning for a weather event, the regional transmission operators ("RTO") use an Energy Emergency Alert ("EEA") rating system. Under this system: EEA 1 status means the RTO suggests utilities issue public alerts; EEA 2 status means the RTO requires the utilities to provide public awareness encouraging customers to conserve; and, EEA 3 status means the RTO may require potential interruptions or load shedding.

The extreme cold temperatures, extended period of those temperatures, and precipitation contributed to what some have described as an "85 year event". The Southwest Power Pool ("SPP") indicated this was the first time in SPP history that it had to move to EEA 2 or EEA 3 status.

According to the National Weather Service, the western side of the state experienced the coldest temperatures, while the St. Louis and Springfield areas experienced larger snowfall amounts. As depicted in more detail in the graphs below for each area, from February 11 through February 17, 2021:

Kansas City saw temperatures from -13 degrees to 23 degrees during this period, with February 15 having a high temperature of -1 degree and a low temperature of -10 degrees. Snow depths were about 1 to 3 inches during this period.

Springfield saw temperatures from -15 degrees to 19 degrees during this period, with February 15, 2021 having a high temperature of 0 degrees and a low temperature of -9 degrees. Snow depth on February 17, 2021 was about 7 inches.

St. Louis saw temperatures from -4 degrees to 22 degrees during this period, with February 15, 2021 having a high temperature of 4 degrees and a low temperature of 0 degrees. Snow depth on February 16, 2021 was about 7 inches.

While the daytime highs on February 16, 2021 were generally in the double digits, each area saw its lowest temperatures on that day, with Kansas City and Springfield hitting lows of -13 degrees and -15 degrees, respectively.

Figure 1

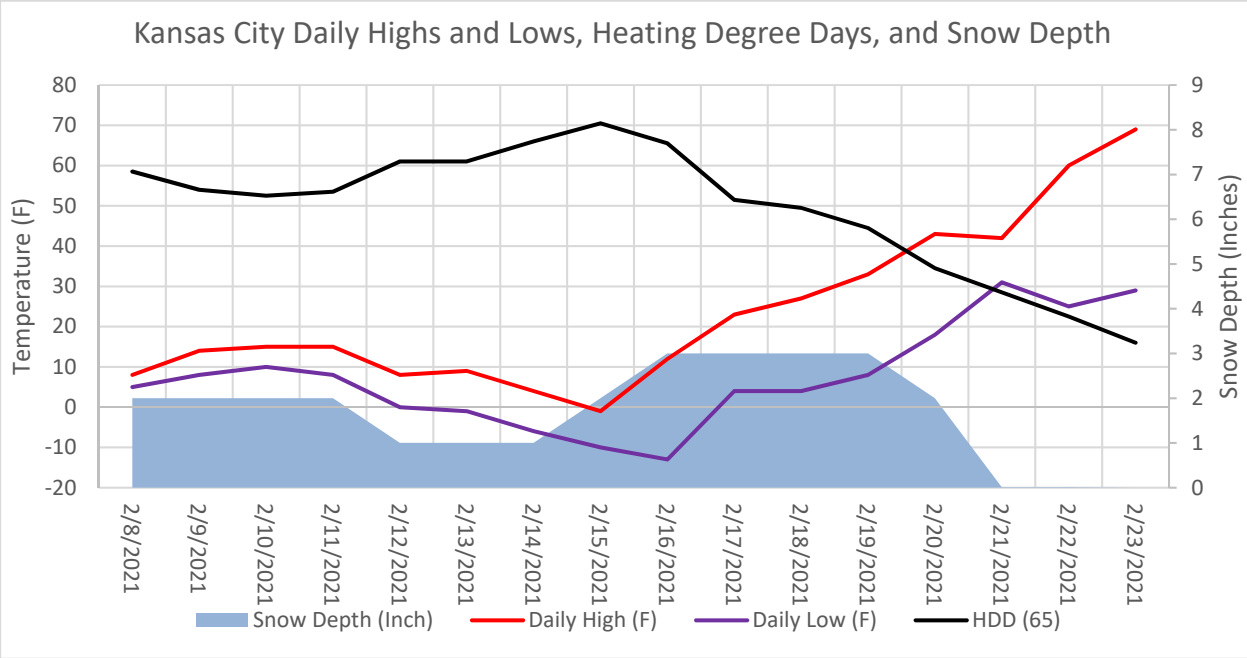


Figure 2

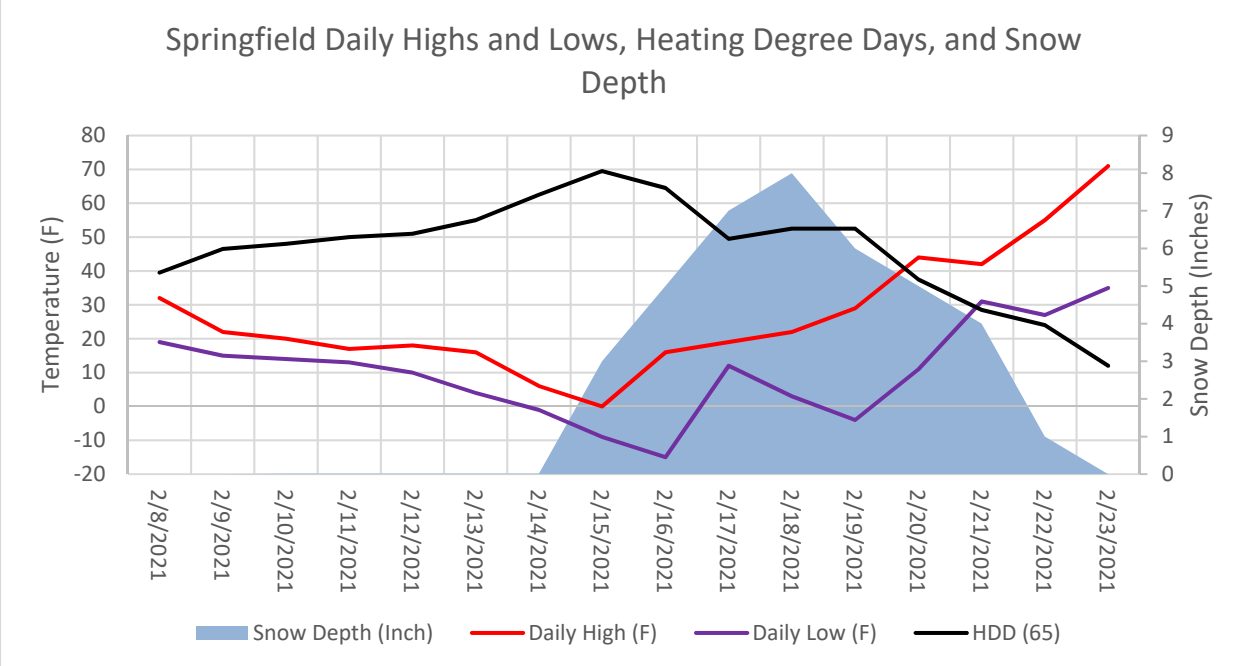


Figure 3

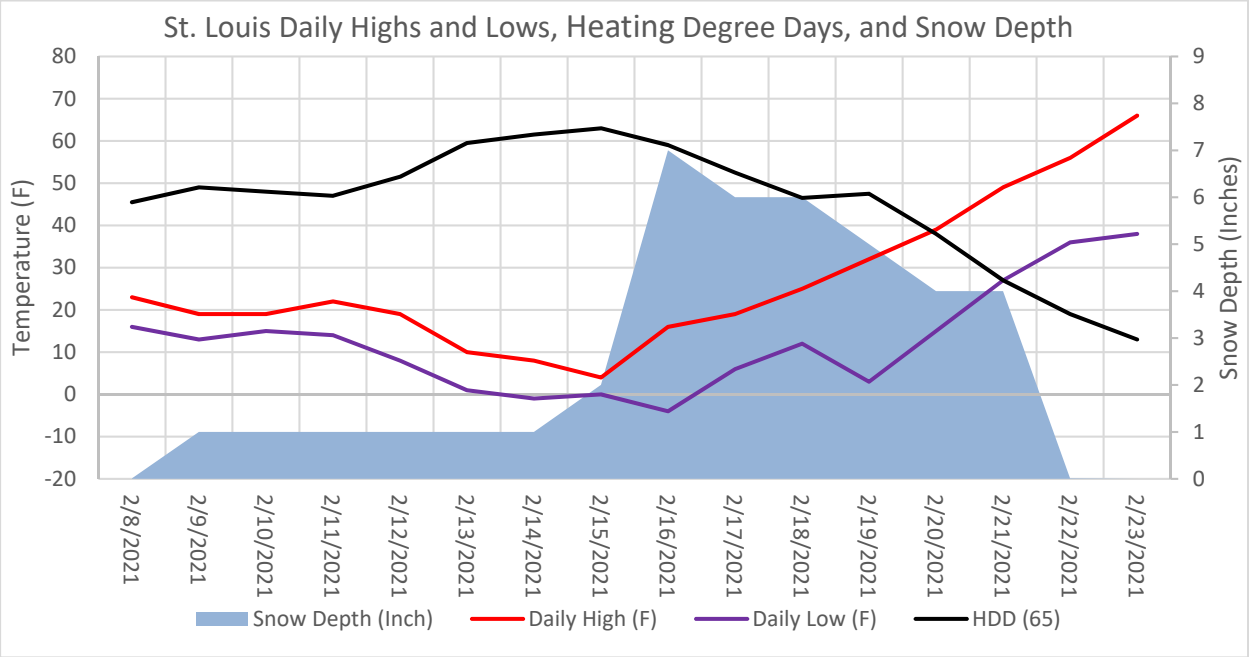
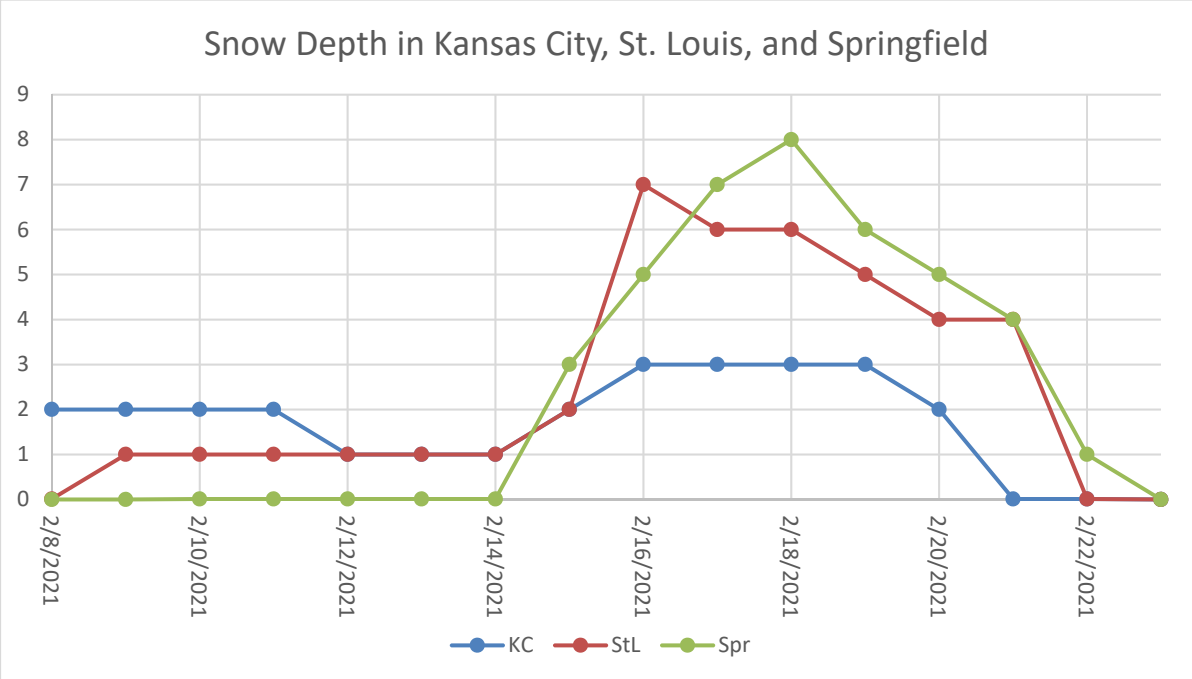


Figure 4



On February 17, 2021, an ice jam formed on the Missouri River in the bend approximately 1 mile upstream from Jefferson City, Missouri. Ice build-up extended approximately 15 miles upstream. The river level below the ice jam dropped from four feet to -0.3 feet in a matter of a few hours. Downstream of the ice jam, the flow dropped by more than 50 percent from about 37,000 cfs (cubic feet per second) to about 17,000 cfs. The next day, February 18, 2021, the Corps of Engineers flew along the Missouri River to investigate. They found the ice back up extended more than 60 miles upstream. Downstream, the river level continued to drop; the lowest recorded level on the gauge at the Missouri River Bridge during the ice jam was -0.5 feet (or one-half foot below zero) on Friday, February 19, 2021. On Monday, February 22, 2021, the ice jam broke loose, resulting in the river level jumping up approximately seven feet in just 15 – 20 minutes.[1]

Contributor: Natelle Dietrich

III. Interstate, Regional and Federal Regulatory Entities Preparation for and Response to the Cold Weather Event

A. Natural Gas Interstate Pipelines Preparation for and Response to the Cold Weather Event

1. Background

The natural gas system from extraction at its source to delivery to its end-users is divided into three key phases, as shown in Figure 5, which are:

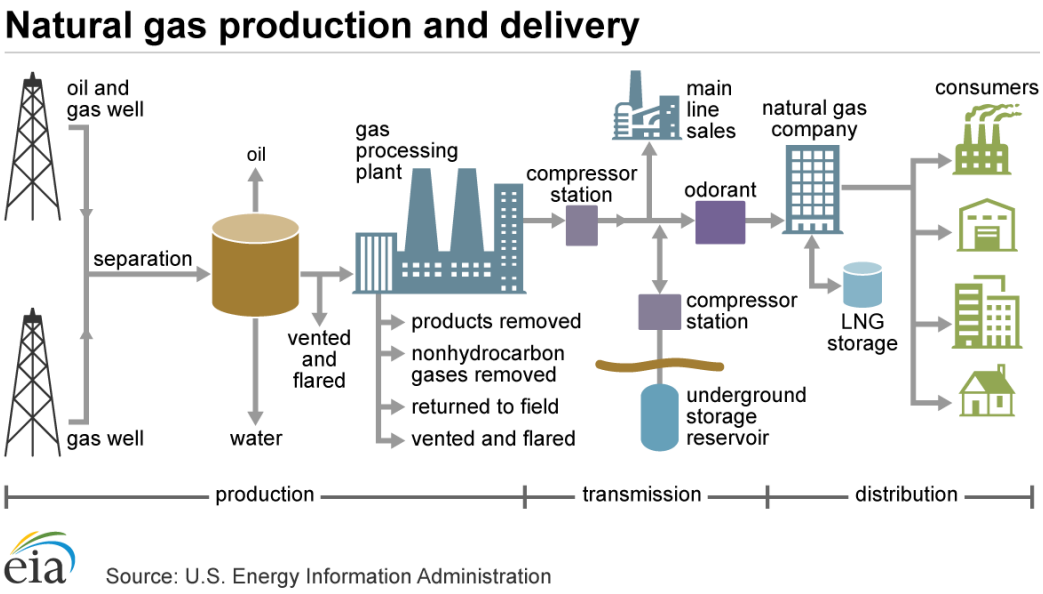
- **Production** – This involves the extraction and processing of the natural gas to meet minimum quality and safety standards in order to be discharged into the transmission system.
- **Transmission** – This involves the transportation of the gas from where it is injected into the interstate pipeline system to where it is discharged from the interstate pipeline system

[1] NEWS. Update for Missouri American Water Staff. Appendix B.

to either a direct customer or to a distribution system. The transmission phase also includes storage.

- **Distribution** – This involves the delivery of the gas through a distribution system to various types of end-user customers.

Figure 5



Source: https://www.eia.gov/energyexplained/natural-gas/

2. Missouri Natural Gas Shippers or End Use Natural Gas Customers[2] Have Access to Diverse Natural Gas Sources

Natural gas is transported to and through Missouri on an interconnected network of interstate pipelines[3] from wellheads[4] in several regions of the country, many of which were adversely affected by the Cold Weather Event. Most natural gas comes to Missouri from the production

[2] Shippers are interstate pipeline customers that hold tariffed service contracts for the delivery of natural gas. The term "customer" and "end-use customer" are used interchangeably with "shipper" throughout this Report.
[3] Interstate pipelines are entities engaged in natural gas transportation subject to the jurisdiction of the Federal Energy Regulatory Commission ("FERC").
[4] A wellhead is equipment at the top of the well that ensures safe operation and manages the flow of natural gas out of the well into the gathering system.

fields of Wyoming, Colorado, Oklahoma, Texas and/or Louisiana, but shale natural gas from areas like the Appalachian Basin also flows into Missouri. Twelve interstate pipelines, which are part of the natural gas transmission system, pass through portions of Missouri[5] providing transportation and delivery of natural gas to end-users. The end-users include industrial customers, ethanol plants, electric generation plants, and regulated and municipal natural gas distribution systems ("LDCs")[6] that deliver to their end-use consumers, residential, commercial, and industrial customers. The Commission website includes a map of Missouri Natural Gas Pipelines with each interstate pipeline and the Missouri towns and cities that they serve.[7]

Additionally, shippers can contract with a natural gas marketer[8] to arrange for both the purchase and delivery of natural gas. Marketers will normally have a portfolio of natural gas suppliers from which they purchase natural gas on a number of natural gas pipeline segments or interconnected pipelines giving further natural gas sourcing diversity.

[5] Panhandle Eastern Pipe Line Company ("Panhandle") and Southern Star Central Gas Pipeline Company ("Southern Star") provide transportation service from western Missouri to eastern Missouri. Southern Star provides natural gas transportation to Kansas and Missouri including Joplin, Springfield, Kansas City and other parts of Missouri. ANR Pipeline Company ("ANR") serves northern Missouri while Texas Eastern Transmission ("TETCO"), Natural Gas Pipeline Company of America ("NGPL"), and Ozark Gas Transmission ("OGT") serve southeastern Missouri. Rockies Express Pipeline ("REX") connects to Panhandle in Audrain County and serves east central Missouri and St. Louis. Enable Mississippi River Transmission ("MRT") serves Missouri from the southeastern border of Missouri to St. Louis. MoGas Pipeline transports gas from Audrain County to Fort Leonard Wood. Tallgrass Interstate Gas Transmission ("TIGT") transports gas to the Kansas City region. Enable Gas Transmission serves Southwestern Missouri. Spire STL Pipeline serves the St. Louis region.

[6] Local Distribution Company ("LDC") – Any entity, other than a natural gas pipeline, engaged in the transportation or local distribution of natural gas and its sale to end-use customers that will consume the gas. Examples of LDCs include investor-owned natural gas utilities regulated by the Commission, as well as municipal utilities.

[7] https://psc.mo.gov/CMSInternetData/Gas/Missouri%20Natural%20Gas%20Pipeline%20Map%207-12-2018.pdf

[8] A natural gas marketer is an entity that arranges purchases and sales of natural gas. Unlike pipeline companies or local distribution companies, a gas marketer does not own physical assets commonly used in the supply of natural gas, such as pipelines or storage fields. A gas marketer may be an affiliate of another company, such as a local distribution company, natural gas pipeline, or producer, but it operates independently of other segments of the company.

3. Natural Gas Production and its Impacts from Extreme Cold Weather

Natural gas straight from the ground cannot safely be injected into an interstate pipeline. It must first be processed to remove hydrocarbons and liquid and to ensure it contains a minimum Btu[9] content per cubic foot. Each interstate pipeline has a tariff approved by the Federal Energy Regulatory Commission ("FERC") setting out these minimum safety and quality standards.

To produce natural gas that meets minimum injection standards requires raw natural gas to be extracted from the ground, transported to a processing facility, and processed. Extreme weather effects, including electric power outages, can disrupt these processes and constrain natural gas supply.

Extraction, transportation, and processing gas each involve mechanical processes that require energy, either electricity or natural gas. For example, natural gas does not simply flow into or through the pipeline. It must be pushed into and through the pipeline using a series of compressors. Because each of these steps may require electricity, any interruption in electric service, like the wide spread power outages in Texas, can prevent processed natural gas from being injected into an interstate pipeline.

Natural gas extraction and processing can also be directly affected by extreme temperatures. For example, when outside temperatures drop below freezing in natural gas producing fields, if a wellhead is unprotected, water and other liquids inside wells, pipes, and valves can freeze and block or "freeze off" the flow of gas. In addition to wellheads freezing, cold can negatively affect the processing equipment that separates gas from liquids and impurities. If that equipment freezes up plants must either heat the equipment up or wait for the temperatures to rise before coming back on-line.

[9] A Btu, or British Thermal Unit, is a measure of energy or heat content of fuels or energy sources. It is a quantity of heat required to raise the temperature of one pound of liquid water by one degree Fahrenheit at the temperature that water has its greatest density (approximately 39 degrees Fahrenheit). https://www.eia.gov

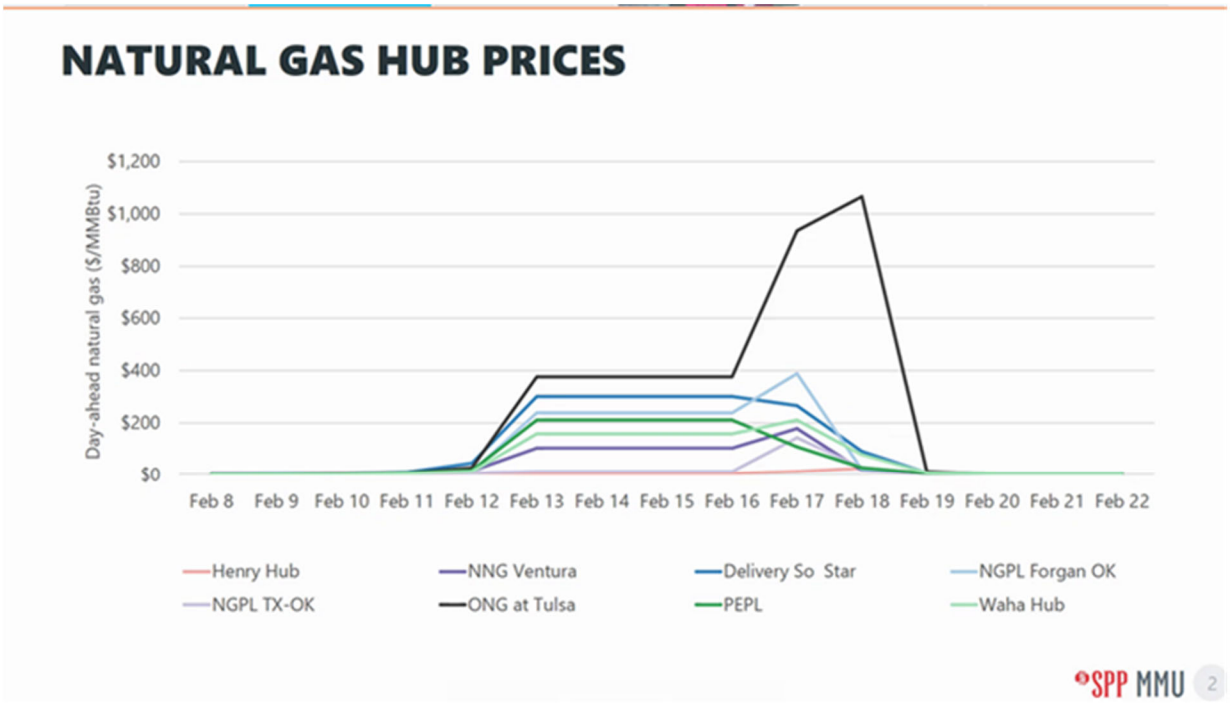
A number of wellheads reportedly froze off in Colorado, Oklahoma, and Texas during the Cold Weather Event constraining local natural gas production. In Texas, arguably the state hardest hit by the Cold Weather Event, Dan Woodfin, a senior director at the Electric Reliability Council of Texas ("ERCOT"), was quoted by the Texas Tribune stating on February 16, 2021, "It appears that a lot of the generation that has gone offline today has been primarily due to issues on the natural gas system."[10]

Weatherization of wellheads can normally allow wellheads to continue production well below freezing. However, weatherization requirements for wellheads are typically regulated by the state in which they are located. The lack of weatherization requirements in Texas, may have contributed to some of their wellhead freeze offs.

During the peak price period between February 16 and 17, 2021, the price escalated in part due to little or no natural gas being available for purchase in certain areas due to not only increased demand, but also production and processing issues resulting from the Cold Weather Event. The chart below shows the day-ahead price per MMBtu[11] reported by S&P Global[12] for natural gas at key distribution hubs[13] within the Southwest Power Pool's ("SPP's") footprint during the Cold Weather Event.

[10] *Texas largely relies on natural gas for power. It wasn't ready for the extreme cold*, by Erin Douglas, The Texas Tribune, February 16, 2021, 5p.m. Central.
[11] A MMBtu is measurement of heat content equal to ten therms, which is equivalent to one dekatherm.
[12] S&P Global Market Intelligence is a provider of multi-asset class and real-time data, research, news and analytics.
[13] A natural gas transportation hub is a central point of interstate natural gas pipeline transmission system infrastructure where natural gas supplies can flow between interconnected pipelines. Hubs are used as a central pricing points for the interstate natural gas market.

Figure 6



4. Natural Gas Storage and Transmission Pipeline Interconnectivity Can Help to Mitigate the Effects of the Natural Gas Price Volatility and Extreme Weather Events

Interstate Pipelines are essential to the natural gas industry, as they transport natural gas from where it is produced to where it is used. Interstate natural gas pipelines typically interconnect with other interstate pipelines, which allows them to offer shippers access to production fields or natural gas marketers not directly connected to their system.

Many interstate pipelines have natural gas storage available. The natural gas is typically stored underground in either depleted natural gas or oil reservoirs, salt cavern formations or aquifers. The storage of natural gas allows shippers the opportunity to reduce natural gas price volatility by buying natural gas when the price is low and then withdrawing the gas from storage later when the

price is higher. The storage of natural gas also allows customers to have another source of natural gas available when natural gas supply is limited or the shipper's demand exceeds its nominations.[14] During the Cold Weather Event, natural gas marketers and shippers were able to minimize the impacts of the wellhead freeze offs in Texas and Oklahoma by having a portfolio of suppliers from which they purchased natural gas on a number of different interstate natural gas pipeline segments. Most shippers, including those in Missouri, were generally able to reach out to marketers and producers that still had natural gas available and to contract for transportation to make up for the natural gas from other regions that did not show up.

5. Securing Delivery of Natural Gas is a Two-Step Process

Getting natural gas to a citygate,[15] which is a withdrawal point, is a two-step process; it typically requires both contracting to buy the natural gas and contracting with an interstate pipeline to transport that natural gas. Different types of contracts are available for both purchasing and transporting natural gas. Each shipper decides which types of gas purchase and transportation contracts and combinations it will enter into based upon the price and level of risk it is willing to bear.

a. Pricing Under Natural Gas Purchase Contracts

While interstate pipelines are regulated by FERC, the purchase price of natural gas is not regulated.[16] The sale of natural gas between two parties is considered an arms-length transaction

[14] A nomination is a formal request by a shipper or marketer to transport natural gas on a pipeline. Shippers, or marketers on their behalf, are required to schedule the transportation of natural gas through a day-ahead nomination process with the interstate pipeline. The nomination cycle provides for an initial nomination and an evening and three intraday nominations to balance the receipt of natural gas into the interstate pipeline and the delivery of natural gas at the shipper's destination. Interstate pipelines require nominations to allow them to manage the system and match up injections and deliveries.

[15] A citygate is a point or measuring station at which a distributing gas utility receives gas from a natural gas pipeline company or transmission system.

[16] FERC routinely monitors both natural gas and electric prices throughout the United States and has the ability to investigate any perceived manipulation of prices and to assess penalties. However, the fact that an investigation is ongoing, as well as any information received in the course

and the price is set by the market or whatever price customers are willing to pay. Customers may purchase natural gas directly from the gas producer or through marketing companies. The customer then contracts with the interstate pipeline to transport the gas from its receipt point to the customer's facility or delivery point. Marketing companies may also contract with the pipeline for transportation service so that the end use customer pays a single price to the marketer at the point of delivery. The shipper of the natural gas, the entity that intends to take the gas off the pipeline at the delivery point, holds the contractual agreement with the natural gas producer or marketer. That private contract will set the price per unit of gas, quantity of gas and delivery date(s).

Natural gas may be priced in a number of ways:

- A fixed price may be negotiated with the producer for a quantity of gas to be delivered at a location for a period of time in the future;
- A gas price may be set based on NYMEX[17] (Henry Hub, Louisiana price) plus a basis differential associated with the delivery point or trading hub on a designated pipeline;
- A first of the month ("FOM") price based on an index platform may set the price for gas deliveries throughout the month; or,
- A spot market price for each day gas is traded (Monday through Friday, except for federal holidays) is also available.

Of these, the spot market price is most volatile as it tends to fluctuate based upon supply and demand, weather conditions, and or pipeline constraint issues. Gas prices vary from pipeline to pipeline and region by region.

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of an investigation, are treated as non-public unless FERC expressly authorizes the public disclosure thereof. The FERC Office of Enforcement annually publishes its Annual Report on Enforcement highlighting significant investigations, including those that have proceeded to FERC Orders to Show Cause and those litigated in Federal District Court.

[17] The New York Mercantile Exchange ("NYMEX") is a commodity futures exchange that includes a natural gas trading platform based on the index price of natural gas at the Henry Hub in Louisiana.

b. Pricing Under Natural Gas Interstate Transportation and/or Storage Contracts

Each interstate pipeline has a FERC-approved tariff that sets out the rates it may charge for different types of transportation and storage services, as well as penalties that may be charged and other actions that may be taken to maintain the integrity of the pipeline system. The physical properties of natural gas limit the storage and operating parameters of all interstate pipelines, and both interstate pipelines and storage facilities can only hold and/or transport a finite amount of natural gas at any given time. One key factor in maintaining the safety and integrity of the pipeline system is to ensure the pressure in the pipeline is in an acceptable range, so gas withdrawn downstream on an interstate pipeline must be matched closely with gas receipts or withdrawn from storage.

There are three predominate types of transportation and storage services that can be contracted for under a transportation and/or storage contract. These are:

- Firm Transportation ("FT") service,
- Interruptible Transportation ("IT") service, and
- Firm Storage ("FS")[18] service.

Customers may opt to enter in to contracts for any combination of these services.

A FT contract guarantees the shipper a set portion of the limited capacity on the interstate pipeline to transport gas from a receipt point, where the natural gas enters the pipeline, to a delivery point. Interstate pipelines are also divided into zones. Typically, the interstate pipeline has a production or field zone and market zone. The longer the pipeline, typically the more zones. A FT rate is set for each zone. The total FT charge to the shipper depends on which zone the receipt of gas takes place in, how many zones the natural gas is transported through and which zone delivery occurs in. It is not unusual for interstate pipelines to offer discounted FT service to shippers. FT contracts

[18] Each interstate pipeline submits to FERC on a quarterly basis an Index of Customers which includes all FT and FS contracts. This information is available to the public.

are for up to a finite quantity of gas, measured in dekatherms ("Dths")[19] to be delivered every day of the contract period.

Similar to a FT contract, a FS contract guarantees the shipper a set portion of limited storage capacity in the interstate pipeline's storage facilities and provides an opportunity to reduce the impact of price volatility and natural gas limitations. The storage contract also sets the maximum quantity of natural gas that may be injected into or withdrawn from the storage facility on a daily basis. The costs of operating and maintaining a natural gas storage field are included in the interstate pipeline's FS rates. Interstate pipeline customers can enter into storage contracts for the storage of specific quantities of gas. Interstate pipeline storage is available to any customer willing to pay. However, as with pipeline capacity, there is a physical limit to the amount of natural gas that each gas storage field can accommodate.

IT service is another contractual transportation service regularly offered by natural gas pipelines regularly where transportation capacity is not guaranteed. Under IT service, a shipper can only transport natural gas on the interstate pipeline if there is sufficient capacity available on the pipeline after all FT customers' gas is accounted for.

FT and IT rates can vary greatly between interstate pipelines as they are based upon each individual interstate pipeline's cost of service. So, when deciding where and how much to pay for natural gas, shippers will factor in the transportation rates on the interstate pipelines needed to transport that natural gas, and may enter any combination of FT and/or IT.

Failing to reserve adequate firm capacity can have serious consequences. For example, a shipper for a natural gas electric generation unit may only contract for IT service if that generation unit is normally used only to cover summer peak electric demand. However, if, as happened to some during the Cold Weather Event, that unit is needed to run during a period when transportation

[19] A dekatherm is a measurement of heat content equal to ten therms, which is equivalent to 1 MMBtu. This measurement is required by FERC for interstate pipeline transportation contracts. A dekatherm is approximately equal to a Mcf when adjusted for temperature and atmospheric pressure.

demand is high, the interstate pipeline may well not have room to carry that IT capacity. Thus, regardless of the availability of natural gas supply, the shipper may not be able to get natural gas to the unit. Similarly, if a FT shipper does not hold sufficient natural gas pipeline capacity to meet its demand, it will need to enter an additional contract to transport that additional natural gas. If that excess demand occurs during a period of high demand on the pipeline, such as the Cold Weather Event, the shipper may find itself unable to find capacity or space on the pipeline to transport that additional natural gas. Ultimately, it is within the shipper's discretion, whether an industrial customer, LDC, or municipal utility, as to what level of risk it is willing to accept when entering transportation contracts with interstate pipelines.

6. Information on Cold Weather Event and Natural Gas Operations

The temperatures experienced throughout the Midwest were well below normal during the Cold Weather Event that occurred between February 8 and February 18, 2021. According to press releases, natural gas wellheads in multiple states were to some degree impacted by the abnormal cold weather. Preparation for the Cold Weather Event and the ability to weatherize the wellheads influenced whether natural gas was available to flow or not. There is no publicly available information site that gathers specific details on wellheads that were shut-in or not operational. Each interstate pipeline would have the details of which of its line segments were able to deliver gas to meet nominations of its shippers and which line segments had issues with producers not being able to deliver natural gas. There were some reported incidents of natural gas deliveries being interrupted or interstate pipeline segments having pressure issues and interstate pipeline interruptible customers were likely not able to transport natural gas during some days and hours of the Cold Weather Event. FT customers were also notified by interstate pipelines if issues existed with pipeline segments serving them that could possibly limit gas deliveries. Customers furthest downstream on a pipeline are impacted by the cumulative actions of customers upstream.

Numerous interstate pipeline critical notices were issued to require shippers to stay within their contracts and to balance their gas nominations and receipts of gas into the interstate pipelines with their deliveries. However, because of the ability to predict potential cold weather well ahead of the Cold Weather Event that occurred, the planning and preparedness of interstate pipelines and

their shippers greatly aided in maintaining the integrity of the interstate pipeline systems. Interstate pipelines began issuing weather related critical notices by at least February 1, 2021. As issues with some gas delivery into the pipeline systems occurred, some shippers were able to access gas from multiple sources to compensate for those areas where natural gas receipts were not sufficient to meet their nominations.

As stated above, the natural gas production process is dependent on power to deliver natural gas to interstate pipelines. Additional power is needed for interstate pipeline storage field injections and withdrawals and compressor stations that help push natural gas through the pipeline system and to maintain pressures throughout the pipeline system so that the integrity of the entire pipeline system remains functional and able to deliver gas to customers. Interstate pipelines serving Missouri kept their pipeline systems up and running through many of the Cold Weather Event obstacles. Over years of planning and experiences, interstate pipelines have developed procedures to address every possible incident. This allowed them to maintain safe and operational pipeline systems throughout the Cold Weather Event. The responsibility of interstate pipelines is immense because of the reliance of millions of end use customers on being able to use natural gas to keep warm. However, entering into contracts to transport natural gas with interstate pipelines and to purchase natural gas from suppliers to meet its needs is the responsibility of the shipper/customer.

7. Natural Gas in Missouri

The Commission regulates Ameren Missouri Gas ("Ameren Gas"), The Empire District Gas Company ("Empire Gas"), Liberty Utilities (Midstates Natural Gas) ("Liberty Midstates"), Spire Missouri East, Spire Missouri West and Summit Natural Gas of Missouri ("SNGMO" or "Summit"). The preparations for and impact of the Cold Weather Event on Missouri natural gas LDCs are discussed in other sections of this Report. In general, the natural gas LDCs regulated by the Commission are winter peaking utilities because natural gas is used for heating by residential, commercial and industrial customers. The Missouri natural gas LDCs firm transportation contract capacities are based on 30-year weather extremes.

The price of natural gas has been volatile over time and has historically been affected by supply and demand. Cold weather events have often increased demand and led to increased natural gas prices. Typically, these cold weather events are short lived and move with the weather from west to east across the country so that the low temperatures do not effect a large section of the country all at once or for an extended period of time. A few notable polar vortex events caused by the jet stream bringing artic air into the central region of the United States have impacted larger regions of the country for longer periods of time. Because gas prices are set at multiple interstate pipeline hubs and vary regionally on a daily basis, weather related demand increases typically impact natural gas prices in a region of the country for only a few days at most. Hurricanes in the Gulf of Mexico have created supply shortages, leading to natural gas price increases. Even the perception of a demand or supply change can impact the price of natural gas.

According to the U.S. Energy Information Administration ("EIA") the national average price of natural gas at citygates has averaged under $5/Mcf since December 2014. The supply of natural gas has increased immensely since shale gas production began and this has reduced and somewhat stabilized the price of natural gas throughout the United States or where shale gas is available to supply customers. However, the history of natural gas prices demonstrates that there can be volatility in the pricing of the natural gas commodity. October 2005 saw an average natural gas price of $12.16/Mcf after hurricanes Katrina and Rita disrupted Gulf of Mexico natural gas production. Natural gas prices also peaked in June and July 2008 at $11.85/Mcf. During 2020 natural gas prices at the citygate averaged between $3/Mcf and $4/Mcf. The impact of the Cold Weather Event on natural gas prices is provided in Section IV. A. of this Report.

8. Information on Natural Gas Penalties

FERC Interstate pipeline tariff provisions provide for the interstate pipeline to assess penalties to shippers where the integrity of the pipeline system may be at risk. The integrity of the pipeline system is dependent on maintaining the appropriate pressure along the pipeline system. Typically a pipeline will have issues with only a segment of pipe and not the entire pipeline system. Imbalances created when shipper nominations or gas receipts into the interstate pipeline do not match the amount of natural gas delivered to, or pulled off the pipeline by, the shipper may lead

to pressure problems or cause the pipeline to buy or sell gas to eliminate the imbalance if customers remain out of balance between their nominations and deliveries for an extended period of time. Some interstate pipelines allow shippers to balance on a monthly basis or more frequently to avoid imbalance penalties.

The imbalance penalty tariff language varies from pipeline to pipeline. There are varying degrees of penalties associated with imbalances when a customer is out-of-tolerance between nominations and receipt of gas into the pipeline system with deliveries to the shipper's facilities. Operational Flow Orders ("OFOs")[20] are only issued by a pipeline as a last resort when shipper compliance has not occurred or the integrity of the pipeline system has been compromised. The OFO typically requires the shipper to be in compliance with the conditions of its contract with the interstate pipeline. This requires balancing on an almost real-time basis. The OFO may affect only shippers within a segment of an interstate pipe or on the entire pipeline system.

The OFO typically does not reduce the shipper's contract deliverability of natural gas. An emergency OFO results from a pipeline system integrity issue that may reduce the availability to transport gas outside of contracted hourly prorated amounts. Force majeure events are extreme emergencies that often reduce the availability of gas to flow to shipper destinations. An explosion on an interstate pipeline is an example of a force majeure event that would limit delivery of natural gas to shippers until repairs are made to the pipeline. Penalties for violating OFOs monetarily incent shippers to return to compliance. The Electronic Bulletin Board ("EBB") of each interstate pipeline is required to provide notices to the public of critical and non-critical events that impact the pipeline. The notices include planned maintenance projects that may restrict gas flow on specific line segments or notices of developing winter weather conditions. Shippers monitor the interstate pipeline EBBs closely and have direct communications with the pipeline system operators.

[20] An Operational Flow Order ("OFO") is an interstate pipeline tariff provision that allows penalties to be assessed to shippers for not complying with contractual and tariff requirements. OFOs would be issued as critical notices on a pipeline and cover a specific period of time. Pipelines also notify the end time of the OFO.

Many critical notices are issued requesting specific shipper compliance with contractual terms without assessing a penalty as long as the problem is rectified without further incident. The purpose of a monetary penalty, when assessed, is to incent the shipper to remain in compliance with its contractual agreement with the pipeline. Because the imbalance of gas may require the pipeline to buy or sell gas to bring the pipeline system into balance, the index price of gas and a multiplier is often used to calculate the penalty. The Cold Weather Event began ahead of the federal President's Day Holiday, February 15, 2021. Interstate pipelines began issuing weather condition critical notices on their EBBs on February 1, 2021. Shippers were given many opportunities to prepare for the Cold Weather Event although the extent of the impact could not be totally predicted or that natural gas prices would increase to as high as $1,000/Mcf. Gas trading platforms were closed Saturday, February 13, 2021 through President's Day. The Friday, February 12, 2021 index prices were in effect until Tuesday, February 16, 2021.

Because of the high price of gas at the time of the Cold Weather Event, any penalties assessed by pipelines to shippers would be correspondingly high. For example, if the gas price was normally $3/Dth and the February 12, 2021 price was instead $600/Dth, the increase of 200 times the normal price would be used in the calculation of the penalty assessed on February 12, 2021. During times of OFOs, shippers are required to nominate and deliver within their contract limits or risk a penalty. A penalty assessed at two times the price of gas is less a concern when the gas price is $3/Dth. The penalty would be included on the interstate pipeline's monthly invoice to each shipper. Several interstate pipelines requested waivers from FERC to allow additional time to calculate penalties before invoices were issued.

Contributors: Janis Fischer and Cherlyn Voss

B. Federal Regulatory Entities Initial and Ongoing Responses to the Cold Weather Event

1. Status of Investigatory Proceedings at FERC and NERC

Although FERC does not regulate the price of natural gas, it routinely monitors both natural gas and electric prices throughout the United States and has the ability to investigate any perceived manipulation of prices. FERC has the ability to assess penalties and Energy Policy Act of 2005 increased both FERC's jurisdiction and its penalty authority, thereby increasing the importance of FERC's enforcement program. All information and documentation received during an investigation, as well as the existence of an investigation, is treated as non-public (only FERC can authorize the public disclosure of an investigation or information obtained during an investigation). More information regarding investigations may be found in the FERC Office of Enforcement's Annual Report on Enforcement, which are issued in the last quarter of each calendar year. These annual reports highlight significant investigations, including those that have proceeded to FERC Orders to Show Cause and those litigated in Federal District Court.

The FERC and North American Electric Reliability Corporation ("NERC") announced on February 16, 2021, that they intend to open a joint inquiry into the operations of the bulk energy system during the extreme winter weather conditions experienced by the Midwest and South-Central States. The joint inquiry is to include the Regional Entities (Texas RE, Midwest Reliability Organization and SERC Reliability Corporation). The joint inquiry is to cover three general themes: 1) Comprehensive, detailed analysis of the event and root causes; 2) Commonalities with other cold weather events, including the 2011 winter event that also impacted Texas; and 3) Findings and recommendations for further action. As of April 22, 2021, the results of this inquiry are still pending.

In addition, FERC announced on February 22, 2021, that its Office of Enforcement is examining wholesale natural gas and electricity market activity during the Cold Weather Event to determine

if any market participants[21] engaged in market manipulation or other violations. If the Office of Enforcement finds any potential wrongdoing, it will be addressed under FERC's statutory authority. FERC will pursue those matters as non-public investigations.

FERC's Division of Analytics and Surveillance ("DAS") monitors market participant behavior in the wholesale natural gas and electricity markets on an ongoing basis. DAS uses market participant-level trading data and data from the financial markets to screen daily and monthly trading at the majority of physical and financial natural gas trading hubs in the United States and the organized and bilateral wholesale electricity markets. DAS closely identifies and scrutinizes any potentially anticompetitive or manipulative behavior to determine if any investigation is appropriate. This monitoring occurs all of the time but additional scrutiny is currently being conducted because of the high natural gas and electricity prices that occurred during the Cold Weather Event. Any referral of suspected market manipulation to the Office of Enforcement will become part of FERC's investigation. Any FERC investigation into wrongdoings will take months to complete and therefore there are no further details to report at this time.

2. Status of Interstate Pipeline Penalties

Many shippers avoided interstate pipeline penalties during the Cold Weather Event when the interstate pipelines waived penalties worth hundreds of millions of dollars. Both Panhandle and Southern Star filed with FERC seeking approval to waive some or all penalties assessed to customers. While interstate pipeline tariffs allow the assessment of penalties to shippers, any collection of penalties are then paid-out to non-offending shippers. The interstate pipelines do not keep any penalty proceeds. Panhandle filed its waiver request on March 9, 2021 (Docket No. RP21-616). Panhandle requested waiver of OFO penalties on Gas Day 15 (February 15, 2021) only. A Gas Day represents the gas nominations provided on a specific calendar day of each month. Over the period of the Cold Weather Event Panhandle assessed penalties in excess of

[21] Market Participants are (a) buyers and sellers of electricity or certain utility level Bulk Electrical Services within an administered energy market run by a Regional Transmission Operator ("RTO") or other similar entity; and (b) financial entities that take financial positions on an RTO's energy market.

$121 million. The waiver of Gas Day 15 applied to $50 million of the penalties. Panhandle did not seek waiver of penalties for Gas Days 16-18. Spire Marketing, Inc., Spire Missouri's gas marketing affiliate, filed a protest in the case. FERC approved Panhandle's waiver request on March 25, 2021 agreeing with Panhandle that such a waiver is not unduly discriminatory because all affected shippers were similarly situated regarding the notice.

Southern Star filed its waiver request on March 11, 2021 and asked for FERC authorization to waive the invoicing, collection and crediting of penalties that were applied to transportation shippers and point operators system wide and to storage customers. Southern Star's penalties to shippers would have exceeded $158 million with an additional $15 million assessed to storage customers. A number of Missouri shippers intervened in Southern Star's case. Spire Missouri filed comments and The Empire District Electric Company, d/b/a Liberty filed a protest. Both the Commission and the Kansas Corporation Commission intervened in the case. FERC approved Southern Star's waiver request on April 9, 2021 agreeing with Southern Star that waiving the penalties was in the public interest.

A number of Missouri interstate pipelines waived some Cold Weather Event related penalties. The waiver of these penalties did not require FERC approval. See the table below for a summary of waivers.

Waivers Issued or Requested by Pipelines that Serve Missouri

Pipeline	**Waiver**	**Explanation**
ANR Pipeline Company	2/5/21 – 2/21/21	Waived all higher Extreme Condition Daily Scheduling Penalties ("DSPs") and Extreme Condition Unauthorized Overrun Service ("UOS") penalties during the posted 2/5-2/21 Extreme Condition period in Zones ML7 and ML3. Non-Extreme Condition DSP and UOS penalty rates continue to apply.
Enable Gas Transmission	Invoice Delay Waiver	Filed with FERC Case No. RP21-611, to delay invoice date to allow calculation of penalties.

MoGas Pipeline Company	None	
Enable Mississippi River Transmission	None	
National Gas Pipeline Company of America ("NGPL")	Cash-out Imbalance Extension Waiver	NGPL is extending the time to calculate and settle existing imbalances on both transportation service agreements and Point Operator Allocation agreements that are subject to AMIP cash-out pursuant to Section 44 of the General Terms and Conditions ("GT&C") of NGPL's Tariff. This is applicable to both long and short positions and will provide time for NGPL and affected Shippers to authenticate the imbalances through mutually agreed to mechanisms and mitigate any negative effects of the price volatility experienced during this 10-day period.
Ozark Gas Transmission	None	
Panhandle Eastern Pipeline Company	Limited Waiver	Filed with FERC Case No. RP21-616, approved March 25, 2021
Rockies Express Pipeline	None	
Southern Star Central Gas Pipeline	Waiver	Filed with FERC in Case No. RP21-618, approved April 9, 2021
Texas Eastern Transmission	2/15/21 – 2/18/21	During the period beginning on February 15, 2021 and continuing through February 18, 2021 Texas Eastern Transmission, LP will waive all applicable OFO penalties.

Tallgrass Interstate Gas Transmission	2/13/21 – 2/18/21	After discussions with many of our customers and customer groups, Tallgrass Interstate Gas Transmission, LLC ("TIGT") is waiving a portion of the penalties related to the Critical Time Operational Flow Order that was in effect from Saturday, February 13, 2021, through Thursday, February 18, 2021 (the "OFO").

3. FERC Potential Next Steps

The outcome of FERC's inquiry will likely be a report. If FERC finds any violations by interstate pipelines under its jurisdiction there could be complaint case dockets initiated by FERC. The Commission and interstate pipeline shippers would have an opportunity to participate in those cases. If FERC's Office of Enforcement files complaints against marketers for natural gas price manipulation, any settlement or resolution will be publicly available although certain confidential information will not be provided. The Commission and shippers that can show harm from any natural gas market manipulation may file in federal court to recover damages from the offending parties. This process would likely extend out years before compensation, if any, was ultimately received.

Contributor: Janis Fischer

C. Regional Transmission Organizations'[22] Preparations for and Responses to the Cold Weather Event

1. Background on RTOs and Operations in Missouri

Pursuant to the *Federal Power Act*, 16 USC § 824a(a), Congress and the FERC established Regional Transmission Organizations ("RTOs") and charged them with eight formal responsibilities. These responsibilities as applied include: the maintenance of the electric system's reliability, the creation of an open access transmission[23] system, and facilitation and operation of a competitive wholesale market for electricity. An RTO does not own or physically operate any electric generation, electric transmission or distribution facilities. RTOs do not sell or issue bills for retail electricity, nor do they set prices or rates for retail electric customers. RTOs are charged with and have limited authority to ensure the wholesale markets they administer are competitive and that the market participants do not abuse market power. If the RTO finds market power abuse or anti-competitive activity that is sufficiently egregious, the FERC enforcement division is notified for further investigation and potential punitive actions. RTOs also can impose penalties for unreserved transmission usage.

Beginning around February 6, 2021[24] an Arctic air mass enveloped much of the continental United States as far south as the Mexican border and from Washington and Oregon to Ohio and Alabama, encompassing all of the Southwest Power Pool ("SPP") and Midcontinent Independent System

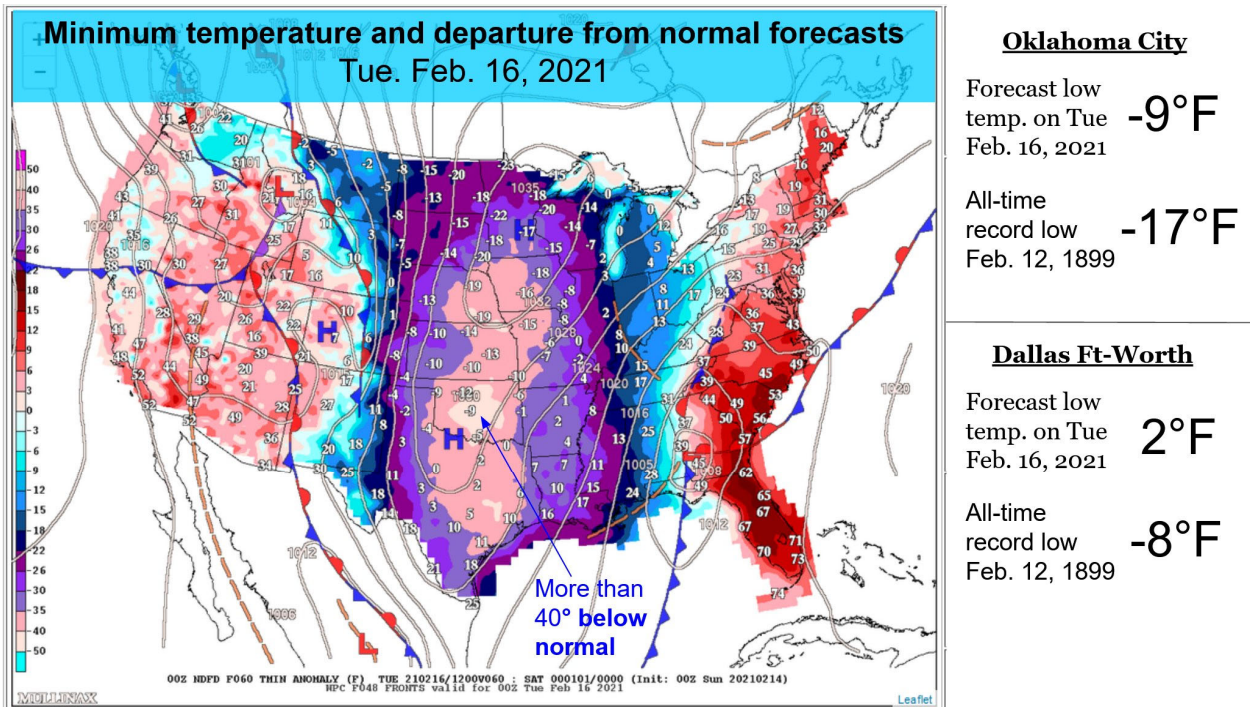
[22] A Regional Transmission Organization ("RTO") the "air traffic controller" of the electric grid within its jurisdiction, which controls, monitors, and coordinates the Bulk Electric System ("BES"). RTOs in Missouri are the Midcontinent Independent System Operator ("MISO") and Southwest Power Pool ("SPP"). RTOs also administer the wholesale energy and capacity markets through which utilities buy, sell, and deliver other utility level services to each other.

[23] Open Access Transmission is a federal policy opening access to the BES to any qualified generator or load and thereby establishing competition between generators for load, and providing load access to less expensive sources of energy.

[24] National Weather Service: "A potential and persistent outbreak of Arctic Air affected our region from 6th through 17th." February 6-17th, 2021 Arctic Blast (weather.gov)

Operator ("MISO"), the RTOs and Bulk Electric System ("BES" or "the grid")[25] managers serving Missouri. Average temperatures fell more than 15ºF or more below normal across the region creating challenging conditions for the utilities to operate, as shown in the graphic below.

Figure 7



Source: National Weather Service ("NWS") Prediction Center Twitter feed, NWS Weather Prediction Center on Twitter: "Widespread extreme #cold has been impacting the Plains and down into the Deep South. This cold snap is forecast to result in record low temperatures that are comparable to the historical cold snaps of Feb 1899 & 1905. Please stay safe and stay warm! https://t.co/S9drmeeirx" / Twitter

Fuel normally used for heating (especially natural gas) and generating electricity became scarce and competition between entities wanting electricity for those uses pushed fuel prices significantly above normal levels. Power was transferred to SPP from MISO and the PJM Interconnection, LLC[26]. As the cold snap persisted, electric demand increased and each RTO's transmission lines

[25] Bulk Electric System ("BES") includes all transmission equipment operated at 100,000 volts or higher, generators connected to the transmission system, and specifically excludes local distribution facilities.

[26] The PJM Interconnection, LLC is an RTO serving parts of Illinois, Ohio, and Indiana, as well as certain other eastern states.

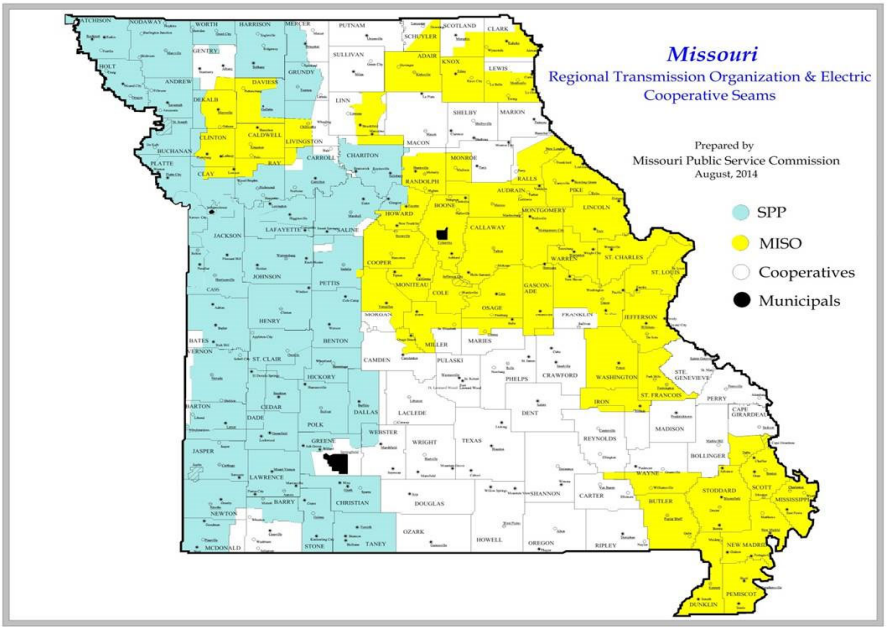
began to experience congestion, which is when electric transmission lines are carrying close to the maximum amount of power they are safely capable of transporting. This reduced the ability of electric utilities and transmission owners operating under the different RTOs to transmit power resulting in temporary rolling black-outs and load shedding[27] events. Emergency operations were concluded and normal operations were declared on February 20, 2021, by MISO and SPP.

Of the two RTOs serving Missouri, MISO serves most of eastern Missouri, (Ameren Missouri and Columbia Water and Light District and other cooperatives and municipal utilities) and SPP serves western Missouri (Evergy Metro, Inc. d/b/a Evergy Missouri Metro ("Evergy Missouri Metro") and Evergy Missouri West, Inc. d/b/a Evergy Missouri West ("Evergy Missouri West") (collectively, "Evergy"), The Empire District Electric Co. d/b/a Liberty ("Liberty-Empire"), City Utilities of Springfield and other municipal utilities and electric cooperatives. Associated Electric Cooperatives, Inc. ("AECI") is not in an RTO but does participate in the energy markets[28] operated by both RTOs.

[27] Load is the consumption or use of electric energy such as a lamp producing light. This term includes use of energy by residential, commercial, and industrial customers. Load Shed is the deliberate shutdown of electric power to certain portions of the BES.

[28] The Electric Energy Market is a commodity market that handles the buying and selling of electricity and electricity-related services. This can be a real time market or a market that sets the wholesale price of that commodity a day or more in advance.

Figure 8



A primary RTO function is to balance the supply and demand for electricity across the BES, i.e., the supply of electricity must be instantaneously adjusted to meet the demand for electricity or it is possible that a deficiency in supply in one utility could damage generators or other utility facilities located elsewhere. Another and less obvious RTO function is to ensure there is sufficient reserve electric generator capacity[29] available to meet electric supply deficiencies even in adverse conditions and arrange for alternate supplies of energy and transmission when there are not.

2. Midcontinent Independent System Operator Preparation for and Response to the Cold Weather Event

MISO divides itself into three large reserve regions as shown in the following map:

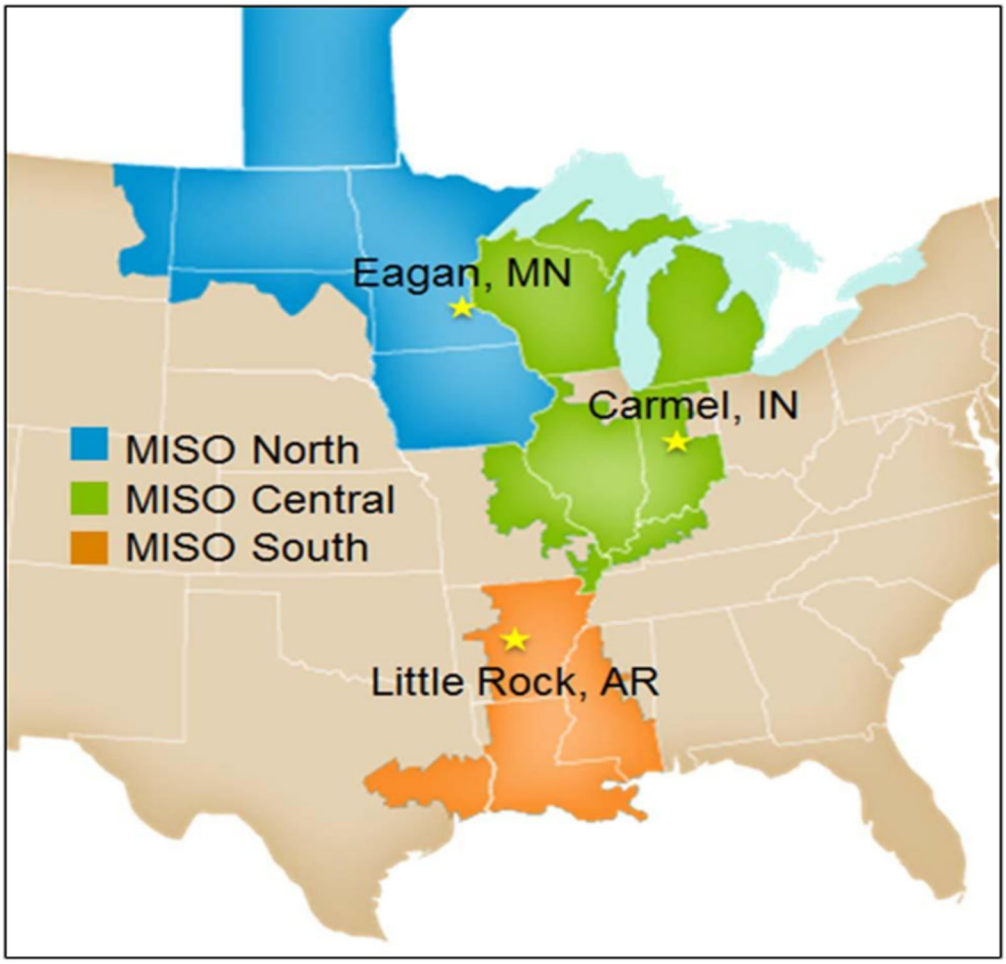
[29] Electric Generator Capacity is the *ability* of a generator to produce electricity and is measured and sold in kilowatts-days or megawatt-days but is not the actual generation of electricity. Electric generator capacity is different from "energy", which is electricity actually being produced and is measured in kilowatt/hours or megawatt/hours.

- MISO Central, which includes all or part of Missouri, Illinois, Indiana, Michigan and Wisconsin;
- MISO North, which includes all or part of Iowa, Minnesota, Montana, North Dakota and South Dakota; and,
- MISO South, which includes all or part of Arkansas, Louisiana, New Orleans, Mississippi and Texas.

The MISO part of Missouri is located in the MISO Central Reserve Region.

Figure 9

MISO Reserve Regions



Used with permission. Credit to Midcontinent Independent System Operator. *MISO Update to Michigan Public Service Commission.* April 2019. Slide 3. Microsoft PowerPoint - 041819 MPSC Meetingv4.pptx [Read-Only] (michigan.gov)

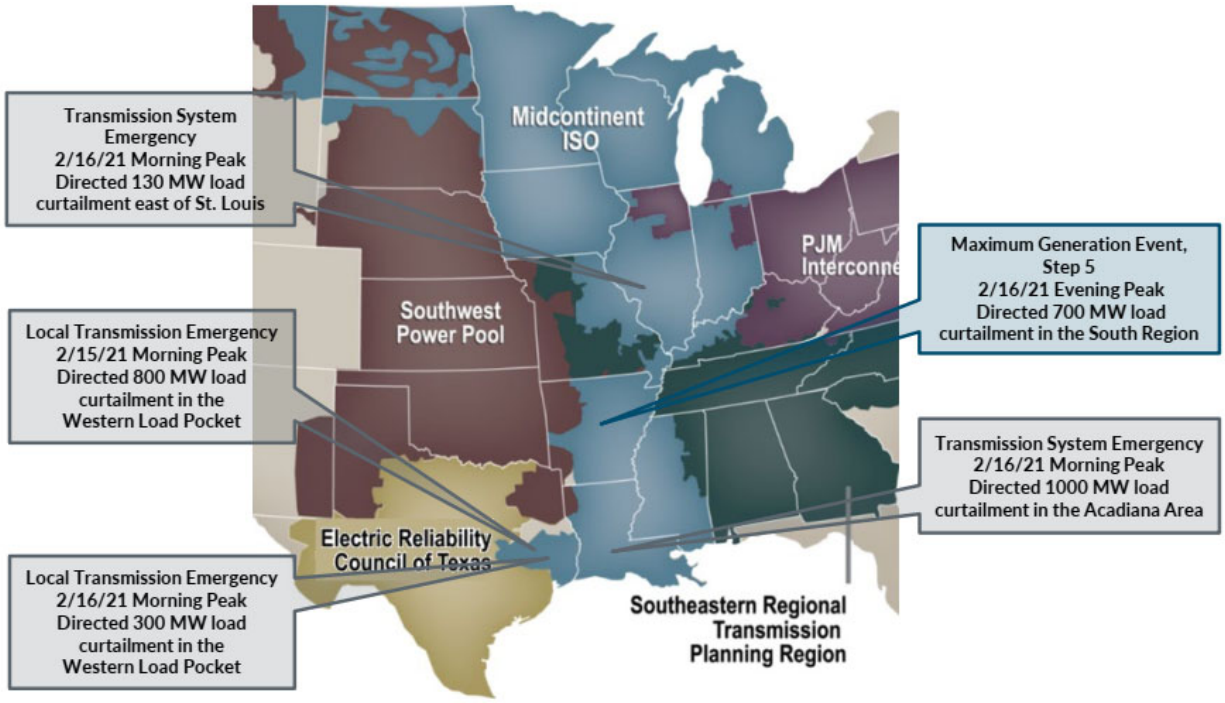
a. Load Shed (Outage Events)

To protect the entirety of the BES from faults that could cascade into major or even regional power outages from which it is difficult to recover, it occasionally becomes necessary to shed load (disconnect load from the BES). For example, this is the action often called for when there is not enough electricity generated to meet demand. Given the magnitude of the threat to the BES, load can be shed on a local basis, over larger areas, in a targeted fashion or through a rolling blackout.

When MISO determines load must be shed, it instructs an entity called a Local Balancing Authority ("LBA")[30] to shed a specific quantity (in megawatts) of load and it becomes the responsibility of the LBA to determine which load is disconnected from the system. MISO directed the following load shed events (outage events) from February 15-17, 2021.

Figure 10

MISO Outage Events During the Cold Weather Event



Source: Midcontinent Independent System Operator, *Overview of February 2021 Arctic Weather.* Presentation to Markets Committee of the Board of Directors. March 23, 2021. Slide 9. Used with Permission.

[30] A Local Balancing Authority ("LBA") is an entity responsible to control and take action to maintain the near-instantaneous equality of electric demand and supply in a given area.

Description	Load Curtailed	Outage Duration[31]	Outage Date	Affected LBA[32]
• Local Generation and Transmission Emergency; • Southeast Texas;	800 MW	16 hours	February 15-17	EES
• Local Generation and Transmission Emergency; • Southeast Texas;	300 MW	5 hours 40 minutes	February 16-17	EES
• System Transmission; Emergency; • Louisiana; • Pro-rata Load Shed[33]	1000 MW	4 hours 5 minutes	February 16-17	EES, CLEC, LEPA, LAFA, LAGN
• System Transmission; Emergency; • Central Illinois	130 MW	7 hours	February 16	AMIL
• Max Gen Event-Step 5 (NERC EEA 3)[34]; • MISO South Region; • Pro-rata Load Shed	700 MW	2 hours 20 minutes	February 16-17	MISO South Region

Source: Midcontinent Independent System Operator, *Overview of February 2021 Arctic Weather*. Presentation to Markets Committee of the Board of Directors. March 23, 2021. Slide 11. Used with Permission.

[31] The Outage Duration is the amount time from when MISO issued a load shed instruction to the LBA until the last customer was restored. Outage Duration time incudes restoration of service to load; i.e., some load may have service restored very quickly while other load may take more time to be restored.

[32] Affected LBAs: AMIL-Ameren Illinois, CLEC-CLECO Power, central Louisiana, EAI-Entergy Arkansas, EES- Entergy Texas, Entergy New Orleans, Entergy Louisiana, EMBA-Entergy Mississippi, LAFA-Lafayette Utility System, LAGN-CLECO, Cajun Louisiana, LEPA-Louisiana Energy and Power Authority, and SMEPA-South Mississippi Electric Power Asc.

[33] Pro-rata load shed is the proportionately equal sharing of the loss of service among the Load Serving Entities in the Local Balancing Area. Alternatively, targeted load shedding is loss of service directed at specific points on the BES.

[34] A NERC EEA is a NERC Energy Emergency Alert. This is part of the NERC Emergency Operating plan which requires jurisdictional entities to prepare Emergency Operating Plans of their own that provide for specific actions under specific, identified circumstances within their jurisdictional areas.

b. MISO North and Central Load Shed

On February 16, 2021, 130 MW load in MISO Central (Illinois), east of St. Louis, was lost due to equipment failure from east to west energy flows exceeding 150% of the line's rated capacity, that is the amount of energy it is designed to transmit without potential material damage. A transmission line splice (the above ground point where the ends of two conductors are joined) failed. Where possible, affected load was served by alternative transmission and distribution lines and full service was restored within seven (7) hours; however, load was progressively restored throughout the day as circumstances allowed. This was the only load shed in the MISO North/Central Regions. That load shed only affected the Ameren Illinois LBA. The Ameren Missouri LBA was not directed to and did not shed load. ***At no point during this event did MISO order Missourians in the MISO part of the state to shed load.***

c. MISO South Load Shed

On February 13-16, 2021, MISO ordered and issued the following alerts or directives to its Southern Region:

Date	Action[35]	Explanation
February 13	Cold Weather Alert	
February 14	Conservative Operations Directive	
February 15	Capacity Advisory	
February 15	Max Gen Alert	Potential generator/transmission issues identified.
February 15, 11 p.m., local time	Max Gen Warning	Increase in unplanned outages and capacity uncertainty.
February 16, 5:35 p.m. CST	Max Gen Event Level 2C	LBAs to issue public notice that load shed is imminent. 2500 MW capacity became unavailable

[35] MISO Actions in MISO South are discussed supra under MISO Emergency Notifications to Stakeholders.

February 16, 6:40 p.m. CST	Max Gen Event Step 5	at 3 p.m. (CST). Appeals for conservation issued. BES instability risk high, imports unavailable. Directed LBA to shed 700 MW.

Source: Midcontinent Independent System Operator, *Overview of February 2021 Arctic Weather.* Presentation to Markets Committee of the Board of Directors. March 23, 2021. Slide 12. Used with Permission.

d. MISO-Texas Load Shed

MISO-Texas experienced local transmission emergencies on February 15-17, 2021, shedding 800 MW, and on February 16-17, 2021, shedding 300 MW. This part of the Texas BES is not part of the Electric Reliability Council of Texas ("ERCOT") and depends on capacity located in Louisiana. These emergencies included voltage concerns (when demand exceeds supply, voltage can drop which damages transmission, utility and customer equipment); as well as, transmission lines exceeding their thermal limits (electrical energy creates heat in the facilities over which it flows and can be damaging if the facilities' temperatures exceed materials-design thresholds) and those lines having to be removed from service to avoid permanent damage, which would result in longer restoration times. To avoid cascading faults, minimize damage to the BES and the time needed to restore damaged facilities it became necessary to shed load.

e. MISO-Louisiana Load Shed

MISO-Louisiana experienced cascading outages on February 16, 2021 (outages of facilities that result in excessive demand falling onto other facilities which then fail) which affected the entire BES in Louisiana. As much as 1,000 MW of load was shed in Louisiana for about 4 hours. These faults were blamed on east-to-west energy flows nearing operating limits on large facilities including, a 500 KV transmission line and several local generators.

f. MISO Capacity (Generation)

Average energy production by fuel type over the period February 7-22, 2021 is illustrated in the following table.

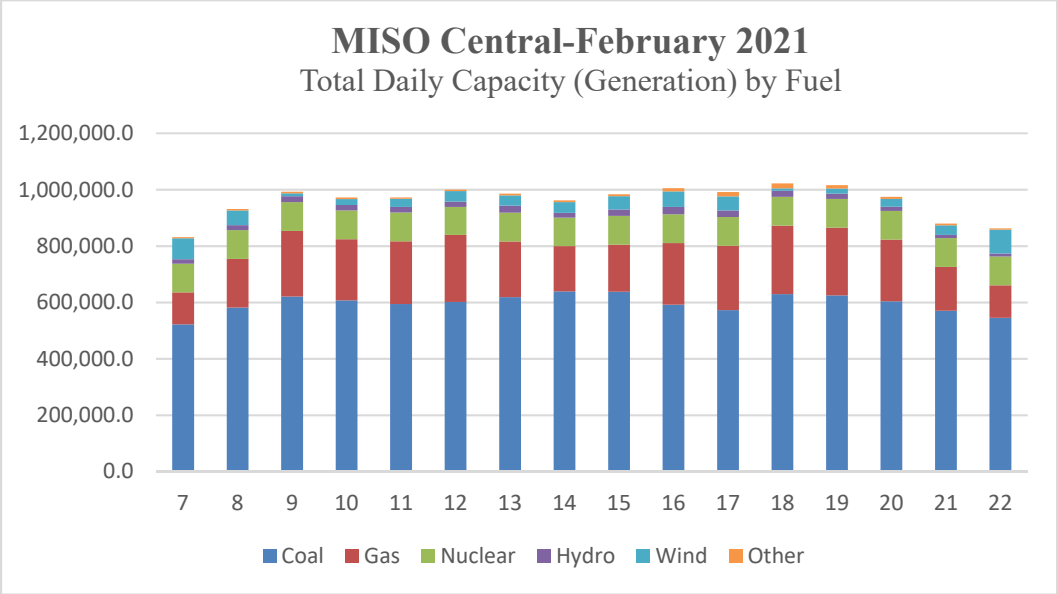
Energy production in the MISO Central region over the period February 7-22, 2021 by fuel type is presented in the following table and chart, based on publically available MISO Market Reports at MISO Market Data (misoenergy.org). In the MISO Central Region, coal was and is the dominant fuel used to produce energy, distantly followed by gas, nuclear, hydro, wind and other generating fuels. The central region's load varied from 831,705 MW on February 7, 2021 to a peak of 1,022,314 MW on February 18, 2021. During this time period, MISO South relied much more on gas generation than coal generation and had double the share of nuclear generation than the total MISO footprint or the MISO North or MISO Central Region.

Percentage MISO Energy Production (Generation) by Fuel Type

February 7-22, 2021

Region	Coal	Gas	Nuclear	Hydro	Wind	Other
MISO Footprint	48%	27%	14%	2%	8%	1%
MISO North	55%	9%	10%	1%	24%	1%
MISO Central	62%	20%	11%	2%	4%	1%
MISO South	15%	56%	25%	2%	0%	1%

Figure 11



g. MISO's Energy Imports, Exports and Wheeling[36]

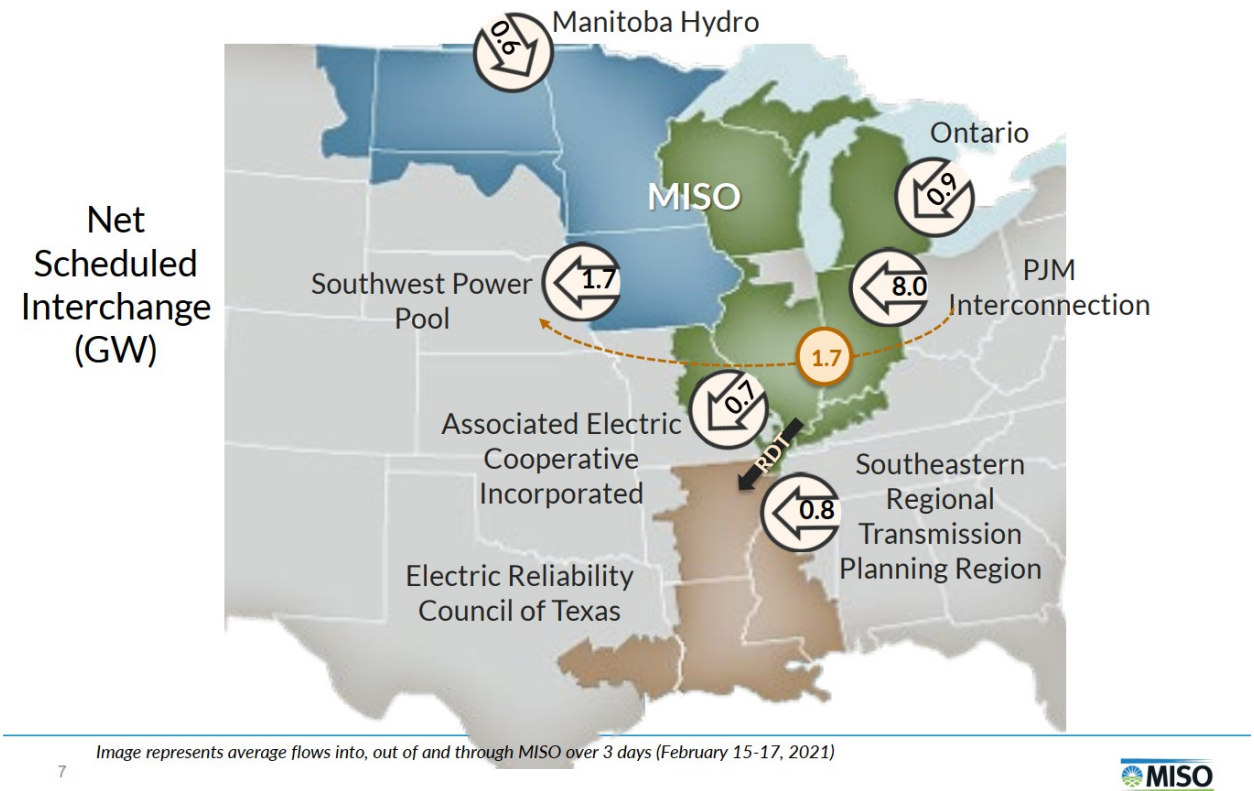
Typically, SPP is an energy exporter, with generators within the SPP footprint generating more energy than SPP load consumes. However, during the Cold Weather Event SPP was importing power from MISO, which was instrumental in assisting other RTOs. MISO and its neighbors exported energy to SPP and MISO wheeled energy from the PJM Interconnection (another RTO) into SPP even though it further strained the MISO grid. MISO also exported energy into Associated Electric Cooperatives, Inc. ("AECI"). MISO imported power from Manitoba Hydro, the Ontario Electric System, PJM and utilities in the Southeastern Regional Transmission Planning Region ("SERTP").

The graphic below illustrates the net scheduled energy interchange between the MISO regions and its neighbors during the February 15-17, 2021 period.

[36] Wheeling is the use of another party's facilities to move energy from a source to a sink, the delivery point of electric energy to load. In this instance, SPP received wheeled energy across MISO from the PJM Interconnection.

Figure 12

MISO Imports, Exports and Wheeling



Source: Midcontinent Independent System Operator, *Overview of February 2021 Arctic Weather*. Presentation to Markets Committee of the Board of Directors. March 23, 2021. Slide 7 Used with Permission.

During February 15-17, 2021 the following energy flows wheeled across MISO into SPP or AECI:

- MISO collectively to SPP: 1700 MW, or 1.7 gigawatts ("GW")
- PJM, wheeled through MISO: 1700 MW
- MISO to AECI: 700 MW

The following energy flows were imported into MISO:

- Manitoba Hydro: 600 MW
- Ontario: 900 MW
- PJM: 8000 MW
- SERTP: 800 MW

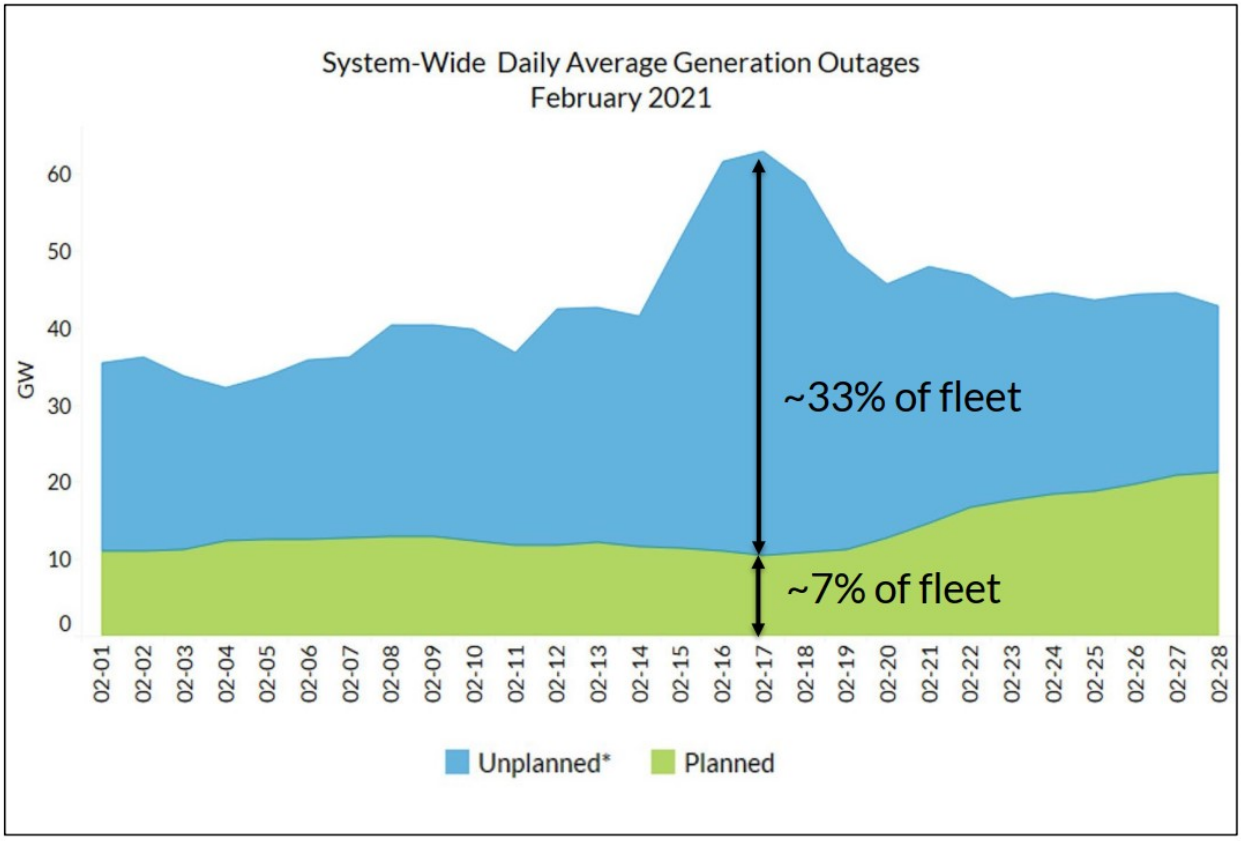
h. Generation Outages

There are two generator outage classifications, or a generator may be derated. They are:

- **Planned Outages** - where the operator deliberately and with notice to affected parties removes the generator from service for maintenance or other purposes, and
- **Forced Outages** - where a generator stops generating energy unexpectedly due to mechanical or fuel related issues or the operator must take it down to avoid damage.
- **Derated -** where the generator's ability to produce electricity is temporarily or permanently reduced from its designed or nameplate electric generation capacity due to a mechanical fault or limitation or an external event (such as fuel limitations).

MISO provided the following graphic to compare planned vs. unplanned system generation outages. "Unplanned" in the graph below includes forced outages.

Figure 13



Source: Midcontinent Independent System Operator, *Overview of February 2021 Arctic Weather.* Presentation to Markets Committee of the Board of Directors. March 23, 2021. Slide 6. Used with Permission.

MISO reported to its Markets Committee of the Board of Directors on March 23, 2021 that approximately 40% (or about 60 GW) of MISO's system wide generation fleet was unavailable for dispatch[37] on February 17, 2021.

[37] Dispatch is an instruction or order from some supervisory entity to a generator owner to produce a certain amount of energy at a specific time for a specific duration or to increase or decrease current output to some other level. RTOs operate wholesale energy markets in which they determine how to equate the supply of energy to the demand for energy and dispatch generators to achieve those requirements.

Explanations for the unplanned outages range from 25% of the generators did not have sufficient fuel (this can include no wind for wind turbines), 15% experiencing mechanical issues, another 15% experiencing unexplained weather-related issues, and 45% other issues.

i. MISO Emergency Notifications

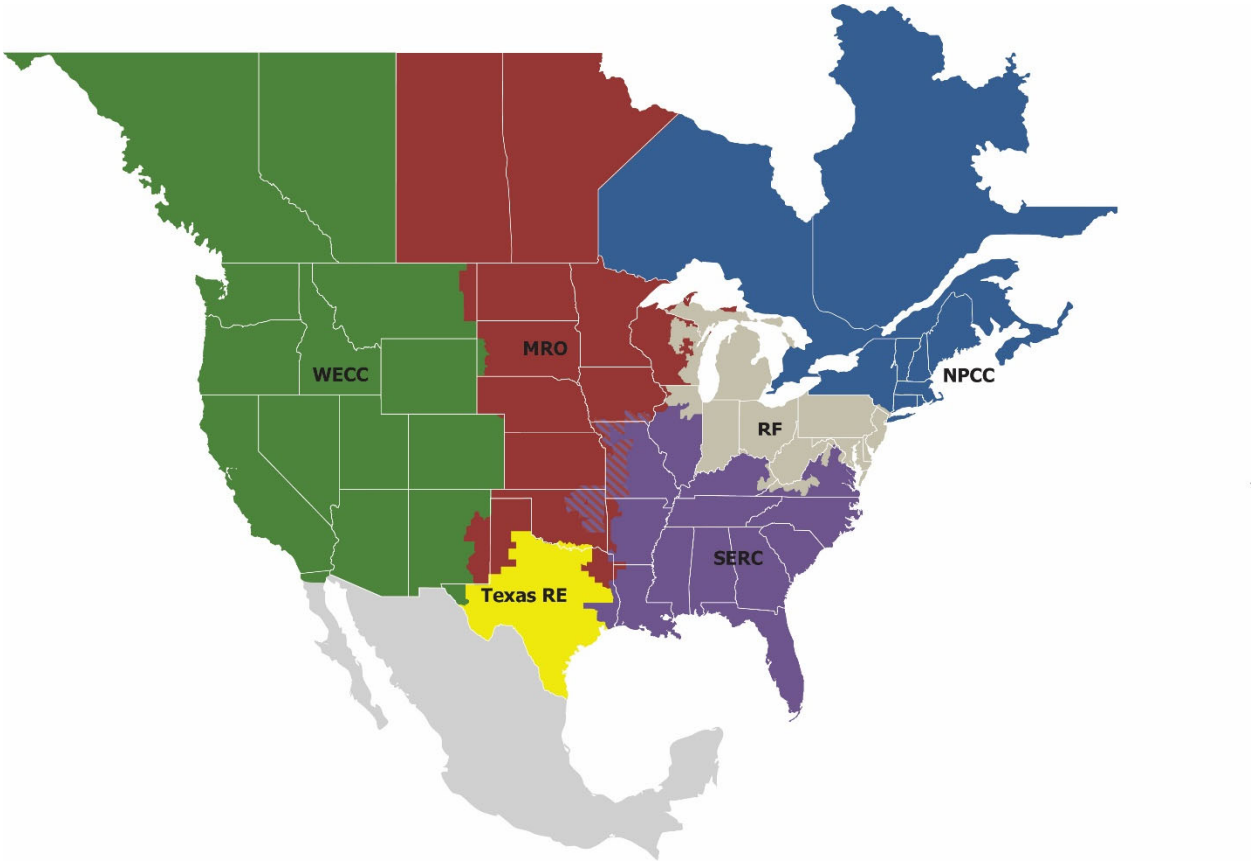
MISO's Emergency Operating Plan ("EOP")[38] provides for a series of escalating alerts to be issued to its members and stakeholders[39] to inform them of local or regional risks faced by grid operators and users, and to advise or order preparations appropriate for the circumstances. These alerts are governed by MISO's Market Capacity Emergency procedures, SO-P-EOP-00-002 MISO Market Capacity Emergency.book (misoenergy.org). Pursuant to MISO's Open Access Transmission Tariff ("OATT"),[40] affected parties are required to comply with these directives. The alerts work in a step-wise progression to ensure that necessary MISO available generation and transmission are on line and ready to be dispatched by MISO to avoid shedding of load; however, as the alerts escalate to the extreme case, they can be used to mandate shedding of load. When load is shed, MISO directs the LBA to shed the load and it is the responsibility of the LBA to determine which load is to be shed.

FERC established NERC to draft and enforce reliability standards on the North American Continent[41]. NERC requires entities subject to its jurisdiction (including the RTOs) under NERC standard EOP-011-1 (Template - Standard (Results Based) (nerc.com) to create and maintain Emergency Operations Plans ("EOPs"), but NERC does not determine how that plan should be

[38] Emergency Operating Procedures ("EOP") are a plan or set of plans that specifically lays out the steps and procedures to be performed by RTOs, utilities and other entities subject to the jurisdiction of the NERC when adverse or emergency circumstances arise that threaten the electric reliability of a region or the BES.
[39] Stakeholders are the interested parties in the operation of the BES by the RTOs and includes state and federal regulators, utilities, generators, market traders, environmental groups and other nongovernmental organizations.
[40] An Open Access Transmission Tariff ("OATT") is a legal document filed by a RTO, transmission facilities owner and services provider, or other jurisdictional entities containing all rates, terms and conditions under which the relevant entity provides transmission services.
[41] Due to its voluntary corporate organizational structure NERC can create regulations applicable in Baja, Mexico and Canada whereas a U.S. governmental entity, obviously, could not.

fleshed-out. MISO's EOP does not use the NERC standard EEA 1, EEA 2 & EEA 3 nomenclature but each of MISO's EOP steps does fall into one of the NERC EOP steps. MISO receives Reliability Coordination oversight from the Midwest Reliability Organization ("MRO"), the Reliability First Corporation ("RF") and the Southeast Reliability Coordinator ("SERC"). MRO and SERC have reliability oversight in Missouri.

Figure 14



Source: North American Electric Reliability Corporation

j. MISO Emergency Operations Plan

MISO's EOP alerts require actions to be taken by MISO and the affected parties that are subject to MISO's tariff. MISO's EOP with abbreviated descriptions of the alerts and required actions to be performed by MISO and stakeholders are as follows:

MISO EOP

- ***Capacity Advisory***-an informational message, not a declaration that must be updated or terminated. This advisory is triggered when reserves decline below a specified threshold for a given area.

NERC EEA 1-All available generation resources are in use

- ***Max Gen Alert***-a positive but low reserve margin[42] has been forecasted;
- ***Max Gen Warning-***a negative reserve margin has been forecasted (load and operating reserve requirements cannot be met with normal economic (market) resources.
- ***Max Gen Event*** *steps:*
    - 1a-Determine area to which the Event applies, commit available resources (generators) to maximum emergency limits and deploy Demand Response ("DR")[43];
    - 1b-Activate resources (generators) emergency maximum limits;

NERC EEA 2-All available generation resources are in use

- 2a-**Implement emergency pricing,** notify LBAs to reduce load, coordinate with Market Participants ("MPs") to deploy Load Modifying Resources[44]

[42] A Reserve Margin is a requirement mandating the quantity of additional energy generating resources that must be maintained as back-up by load servings to ensure the BES is able to reliably provide power to load.
[43] A Demand Response ("DR") Program is a utility level program where a consumer of electricity enrolls in a program to consume less electricity, usually in exchange for a monetary payment or bill credit.
[44] Load Modifying Resource is a term used in the electrical industry combining both DR and behind the meter generation, that is a generator physically located on the retail side of an electric

- 2b-Commit emergency DR and inform LBAs emergency DR have been dispatched
- 2c-MISO to coordinate with neighboring Reliability Coordinators ("RCs")[45]; implement emergency energy purchases from neighboring Balancing Authorities ("BAs"), direct LBA to issue public appeals to conserve.

NERC EEA 3-Firm Load[46] Interruption is imminent or in progress

- 3a-Instruct Generator Owners ("GOs") to seek waiver of environmental restrictions from appropriate environmental authorities; implement use of all spinning and supplemental reserves as possible; if not possible, EEA 3 may be declared (shed load);
- 3b-May begin pro-rata load shed in declaration area. Begin with interruptible demand not previously called upon;
- 4a-Implement reserve call from contingency reserve sharing group (this includes shared reserves that are off-line);
- 4b-Coordinate with neighboring RCs and Balancing Authorities to identify additional available emergency energy and operating reserves; implement emergency purchases of energy previously contracted; if insufficient declare EEA 3 (load shed)
- 5- ***Firm load shed***; instruct LBAs to shed load in specific MW quantities; set all affected Locational Marginal Prices ("LMPs"[47]) to the Value of Lost Load ("VOLL")[48]

meter, such as a generator owned by a municipal utility or an industrial customer that purchases power from a retail utility and produces its own power for its own purposes.

[45] The Reliability Coordinator is a North American Electric Corporation authorized entity that provides reliability oversight functions to the grid operators and BAs controlling the BES. These functions include security operations and emergency operations coordination.

[46] Firm load is load with FT service, which has paid to have priority access to generators and other resources on the BES.

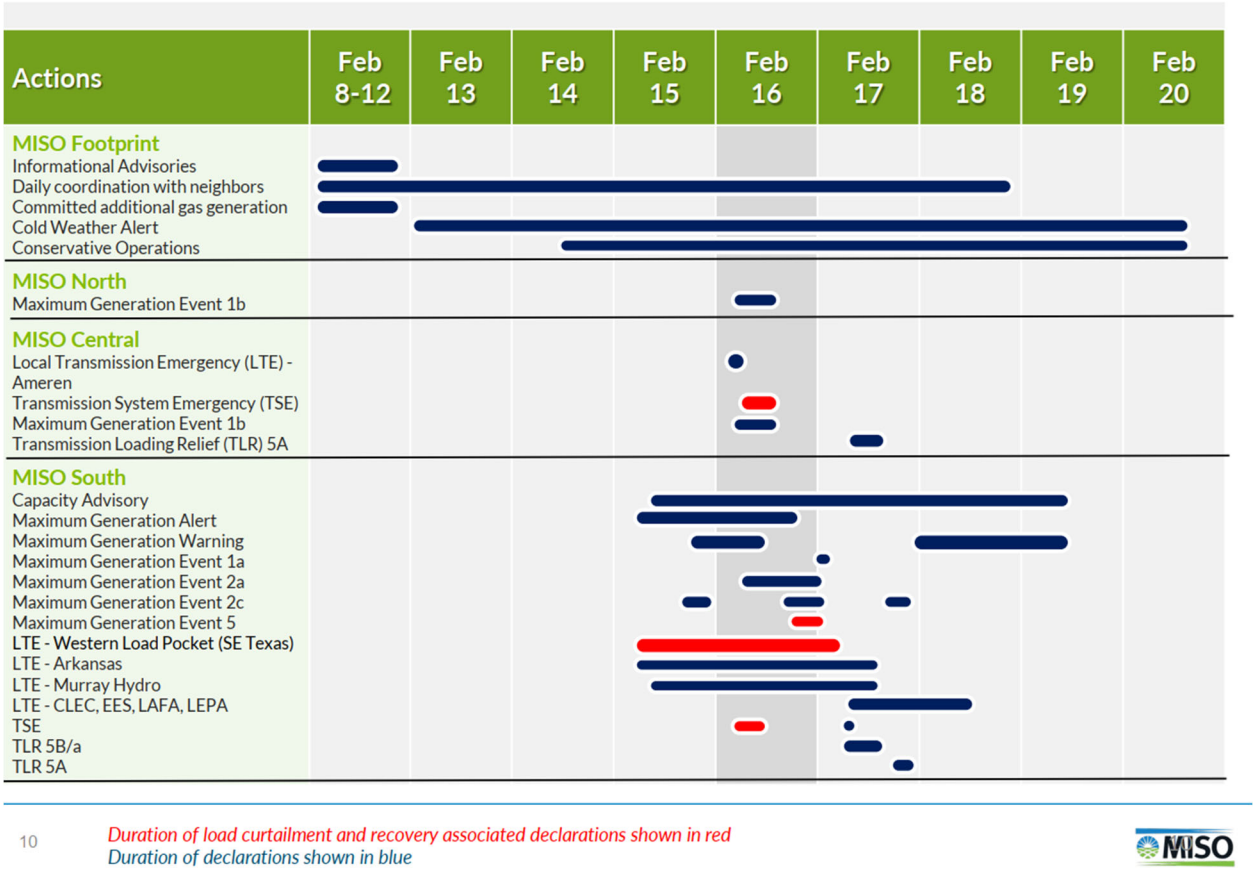
[47] The Locational Marginal Price ("LMP") is the wholesale price of electricity at a single point on the BES.

[48] The Value of Lost Load ("VOLL") is the maximum, estimated wholesale price that a Load Serving Entity ("LSE") receiving electricity with firm contracts would be willing to pay to avoid a disruption in their electricity service.

- **Max Gen Event Downgrade/Termination**-inform LBAs; perform necessary steps to back-out of emergency operations actions.

The following figure describes the dates and durations of the different alerts MISO issued in accordance with its EOP over February 8-20, 2021 and to which MISO region they applied.[49]

Figure 15



Source: Midcontinent Independent System Operator, *Overview of February 2021 Arctic Weather.* Presentation to Markets Committee of the Board of Directors. March 23, 2021. Slide 10. Used with Permission.

[49] Acronyms in this slide: LTE-Local Transmission Emergency, TLR-Transmission Loading Relief (this is a NERC procedure to reduce energy flows over an overloaded or near-overloaded facility on the BES.), and TSE-Transmission System Emergency.

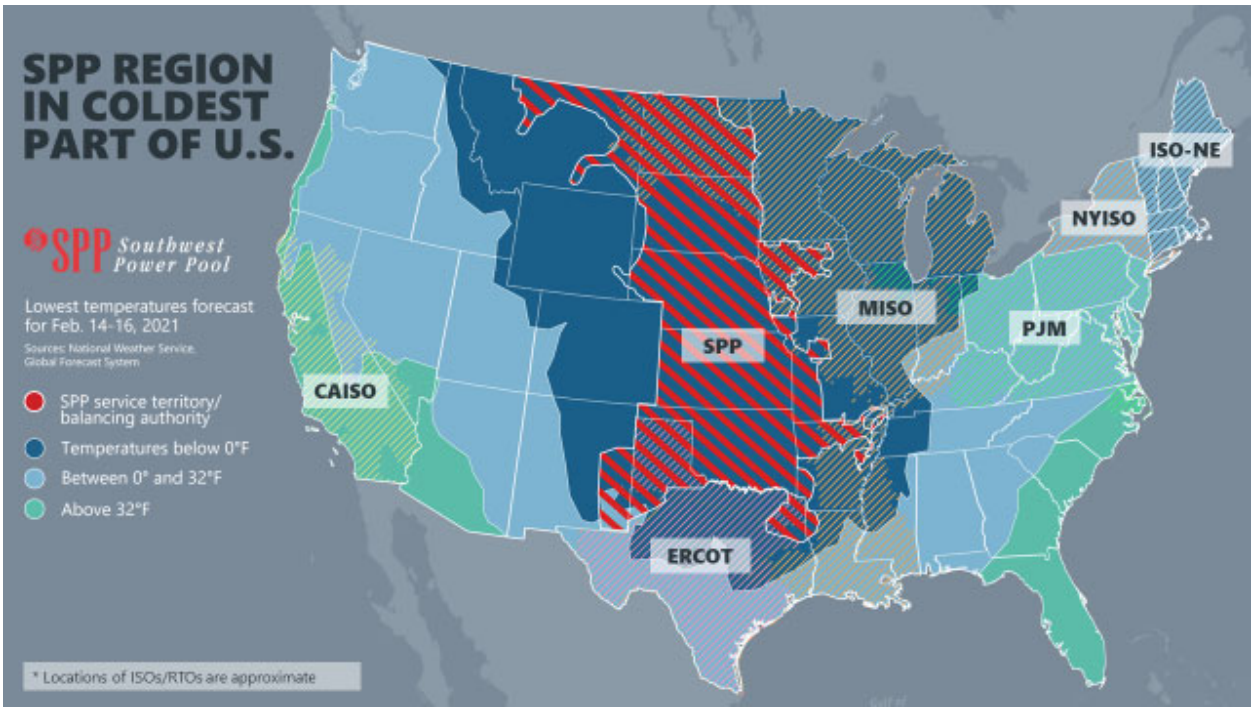
On February 9, 2021 MISO declared a footprint-wide cold weather alert effective February 13, 2021 that continued through February 23, 2021. MISO issued 31 emails either notifying affected parties of some action or event or instructing parties to prepare for some action or event. MISO issued its termination of cold weather actions by email on February 23, 2021 to be effective on February 23, 2021 11:59 CST.

MISO notifications and directives calling for specific actions are communicated to the LBAs over the MISO Inter-Control Center Communications Protocol, a secure communications channel and not just by email.

3. Southwest Power Pool Preparation for and Response to Cold Weather Event

a. SPP-February 2021 Overview

Figure 16



Source: *February 2021 Winter Storm Event*, Lanny Nickell, slide deck report to SPP Regional State Committee March 8, 2021, slide 3. Used with permission.

The SPP footprint was entirely contained within the February 2021 arctic air mass that swept over much of the country and saw many record-low high temperatures broken.[50] For example, the National Weather Service ("NWS") reported part of central Oklahoma endured temperatures more than 40º below normal.[51]

b. SPP Preparations Instructions to Stakeholders

SPP's EOP is subject to the same NERC regulations and standards[52] as is MISO's EOP. Pursuant to the *SPP BA Emergency Operating Plan*[53, 54] (spp ba emergency operating plan_v 7.5.pdf) the following alerts and instructions were issued to SPP Transmission Owner Operators, Generator Owner Operators and other affected stakeholders that are subject to the SPP tariff.

[50] NWS Weather Prediction Center on Twitter: "Over 3000 daily record cold temperatures (minimum and maximum) have now been reported from February 12-17 at ***long term observations*** (75+ years of data). Within that dataset there were 79 all-time cold records. Search the data here: https://t.co/6uBMN37TNQ" / Twitter

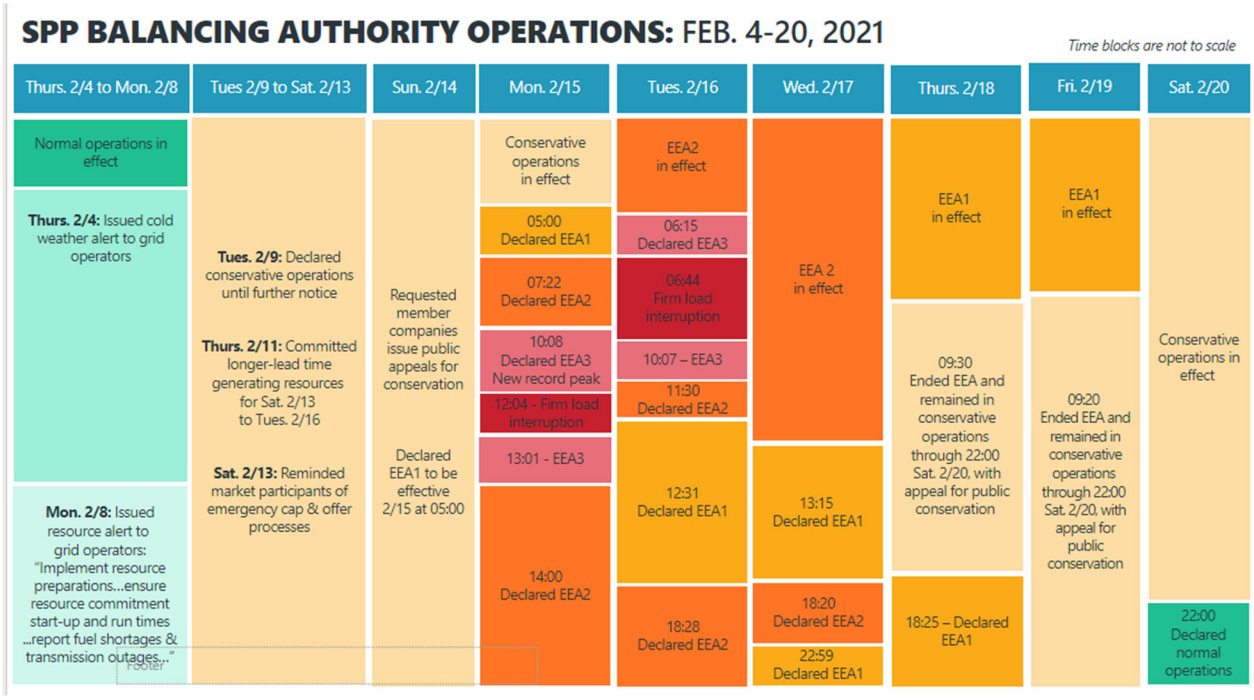
[51] NWS Weather Prediction Center on Twitter: "Widespread extreme #cold has been impacting the Plains and down into the Deep South. This cold snap is forecast to result in record low temperatures that are comparable to the historical cold snaps of Feb 1899 & 1905. Please stay safe and stay warm! https://t.co/S9drmeeirx" / Twitter

[52] See NERC EOP-011-1, Template - Standard (Results Based) (nerc.com).

[53] BA refers to Balancing Authority. BAs tend to be utilities or transmission owners with the responsibility to balance electrical load (or demand) with electrical supply (or generation) in their designated areas.

[54] SPP is a Consolidated Balancing Authority, an entity charged with the duties of a BA in combined Bas in the combined areas in which those BAs operate. That is, the SPP Regional Transmission Organization assumes the Local Balancing Authority responsibilities and actions mentioned in footnotes 1 and 7 as new members with BA responsibilities join.

Figure 17

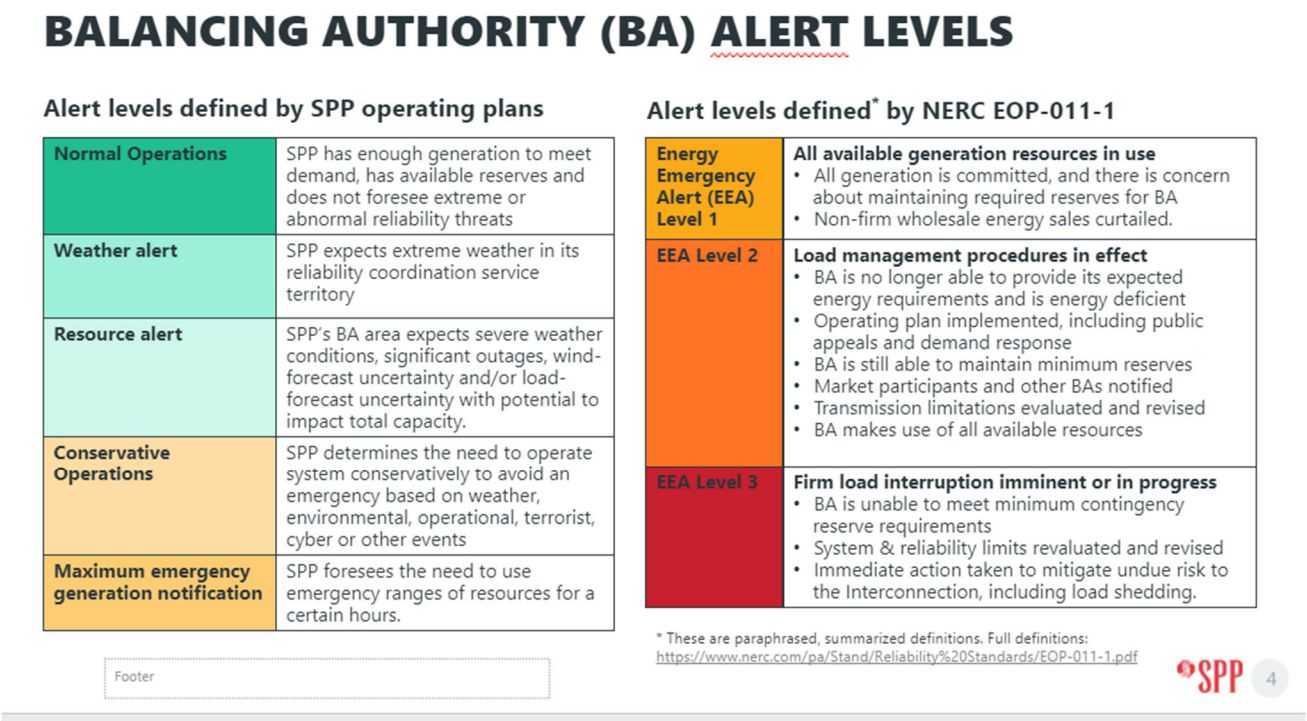


Source: *February 2021 Winter Storm Event*, Lanny Nickell, slide deck report to SPP Regional State Committee March 8, 2021, slide 5. Used with permission.

c. SPP EOP

The following slide illustrates the SPP EOP and compares it to NERC's EOP-011-1 standard.

Figure 18



Source: *February 2021 Winter Storm Event*, Lanny Nickell, slide deck report to SPP Regional State Committee March 8, 2021, slide 4. Used with permission.

d. SPP Advisories, Orders, Load Shed Selected Events

The table below presents selected SPP advisories and orders issued from February 4 – 20, 2021.

Timeline		
Date	Time	Actions
February 4		SPP Balancing Authority issued cold weather alert to gird operators.
February 8		Issued resource alert to grid operators to "implement resource preparations … ensure resource commitment start-up and run times … report fuel shortages and transmission outages."

February 9		SPP declared conservative operations until further notice
February 10		MMUJ began receiving requests from market participants to switch fuel resources for offers. Most from gas to oil.
February 11		SPP Operators committed generating resources for February 13 – 16 using Multi-Day Reliability Assessment process.
February 13		SPP reminded market participants of emergency cap and offer processes
February 14		**SPP requested member companies issue public appeals for conservation** **SPP declared Energy Emergency Alert 1 (EEA1) to be effective February 15 at 5:00 a.m.**
February 15	5:00 a.m. 7:22 a.m. **10:08 a.m.** **12:04 p.m.** **1:01 p.m.** **2:00 p.m.**	EEA 1 declared EEA 2 declared **EEA 3 declared, new record winter peak set** **Temporary service interruptions began, 610 MW load shed** **EEA 3 still in effect, service interruptions restored** **EEA 2 declared**
February 16	6**:15 a.m.** **6:44 a.m.** **10:07 a.m.** 11:30 a.m. 12:31 p.m. 6:28 p.m.	**EEA 3 declared** **Temporary service interruptions began, 2,718 MW Load shed** **EEA 3 still in effect, demand interruptions restored** EEA 2 declared EEA 1 declared EEA 2 declared

February 17	1:15 p.m. 6:20 p.m. 10:59 p.m.	EEA 1 declared EEA 2 declared EEA 1 declared
February 18	**9:30 a.m.** **6:25 p.m.**	**SPP ended Energy Emergency Alert** and remained in conservative operations until February 20 at 10:00 p.m., with **appeal for public conservation** EEA 1 declared
February 19	**9:20 a.m.**	**SPP ended Energy Emergency Alert** and remained in conservative operations until February 20 at 10:00 p.m., with **appeal for public conservation**
February 20	**10:00 p.m.**	**SPP declared normal operations**

Source: SPP MMU *State of the Market Report Winter 2021*, pp 61-62.

The reasons for load shed included:[55]

- Lack of fuel supply, icing and other cold weather related causes;
- Rapid reduction of energy imports related to transmission congestion and tightening energy supply from and emergency conditions in neighboring areas;
- Record energy consumption.

[55] Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021*, pp. 61-62.

The SPP Market Monitoring Unit ("SPP MMU")[56] was informed on February 10, 2021 that market participants would be updating their energy market offers due to the need to seek alternative fuels (gas to oil).[57]

e. SPP Capacity (Generation)

The SPP MMU indicates during the periods where Emergency Energy Alert level 3 (at this level temporary service interruptions may be, and in this case were imposed, February 15 and 16, 2021[58]):

- Gas-fired hourly generation was in the 10-11 GW range;
- Wind generation was around 4 GW; and,
- Coal-fired hourly generation was in the 15-18 GW range.

The SPP MMU noted that prior to the Cold Weather Event gas-fired generation produced a maximum output around 17 GW and coal generation generally remained steady leading up to and through the Cold Weather Event. The following graphic indicates SPP real-time generation by fuel type from February 11 to February 20, 2021.[59]

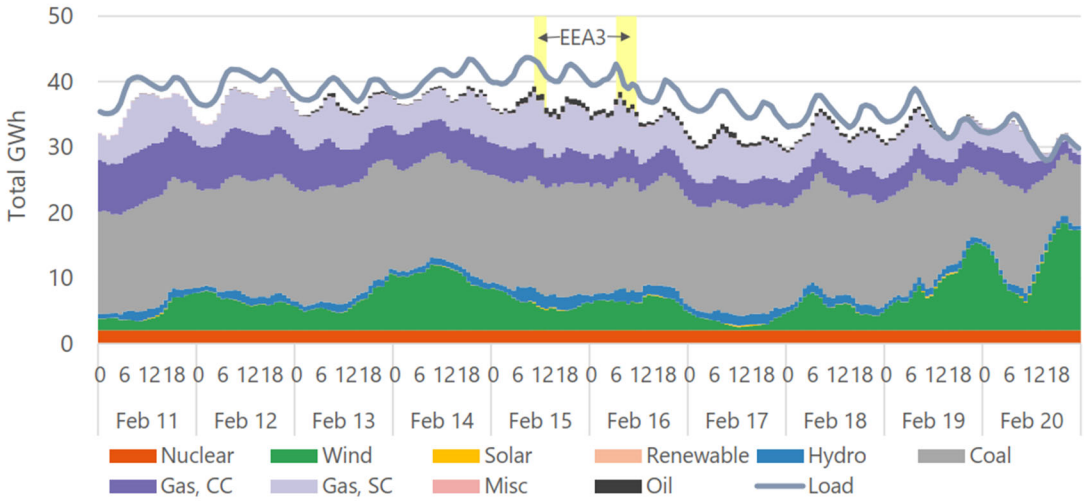
The SPP MMU noted that real-time wind output was higher than that bid into the day-ahead wholesale energy market throughout the Cold Weather Event except for February 17, 2021.[60]

[56] The SPP Market Monitoring Unit ("SPP MMU") is the SPP internal entity required by FERC to monitor the SPP markets to ensure they remain competitive and that no MP employs Market Power.
[57] Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021*, pp. 61-62.
[58] See table in subsection d. above.
[59] Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021,* p. 70.
[60] Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021,* p. 71.

Figure 19

SPP Real-Time Generation by Fuel Type

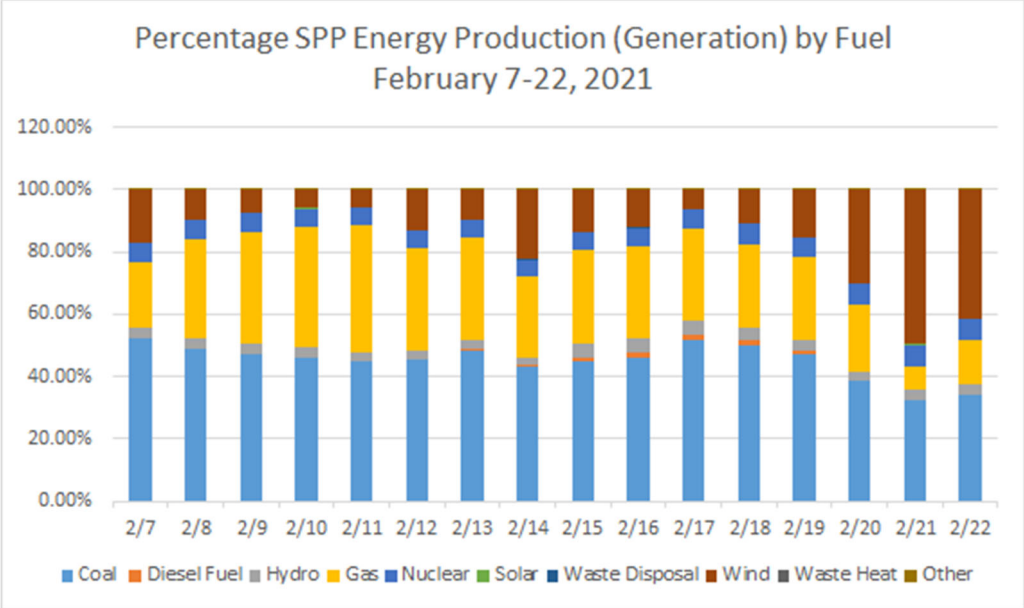
February 11-20, 2021



Source: Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021,* p. 70. Used with Permission.

Note in graph above, the white area between the gray load line at the top of the graphic and the lavender region represents the volume of energy demand that is not able to be met by SPP generation. This demand for energy can only be met by energy provided and transported to SPP by other regions such as MISO, PJM or elsewhere.

Figure 20



Energy production in the SPP footprint over the period February 7-22, 2021 by fuel type is presented in the preceding and chart and following table, based on publicly available SPP Market Reports at SPP's Market Portal: https://marketplace.spp.org/pages/generation-mix-ytd. In the SPP region over the period February 7-22, 2021 coal was and is the dominant fuel used to serve load, distantly followed by gas, wind, nuclear, hydro, other generating fuels and imports (about 6.5% on average).

Percentage SPP Load Served by Fuel Type February 7-22, 2021						
Coal	Gas	Wind	Nuclear	Hydro	all other	Imports
42%	26%	16%	6%	3%	<1%	6.50%

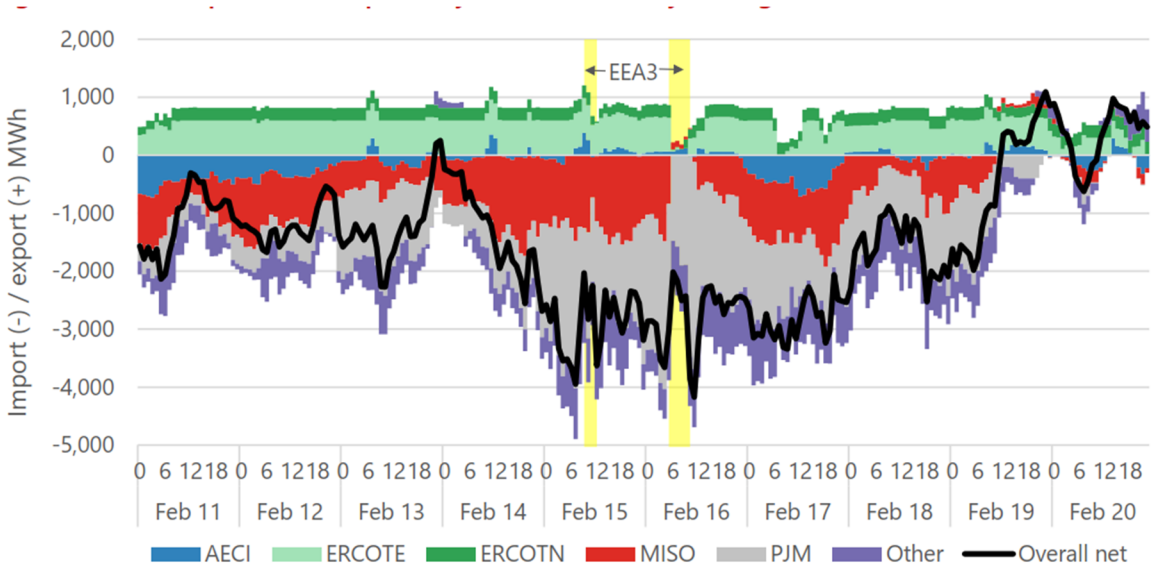
f. SPP Imports and Exports[61]

Under normal conditions, energy exports and imports into SPP fluctuates by +/- 200MW per hour. However, during the Cold Weather Event, SPP imported energy from PJM, MISO and the Western Interconnection, and **exported** energy to the Electric Reliability Council of Texas ("ERCOT"). SPP imports/exports returned to a more normal pattern on and after February 19, 2021 and SPP ended its emergency operating procedure at 10:00 p.m. February 20, 2021.

g. SPP Imports and Exports by Trading Interface, Hourly Average and in Real Time[62]

Figure 21

Real Time Average Imports and Exports Between February 11 and 20, 2021



Source: Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021,* p. 69. Used with permission.

[61] Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021,* pp. 68-69.

[62] SPP trades energy with Associated Electric Cooperatives ("AEC"), ERCOT and MISO on a regular basis. SPP and PJM rarely trade energy. ERCOT limits energy exchanges with SPP by

The preceding graphic treats exports as a positive number (more than zero) and imports as a negative number (less than zero). All colored regions above zero are exports from SPP and below zero are imports. The black line represents the net exports, the difference between exports and imports (net exports = exports – imports). Where net exports are below zero, energy imports are required to meet electric load.

The light and dark green regions indicate exports to ERCOT through the two direct current links SPP has with ERCOT (one in the east and one in the west). In the yellow EEA 3 bar to the right (February 16, 2021), the green region goes to zero, indicating no exports to ERCOT. The red region indicates imports from MISO, the gray region from PJM, and the blue from AECI. Clearly SPP received an abundance of assistance from its neighbors.

The MMU and graphic indicate that at times SPP net-exports exceeded 3,600 MW per hour from PJM (which was wheeled through MISO). The graphic indicates that before the first EEA 3 imports approached 5000 MWh and before and after the second EEA 3, imports were in the 4,500 MWh range, or more.

Early on February 16, 2021, MISO experienced emergency conditions on its own system and curtailed exports to SPP which limited wheeled power from PJM. It was at this time, 6:15 a.m. that the EEA 3 was declared.

h. Generator Outages

The MMU reported on February 10, 2021, about 11,750 MW of gas generation was on unplanned outage. However, due to fuel related issues and by February 18, 2021, fuel related outages reached a peak near 25,000 MW.

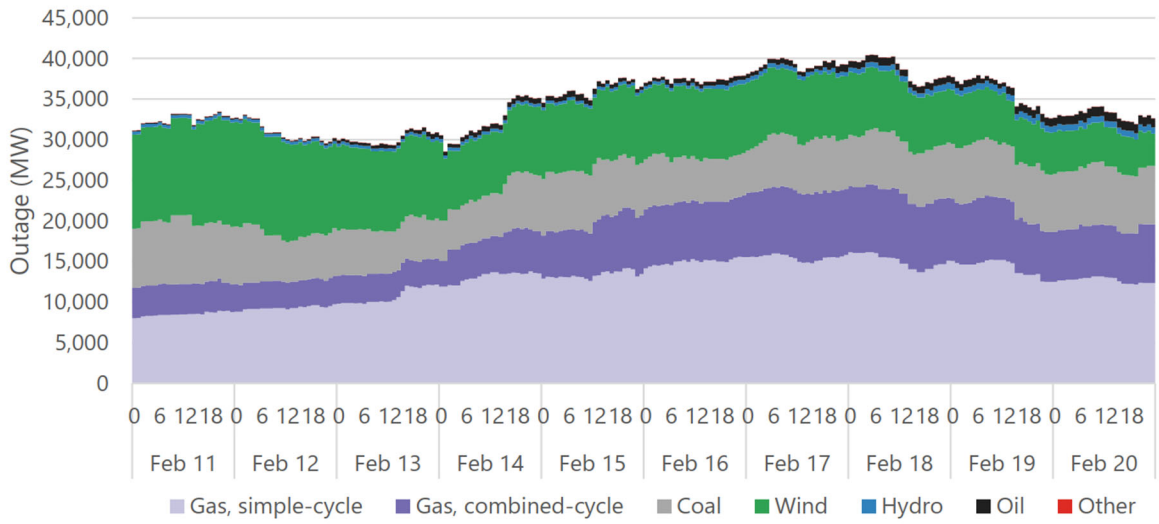
Wind resources were affected by icing on February 7 and 8, 2021 and were slow to recover. On February 10, 2021, 11,000 MW of wind was on outage but by the peak of the winter event, that

using two Direct Current interconnection points (called DC-ties) which are identified in the graphic as ERCOTE ("ERCOT-East") and ERCOTN ("ERCOT-North").

outage **improved** to about 8,000 MW, meaning three GW of wind generation were restored to service. The following graphic illustrates SPP generator outages by generator fuel type from February 11-20, 2021.[63] Note that the graphic does not ascribe the resource outage to lack of the appropriate fuel, merely that the generator type was not in service.

Figure 22

SPP Generation Outages by Generator Fuel Type



Source: Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021,* p. 65. Used with permission.

The preceding graphic indicates gas-fired, coal-fired, wind, hydro, oil-fired and other generators went down and suffered outages. Gas-fired generation, consistent with MMU reports statements, gas-fired generators appear to have 25,000 MW on outage on or near February 18, 2021 (the lavender and purple regions appear to reach a maximum) and wind outages appear to decline (the green region appears to become smaller, thinner) from February 11, 2021 through the end of the Cold Weather Event.

[63] Id. at p. 65.

i. SPP Energy Prices [64]

SPP (and MISO) employs a wholesale day-ahead and wholesale real-time energy market structure in which generators offer "today" to produce a given number of megawatts at a specific price and load bids for that energy for delivery "tomorrow," in real time. Real-time circumstances can deviate from what was assumed when the prices were offered or bid in the day-ahead market which can cause the real time prices to be different from those created in the day-ahead market. In this market structure, buyers and sellers enjoy competitively set prices and a degree of price certainty, benefiting all market participants. Prices are referred to as LMPs because the prices indicate the wholesale charge of acquiring one-more megawatt of energy (the margin) and do vary from location to location.

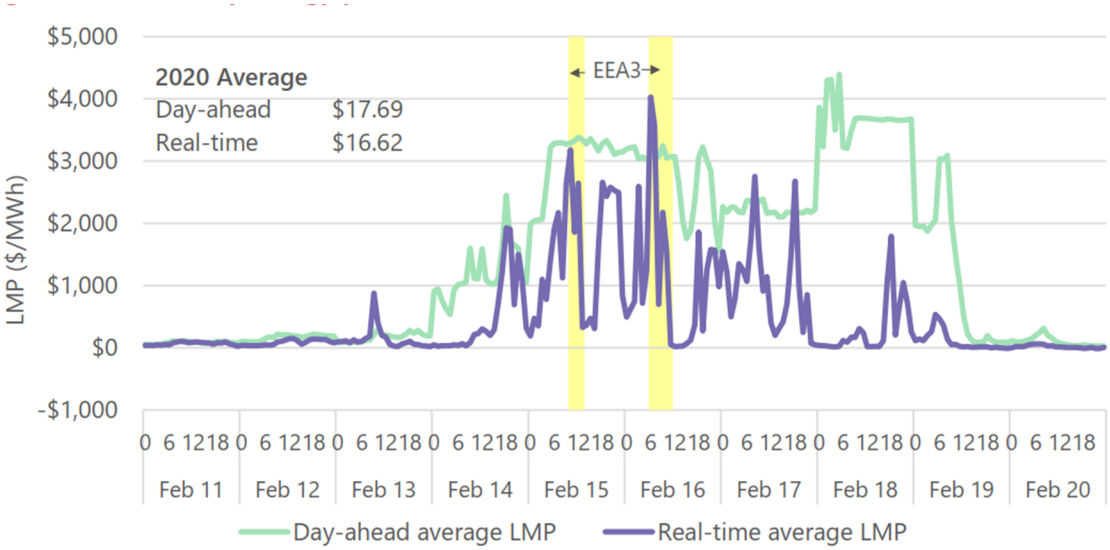
When adverse circumstances arise and capacity becomes scarce, Scarcity Pricing protocols are engaged which attempt to ensure reliable supplies of energy at reasonable prices given the circumstances. The following graphic shows the Day Ahead and Real Time average LMPs (average wholesale energy prices) from February 11-20, 2021. Prior to February 13, 2021 and after some time on February 19, 2021, Real-Time and Day-Ahead prices tend to converge (or track one-another), which is ideal. From February 13, 2021 to February 19, 2021, Day-Ahead prices exceeded Real-Time prices except during the second EEA 3, February 16, 2021, where Real-Time prices peaked at $4,029/MWh. The graphic also indicates the average 2020 Day-Ahead and Real-Time Prices which reflect an energy demand under a more "normal" pattern.

[64] See Southwest Power Pool Market Monitor. *State of Market Winter Report 2021,* pp. *71-74.*

Figure 23

SPP Hourly Energy Prices

February 11-20, 2021



Source: Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021,* p.72. Used with permission.

Pursuant to FERC Order 831, wholesale energy offers into organized energy markets (such as the RTOs') are soft-capped at $1,000/MWh; however, if circumstances warrant and evidence justifies, offers may exceed the soft cap up to a hard cap of $2,000/MWh. Given short resources, energy imports, transmission congestion and losses, it is possible for LMPs to exceed $2000/MWh.[65]

j. Takeaways

SPP and MISO energy markets worked effectively through the Cold Weather Event. When fuel was abundant or demand was low, electrical energy prices were within or near historical ranges. When temperatures fell and demand began to creep upward, energy market prices increased reflecting diminishing fuel availability (also reflected in increasing fuel prices) and diminishing

[65] Source: Southwest Power Pool Market Monitoring Unit. *State of the Market Report Winter 2021,* p. 72.

reserve capacity. When capacity was insufficient to meet demand, scarcity pricing was invoked and external sources of energy, imports from MISO, PJM and other entities were made available.

Generator outages occurred across all types of electrical generators, not just renewables. Gas supplies appear to have been most impacted due to weather impacts and competition for heating fuels which resulted in part to 25,000 MW of SPP controlled gas-fired resources being unavailable. Leading into the cold snap 11,000 MW of wind-powered generation was off-line but as the cold snap persisted, wind outages declined to 8,000 MW and continued to fall afterward. Coal outages appear to have been consistent across the period.

There were no weather related service interruptions in MISO-Missouri. To compensate for capacity shortages in the SPP region, limited, temporary service interruptions were shared on a proportional basis among all SPP transmission owning entities, including Evergy, Liberty-Empire and City Utilities of Springfield to help utilities in need.

Contributors: Walt Cecil and Adam Mckinnie

IV. Missouri Local Distribution Company Prices for Cold Weather Event

A. Market Prices

The extensive increase in daily February market prices has been described as a Midwest and West phenomenon driven by extremely cold temperatures impacting states west of the Mississippi River to a greater extent than those to the East. The deeper reach of very cold weather into southern states like Oklahoma and Texas significantly impacted wellhead operations, freezing unprotected wells and thereby impacting the operations on interstate pipelines.

All local distribution companies ("LDCs") in Missouri develop hedging plans to address natural gas volatility. This generally includes both the acquisition of natural gas storage and the use of financial instruments to fix the price for a portion of anticipated gas supply. However, the Cold Weather Event impacted daily gas supplies. Daily price volatility is difficult to hedge, and is

typically subject to market pricing for those volumes needed over baseload (supply that is easily hedged) and storage volumes.

Generally speaking, the greater the exposure to daily priced gas during the Cold Weather Event, the greater the negative impact on the customer.

LDC prices are often referenced to a natural gas index. Index prices are calculated by industry trade publications. Samples of actual fixed price transactions for various locations are used to develop a weighted average price on a monthly and daily period. The methodology of index prices in general has been the subject of various Federal Energy Regulatory Commission ("FERC") cases over the years. The latest FERC case to review index pricing practices is Docket No. PL20-3-000, *Actions Regarding the Commission's Policy on Price Index Formation and Transparency, and Indices Referenced in Natural Gas and Electric Tariffs Liquidity and Transparency*.

In a March 22, 2021, filing in the above FERC docket, the American Public Gas Association ("APGA"), offered "a sampling of indices that affected a number of its members during" the Cold Weather Event. As indicated by the APGA, the data was taken from the publications of S&P Global Platts: *Inside FERC Gas Market Report* and *Gas Daily*.

One of the data tables provided was for Southern Star Central Gas Pipeline, a FERC-regulated interstate pipeline that provides significant capacity and flows to Missouri LDCs, especially on the west side of the state. The data includes "Flow dates", Price, Number of Deals, and the Volumes associated with the deals used to develop the price. In the table, "FOM" stands for "first of month" price. Prices are in $/MMBtu.

Southern Star Data Table

Flow Date(s)	Price	Volume (000s)	Deals
FOM	$2.520	83	14
Feb. 12	$44.780	104	26

Feb. 13-16	$329.595	50	7
Feb. 17	$622.785	16	2
Feb. 18	$44.530	75	13

In the gas industry, it is a common practice to price "baseload" gas purchases (supply that flows evenly every day of the month) using a First of Month or FOM price. As seen in the table above, the FOM price applicable to Southern Star was $2.520/MMBtu. Prices in the first of the month market (monthly prices) have generally been in a range of $1.50 to $3.50 per MMBtu for an extended period of time and have been relatively stable. Even though more volatile, it is rare for the daily market price to exceed $10.00/MMBtu. The daily index escalation in price shown in the above table for February 12th through February 18th is, to Staff's knowledge, without precedent for interstate pipelines serving Missouri (See slide 8 of Spire's presentation[66] in this case for February 2021 daily natural gas prices).

Of particular concern is the price level for the February 17th flow date (Issues regarding liquidity of natural gas indices are part of an ongoing FERC case, Docket No. PL20-3-000). On that day, the published price for gas flowing on Southern Star was $622.785 per MMBtu. (See the above table, which is an excerpt from pages 5 and 6 of the American Public Gas Association's Initial Comments in FERC Docket No. PL20-3-000). In the above table, only two deals with a related volume of 16,000 MMBtu were used to establish the daily index price for February 17th. It is difficult to understand how so few transactions can set the price of a daily index that detrimentally impacted hundreds of thousands of customers. Spire noted this concern when it described its inquiries into the Southern Star index (Case No. AO-2021-0264, Tr. page 24, line 10, and page 30, line 3.)

Contributor: David M. Sommerer

[66] Case No. AO-2021-0264. EFIS No. 9. March 23, 2021.

V. Response of Utilities Subject to Commission Jurisdiction

A. Local Distribution Companies (Natural Gas)

Overall, the LDCs in Missouri had hedging plans in place prior to the winter of 2020-2021. These plans generally used a combination of storage, when available, and financial instruments to hedge baseload supplies. Spire West, The Empire District Gas ("Empire Gas"), and Liberty Utilities (Midstates Natural Gas) ("Liberty Midstates"), all issued Operational Flow Orders ("OFO") to their transportation customers. Operational Flow Orders are issued by a regulated utility to require a specific action to preserve the integrity of the utility's system. Additionally, per Summit Natural Gas of Missouri's ("SNGMO" or "Summit"), March 26 written responses to Commission questions in this docket, "SNGMO asked interruptible customers to reduce usage to heat load only but did not fully curtail any customers. Those asked to reduce to heat load complied and SNGMO was able to avoid any curtailments." Spire East and Ameren Missouri Gas Operations ("Ameren Gas") sent news releases to local media requesting that customers take steps to reduce demand.

Disputes with regard to Spire West's OFOs are ongoing (see Case Nos. GC-2021-0315, GC-2021-0316 and GC-2021-0353). There have also been informal inquiries with regard to Summit's monthly "cash-out" billings. These inquiries primarily related to end-user transportation customer concerns about very high gas bills that resulted from a monthly comparison of receipts of gas versus deliveries of gas for February 2021. Cash-outs refer to the tariff process of reconciling the receipt of gas by the LDC (from the end-user) compared to the end-user's consumption.

One issue that arose as a result of the Cold Weather Event regarding the gas utility responses and actions includes transportation customer concerns and confusion related to the natural gas marketer part of the bill versus the utility part of the bill. Charges for gas supply that are invoiced by the natural gas marketer are likely the result of a private contract between the natural gas marketer and the transportation customer. These contracts, and the charges invoiced under the contract, are not under the Commission's jurisdiction. Another significant issue impacting sales customers is the extent and timing of increases in their bill that result from the Cold Weather Event.

Estimates of these impacts for sales customers are provided under the Customer Impact section, Section VII. B., of this Report.

An additional issue includes how liquid the natural gas index pricing point may be. The liquidity and transparency of the natural gas indices is overseen by FERC since index prices are referenced in interstate pipeline tariffs. As part of the Actual Cost Adjustment ("ACA") reviews, Staff intends to monitor any actions taken by the LDCs in the FERC proceedings/investigations regarding the gas indices. The issues related to Operational Flow Orders including how LDC tariffs and actions encouraged delivery from natural gas marketers during the Cold Weather Event are the subject of complaint cases before the Commission. Disputes with regard to Spire West's OFOs are ongoing (see Case Nos. GC-2021-0315, GC-2021-0316 and GC-2021-0353).

Contributors: David M. Sommerer and Keenan B. Patterson, PE

VI. Customer Notifications/Impacts by Utilities Subject to Commission Jurisdiction

A. Communication Efforts with Customers, Media and Government Officials

A coordinated, consistent, and effective communications effort is critical when informing the public of service outages or the threat of service outages. Clear communication is a component of good customer service, which is expected by customers and the general public during service outages, particularly during extreme weather conditions. Staff inquired about each utility's communications procedures regarding outages, and questioned if procedures were in place and followed during the Cold Weather Event. Staff requested a copy of utility procedures and scripts when communicating outage information to residential and non-residential customers, the media, government officials and critical facilities. The information provided by each utility regarding its recent communication efforts follows.

1. Ameren Missouri

Ameren Missouri experienced no major outages due to the Cold Weather Event. If Ameren Missouri had, processes are in place to notify affected customers through multiple channels such as Ameren's Missouri's social media channels on Facebook and Twitter, on Ameren Missouri's website and outage map, through local press releases, text alerts, etc. Ameren Missouri has the capability to pre-notify customers through automated phone calls or text alerts if it knows in advance a planned outage will occur for certain customers. In addition, Ameren Missouri provides Estimated Safe Restoration Times ("ESRTs") to its affected customers that provide additional information about the current outage once known.[67]

During the Cold Weather Event, Ameren Missouri issued three press releases and worked with numerous media outlets related to weather and energy conservation across both natural gas and electric customers. Ameren Missouri also shared publicly other safety messages, including dock safety at Lake of the Ozarks in light of the extreme weather event. Safety and energy conservation messages were communicated to the public through social media, news conferences and media interviews. [68]

Ameren Missouri utilized its Facebook and Twitter accounts to proactively communicate safety messages, energy conservation and service reliability messages before, during and after the Cold Weather Event. Ameren Missouri stated that its Corporate Communication and Digital Customer Care teams monitored and responded to social media posts/comments in a timely and efficient manner. In addition, press releases were also made and submitted for public consumption.[69]

Automated outage notifications were sent for customers experiencing outages during this event. The outage notification process was executed as normal and not modified for this event. Ameren Missouri provided Staff scripts for the text outage related notifications for Potential Power Outages (PPO alert), Estimated Safe Restoration Time ("ESRT"), and Restoration alert. A system issue

[67] Ameren Missouri Response to Staff Data Request No. 0129.
[68] Ameren Missouri Response to Staff Data Request No. 0131.
[69] Ameren Missouri Response to Staff Data Request No. 0134.

did affect the delivery of the ESRT and Restoration alerts during the Cold Weather Event. The issue is described in the Technical Issues section, Section VI. C., of this Report.[70]

For critical customers (e.g., major hospitals, water facilities), large industrials, and any other critical customers, Ameren Missouri has a team that proactively reaches out to notify them of any potential outages or existing outages to provide feedback. In addition, Ameren Missouri has a Missouri Regulatory team that ensures state and local government officials are kept up-to-date and aware of large concerns. Ameren Missouri partners with the State Emergency Management Agency ("SEMA") if any emergency services are needed or simply just to communicate status with current emergency events.[71]

Ameren Missouri did not curtail natural gas customers during the Cold Weather Event; therefore, its Curtailment Plan was not utilized.[72]

B. Customer Calls/Informal Commission Complaints

As of February 19, 2021, the Commission's Consumer Services Department estimates receiving approximately 20 phone calls and five emails with comments from only Evergy and Liberty-Empire customers regarding the outages.

Contributor: Contessa King

C. Technical Issues

Staff inquired whether or not the utilities had any technical issues concerning their websites, customer information systems ("CIS"), interactive voice response ("IVR"), and call center/field operations. The following section discusses the responses Staff received.

[70] Ameren Missouri Response to Staff Data Request No. 0133.
[71] Ameren Missouri Response to Staff Data Request No. 0130.
[72] Ameren Missouri Response to Staff Data Request No. 0339.

1. Ameren Gas[73]

These utilities did not experience technical issues with their IVR, customer information systems ("CIS"), websites, and call centers or field operations while responding to the Cold Weather Event.

Contributor: Scott Glasgow

D. Policies and Procedures

Most of the utilities have some type of emergency response plan ("ERP") in place that can be referenced in situations such as the Cold Weather Event. Some utilities experienced load curtailments or load shedding while others did not. When required, most companies referenced their plans and procedures for the proper protocols for customer contact and notifications in load curtailment or shedding situations. These notifications included the use of social media platforms such as Facebook or Twitter, utilization of a notification system based on customer preference and use of email, text, and automated phone calls.

1. Ameren Gas

Ameren Gas has a communications plan in place but did not utilize it because no customers were curtailed.[74] Ameren Gas does not have a standard curtailment or energy conservation message that is delivered, but indicated it has the capability to develop a customized message which can be delivered to customers via email, phone, and text.[75] Ameren Gas provided its tariff related to curtailments. P.S.C. Mo. No. 2, 2nd Revised Sheet No. 69.[76] Ameren Gas stated that its Operations response to cold weather related emergencies is outlined in the Ameren Missouri Operations and Maintenance Plan and Regional Curtailment Plans. Ameren Gas also has a Cold Weather Electric Outage Restoration Plan.[77] Ameren Gas stated it does not have an ERP concerning

[73] Ameren Missouri Response to Staff Data Request No. 346.
[74] Ameren Missouri Response to Staff Data Request No. 339.
[75] Ameren Missouri Response to Staff Data Request No. 343.
[76] Ameren Missouri Response to Staff Data Request No. 348.
[77] Ameren Missouri Response to Staff Data Request No. 227.

curtailments/interruptions.[78] A Staff recommendation concerning this point follows. Ameren Gas' communications team met during and after the Cold Weather Event to evaluate whether its communication efforts were effective. The team felt actions were efficient and productive.[79]

a. Staff Recommendation for Ameren Gas

1. Staff recommends Ameren Gas evaluate and implement an ERP for curtailments/interruptions in accordance with 20 CSR 4240-40.030(12)C, if not already covered by the other plans.

Contributors: Tammy Huber and Sarah Fontaine

E. Missouri Call Center Operations

Customers were given a variety of resources they could contact for additional information or questions regarding their utility service during the time frame of the Cold Weather Event. One of these resources was the Call Center for each of the utilities. Customers are provided with a number to reach the call center if they have service or billing questions, as well as to report outages and safety concerns. Call Centers provide the customer a number of options with which they can obtain information and conduct transactions with the company. When their call is initially answered, Interactive Voice Response ("IVR") systems offer the customer the ability to select from a variety of options to target the method of resolving their inquiry or conducting a transaction. The IVR also offers the opportunity to connect with a Customer Service Representative ("CSR") if they wish to speak to someone during normal business hours. Customers are provided with updated information on the anticipated length of time before they will be able to speak with a CSR. In some instances, companies also utilize call deferral technologies that allows the customer to maintain their place in the call queue and select a return call for a later time.

[78] Ameren Missouri Response to Staff Data Request No. 350.
[79] Ameren Missouri Response to Staff Data Request No. 347.

Overall, the utilities were able to respond to the increased call volume experienced during the Cold Weather Event from what they would have experienced in a more typical February time frame. Some utilities experienced technical issues with internet service and messaging services and these issues are discussed in more detail in the Technical Issues section, Section VI. C., of this Report. While customer wait times were longer than would be normal, in Staff's opinion, under the circumstances they did not reach excessive levels given the circumstances. The extended utilization of the IVR to direct customers to a specific option allowed customers to conduct a number of actions with the utility without having to speak to a customer service representative. This assisted in keeping the wait times (also known as Average Speed of Answer or ASA) and the number of abandoned calls (referred to as Abandoned Call Rate or ACR) from becoming much higher than they could have been.

1. Ameren Missouri and Ameren Gas (collectively "Ameren")[80]

Ameren Customer Care Center ("CCC") representatives were provided with information on energy savings tips and reports of current outages. Ameren CCC representatives also received information regarding the potential for technical situations with outages which could extend the time to restore service in some circumstances. The IVR system was not modified, as Ameren's system operates on a natural language understanding IVR, which responds directly to what the customer says.

During the time period of the Weather Event, Ameren received 10,290 calls into its IVR on February 16, 2021. In February 2020, Ameren received an average of over 3,700 calls a day or a total of 108,195 calls into its IVR for the entire month. Ameren's CCC representatives were sent 5,999 of these 10,290 IVR calls received on February 16, 2021 to respond to. On that day, Ameren's CCC staffing was at its highest level and the ASA was ten minutes eight seconds for calls answered.

Contributor: Deborah Ann Bernsen

[80] Ameren Missouri Response to Staff Data Request Nos. 132 and 342.

VII. Mechanisms That Could Potentially be Used to Address Impacts on Customers Served by Utilities Under Commission Jurisdiction

A. Accounting Authority Orders

Accounting authority orders ("AAOs") are directives from the Commission ordering utilities to account for their financial results in a way that differs from the prescribed Uniform System of Accounts that normally govern the utilities' regulatory accounting for revenues, expenses and capital costs in this jurisdiction. AAOs are almost always used in Missouri to authorize utilities to book extraordinary costs in a certain manner. Extraordinary costs results from events that are unusual, unique or non-recurring, and accordingly are not considered in setting utility rates in most circumstances. Extreme weather events are a common type of extraordinary event.

AAOs are typically used to authorize utilities to "defer" extraordinary expenses on their books and records. Deferral treatment allows the utility to record the extraordinary costs as an asset instead of recording the amounts as a period expense, which in turns preserves the costs on the balance sheet so that the utility may seek rate recovery of the costs in subsequent rate cases. However, in AAOs the Commission has a long-standing practice of making no ratemaking findings, with any decisions regarding whether to allow deferred extraordinary costs to be included in rates reserved for later general rate proceedings.

AAOs are one possible way to handle the accounting and ratemaking treatment of the extraordinary costs associated with the Cold Weather Event. If this path is taken, the weather event impact of the electric utilities' fuel and purchased power expense would be removed from the operation of the Fuel Adjustment Clause ("FAC"), and the weather event impact of gas utilities' purchased gas expense would be removed from operation of the Purchased Gas Adjustment/Actual Cost Adjustment ("PGA/ACA") mechanism, with both sets of costs instead recorded on the utilities' balance sheets as deferred costs. Then, in its next general rate case, the electric or gas utility would be able to seek inclusion in rates of the deferred extraordinary weather event costs, presumably through a multi-year amortization to expense. This would allow the utility and the Commission a

ready means to "spread out" rate recovery of the weather event cost spike over a longer period of time to ease rate impacts on customers than if the costs were flowed through the FAC or PGA/ACA in the normal manner.

If deferral treatment is to be sought by utilities, generally they must to file an AAO application with the Commission. However, if the utility has a general rate case pending, the Commission can order deferral treatment of particular costs in the context of those proceedings. In either case, the utility will be expected to demonstrate that the costs in question are truly extraordinary in nature and that the extraordinary costs have been accurately quantified.

Contributor: Mark L. Oligschlaeger

B. Local Distribution Company Customers

The following impacts were provided in the LDC presentations.

1. Ameren Gas

Ameren Gas's purchased gas costs for February 2021 were approximately $60.6 million. Its purchased gas costs for calendar year 2020 were approximately $31 million.

Ameren Gas's current residential PGA ("RPGA") is 44.86 cents/Ccf. Ameren Gas anticipates its RPGA will rise to 50.58 cents/Ccf. Its current residential ACA is -7.23 cents/Ccf, which Ameren Gas projects will increase to 45.86 cents/Ccf. These numbers do not assume special rate treatment or multi-year amortization.

2. Marketer Comments

Staff notes that comments regarding the Cold Weather Event were received from Oklahoma Energy Source, Clearwater Enterprises, Symmetry Energy Solutions, and Constellation NewEnergy. A reply to Symmetry and Constellation's comments was provided by Spire Missouri.

Since ongoing complaint cases exist for Clearwater, Symmetry, and Constellation, Staff views those cases as providing a platform for further investigation and discussion of the concerns expressed in the marketer comments. With regard to Oklahoma Energy Source, a broad spectrum of structural recommendations, prudence concerns, and tariff issues were raised in its comments. In fact, given the breadth and depth of those comments, and some structural issues raised in the other marketer comments (and Spire Missouri's response), Staff recommends a separate proceeding to address, in detail, the broad issues of transportation service, curtailment provisions, operational flow order provisions, cash-out provisions, nomination systems, pooling processes, interruption criteria, marketer agency agreements, marketer qualification, and other transportation issues that may require updating given the experiences of the Cold Weather Event.

Contributors: David M. Sommerer and Keenan B. Patterson, PE

C. Local Distribution Companies - Purchased Gas Adjustment/Actual Cost Adjustment

Summary of how Missouri Purchased Gas Adjustment ("PGA") tariffs operate in the context of the Cold Weather Event.

All Missouri PSC regulated natural gas companies have a PGA "clause" contained within their tariffs. Generally, these PGA tariffs operate in the same fashion for each utility with slight differences with regard to time of annual filings, and Actual Cost Adjustment ("ACA") periods. Each Local Distribution Company ("LDC") is required to make one mandatory PGA/ACA filing per year. The filing dates are generally between mid-October and mid-November each year. The PGA part of the filing calculates an estimate of natural gas supply, transportation, and storage costs for the upcoming winter. The estimates typically include storage withdrawal volumes and costs, FERC regulated interstate pipeline capacity costs, and gas supply costs. Also included in the estimate of gas costs is any hedging cost related to some portion of the anticipated purchase of gas supplies.

At the same time as the mandatory fall PGA estimate, an ACA reconciliation is calculated that compares 12 months of actual gas costs to the PGA revenues billed to the customer for a fixed timeframe. That timeframe, known as the ACA period, is generally for the 12 month period ending in August or September.

In addition to the mandatory fall PGA/ACA filing, the LDCs have "optional" PGA filings available that allow for updates to the PGA estimate. The ACA rate however does not change between the mandatory annual filings.

For example, an LDC could consider updating its PGA rate in the spring, to reflect more current estimates of gas costs going forward. It could not adjust to reflect corrections to past time period estimates.

It should be noted that some LDCs do have a limited ability to adjust gas rates for under or over recoveries of actual gas costs between ACA filings with a separate factor, but only up to 50 cents per MMBtu, a fairly limited correction factor. This is not an adjustment to ACA rates but a separate factor that has the effect of reducing or increasing the overall rate billed to the customer for gas costs. Based upon a review of Missouri LDC tariffs, the following LDCs have this type of "Filing Adjustment Factor" ("FAF"): Spire East, Spire West, Ameren (Gas), Liberty Midstates. Empire District Gas and Summit Natural Gas do not have this tariff provision.

Therefore, if an LDC had an extensive under-recovery of gas costs for any reason, it would likely show up in the fall mandatory PGA/ACA filing as a large under-recovery of the ACA balance, resulting in a very high ACA factor to be added to the separate estimate of current gas costs (the PGA rate).

It is important to note the PGA tariffs require the under-recovered balance from the ACA gas costs to gas revenues comparison to be collected in the subsequent 12-month period starting with the effective date of the mandatory fall PGA filing; i.e., any under-recovery is not "spread out" in rates longer than one year per the tariffs.

Any recognition in rates of that potentially large under-recovery of actual gas costs would be seen with the new ACA rates going into effect around November or early December with Commission approval of the PGA and ACA rates on an interim, subject to refund, basis. The rates are approved on an interim basis since a prudence and compliance review is performed in the calendar year following the fall mandatory filing.

Contributor: David M. Sommerer

Atttachments:

Appendix A - Appendix of Acronyms and Key Terms

Appendix B - NEWS. Update for Missouri American Water Staff

APPENDIX OF ACRONYMS AND KEY TERMS

ACA - Actual Cost Adjustment: compares 12 months of actual gas costs to the PGA revenues billed to the customer for a fixed timeframe.

AMMO – Ameren Missouri

ANR – ANR Pipeline Company

APGA – American Public Gas Association

BA – Balancing Authority: the entity responsible to plan in advance how generation and the consumption of electric energy will be will be balanced and kept in balance in real time in a specified geographical area. This entity issues instructions to increase or decrease generation to meet changes in the demand for electricity in real time and for ensuring the instantaneous equality of electricity generated, consumed, exported from and imported into a geographical area is maintained.

BTMG - Behind the Meter Generation

Citygate - A point or measuring station at which a distributing gas utility receives gas from a natural gas pipeline company or transmission system

CTG – Combustion Turbine Generators

BES - Bulk Electric System: all transmission equipment operated at 100,000 volts or higher, generators connected to the transmission system, and specifically excludes local distribution facilities.

Ccf – 100 cubic feet

CBA - Consolidated Balancing Authority: an entity performing the duties of multiple, combined Balancing Authorities in the combined areas in which those BAs operated.

DAS – Division of Analytics and Surveillance

Derated - a physical state in which a generator's ability to produce electricity is temporarily or permanently reduced from its design capacity due to a mechanical fault or limitation or an external event (such as fuel limitations).

DR – Demand Response

DSP – Daily Scheduling Penalties

Dth – Dekatherm: a measurement of heat content equal to ten therms, which is equivalent to 1 MMBtu. This measurement is required by FERC for interstate pipeline transportation contracts. A Dth is approximately equal to a Mcf when adjusted for temperature and atmospheric pressure.

EBB – Electronic Bulletin Board

EEA - Energy Emergency Alert rating system. Under this system: EEA1 status means the RTO suggests utilities issue public alerts; EEA2 status means the RTO requires the utilities to provide public awareness encouraging customers to conserve; and, EEA3 status means the RTO may require potential interruptions or load shedding.

EECP – Emergency Energy Conservation Plan (Empire)

Energy Market - a commodity market that handles the buying and selling of electricity and electricity related services. This can be a real time market or a market that sets the wholesale price of that commodity a day or more in advance.

Electric IOUs – Ameren Missouri, Empire, Evergy Missouri Metro and Evergy Missouri West, collectively

EDG – The Empire District Gas Company d/b/a Liberty

EIA- U.S. Energy Information Administration

EOP – Emergency Operations Plan: a plan or set of plans that specifically lays out the steps and procedures to be performed by RTOs, utilities and other entities subject to the jurisdiction of the NERC when adverse or emergency circumstances arise that threaten the electric reliability of a region or the BES.

ERCOT – Electric Reliability Council of Texas

ERP – Emergency Response Plan

FAC – Fuel Adjustment Clause allows costs to be passed through a rider mechanism that reflect differences between actual fuel and purchased power costs and the net base energy costs.

FERC – Federal Energy Regulatory Commission

Firm Load - load with firm transmission service, which has paid to have priority access to generators and other resources on the BES.

FTS - Firm Transportation Service: a firm transportation contract service shipper reserves space, called capacity, on the pipeline for a quantity of gas to be transported across the interstate pipeline and delivered each and every day of the contract period.

FOM – First of Month: a common practice to price "baseload" gas purchases (supply that flows evenly every day of the month)

Gas Marketer - an entity that arranges purchases and sales of natural gas. Unlike pipeline companies or local distribution companies, a gas marketer does not own physical assets commonly used in the supply of natural gas, such as pipelines or storage fields.

ITS - Interruptible Transportation Service: a natural gas arrangement under which, in return for lower rates, the customer must either reduce energy demand on short notice or allow the interstate pipeline to temporarily cut off the natural gas supply to maintain service for higher priority users. This interruption or reduction in demand typically occurs during periods of high demand for the energy (winter for natural gas).

IVR – Interactive Voice Response

LBA – Local Balancing Authority: an entity charged with the duties of a BA in a specific area. These LBAs may be independent or members of a Regional Transmission Organization.

LDC - Local Distribution Company

Liberty – Empire – The Empire District Electric Company d/b/a Liberty

LMP - Locational Marginal Price: the wholesale price of electricity at a single point on the BES.

LMR - Load Modifying Resource

Load - the consumption or use of electric energy such as a lamp producing light. This term includes use of energy by residential, commercial, and industrial customers.

Load Pocket - a geographic area with limited electric connections (because of limited transmission lines) to the remainder of the BES. This area depends on generators within the load pocket to deliver electricity to consumers.

Load Shed - the deliberate shutdown of electric power to certain portions of the BES.

LSE - Load Serving Entity

Mcf – is a thousand cubic feet. It is a volumetric measurement used for the sale of natural gas. Missouri natural gas LDCs bill customers based on ccf, which is one hundred cubic feet. Therefore, a Mcf is equal to 10 ccf. A Mcf is approximately equal to a Dth when adjusted for temperature and atmospheric pressure.

MEEIA – Missouri Energy Efficiency Investment Act

MISO – Midcontinent Independent System Operator

MP - Market Participant: can be a buyer or seller of electricity or certain utility level Bulk Electrical Services within an administered energy market run by an RTO or other similar entity; or (b) a financial entity that takes financial positions on an RTO's energy market

MRT – Mississippi River Transmission

NERC – North American Electric Reliability Corporation: is the Electric Reliability Organization (ERO) for North America, subject to oversight by the FERC and governmental authorities in Canada. NERC's jurisdiction includes users, owners, and operators of the bulk energy system, which serves nearly 400 million people.

NERC EEA – NERC Energy Emergency Alert: is part of the NERC Emergency Operating plan which requires jurisdictional entities to prepare Emergency Operating Plans of their own that provide for specific actions under specific, identified circumstances within their jurisdictional areas.

NGPL – Natural Gas Pipeline Company of America

Nomination - is a formal request to transport natural gas on a pipeline. Shippers, or marketers on their behalf are required to schedule the transportation of natural gas through a day-ahead nomination process with the interstate pipeline.

NYMEX - New York Mercantile Exchange: is a commodity futures exchange that includes a natural gas trading platform based on the index price of natural gas at the Henry Hub in Louisiana.

OATT - Open Access Transmission Tariff: a legal document filed by a RTO, transmission facilities owner and services provider or other jurisdictional entities containing all rates, terms and conditions under which the relevant entity provides transmission services

OFO – Operational Flow Order: is an interstate pipeline tariff provision that allows penalties to be assessed to shippers for not complying with contractual and tariff requirements. OFOs would be issued as critical notices on a pipeline and cover a specific period of time. Pipelines also notify the end time of the OFO.

OGT – Ozark Gas Transmission

Panhandle – Panhandle Eastern Pipeline Company

PGA – Purchased Gas Adjustment: calculates an estimate of natural gas supply, transportation, and storage costs for the upcoming winter.

PPA – Purchased Power Agreements

RDT - Regional Directional Transfer

Reserve Margin - a requirement mandating the quantity of additional energy generating resources that must be maintained as back-up by load servings to ensure the BES is able to reliably provide power to load.

REX – Rocky Express Pipeline

RTO – Regional Transmission Organization: the "air traffic controller" of the electric grid within its jurisdiction, which controls, monitors, and coordinates the BES. RTOs in Missouri are the MISO and Southwest Power Pool. RTOs also administer the wholesale energy and capacity markets through which utilities buy, sell and deliver other utility level services to each other.

Shippers - interstate pipeline customers that hold tariffed service contracts for the delivery of natural gas.

Sink – the delivery point of electrical energy to load.

Source – the portion of the BES where electricity is generated.

SPP – Southwest Power Pool

SPP MMU – Southwest Power Pool Market Monitoring Unit: the SPP internal entity required by FERC to monitor the SPP markets to ensure they remain competitive and that no MP employs Market Power.

Southern Star – Southern Star Central Gas Pipeline Company

TETCO – Texas Eastern Transmission

TIGT – Tallgrass Interstate Gas Transmission

TLR - Transmission Loading Relief: a NERC procedure to reduce energy flows over an overloaded or near-overloaded facility on the BES.

UOS – Extreme Condition Unauthorized Overrun Service

VOLL - Value of Lost Load: the maximum, estimated wholesale price that a Load Serving Entity (LSE) receiving electricity with firm contracts would be willing to pay to avoid a disruption in their electricity service.

Wheeling - transportation of electric energy from or within an electrical grid to an electrical load outside that grid's boundaries. For example, electricity can be wheeled from one RTO to another across a third.

NEWS

Update for Missouri American Water Staff

Water service keeps flowing to Missouri's Capital despite 60-mile ice jam on the Missouri River

Earlier this year, Missouri experienced an extended period of unseasonably cold temperatures from Feb. 6 to 19, when temperatures averaged more than 20 degrees below normal. It was reportedly the coldest two-week period to impact Missouri in over 30 years.

Many water systems with river intakes, like Missouri American's Jefferson City system, know the dangers of ice jams, as they form and as they clear. On Wednesday, Feb. 17, an ice jam formed on the Missouri River in the bend approximately one mile upstream of the Jefferson City raw water intake. The ice quickly built up behind the jam, extending an estimated 15 miles upstream.

At the same time, the river level below the ice jam dropped from four feet to -0.3 feet in a matter of a few hours. Downstream of the ice jam, the flow dropped by more than 50 percent from about 37,000 cfs (cubic feet per second) to about 17,000 cfs. The next day, Feb. 18, the Corps of Engineers flew along the Missouri River to investigate. They found the ice back up extended more than 60 miles upstream. Downstream, the river level continued to drop; the lowest recorded level on the gauge at the Missouri River Bridge during the ice jam was -0.5 feet (or one-half foot below zero) on Friday, Feb. 19.

The Missouri American Water Jefferson City system kept their customers in water service despite this unprecedented event, in large part due to their prior capital investments and the excellent work of the team. A new intake facility built in 2011 replaced a 1960s vintage facility that was vulnerable to low river levels. The new intake eliminates the need for extreme mitigation actions.

"Without this proactive approach, we would have had to rely upon our emergency interconnects with adjacent water districts and possibly been vulnerable to additional concerns for sustainable service," said Operations Manager **Brent Haas**.

The need to relocate and reconfigure the 1960s intake was identified in a 2007 Comprehensive Planning Study (CPS). The intake system as it exists today is about 30 feet deeper and extends 80 feet farther into the river than the replaced 1960s system. The intake is constructed on the bottom of the main channel of the river to safeguard against low river levels impacting the supply of water.

The Jefferson City Operations team monitored the situation closely around the clock, and for a couple days during the low water event, they experienced needle ice formation on the minimally submerged intakes between the hours of 1 – 4:00 am. However, this situation was managed by alternating use of one riser then the other for about 30 minutes at a time, allowing each side to clear, as well as morning sun helping to melt

the ice away. A camera was installed on the low lift pump station at the river's edge, providing additional remote monitoring capabilities of river ice conditions and the intake facility.

On Monday, Feb. 22, the ice jam broke loose, resulting in the river level jumping up approximately seven feet in just 15 – 20 minutes. Fortunately, the ice easily flowed down river and it was uneventful for the integrity of our facilities, operation of the system, and service to our customers.

"From the 2007 CPS, to the 2011 capital improvement project, to the Operations team's close monitoring of the situation, our collective ability to identify problems and provide solutions enhances our resiliency level," said Engineering Manager Jennifer Birger.