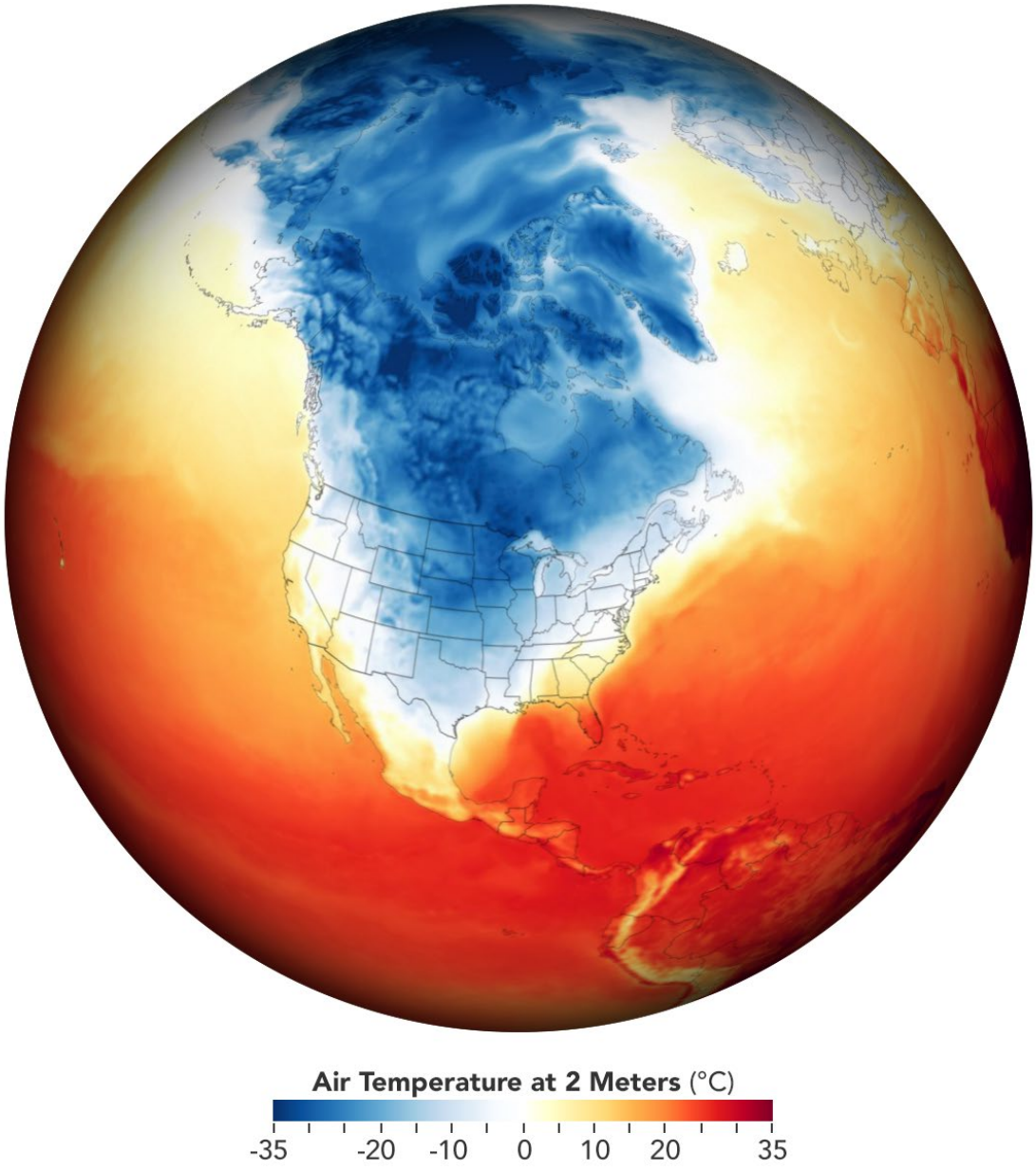
The Polar Vortex Load Shedding Event

February 4 – 20, 2021



NASA. *Extreme winter weather causes U.S. blackouts*. NASA. https://earthobservatory.nasa.gov/images/147941/extreme-winter-weather-causes-us-blackouts.

Event Summary, Lessons Learned, Recommendations for Improvement

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ABOUT OPPD

Mission: To provide affordable, reliable and environmentally sensitive energy services to our customers.

Omaha Public Power District is a publicly owned electric utility that serves an estimated population of 850,000 people, more than any other electric utility in the state. Operating since 1946, the public utility is governed by an elected board of eight directors. While its headquarters is located in Omaha, Neb., OPPD has several other service locations in its 13–county, 5,000-square-mile service area in southeast Nebraska.

OPPD uses baseload power facilities fueled by coal and natural gas, peaking units fueled by natural gas and oil, and renewable energy, including wind, solar, landfill gas, and hydropower.

www.oppd.com

ABOUT SPP

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

According to its website information, Southwest Power Pool (SPP) is about more than power. We're about the power of relationships. We work together with our members and other stakeholders to ensure electricity is delivered reliably and affordably to the millions of people living in our multistate service territory.

SPP is a regional transmission organization (RTO): a nonprofit corporation mandated by the Federal Energy Regulatory Commission (FERC) to ensure reliable supplies of power, adequate transmission infrastructure and competitive wholesale electricity prices on behalf of its members.

SPP was founded in 1941 when 11 regional power companies pooled their resources to keep Arkansas' Jones Mill powered around the clock in support of critical, national defense needs.

Eight decades later, SPP still reflects our early principles of collaboration in the interest of providing a critical service for the good of our region. Our vision is to lead our industry to a brighter future, delivering the best energy value.

https://spp.org/

Introduction

To the OPPD Community,

I am pleased to deliver this After Action Report examining the Polar Vortex event in February of 2021. The OPPD leadership team requested this review in order to reflect on the event, how we responded, and how we could better respond should future events require a similar response. The men and women of OPPD responded to this unprecedented event with passion, responsibility, and a service attitude exemplifying our core values. I could not be prouder of the effort that went into maintaining the electric grid through this unprecedented event.

In nearly 75 years of OPPD operations, not once had there been an event when customer power was intentionally turned off to save the bulk electric system. We carry the weight of knowing many of our customers use our electricity for life-saving and life-maintaining services, and will always do our utmost to keep the lights on and power flowing. As a customer-owned public utility, our primary obligation is to provide reliable electricity as a fundamental component of modern society.

OPPD employees take great pride in delivering affordable, reliable, environmentally sensitive electricity to our 850,000 customer-owners. When the Southwest Power Pool (SPP) directed us to shed load, it was a very difficult moment for all of us. We have benefited greatly from our membership in SPP, and although a difficult choice was handed to us, we responded as we always do – professionally, immediately, and with the best interests of our customer-owners in mind.

With over 80 employees contributing their experience and reflections to the preparation of this report, I am confident we will continue to learn the necessary lessons that come from such a comprehensive review. We will take positive steps based on the recommendations enclosed herein, so OPPD is better prepared for future emergencies. My deepest hope is that we will never need to shed load again; however, I am confident that if we do, we will be prepared.

Sincerely,

Javier Fernandez

OPPD President and Chief Executive Officer

Polar Vortex Synopsis

While the Omaha area and the central plains have seen cold weather before, it has been some time since the region saw a weather pattern like the one experienced in February, 2021. The National Oceanic and Atmospheric Administration (NOAA) stated the cold wave experienced by the contiguous U.S. was the strongest seen in 30 years.[1] Much of the plains region averaged more than 30 degrees below normal for the period from February 7-21, 2021. The source of much of these cold temperatures was a phenomenon informally known as the "polar vortex" or what climate scientists call an Artic Oscillation (AO). The intensity for this AO at its peak tied for the most extreme February on record since 1950. For context, 99.9% of all days since 1950 had an intensity lower than those seen during the peak of this event. In short, while it gets cold in this region, it almost never gets this cold over such a large area.

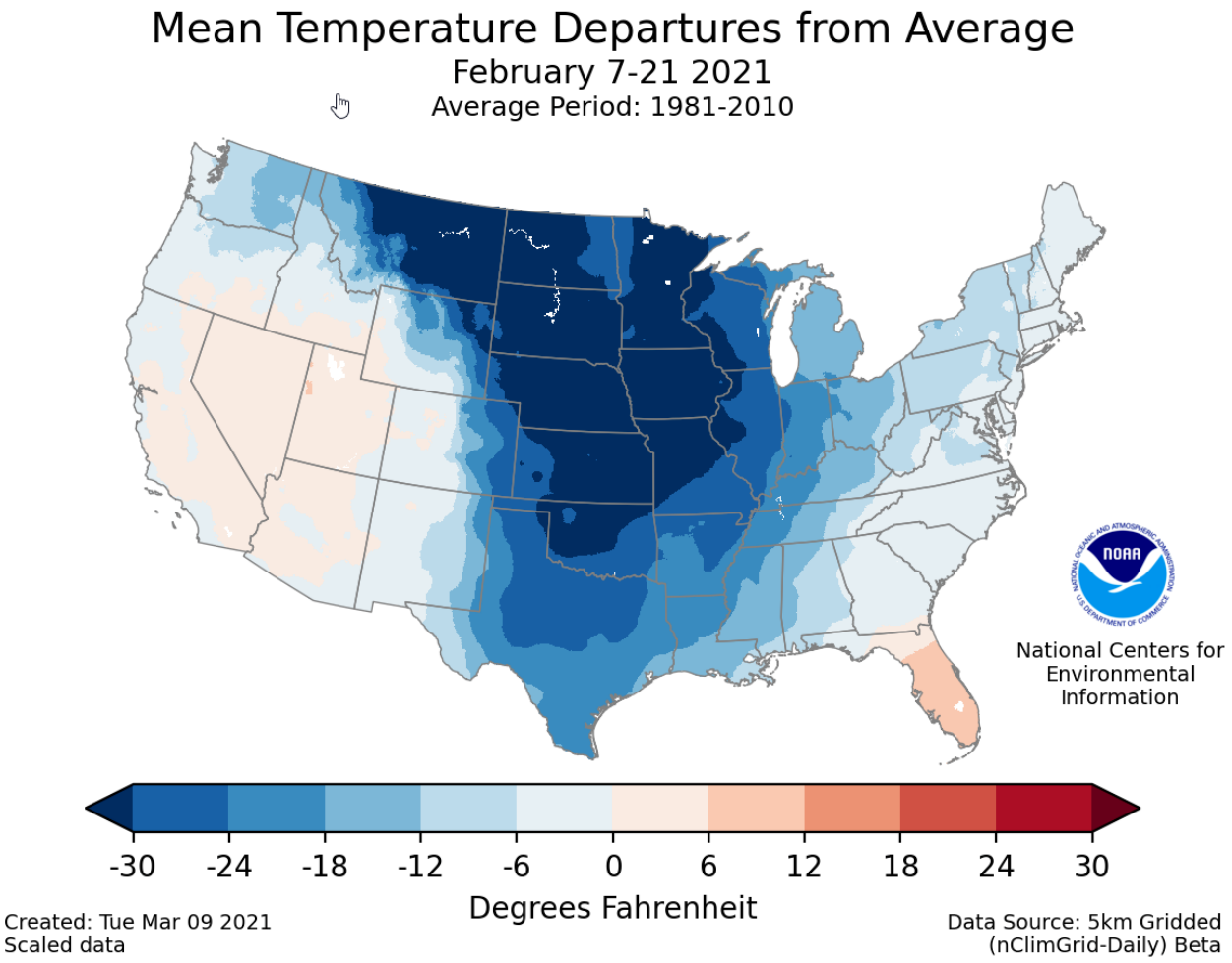


Figure 1 – NOAA NCEI: Mean Temperature Departures from Average Map

[1] https://www.ncdc.noaa.gov/sotc/synoptic/202102

The geographic size, duration, and magnitude of this Polar Vortex put considerable strain on the bulk electric system in the SPP region and neighboring regions, as shown in this map provided by SPP.

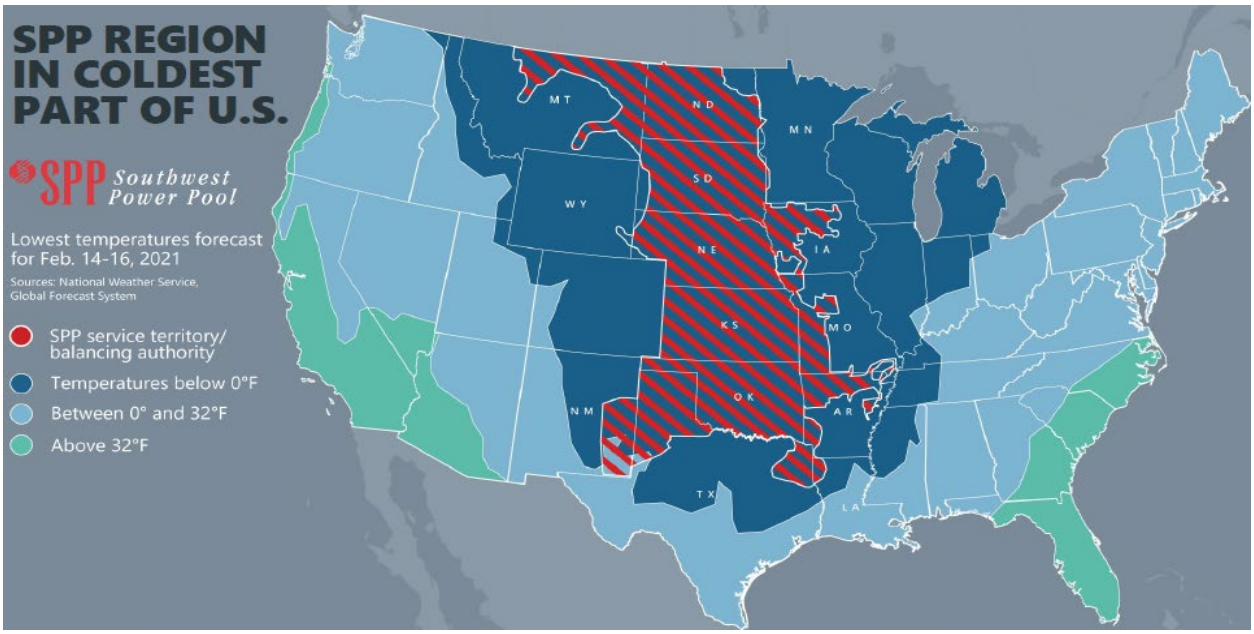


Figure 2 – SPP: Low-Temperature Map

With almost the entire SPP footprint experiencing below-zero temperatures from February 14-16, these temperatures created record setting increased demand for home heating and electricity across the entire highlighted SPP region. SPP's after action report on this event will provide more detail on the reasons for the need to enact load shedding to maintain the stability of the regional bulk electric system. This report will focus on review of OPPD's emergency operating plans and how OPPD locally prepares for and responds to these extreme events. Being a member of SPP and required under the shared regulatory requirements from FERC and NERC to maintain the stability of the bulk electric system, OPPD must have a regionally coordinated operating plan in place to be able to respond without intentional delay when the order to shed load is given. Because this was the first time in OPPD's history that the organization had to enact load shedding, and the first time SPP has requested it, both organizations identified the need to learn and improve. This report will focus on the review of OPPD actions so the organization will be better prepared in the future should shedding again be needed to maintain the bulk electric system.

In order to better understand this event and how the electric grid responded, it is critically important to understand that OPPD is part of a regional networked transmission grid, which interconnects our electric system with our neighbors. Being part of this network provides tremendous reliability and economic benefit to our customer-owners in the form of importing and exporting power within the region, which OPPD has leveraged for many years. The Southwest Power Pool (SPP) is the authority over the region of which OPPD and the rest of the large electric utilities in Nebraska are members. OPPD has representatives on several SPP working groups who have performed deeper dives regarding this event and developed recommendations to the SPP Board of Directors. OPPD's involvement includes the review of reliability operations, resource adequacy, transmission planning, market operations and the Comprehensive Review Steering Committee. These recommendation were included in the final report delivered to the SPP Board of Directors at their July 2021 SPP Board

Meeting. OPPD will continue to collaborate with SPP through the various working groups to ensure that SPP's recommendations are implemented in a timely and efficient manner.

It should be noted that OPPD's local electric system performed well during this polar vortex event as evident in the availability of our local power generation and delivery system to meet our customers' needs during the days in which SPP requested load shedding across its entire footprint. However, the combination of increased regional electric demand coupled with reduced availability of power generation in the overall SPP region led to the call by SPP for regional load shedding in order to maintain stability of the reigonal grid. The combination of each SPP member's local after action reviews along with the coordinated SPP regional after action review of this historic event will better prepare us indivually and collectively for future weather events.

Key Takeaways

This extreme event underscores the stresses that come with providing reliable energy despite the most challenging of circumstances. As OPPD looks to improve upon what it can control in this event, below are the key takeaways that were identified.

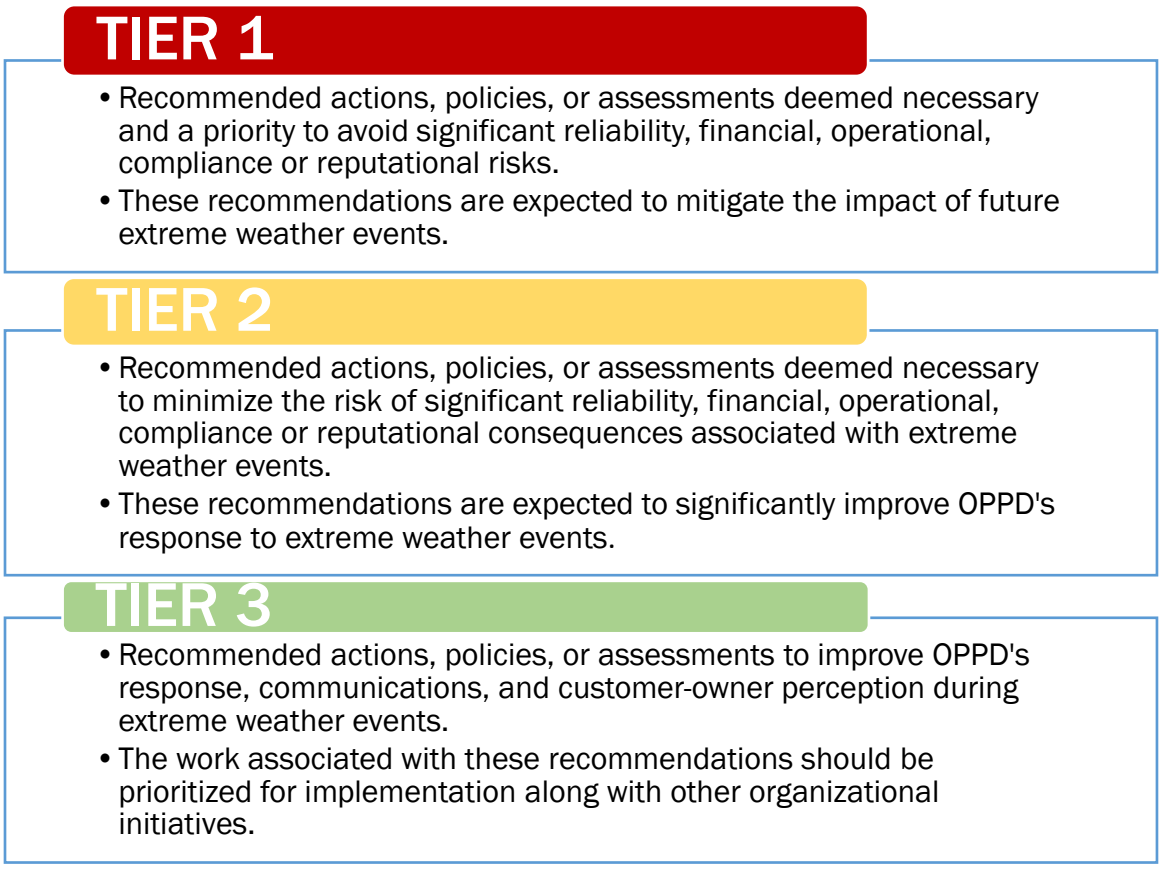
1. More accessible, individualized, and timely communication is critical to our customers during an energy emergency event and OPPD will improve to meet our customer-owner's communications needs.
2. OPPD's emergency event plan should be enhanced and made more robust to better support grid reliability during extreme events.
3. Given the increased financial risk of a more volatile and interconnected energy market, OPPD should review and consider expansion of its energy and fuel risk mitigation options to reduce the potential impact from future extreme events.
4. OPPD should review customer demand for and consider expanding its customer products and services to increase the usage and flexibility of self-generation and curtailment programs to minimize customer impact during extreme events.
5. OPPD's membership in SPP is critical to our organization's ability to meet our strategic goals and support the delivery of reliable energy during local emergency events (e.g. floods). OPPD should continue to extract value from its SPP membership and leverage our expertise and influence in the SPP stakeholder process to enact positive changes to the benefit of our customers

Recommendations & Prioritization

Recommendations derived from the After Action Review were presented and accepted by OPPD Senior Management and reviewed by the OPPD Board of Directors on June 15, 2021.

Subsequently, each recommendation was evaluated and scored based on the impact to each of the 15 OPPD Strategic Directives, the size of the project, and prioritized by tier for implementation. The evaluation and scores were reviewed and approved by OPPD Senior Management.

The graphic below depicts the prioritization tiers and related definition:



TIER 1 Recommendations

Technology Recommendation 1

> *Develop or acquire technology tools to better serve our employees and customer-owners with the ability to efficiently and effectively communicate information. (i.e. Advanced Metering Infrastructure (AMI), Customer Relationship Management (CRM), Geographic Information System (GIS), and a more granular power outage map).*

Having additional tools to better manage customer data and also have the capability to load shed each meter individually instead of at the circuit level would allow OPPD greater flexibility in responding to load-shedding orders while also responding to individual customer needs.

Enterprise-Wide Recommendation 1

> *Enhance OPPD's blueprint to improve OPPD's resilience to extreme weather and/or extended duration reliability events; including, at a minimum (in no particular order): a) fuel supply capacity & delivery planning, (fuel strategy), b) inventory management (peaking, plant, service centers), (inventory strategy), c) defining critical customer load and process to keep current, (critical load strategy), d) union contract considerations, (staffing strategy), e) physical location of key personnel, (physical location and facility needs), f) maintenance of plants (peaking), (outage & maintenance strategy), g) retain & validate, periodically, a list of customer contact information for those large customers with their own generation, h) employee fatigue considerations (physical and mental well-being), and i) methods and limits for OPPD facility support (e.g. load shedding).*

OPPD's and the SPP regions' generation mix is changing along with the demand on those systems (from extreme weather and evolving customer needs). To continue providing affordable, reliable, and environmentally sensitive energy services to our customers in the future, OPPD needs to evaluate the individual and collective strategies critical to our operations to ensure reliable and resilient energy is provided and processes supporting these strategies are comprehensive and sustainable.

Customer Experience Recommendation 1

> *Evaluate the priority for a Customer Contact Preference Center to support enhanced customer communications during extreme events.*

Extreme events require communication methods with our customers that normal operations do not. Having a tool to manage and maintain customer contact information, and their preferences for communication would allow for improved customer communication during future extreme events. This should include a process that requires OPPD to periodically review and expand the list of customers on our contact list by reaching out to trade associations to ensure small commercial customers are well represented in our contacts.

Enterprise-Wide Recommendation 2

> *Develop an enterprise definition for resiliency and consider whether additions to SD-9 are needed to ensure appropriate management focus, oversight, and funding.*

A resilient utility, one that can withstand disruption and quickly resume normal operations after a significant event, is different conceptually than a reliable utility. Having a clear, enterprise-wide definition will better allow for consistency of evaluating and funding various projects that provide increased resilience to the organization.

Customer Experience Recommendation 2

> *Evaluate additional customer products and services including rates and information sharing systems needed to provide the organization additional options to manage through emergency events.*

Additional distributed energy resources (DER) and demand side management (DSM) via customer products and services would give OPPD additional tools to mitigate potential reliability and financial impacts from extreme events.

TIER 2 Recommendations

Financial Recommendation 1

> *Evaluate the energy and fuel hedging & trading strategy and risk policy to consider: a) a more diverse portfolio of hedging and insurance options both physical & financial, b) situational (e.g. Energy Emergency Alerts - EEAs) based trading limits, c) emergency price volatility options (ex. out of the money call options), d) cost/benefit of an OPPD natural gas desk, and e) role and scope of Energy Marketing, Trading and Fuels (EMTF) Risk Management to support these efforts.*

Evaluating various options to improve OPPD's ability to minimize the financial impacts of extreme events will limit the potential for unforeseen costs to impact rates.

Financial Recommendation 2

> *Evaluate ways to enhance current curtailment rate offerings to customer-owners (more participation, remove seasonal/weekend/holiday restrictions, additional monitoring and control capability by OPPD).*

Requests for energy conservation from our customers involving voluntary demand reduction along with established curtailment programs involving dispatching customer owned generation were effective at reducing the overall demand on the system from what it could have been. However, a majority of OPPD's current curtailment offerings are designed for summer peak-load situations and none of the programs are set up with the required level of advanced OPPD monitoring and control which would be needed to ensure effective response to a Bulk Electric System load shedding event.

These programs should be evaluated for expanded use during non-summer seasons, be equipped with appropriate monitoring and control capability and also identify ways to increase participation in these programs.

Customer Experience Recommendation 3

> *Evaluate enhancements to our public education program to include basic utility operations, purpose and benefits of SPP, regulatory requirements, etc. to be delivered in a variety of methods (i.e. short video clips, newsletters, OPPD.com, etc.).*

During extreme events, customers need to be able to quickly locate and understand the information they are seeking. OPPD should evaluate the various methods and mediums that information is available on and implement improvements.

Enterprise-Wide Recommendation 3

> *Evaluate the necessity to conduct a Climate Vulnerability Assessment.*

Partnering with an outside firm or university to understand the potential and likely climate vulnerabilities for our service territory, state, and region will allow OPPD the best opportunity to deliver on its mission despite a changing climate.

Enterprise-Wide Recommendation 4

> *Develop corporate policy to require cross-functional after action reviews or similar analyses for all significant events, with oversight/management by the Emergency Management team and facilitated by the Continuous Improvement team.*

While many parts of the organization already conduct lessons learned exercises after various events, there is a lack of consistency at the enterprise level after significant events. Requiring this would ensure cross-functional lessons learned are identified and recommendations for improvement implemented in a more formal way.

Enterprise-Wide Recommendation 5

> *Establish an Emergency Response Team (ERT) similar to or modified from the existing Business Continuity structure to provide clarity, transparency and structure to the emergency response efforts.*

Business continuity plans are generally designed for when normal operations are significantly impacted or impossible to perform. The polar vortex event was about performing normal operations during an extreme event. Creating a new process or modifying the existing BCP process to align and support operations at an enterprise level for these types of events will improve the organization's preparation and response to extreme events.

Enterprise-Wide Recommendation 6

> *Refresh, socialize, and test/drill the load shedding, black start, and normal communication channels down plans districtwide, on a regular basis.*

Emergency event plans are routinely drilled by the operational teams who would enact them. Teams in supporting roles are not always involved at the level they should be, which creates the potential for execution gaps. A more expansive program to educate and drill these plans with support functions would better prepare the organization for future extreme events.

Education/Training Recommendation 1

> *Conduct periodic live simulation training exercises for cross-functional emergency response.*

Similar to the above, a more granular recommendation, this recommendation identifies the need for company-wide, live drills of extreme events to ensure organizational readiness.

Communication Recommendation 1

> *Review/enhance role clarity and authorization levels during emergency events for internal and external communications.*

Internal and external communications during extreme events is critical. Reviewing and streamlining existing processes to expedite communications without compromising accuracy would greatly benefit our customer-owners and employees during extreme events. This effort should also confirm that needed skillsets are broadly present amongst the teams responsible for the various roles.

Technology Recommendation 2

> *Evaluate the need/benefits of Energy Management System (EMS), Outage Management System (OMS), and Customer Information System (ICIS) integrations to support day to day and emergency operations.*

These different critical systems support various aspect of managing the reliability of the grid, outage events, and customer information. While there is some integration between these systems, they are not fully tied together in a way that the organization can see the individual customer impacts of opening a breaker on the distribution system. Having these systems fully integrated would provide additional visibility during both day to day and emergency operations.

Communication Recommendation 2

> *Enhance Communication Plan to include the process for advance district wide/targeted area notification of pending extreme events to improve awareness and any necessary preparation and planning. The process should include thresholds/triggers for level of internal/external communications, in alignment with the emergency event plan and processes.*

While specific operating areas were monitoring the potential for grid-related impacts from the polar vortex event in advance, other supporting areas were not made aware of the potential for load shedding until much later in the month, primarily through ad-hoc communication. A more formalized communication plan to alert the organization as needed would improve organization readiness.

Resources Recommendation 1

Analyze and develop resource requirements to ensure efficiency while mitigating high market costs and employee fatigue during normal operations and emergency events. Specific considerations: EMTF Risk Management, natural gas traders, meteorologist, two Real Time desk operators, additional external communication surge capacity, etc.

During the After Action Review interviews, some individuals identified various potential benefits both during normal operations and emergency events of additional staffing resources. Specific staffing recommendations were outside the scope of this review, however it is recommended to have a subject matter expert team perform a more focused review of the items listed above to determine if they are in the best interest of our customer-owners.

TIER 3 Recommendations

Resources Recommendation 2

Develop dedicated role(s) for multi-lingual employees for real-time external communication translation and communication planning.

All customers need to be able to receive critical communications during extreme events to protect their health and safety. Dedicated multi-lingual employees would allow for improved planning and execution of critical event communications to non-English speaking customers.

Education/Training Recommendation 2

Evaluate increasing the frequency and use of scenario-based training for FERC Standards of Conduct to improve employee awareness.

Improved awareness and understanding by impacted employees of what is and isn't allowed when FERC Standards of Conduct are raised or lowered would improve internal communications during extreme events.

Education/Training Recommendation 3

Develop specialized training courses for Customer Service representatives to increase knowledge of utility operations.

Customer Service Representatives are OPPD's front line when responding to customer inquiries during extreme events. Raising the organizational, regional, and industry knowledge of these representatives will improve their ability to confidently respond to the needs and questions of our customer-owners.

Education/Training Recommendation 4

Evaluate the need for a real-time energy marketer simulator to support emergency training and readiness of real-time marketers.

Adding this best practice functionality to the existing energy marketer simulator would improve this area's ability to prepare and respond to extreme events.

Resources Recommendation 3

> *Enhance Power Purchase Agreements (PPA's) template language and seek to amend, as applicable, existing PPA language to ensure generation ownership, responsibilities, and expectations are clearly defined.*

Ensuring performance responsibilities and expectations during extreme events are clear for OPPD's non-owned generation partners is beneficial to our ability to manage through such events.

Communication Recommendation 3

> *Perform a legal review of any and all applicable laws/statutes on what can/cannot be communicated before/during/after emergency events.*

This review would provide OPPD an up-to-date legal basis on what can and cannot be communicated to our customers before, during, and after an extreme event.

Financial Recommendation 3

> *Develop a financial plan to prioritize and budget for implementation costs associated with the Polar Vortex After Action Review recommendations.*

The above recommendations require various levels of resources to implement. Developing a prioritized plan to resource these recommendations will better ensure their implementation and the realization of the anticipated benefits.

Summary of Key Activities

Energy Production & Nuclear Decommissioning (EP&ND)

Preparation & Planning

The EP&ND team did what they do best in the days leading up to the Polar Vortex – they produced power, despite a string of extremely cold days. North Omaha Station 5, which had been on a planned outage for winter maintenance, was brought back online 18 hours ahead of schedule to support the grid during the extreme cold. Both Nebraska City Units 1 and 2 tripped offline during the week prior to the load-shedding event, and staff performed extraordinary measures to ensure both units were back online for the coldest days. The team utilized new drone technology to inspect the known tube leak, rather than wait for the boiler to cool down. This saved hours and provided the ability for the unit to be brought back online ahead of predictions.

The Polar Vortex presented unexpected challenges, which should be considered for future emergency event preparation. Due to a delayed inspection, the Sarpy County Station fuel oil tank was not filled prior to the emergency event. This limited the capacity of the Sarpy County Station even before the event started. In addition, Supply Chain Management was not provided sufficient advanced communications regarding the pending reliability event, which created challenges in receiving necessary equipment and parts for repairs/maintenance.

Response & Execution

Through the coldest days of the Polar Vortex, when SPP requested all available units to be ready and available to respond in a variety of manners, the EP&ND team ensured all generation units were ready and capable to respond. Given the weather, this was not an easy task. Yet the team braved the frigid weather to keep producing energy for our customers. For example, coal-handling crews kept both Nebraska City and North Omaha stockpiles active and accessible throughout the event, whereas other utilities reported suffering from frozen coal stockpiles. Additionally, Operations staff were in place for fuel offloading, working in harsh conditions to keep units running. These teams ultimately operated OPPD generation at a level sufficient to cover the OPPD load.

The following opportunities were identified and should be improved for future emergency events; insufficient stock of heaters for use at the plants to keep all critical systems warm, asset inventory was inaccurate, causing delays on repairing key parts, and communication was inconsistent, leading to some challenges – challenges, in part, exacerbated by the pandemic and inability to gather in person.

Energy Delivery (ED)

Preparation & Planning

The ED team is comprised of multiple critical teams, and each played an important and valuable role in preparing for and responding to the Polar Vortex. The teams were well-trained and demonstrated situational awareness of potential issues and prepared accordingly, for this first-time emergency event. Leaders reviewed the load-shedding plan in advance and began preparing colleagues for the potential event prior to the actual load-shedding requests from SPP. In addition to reviewing the load-

shedding plan, the Black-Out Team met regularly after the California outages in the summer of 2020 and have been preparing and training for this kind of scenario.

OPPD's planning and preparation benefited from a well-maintained grid, prepared operators, and up-to-date command and control facilities. The Energy Control Center upgrade provided the necessary capability and capacity for critical communication, situational awareness, and safe operations supporting pandemic protocols. The ED team coordinated well with SPP, SMT, Customer Service, and Corporate Communications.

Response & Execution

Load shedding was executed in accordance with the Load Shedding Plan and the ED team demonstrated agility and flexibility addressing the emergency event. ED quickly responded to SPP requests and dynamically acted to establish additional load-shedding blocks to reduce the chance of areas or customers being repeatedly impacted.

Improvements, for future events, were noted regarding the Energy Management System (EMS) and Outage Management System (OMS) integration. As of today, OPPD does not have the capability to test load shedding down to the user level.

While SPP and internal communication with key stakeholders proved beneficial, customer engagement and communication of the load-shedding plan, throughout the utility, needs improvement.

ED should consider involving cross-functional departments in the review/validation of plan(s) and in maintaining information on critical load. Additionally for consideration, the plan was developed for summer load, and OPPD should evaluate and revise it for seasonal differences as part of the validation of the current plan.

Financial Services (FS)

Preparation & Planning

While all FS staff were ready to support, two departments within the Business Unit – Energy Marketing & Trading (EM&T) and Supply Chain Management (SCM) – played large and important roles in preparing OPPD for the Polar Vortex.

The EM&T team declared OPPD Conservative Operations days before SPP issued their own Conservative Operations directions, which provided key OPPD staff warning and lead time that a significant weather event was approaching. Due to semi-annual black start drills, the real-time energy marketers were prepared leading up to the event.

Unit commitments to SPP reflected unusual activity in the days leading up to the load shedding event, and the Day-Ahead team executed those commitments and related gas acquisition without error under significant time, staffing, and considerable financial pressure.

The Supply Chain Management team expanded the list of fuel oil providers and established contracts quickly, to assist the fuels team in acquiring sufficient fuel oil for the weather event. Supply Chain also acquired a range of key parts and consumables on short notice to keep plants operational.

Opportunities for OPPD to consider going forward include:

- **Risk Policy Refinement:** The Energy Marketing & Trading Risk Policy caps trading activity at a certain level, which then requires additional approvals. These approvals impede trading and may lead to higher prices paid. Energy emergency heightened approval levels would still have appropriate oversight.
- **Gas Supply Capabilities:** With a single gas supplier, OPPD lacked visibility in the gas market for real-time prices.
- **Inventory Control Investment:** Some inventory records were inaccurate, leading to last-minute purchasing and high shipping costs.
- **Communications:** Communication from SCM on material and service needs could have been more effective in establishing next steps, timelines, and setting specific expectations for business partners.

Response & Execution

During the event, EM&T and SCM stepped up and coordinated necessary activities throughout the event. The Day-Ahead team committed large dollar amounts in the market for purchasing both fuel and energy, roughly 100 times normal prices, and acknowledged receiving the full support from SMT leadership and across the organization.

The real-time energy marketers brought in an additional colleague to assist with the many activities, providing enhanced organizational coordination and response. The Transportation & Construction Equipment team members were responsive and effective in maintaining and restarting vehicles and equipment throughout the brutally cold conditions.

Improvements to consider going forward, include:

- Improved real-time communications between SCM staff and users, ensuring clarity on timelines and expectations.
- Notify all wholesale customers with generation and retail customers with behind the meter generation to lessen the overall demand on the grid, which in turn could have saved money.
- Remote work led to several key fuel procurement telephone conversations not being recorded, which is a requirement during emergency events.

Customer Service (CS)

Preparation & Planning

The CS team took a proactive approach in planning and preparing for the Polar Vortex. OPPD communicated and worked with our large commercial & industrial customers to achieve additional voluntary load reductions or self-generation to lessen the demand on the grid. Overall, customers responded positively for these requests to start generation, though a few customers were resistant at first due to environmental concerns.

The communication and coordination within CS and between EM&T, Energy Delivery, and Corporate Communications were noteworthy. Product Development and Marketing, in particular, led the effort to support residential customer communications to ensure messaging was customer-centric.

The collaboration between EM&T and CS facilitated agile, creative, and responsive options to design payments for those customers generating electricity. Additionally, the transition of Customer Care's

social media efforts to Public Affairs (Corporate Communications) occurred seamlessly and as planned.

The internal CS meetings increased overall situational awareness and ability to respond to the customer-owner inquiries.

Two areas to improve customer engagement surfaced during this phase of the event. First, an earlier review of the load-shedding blocks may have better prepared CS to develop messaging and services targeted to the customers who were going to be impacted. Secondly, the Customer Care representatives did not have talking points prior to the commencement of load shedding. This limited their ability to respond to general customer questions/concerns.

Response & Execution

The CS team demonstrated commitment, flexibility, and patience throughout the emergency event. OPPD received more than 4,000 calls during the load-shedding event and Customer Care representatives quickly adapted to the changing situation and increased call volume.

During this phase of the event, CS's collaboration with Energy Delivery's system operations specialists was critical. The Substation team was postured to quickly respond to circuits that would not close remotely.

Throughout the event, the following areas were identified for future consideration:

- Process – insufficient ability to identify critical-load customers and curtailment programs that are designed only for summer loads.
- Communication – external mass communication with small and medium-sized businesses was insufficient and the established procedure between CS and Public Affairs (total of five departments) delayed the approval process.
- Resources - resource materials were not provided early enough leaving Customer Care representatives challenged to address customer questions and concerns. Translation was not available at first for outbound customer messages.
- Technology – upgrades (or additions) to the outage map, customer notification preference center and CRM tool would improve OPPD's ability to manage customers (as required) through a load-shedding event.

Public Affairs

Preparation & Planning

The Public Affairs team was engaged and aware as the weather forecast worsened. Energy Regulatory Affairs was in touch with multiple external groups, including SPP and FERC, to better understand the challenges and implications of the impending weather event.

Environmental Affairs coordinated with city and state governmental entities, in particular the Nebraska Department of Environment and Energy, to secure waivers and approval to run additional generation which might exceed permit limits under normal circumstances.

The Corporate Communications team coordinated with the Customer Care team regarding social media messaging to achieve two goals: first, to relieve resources to allow Customer Care to respond more quickly to customers, and second to maintain a common and consistent message through all

external sources. Due to uncertainty around what could transpire during the Polar Vortex, the team prepared a set of general materials for multiple media sources.

Areas identified for improvement include: Improved coordination with Energy Delivery on the load-shed plan and better understanding how to communicate it would be beneficial. Plus the development of communication templates for impending weather events, particularly in the days leading up to a potential event when the goal is to advise but not raise fear, would be helpful to develop in advance.

Response & Execution

The Public Affairs team was highly engaged during the most intense two days of the polar vortex. With the initial unprecedented request from SPP to implement region wide load shedding for the first time in this region's history there were initial internal and external communication challenges, but by Monday afternoon the communications team was able to fully meet internal and external needs.

Energy Regulatory Affairs established regular communications with SPP and FERC to inform decision-making and influence how outages were coordinated in an effort to protect the bulk electric system. Existing relationships with utility peers, including Nebraska Public Power District (NPPD) and Lincoln Electric System (LES), were invaluable to ensure the industry was aligned regarding to public communication, and the overall messaging aligned with SPP.

Initially, it was challenging to develop communications with proper messaging at the beginning of the load shedding event. As an example, Employees noted the home page of the Intranet site did not focus messaging on the emergency event, but on more trivial, in comparison, information.

Additionally, enhanced technology would provide improved and efficient messaging, to create a more streamlined approach for different messaging across both media and customer recipients. The approach of the CEO providing individual interviews, rather than holding a press conference, led to layers of messaging which would not have happened with a press conference approach. Social media communications capabilities and staffing should be re-evaluated for these types of events.

Business Technology & Building Services (BTBS) / Safety & Technical Training (S&TT) / Human Capital (HC) / Corporate Strategy & Governance (CS&G) / Executive

Preparation & Planning

This section captures the planning and preparation efforts from an enterprise perspective. OPPD continuously prepares for extreme weather events. A significant aspect of preparation is OPPD's strong commitment and investment in preventative maintenance; to ensure critical assets perform under stress. Preventative maintenance coupled with the organization's ability to quickly and effectively prepare for and execute the load-shedding plan is noteworthy. Additionally, the agile communication with the Board of Directors and the Board's support positively impacted OPPD's ability to prepare for and respond to the Polar Vortex event.

The BTBS team played a critical role in this phase. Corporate Security proactively coordinated with NPPD and LES to share information and resources with the intent of protecting OPPD's critical infrastructure. This effort also extended to the partnering with law enforcement organizations and the monitoring of social media for signals or warnings.

Per executive feedback, there were two areas warranting further review and consideration include: providing one initial press conference versus multiple media outlet engagements to efficiently and effectively communicate a clear and consistent message. And, SMT's management of the event was largely ad-hoc in nature, and while prudent decisions were made based on the successful execution of the controlled outage process and maintaining our fleet generating power, a more structured approach would have been beneficial.

Response & Execution

This section captures the response and execution efforts from an enterprise perspective. OPPD is exceptional in responding to an emergency or extreme weather event. The passion of OPPD employees to serve and the agile communication and collaboration amongst the SMT are noteworthy and to be recognized. The District's training, preparation, caring, and leadership resulted in zero injuries, DARTs, or SIFs the week of and after load shedding.

A few areas were identified for future consideration and refinement:

Ensure appropriate personnel are informed and trained to execute the plan. For example, an increased legal review of load shedding, black start and any other NERC-required plans could have been requested and conducted either ahead of the event, or as the event unfolded. Overall, there were varying levels of knowledge/understanding of the load-shedding plan and potential impacts to OPPD facilities (e.g. EP, ECC).

OPPD's primary command, control and communications plan performed well. However, there was limited awareness of and ability to execute the secondary and tertiary back-up plans.

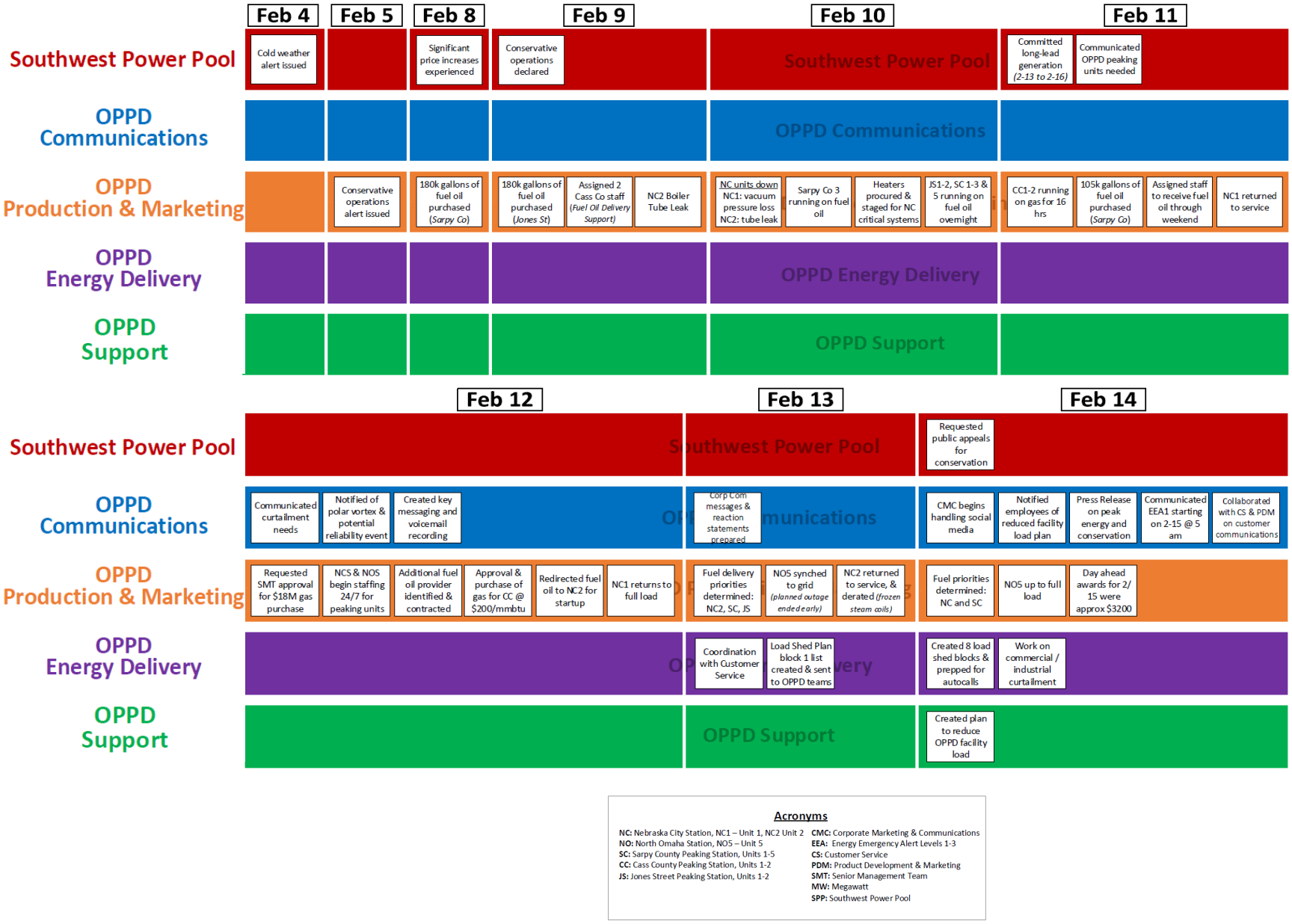
Also the ability to increase awareness of the potential of increased cyber-attacks could have been identified sooner.

Beyond the load-shedding plan, it was noted OPPD does have a robust framework for storm events and business continuity events but no specific (District-level) plan for non-storm grid emergency events.

Lastly, OPPD should focus on employee fatigue and mental well-being throughout the enterprise during and after any stressful event. Specifically focus on the operational areas most heavily called upon during a resiliency event including the Call Center, the Energy Control Center, Energy Marketing & Trading, and the Generation sites.

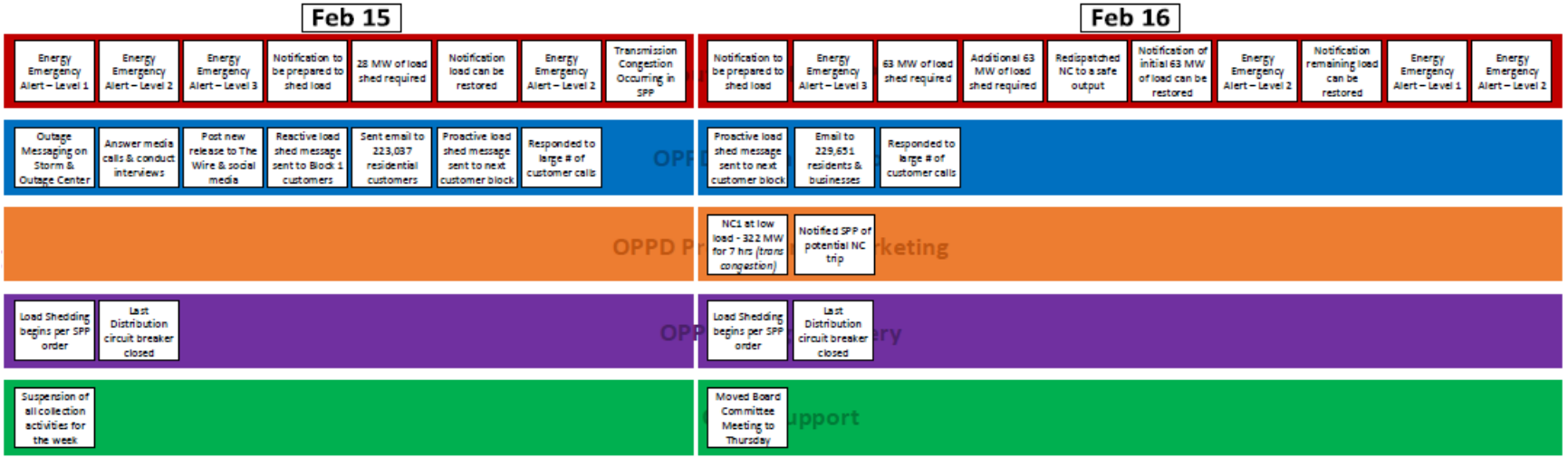
Visual Timeline (Pages 21 and 22)

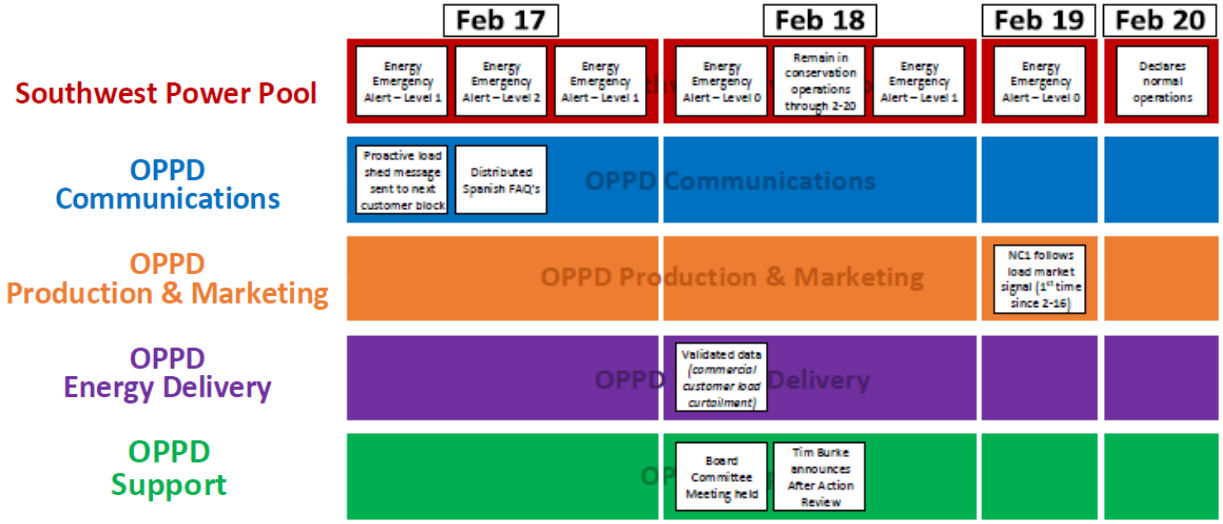
The next two pages provide a high level summary view of the significant actions that took place during each day of the event. The goal of this view is to quickly show what actions, many happening simultaneously, were occurring as OPPD prepared and responded to this event. This event was a first of its kind for both OPPD and SPP and a visual layout of each day's actions better convey its complex nature and the heroic efforts of OPPD employees to maintain the integrity of the bulk electric system.



Acronyms

NC: Nebraska City Station, NC1 – Unit 1, NC2 Unit 2
NO: North Omaha Station, NO5 – Unit 5
SC: Sarpy County Peaking Station, Units 1-5
CC: Cass County Peaking Station, Units 1-2
JS: Jones Street Peaking Station, Units 1-2
CMC: Corporate Marketing & Communications
EEA: Energy Emergency Alert Levels 1-3
CS: Customer Service
PDM: Product Development & Marketing
SMT: Senior Management Team
MW: Megawatt
SPP: Southwest Power Pool





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Polar Vortex Explained

What is the Polar Vortex?

The polar vortex is a circulation of strong, upper-level winds that surround the artic. These winds tend to hold the bitterly cold polar air in the Artic regions of the Northern Hemisphere. Occasionally, the vortex is disturbed, begins to wobble, and these distortions reach much farther south than is normal. Given the wobbly nature of such an event, only portions of the Northern Hemisphere will experience the extremely cold temperatures that come with a polar vortex event. Each event is different, not only by the area it impacts, but the severity of the event itself can also vary greatly. All polar vortex events bring cold weather, however the most impactful events bring extremely cold temperatures for an extended period of time. When this occurs, especially when an event is particularly strong in both intensity and duration, it is a significant risk to the health and safety of the populations impacted.

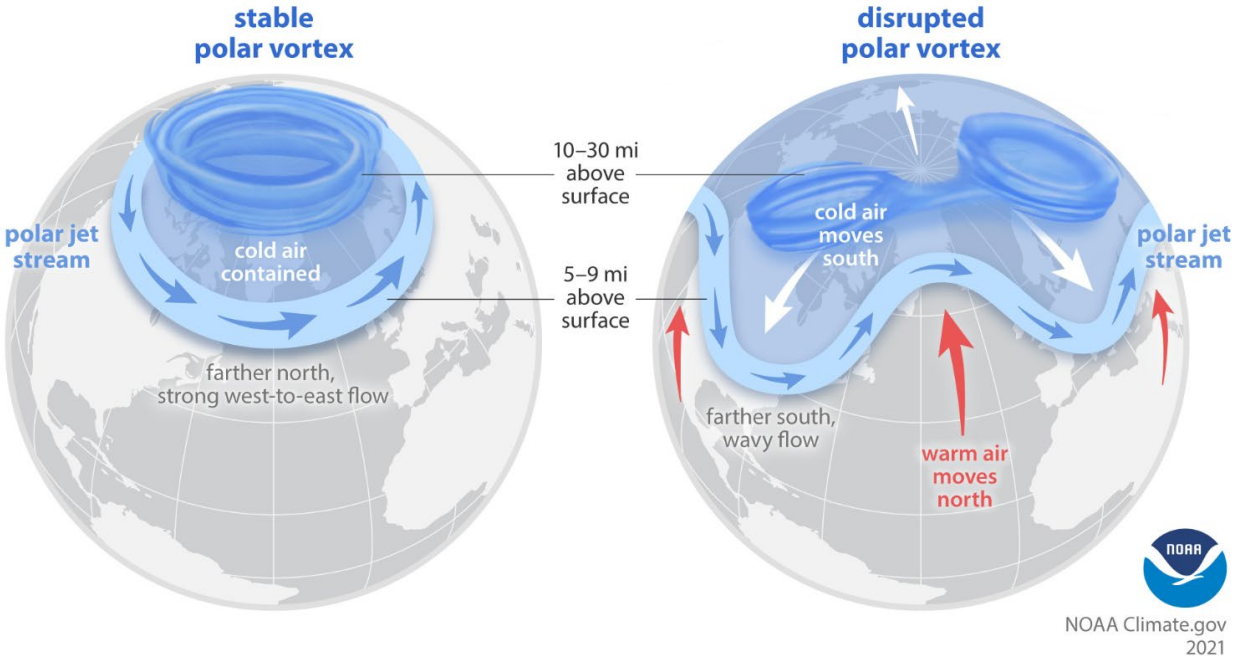

Figure 3 – NOAA: What is the Polar Vortex?

Some additional external links with more information on this topic are:

Jones, J., Miller, B., & Duke, A. (2019, January 30). *Polar vortex: Your questions answered.* CNN. https://www.cnn.com/2019/01/28/us/polar-vortex-explained-wxc/index.html.

US Department of Commerce, N. O. A. A. (2018, March 27). *What is the POLAR VORTEX?* National Weather Service. https://www.weather.gov/safety/cold-polar-vortex.

Understanding the arctic polar vortex: NOAA Climate.gov. Understanding the Arctic polar vortex | NOAA Climate.gov. (2021, March 5). https://www.climate.gov/news-features/understanding-climate/understanding-arctic-polar-vortex.

How significant was this event?

The February 2021 polar vortex event was significant compared to other polar vortex events or extreme cold snaps, at least as far as observational data allows for historical comparisons. The geographic area impacted and the duration of the extreme cold were both historic in their intensity. The earlier section on the weather event covered how severe this polar vortex event was compared to normal. To understand this event at a more local level, additional research was conducted by the National Weather Service office in Valley, Neb.

For the Omaha area in particular, the region sees three or more consecutive days of below zero average temperatures roughly every 5 years, when reviewing temperature data from 1900 to current. This past February the region saw a 3-day event (Feb 7-9) followed by a 5-day event (Feb. 12-16). Prior to the 2021 event, the region hadn't see an event meeting this definition since 2004, which was the longest period of time between events in different years in the entire period analyzed. The most significant events in the period analyzed was the winter of 1936, which was an 11-day, consecutive below-zero average temperature event, and the winter of 1983, which was a 9-day event.

It is important to note that any period of extreme cold in Omaha doesn't always indicate a polar vortex event. Extreme cold in Omaha does not always correlate with extreme cold across the SPP footprint. However, when extreme cold is seen in larger cities to our south (ex. Kansas City, Oklahoma City, and Dallas) there is generally extreme cold in Omaha at the same time. However, there are outliers to this data. For example, Texas experienced its last extreme cold load-shedding event from Feb. 1-5, 2011. Temperatures in Omaha at this time were not significantly cold, with the coldest day being 3 degrees above zero on average and the remaining days were above 10 degrees.

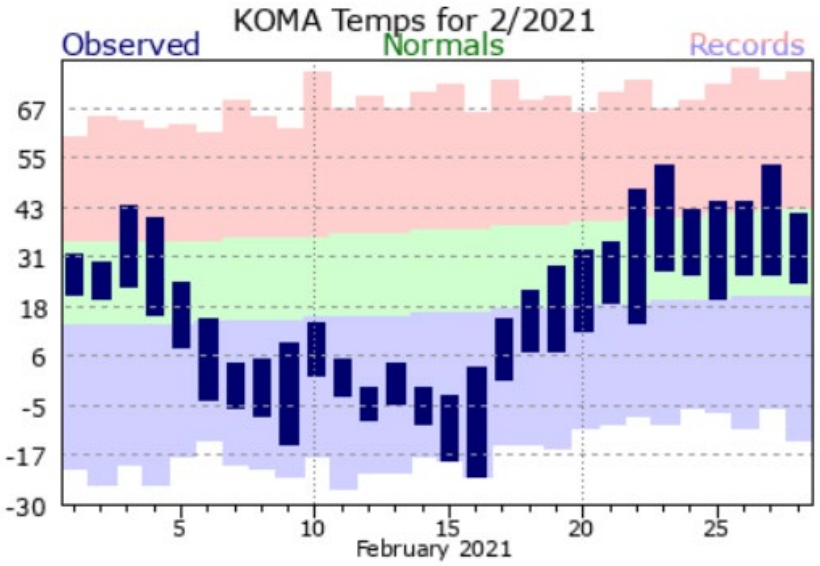

Figure 4 – National Weather Service (NWS) – Valley: Omaha Observed Temperatures Feb. 2021

Previous polar vortex events:

Wikimedia Foundation. (2021, March 24). *January–February 2019 North American Cold wave*. Wikipedia. https://en.wikipedia.org/wiki/January_February_2019_North_American_cold_wave.

Wikimedia Foundation. (2021, July 26). *December 2017–January 2018 North American Cold wave*. Wikipedia. https://en.wikipedia.org/wiki/December_2017_January_2018_North_American_cold_wave.

Wikimedia Foundation. (2021, February 22). *February 2015 North American Cold wave*. Wikipedia. https://en.wikipedia.org/wiki/February_2015_North_American_cold_wave.

Wikimedia Foundation. (2021, April 17). *November 2014 North American Cold wave*. Wikipedia. https://en.wikipedia.org/wiki/November_2014_North_American_cold_wave.

Wikimedia Foundation. (2021, June 30). *Early 2014 North American Cold wave*. Wikipedia. https://en.wikipedia.org/wiki/Early_2014_North_American_cold_wave.

Other external link to understand the significance of this event.

US Department of Commerce, N. O. A. A. (2018, February 8). *Monthly climate and records*. National Weather Service. https://www.weather.gov/oax/monthly_climate_records.

NOAA National Centers for Environmental Information, *State of the Climate: Synoptic Discussion for February 2021*, published online March 2021, retrieved on July 29, 2021 from https://www.ncdc.noaa.gov/sotc/synoptic/202102.

Assessing the U.S. climate in February 2021. National Centers for Environmental Information (NCEI). (2021, March 11). https://www.ncei.noaa.gov/news/national-climate-202102.

How often do polar vortex events occur?

The polar vortex, which is always present in the Artic during the winter, has been disturbed on average every other year since 2000, and even back to the 1970's when satellite data became widely available. That being said, each polar vortex event is different and will impact different portions of the Northern Hemisphere differently. The 1990's was an unusually quiet decade for polar vortex disturbances. This may be the result of some natural variability in the atmosphere, or it may be impacted by other external factors that scientists are still trying to understand. Direct measurements of the stratosphere, where the polar vortex resides, go back to the 1950s, which makes it difficult to understand what, if any, longer-term natural variability might exist with the polar vortex.

On the sudden stratospheric warming and polar vortex of early 2021: NOAA Climate.gov. On the sudden stratospheric warming and polar vortex of early 2021 | NOAA Climate.gov. (2021, January 28). https://www.climate.gov/news-features/blogs/enso/sudden-stratospheric-warming-and-polar-vortex-early-2021.

Was this event foreseeable?

Yes and no. It is possible to monitor and forecast the strength of the polar vortex around the North Pole. Climate scientists already identify when the polar vortex weakens and is disturbed, and even sometimes splits. When this happens it generally leads to greater variability in mid-latitude temperatures in the coming weeks.

That being said, as shown in the article provided below, the ability to predict where the polar vortex might bring extreme cold, and the duration and expanse of that cold, is beyond current weather forecasting capabilities. Surface-level and lower atmosphere conditions have a large impact on where and when this surge of Artic air will occur. Meteorology is generally only able to accurately predict coming weather conditions 7-14 days into the future. This is why it took until early February for various weather services to begin signaling the coming cold, despite the breakdown of the polar vortex in early January.

Kaufman, M. (2021, January 7). *The polar vortex has been disrupted. What does that bode?* Mashable. https://mashable.com/article/polar-vortex-explained.

Polar Vortex & Climate Change

The Earth's climate is an immensely complex system impacted by a multitude of factors along various time scales. The majority of climate scientists agree that the climate is warming overall and the National Weather Service-Valley analysis shows that Omaha's average temperature has warmed in the years 1900 to current. In general, this warming trend should result in winters that are less cold on average in the future compared to historical averages. Despite an overall warming trend, it is still possible to experience extreme cold spells and record low temperatures in any given winter.

The exact connection between climate change and how it will impact the polar vortex is not fully understood at this time. Some models indicate warming will strengthen the polar vortex, while others show it will weaken it. Regardless, more research is needed to better understand this phenomenon and its impact on weather and climate in the future.

Understanding the arctic polar vortex: NOAA Climate.gov. Understanding the Arctic polar vortex | NOAA Climate.gov. (2021, March 5). https://www.climate.gov/news-features/understanding-climate/understanding-arctic-polar-vortex.

Conclusion

The polar vortex event of February 2021 was an unprecedented event for the electric industry, OPPD, and our customer-owners. While the event was historic in its size, magnitude, duration, and the response necessary to preserve the integrity of the bulk electric system, it also was an opportunity for OPPD to learn and improve.

This after action report is intended to be the record of how OPPD prepared for and responded to this regional energy emergency event as well as to capture the improvements and lessons learned to be better next time. While the organization hopes that load shedding will never again be needed to maintain the stability of the grid, it is prudent to prepare in the event that it is. There are many factors that are beyond any utility's control when facing the threats of extreme weather events. This report demonstrates OPPD's responsibility to improve on what it can control to safeguard our mission of providing affordable, reliable, and environmentally sensitive energy services to our customers even in the most challenging of circumstances. As the recommendations included in this report are prioritized and implemented, the organization will continue to improve and advance our commitment as the trusted energy partner for the communities it serves.

Appendix

List of Polar Vortex After Action Review Interviews by Business Unit

List of Related External Reports on the 2021 Polar Vortex Event

List of Polar Vortex After Action Review Interviews by BU		
Name	Position	Business Unit
Jake Farrell	Manager, Building Services & Operation	BTBS
Owen Yardley	Director, Building Services & Corp Security	BTBS
Dave Whisinnand	Director, Ent Infrastructure	BTBS
Kate Brown	VP & CIO, Business Technology & Building Services	BTBS
Meredith Comstock	Supervisor, Building Services & Operations	BTBS
Chris Fosmer	Supervisor, Building Services & Operations	BTBS
Nicole Luna	Customer Experience Designer	CS
Nitin Gambhir	Customer Care Coordinator	CS
Pat Almgren	Supervisor, Customer Care Services	CS
Hallie Rodis	Supervisor, Customer Care Services	CS
Shenisa Neal	Supervisor, Customer Care Services	CS
Beth Klauschie-Perez	Supervisor, Customer Care Services	CS
Tracy Herman	QA & Metrics Specialist	CS
Lindsay Grashorn	Business Solution Representative	CS
Omar Alnazer	Lead Representative	CS
Gabi McVay	Call Center Representative	CS
Andrew Ciurej	Call Center Representative	CS
Aaron Smith	Director, Customer Experience	CS
Steve Sauer	Manager, Large C&I Sales & Services	CS
Jim Krist	Director, Customer Sales & Services	CS
Ron Mahoney	Senior Account Executive	CS
Donna Miner	Manager, Customer Operations	CS
Heather Siebken	Director, Product Development & Marketing	CS
Corey DeJong	Manager, Product Marketing	CS
Wyndell Young	Manager, Mid/Small C&I Sales & Services	CS
Jay Schubert	Engineer III	CS
Juli Comstock	VP, Customer Service	CS
Moe Hinners	Senior Corporate Governance Specialist	CSG
Scott Focht	VP, Corporate Strategy & Governance	CSG
Neal Faltys	Principal Engineer	ED
Amanda Underwood	Senior Engineer	ED
Mike Herzog	Manager, Distribution Planning	ED
Todd Gosnell	Manager, Ops Engineering & Training	ED
Matt Shanzt	Lead Distribution Operations	ED
Joel Adams	Distribution System Operator	ED
Doug Peterchuck	Manager, Transmission Operations	ED
Rita Hatfield	System Operations Specialist	ED
Brad Heimes	Lead Transmission Operations	ED
Joel Adams	Distribution System Operator	ED
Troy Via	VP, Energy Delivery	ED

Name	Position	Business Unit
Eric Yowell	Transmission System Operator	ED
Lee O'Neal	Director, T&D Construction	ED
Brian Kramer	Manager, Substation & System Protection	ED
Adam Staebell	Manager, Maintenance Services	EPND
Kyle Brinkcerhoff	Manager, Maintenance Services	EPND
Clint Zavadil	Manager, System Engineering	EPND
Gary Ruhl	Manager, Programs	EPND
Claude Strope	Lead Engineer	EPND
Tim Uehling	Senior Director, FCS Decom	EPND
Todd Anderson	Lead Engineer	EPND
Scott Eidem	Director, Engineering Services	EPND
Barb Parolek	Fuels Supply Manager	EPND
Deb Burns	Fuels Supply Manager	EPND
Ryan Stigge	Program Manager, Decarbonization SI	EPND
Kelly Anderson	Supply Doc Control Admin Support	EPND
Joseph Mise	Engineer III	EPND
Bud Chapin	Director, Maintenance Services	EPND
Mary Fisher	VP, Energy Production & Nuclear Decommissioning	EPND
Ryan Gerdts	Manager, Station Operations	EPND
Allan Vacek	Manager, Station Operations	EPND
Justin Wiemer	Supervisor, Peaking Stations	EPND
Ryan Headley	Manager, Energy Marketing	FS
Justin Kathol	Manager, Settlements & Risk	FS
David Theobald	Senior Term Trader	FS
Rick Yanovich	Structured Deal & Congestion Trade Manager	FS
Mark Trumble	Director, Energy Marketing & Trading	FS
Joel Robles	Senior Energy Coord NERC Comp & Training	FS
Mike Donahue	Manager, Transportation & Construction Equip	FS
Tim McAreavey	Director, Supply Chain Management	FS
Jane Metzer	Supervisor, SCM Warehousing	FS
Javier Fernandez	VP & CFO, Financial Services	FS
Joe Waszak	Senior Settlement Analyst	FS
Chris Campos	Day Ahead Energy Marketer	FS
Ryan Murphy	Day Ahead Energy Marketer	FS
Brad Underwood	Director, Financial Plans & Analysis	FS
Mart Sedky	VP, Human Capital	HC
Steve Bruckner	General Counsel	LEGAL
Tim Burke	President & CEO	OPPD
Joe Lang	Director, Energy Regulatory Affairs	PA
Mahmood Safi	NERC Compliance Manager	PA
Kate Thomas	Director, Corporate Market & Communication	PA

Name	Position	Business Unit
Mary Oswald	Manager, EE Communication & Collaboration	PA
Jeremy Bowers	Director, Environmental & Regulatory Affairs	PA
Bryan Lorence	Manager, Environmental Operations	PA
Kerri Teter	Sr. Environmental Specialist	PA
Bob Holmes	Program Administrator	PA
Lisa Olson	VP, Public Affairs	PA
Kevin McCormick	Senior Director, Safety & Technical Training	S&TT

Count by Business Unit	TOTAL
BTBS	6
CS	21
CSG	2
ED	14
EPND	18
FS	14
HC	1
LEGAL	1
OPPD	1
PA	9
S&TT	1
All Business Units	88

Links to Related External Reports on the 2021 Polar Vortex Event:

Southwest Power Pool (SPP)

https://www.spp.org/documents/65037/comprehensive%20review%20of%20spp's%20response%20to%20the%20feb.%202021%20winter%20storm%202021%2007%2019.pdf

SPP Independent Market Monitoring Unit

https://www.spp.org/documents/64975/spp_mmu_winter_weather_report_2021.pdf

Midwest Independent System Operator (MISO)

https://cdn.misoenergy.org/2021%20Arctic%20Event%20Report554429.pdf