



FEBRUARY 2021 WINTER STORM EVENT

PRESENTATION TO OKLAHOMA CORPORATION COMMISSION

LANNY NICKELL

EXECUTIVE VICE PRESIDENT & COO

SOUTHWEST POWER POOL

Updated 3/8/21

*Helping our members work together to keep
the lights on... today and in the future.*



SouthwestPowerPool



southwest-power-pool



SPPorg

ABOUT SPP

WHO IS SPP?

501(c)(6) nonprofit corporation

One of 9 regional grid operators

104 member companies in 14 states

“Air traffic control” for high-voltage grid

Balances supply and demand across region

Maintains reliable grid operations

Operates wholesale energy market

Plans future transmission needs

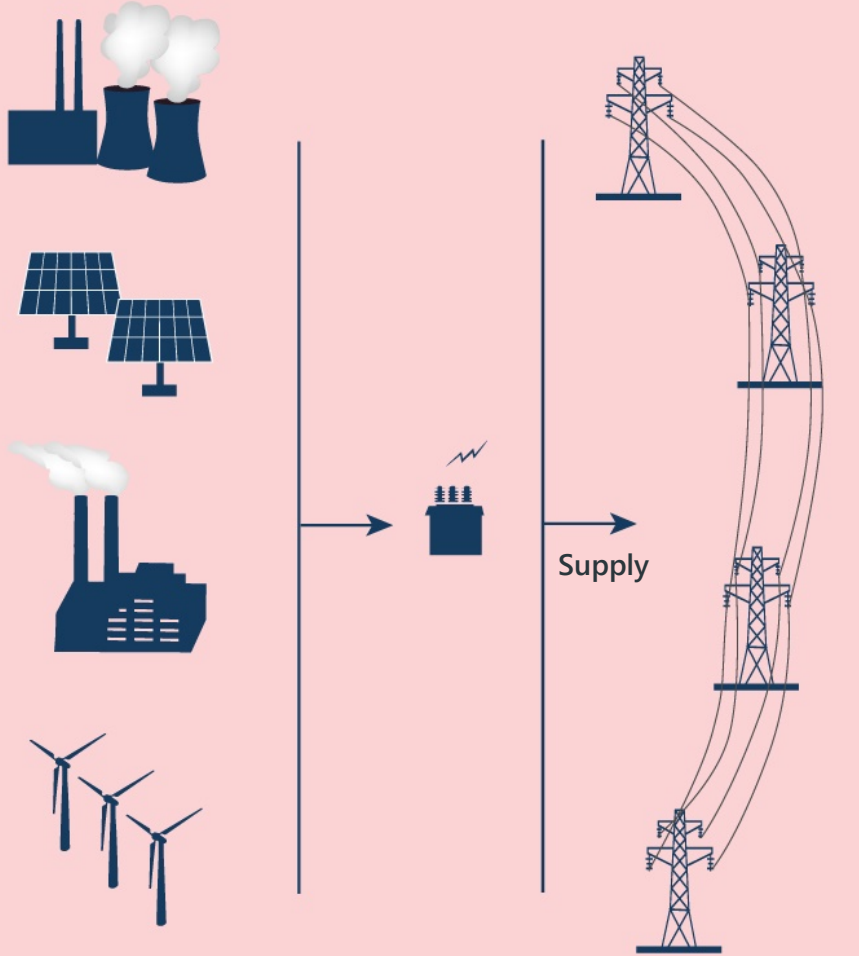


SPP's Reliability Objectives

1: Energy supplied to grid must equal energy demands

2: Transmission system must be operated within safe, reliable limits

WHOLESALE ENERGY AND TRANSMISSION

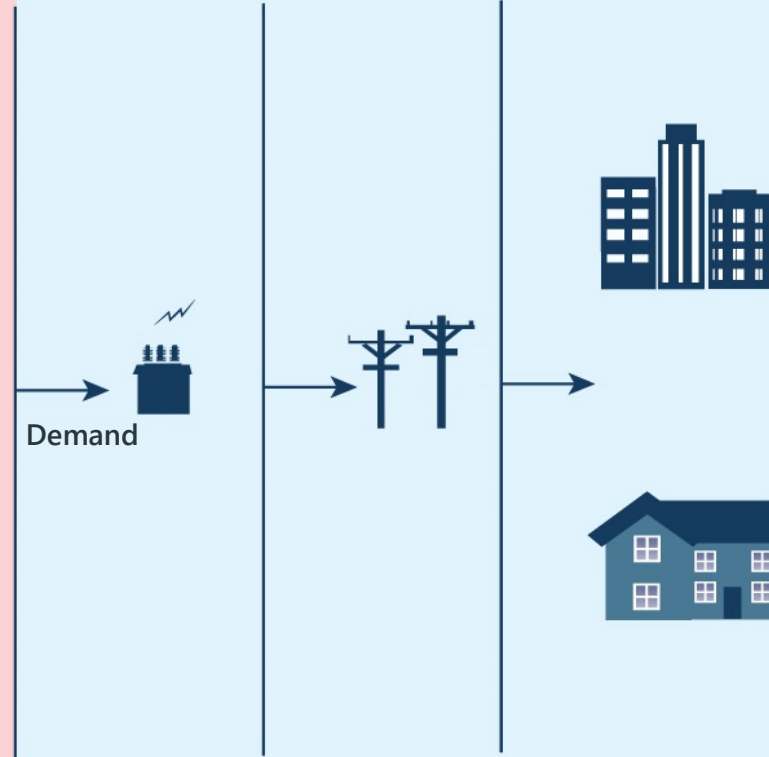


Power plant generates electricity

Transformer steps up voltage for transmission

Transmission lines carry electricity long distances

RETAIL ENERGY AND DISTRIBUTION

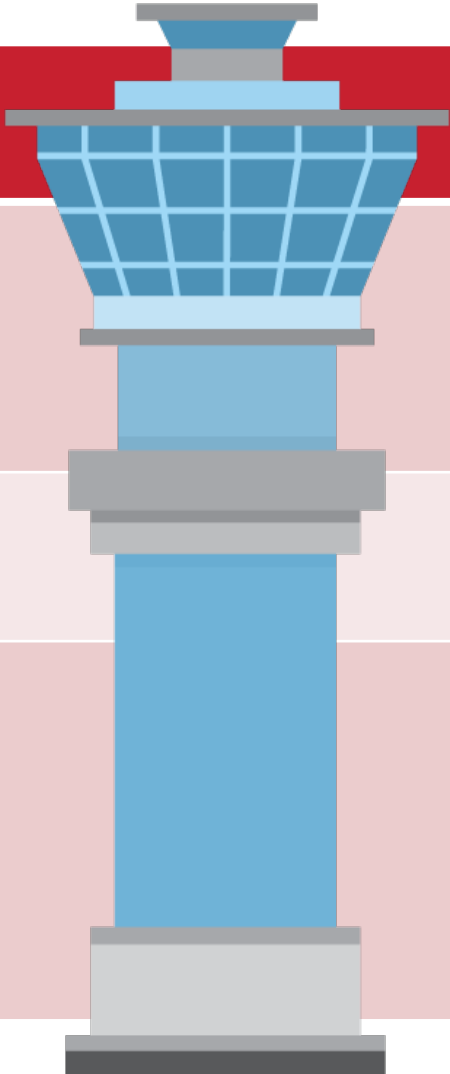


Neighborhood transformer steps down voltage

Distribution lines carry electricity to homes and businesses

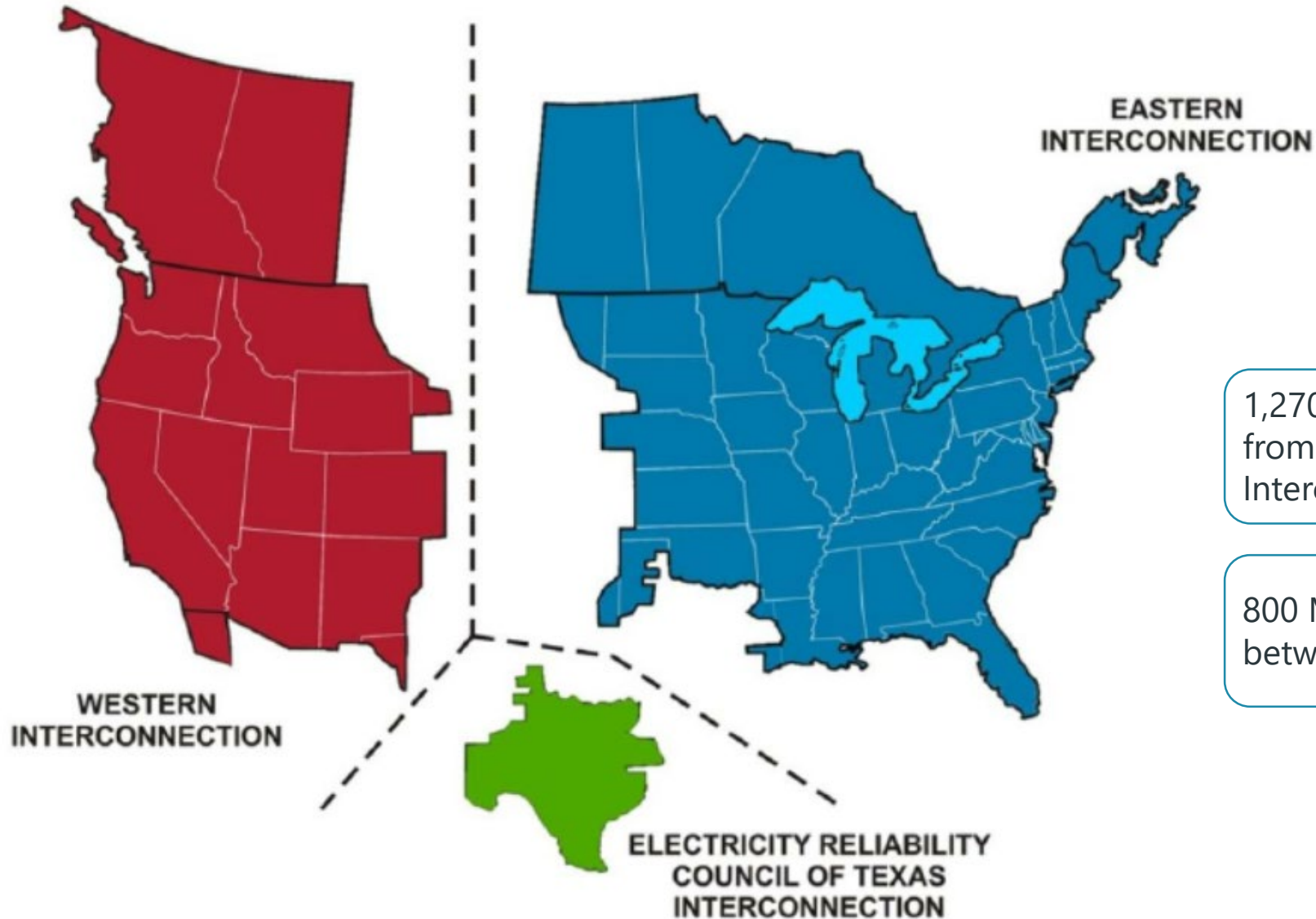
Transformers on poles step down electricity before it enters houses

AIR TRAFFIC CONTROL: AN ANALOGY



Air Traffic Control		Southwest Power Pool
Does not own airplanes, airlines or airports		Does not own utilities, power generators or transmission lines
Does not own the airspace it monitors		Does not own the land electricity flows across
Directs air routes to ensure airplanes and passengers are safely transported		Monitors and directs regional bulk power grid to ensure electricity gets from where it's made to where it's needed

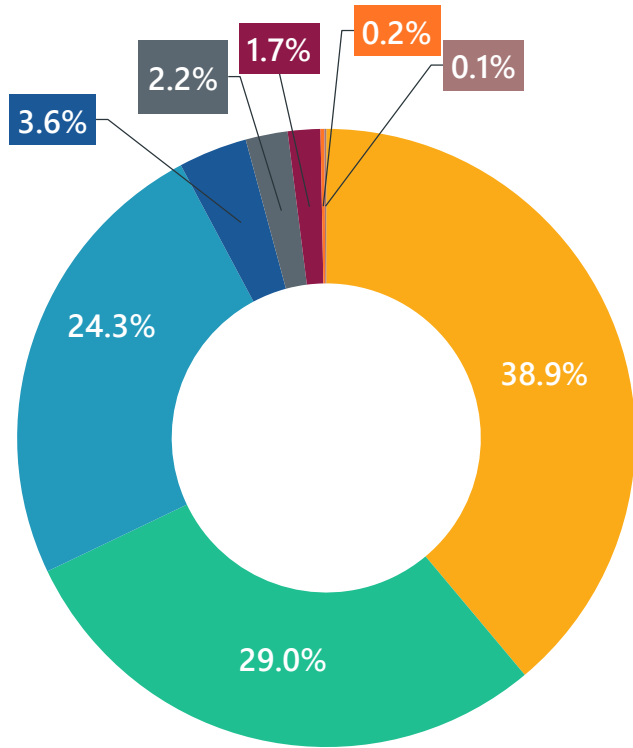
THREE ELECTRIC INTERCONNECTIONS



1,270 MW potential transfer capability from Western to Eastern Interconnection

800 MW potential transfer capability between SPP and ERCOT

NAMEPLATE CAPACITY* 94,648 MW

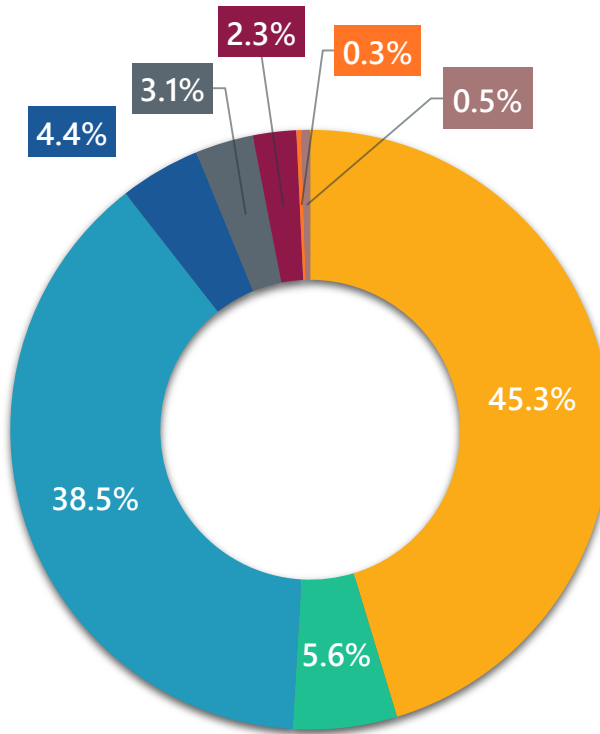


- Natural Gas (36,783 MW)
- Wind (27,458 MW)
- Coal (22,992 MW)
- Hydro (3,428 MW)
- Nuclear (2,061 MW)
- Fuel Oil (1,570 MW)
- Solar (235 MW)
- Other (121 MW)

* As of 1/13/21

GENERATION IN SPP

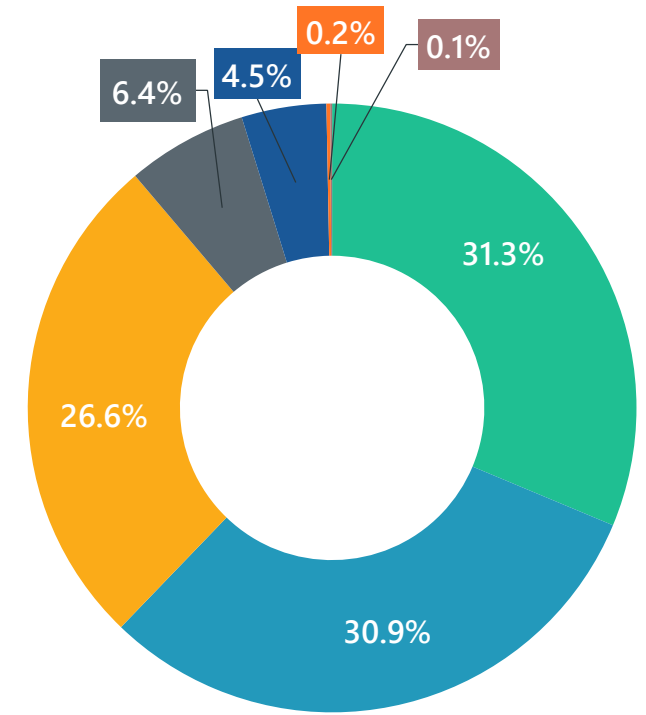
ACCREDITED CAPACITY† 62,281 MW



- Natural Gas (28,230 MW)
- Wind (3,490 MW)
- Coal (23,986 MW)
- Hydro (2,716 MW)
- Nuclear (1,944 MW)
- Fuel Oil (1,455 MW)
- Solar (162 MW)
- Other (298 MW)

†As of 6/15/20

2020 ENERGY PRODUCTION 262.730 TWH



- Wind (82,280 GWh)
- Coal (81,131 GWh)
- Natural Gas (69,903 GWh)
- Nuclear (16,823 GWh)
- Hydro (11,701 GWh)
- Solar (568 GWh)
- Other (323 GWh)

SPP'S EMERGENCY RESPONSE FRAMEWORK

FERC AND NERC JURISDICTIONAL

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION



SPP and utilities must comply with mandatory, enforceable NERC standards

Government enacted reliability standards after 2003 blackout

NERC regularly audits SPP

NERC directs how much energy SPP must keep for emergencies

FERC approves NERC standards

SPP must comply with FERC directives

CONTINUAL EMERGENCY TRAINING

- Year-round planning for worst-case scenarios & cold weather events
- NERC certifies operators & approves SPP training program
- Operators receive 85-100 training hours per year
- In 2020, SPP provided 26,000 hours of training to 251 organizations
- In 2020, SPP drilled with MISO, CAISO & our joint operating companies

BALANCING AUTHORITY (BA) OPERATING LEVELS

Levels/alerts defined by SPP operating plans

Normal Operations	SPP has enough generation to meet demand, has available reserves and does not foresee extreme or abnormal reliability threats
Weather alert	SPP expects extreme weather in its reliability coordination service territory
Resource alert	SPP's BA area expects severe weather conditions, significant outages, wind-forecast uncertainty and/or load-forecast uncertainty with potential to impact total capacity.
Conservative Operations	SPP determines the need to operate system conservatively to avoid an emergency based on weather, environmental, operational, terrorist, cyber or other events
Maximum emergency generation notification	SPP foresees the need to use emergency ranges of resources for a certain hours.

Levels defined* by NERC EOP-011-1

Energy Emergency Alert (EEA) Level 1	All available generation resources in use <ul style="list-style-type: none"> All generation is committed, and there is concern about maintaining required reserves for BA Non-firm wholesale energy sales curtailed.
EEA Level 2	Load management procedures in effect <ul style="list-style-type: none"> BA is no longer able to provide its expected energy requirements and is energy deficient Operating plan implemented, including public appeals and demand response BA is still able to maintain minimum reserves Market participants and other BAs notified Transmission limitations evaluated and revised BA makes use of all available resources
EEA Level 3	Firm load interruption imminent or in progress <ul style="list-style-type: none"> BA is unable to meet minimum contingency reserve requirements System & reliability limits reevaluated and revised Immediate action taken to mitigate undue risk to the Interconnection, including load shedding.

* These are paraphrased, summarized definitions. Full definitions: <https://www.nerc.com/pa/Stand/Reliability%20Standards/EOP-011-1.pdf>

2021 WINTER STORM GRID EMERGENCY

THE BIG PICTURE



Early prep helped

2/4: Issued cold weather alert

2/8: Issued resource alert

2/11: Committed long-lead generation



Public appeals reduced demand

Demand dropped below forecast, helping minimize interruptions



We used every MW we could get

We ran every available generator and imported energy from neighbors



Service interruptions required

2/15
~1.5% of system demand for 57 min.

2/16
Up to ~6.5% of system demand for 3 hr. 23 min.



Collaboration reduced impact

Controlled, temporary interruptions prevented uncontrolled blackouts

HISTORIC WEATHER EVENT

- 73% of mainland U.S. covered in snow ¹
- 3,000 daily and 79 all-time local low temperature records broken ²
- “Comparable to the historical cold snaps of Feb. 1899 & 1905.” ³

1 – [National Operating Hydrologic Remote Sensing Center](#)

2 – [National Weather Service Weather Prediction Center](#)

3 – [National Weather Service Weather Prediction Center](#)

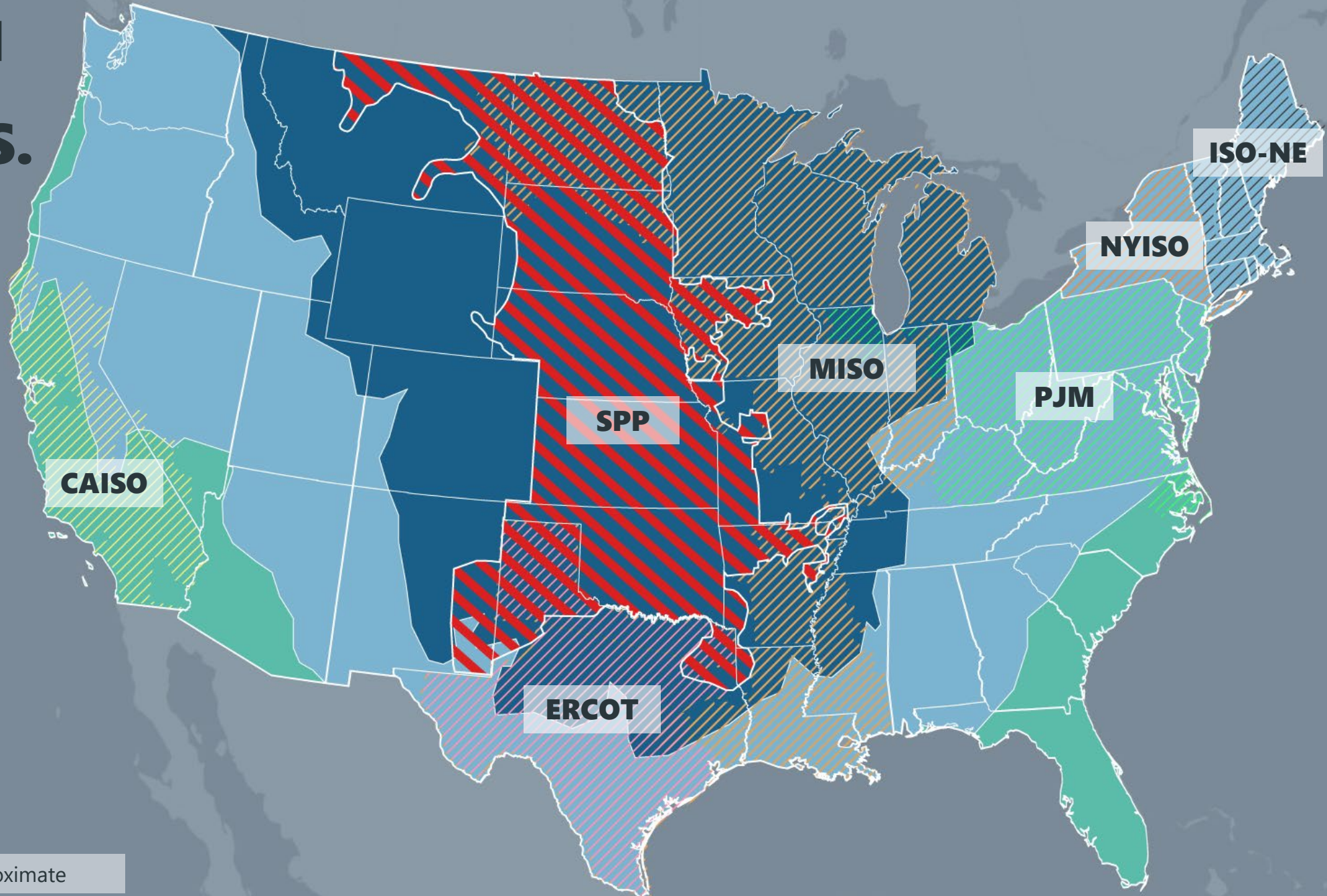
SPP REGION IN COLDEST PART OF U.S.



Lowest temperatures forecast
for Feb. 14-16, 2021

Sources: National Weather Service,
Global Forecast System

- SPP service territory/
balancing authority
- Temperatures below 0°F
- Between 0° and 32°F
- Above 32°F



* Locations of ISOs/RTOs are approximate

DRIVERS OF TEMPORARY SERVICE INTERRUPTIONS

1. Generation unavailability

- Lack of fuel supply
- Icing and extreme cold weather-related outages

2. Rapid reduction of energy imports

- Related to transmission congestion
- Tightening supply conditions in neighboring areas

3. Record winter energy consumption

ADVANCE PREPARATIONS

- **Alerted** operators as conditions changed
- **Rescheduled** transmission & generation maintenance outages
- **Committed** generation that takes days to ramp up
- **Invited** members' communications & government affairs staff to briefings
- **Issued** public appeals to conserve power
- **Updated** regulators

SPP BALANCING AUTHORITY OPERATIONS: FEB. 4-20, 2021

Time blocks are not to scale

Thurs. 2/4 to Mon. 2/8	Tues 2/9 to Sat. 2/13	Sun. 2/14	Mon. 2/15	Tues. 2/16	Wed. 2/17	Thurs. 2/18	Fri. 2/19	Sat. 2/20							
Normal operations in effect	<p>Tues. 2/9: Declared conservative operations until further notice</p> <p>Thurs. 2/11: Committed longer-lead time generating resources for Sat. 2/13 to Tues. 2/16</p> <p>Sat. 2/13: Reminded market participants of emergency cap & offer processes</p>	<p>Requested member companies issue public appeals for conservation</p> <p>Declared EEA1 to be effective 2/15 at 05:00</p>	Conservative operations in effect	EEA2 in effect	<p>EEA 2 in effect</p>	<p>EEA1 in effect</p>	<p>EEA1 in effect</p>	<p>Conservative operations in effect</p>							
<p>Thurs. 2/4: Issued cold weather alert to grid operators</p>			05:00 Declared EEA1	06:15 Declared EEA3					06:44 Demand interruption	10:07 – EEA3	<p>09:30 Ended EEA and remained in conservative operations through 22:00 Sat. 2/20, with appeal for public conservation</p>	<p>09:20 Ended EEA and remained in conservative operations through 22:00 Sat. 2/20, with appeal for public conservation</p>			
			07:22 Declared EEA2	10:08 Declared EEA3 New record peak					11:30 Declared EEA2	12:31 Declared EEA1			<p>13:15 Declared EEA1</p>		
			12:04 - Demand interruption	13:01 - EEA3					14:00 Declared EEA2	18:28 Declared EEA2				18:20 Declared EEA2	
														22:59 Declared EEA1	
															18:25 – Declared EEA1

AFTER THE STORM

- Collaborate with members and industry to ensure region is equipped to manage future crises effectively
- Comply with FERC and NERC inquiries
- Review processes for improvement areas
- Document lessons learned



ESSENTIAL POINTS

Our large, interconnected network minimized interruptions

- SPP's transmission operators and neighboring regions all shared energy
- Helping each other in all directions minimized impacts to any one entity

Diverse generation mix gave flexibility during storm response

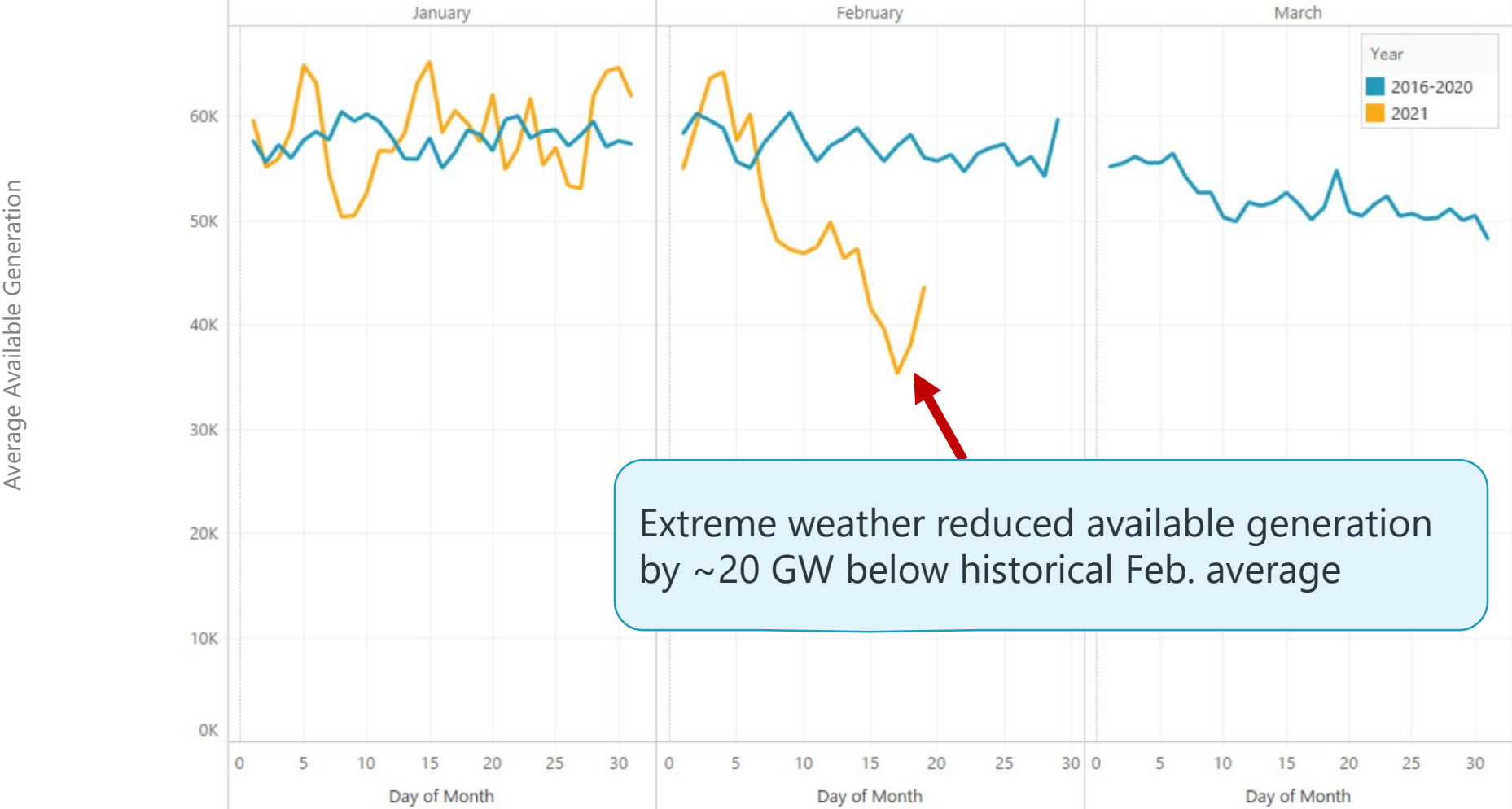
- Many types of generators provided power
- Because all fuel sources and generators are subject to problems in extreme weather, we needed many sources to call on

We avoided widespread, severe blackout by:

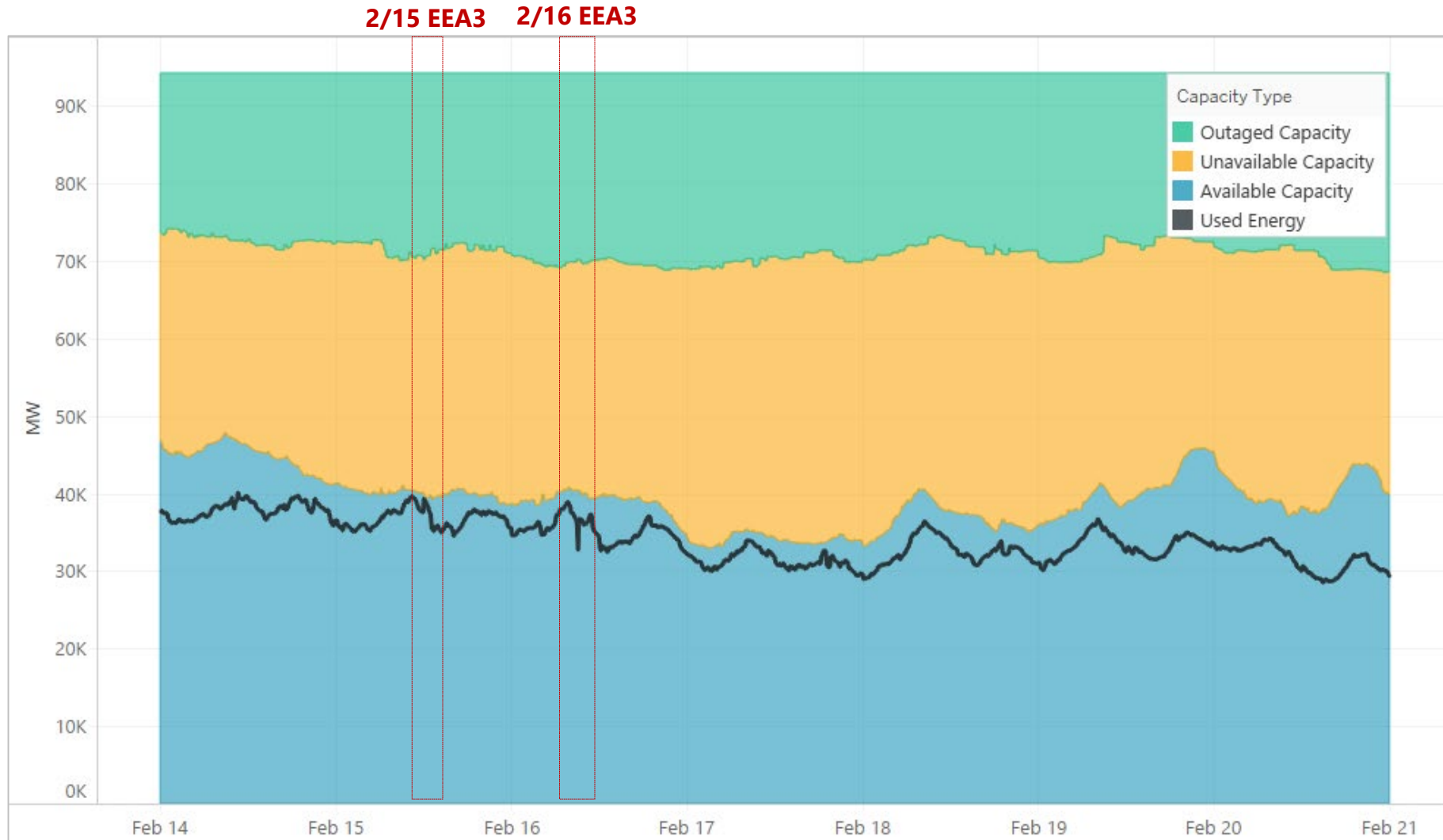
- Working closely with our neighbors
- Following NERC regulations and executing training scenarios
- Directing short curtailments to prevent grid from cascading out of control

OPERATIONS DATA

AVAILABLE GENERATION IN SPP MARKET

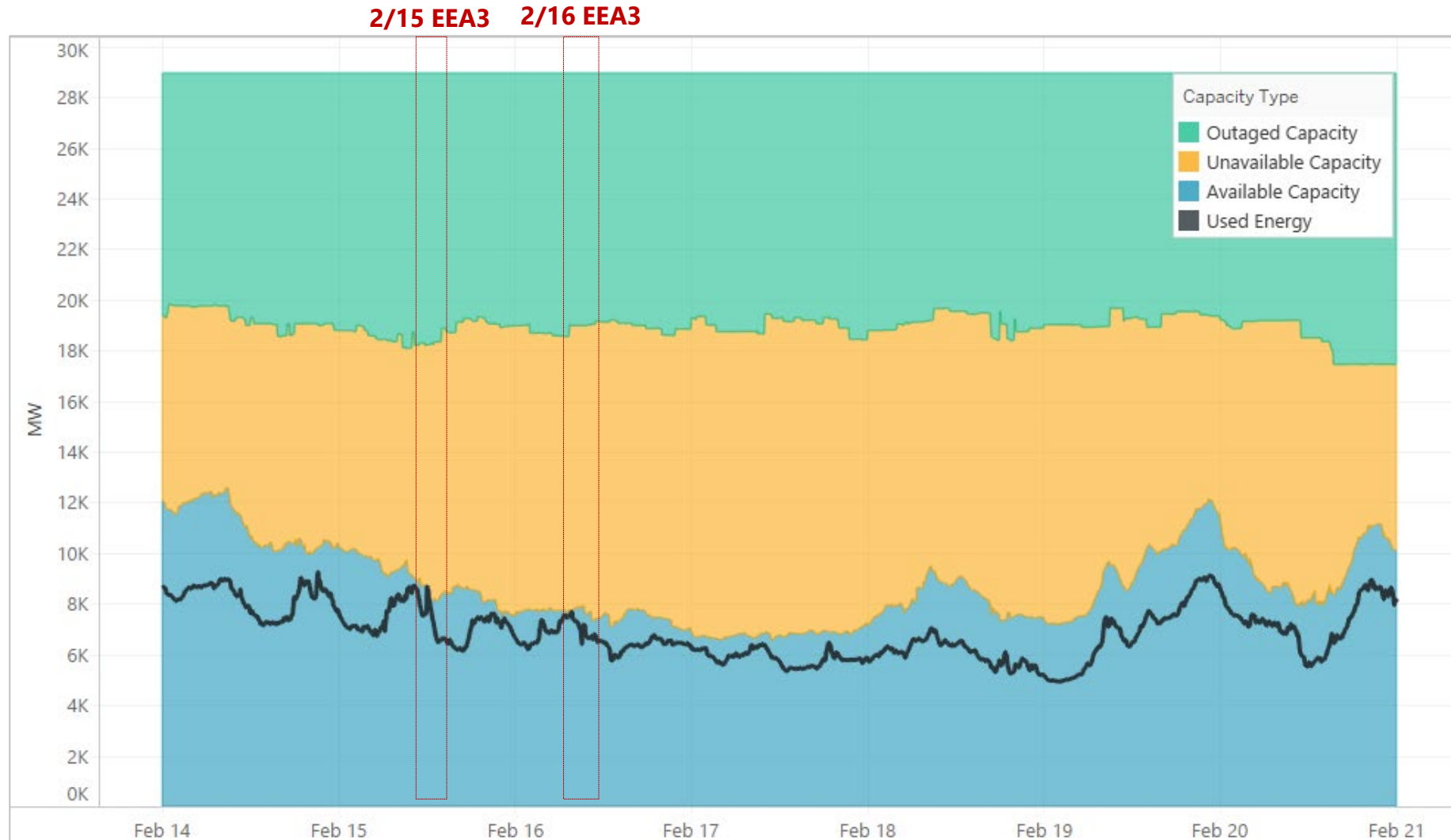


TOTAL GENERATING CAPACITY IN SPP



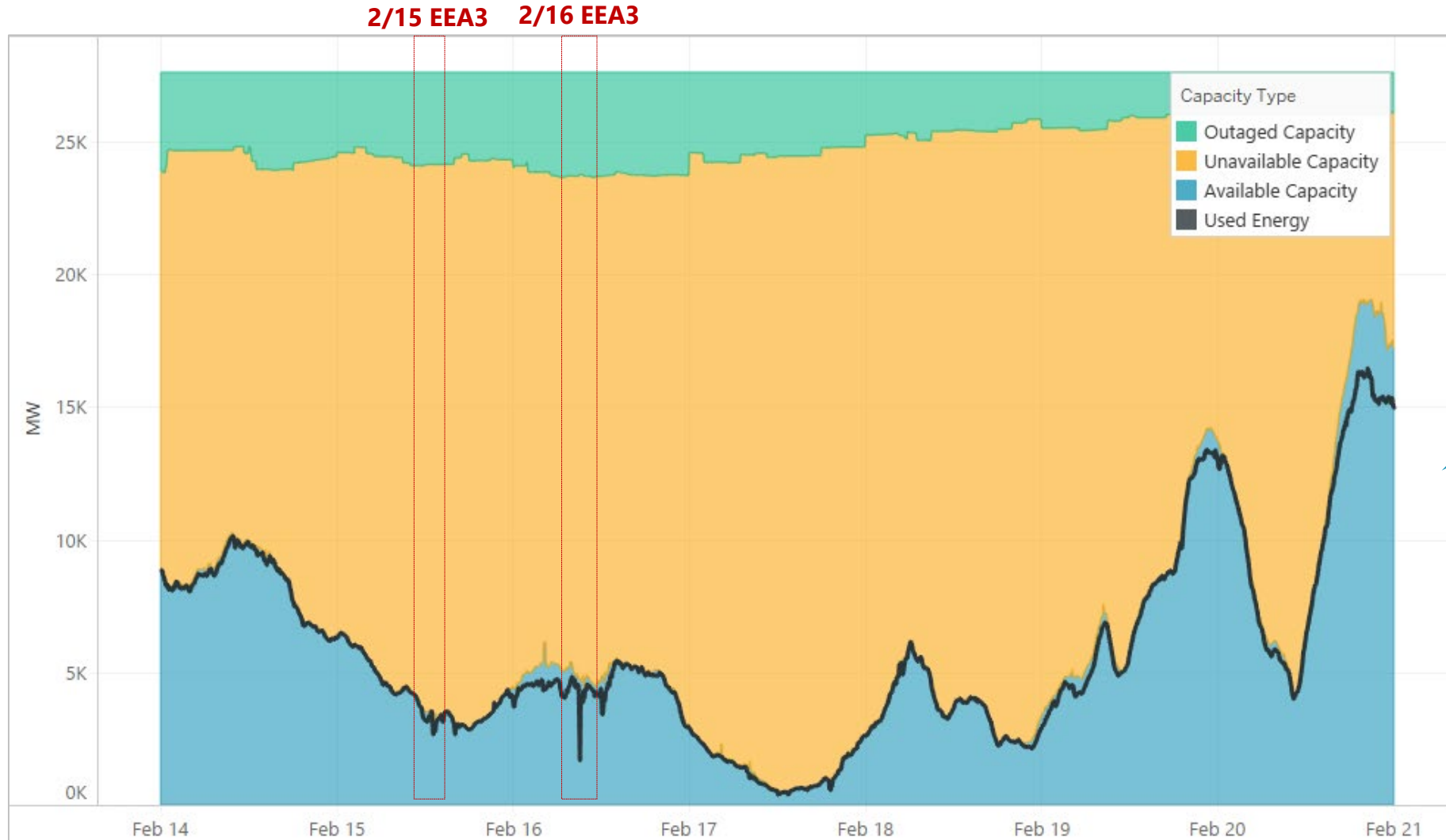
Appr. 42% of nameplate capacity and 65% of accredited capacity in SPP was available during EEA3 periods

TOTAL GENERATING CAPACITY – OKLAHOMA



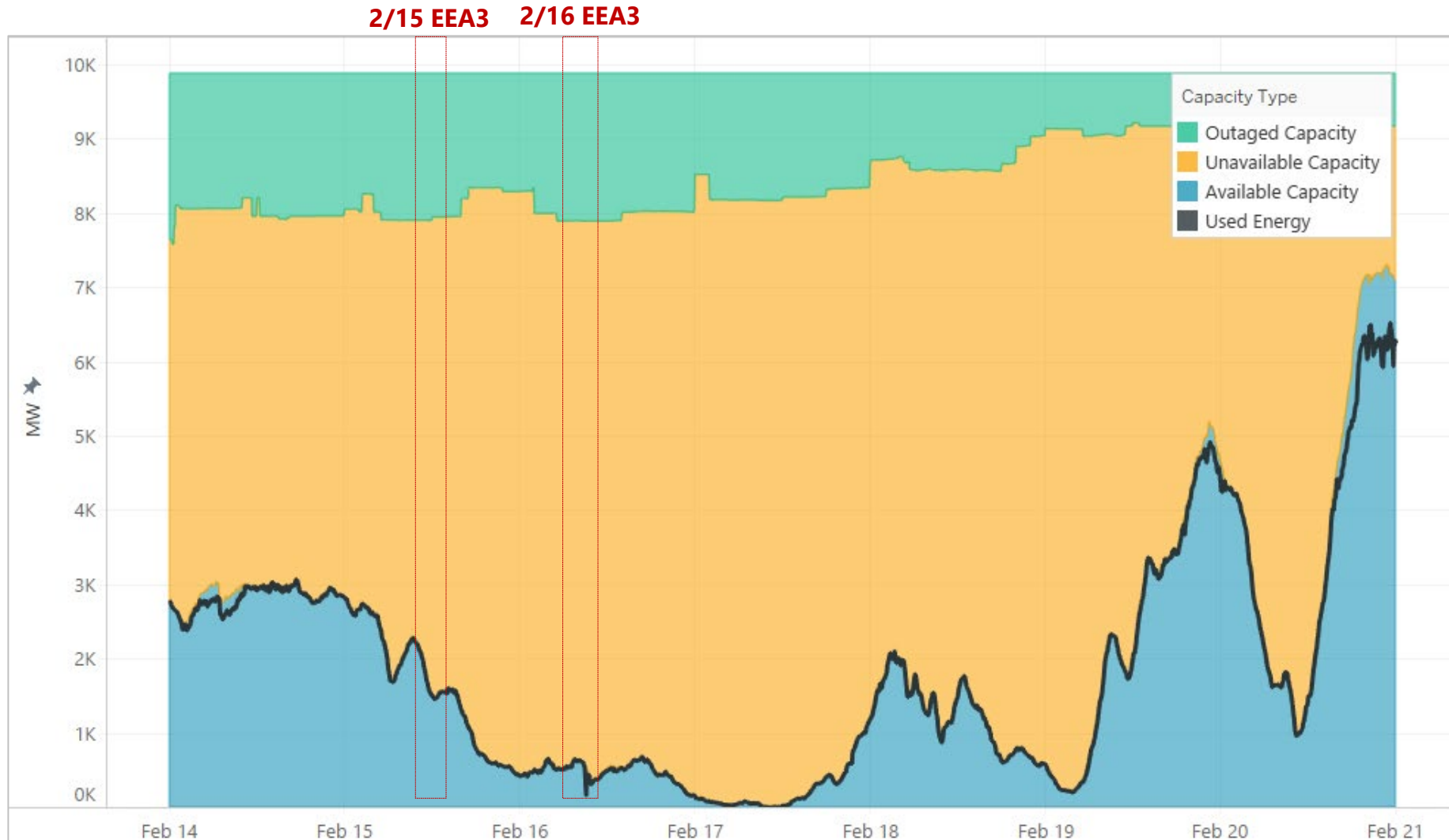
Appr. 26-28% of nameplate capacity in OK was available during EEA3 periods

GENERATING CAPACITY IN SPP – WIND



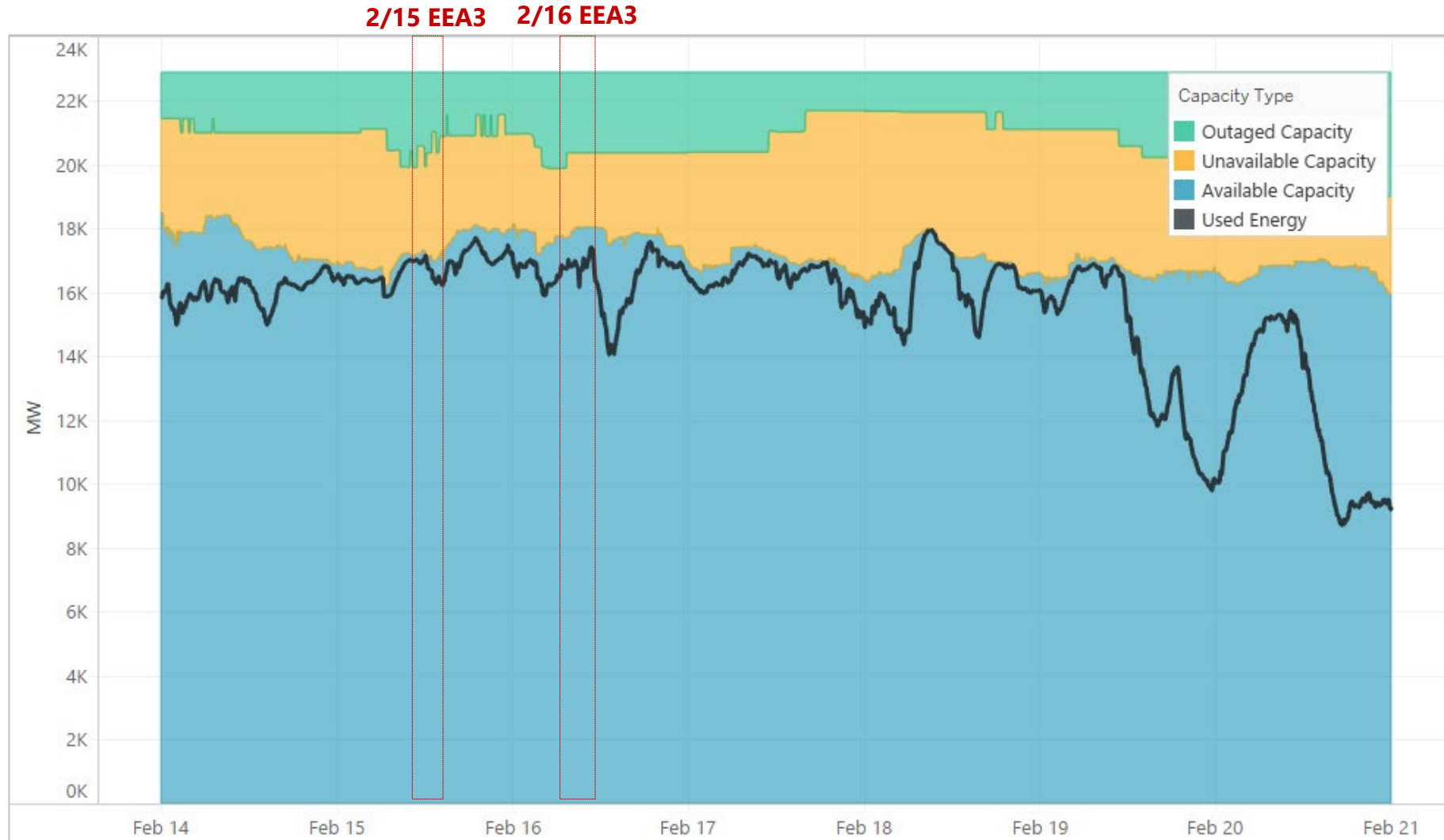
For wind generation in SPP, 3.5-4.6% of nameplate capacity and 95-123% of accredited capacity was available during EEA3 periods

GENERATING CAPACITY – WIND – OKLAHOMA



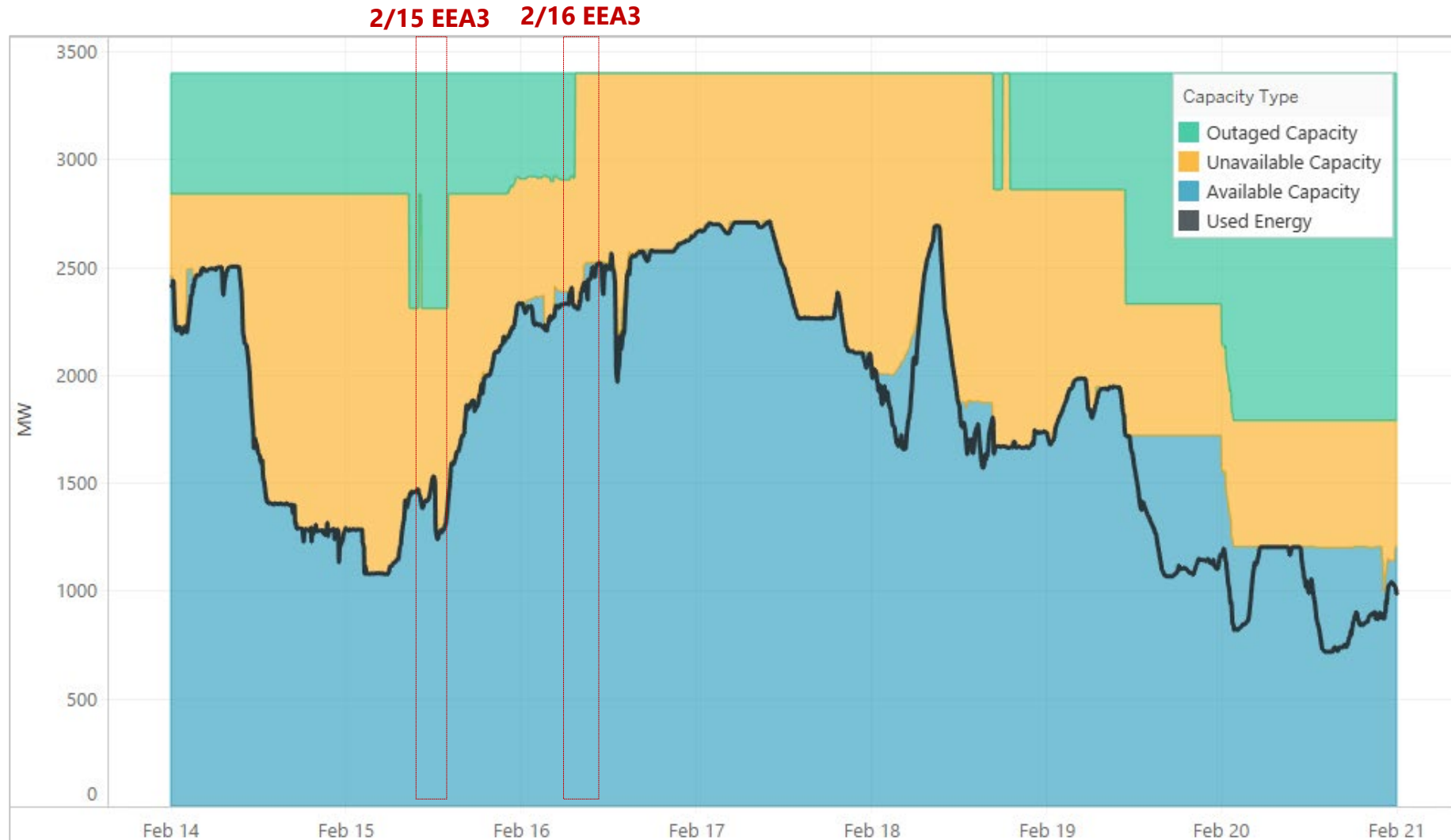
During the EEA3 events, wind in OK contributed nearly half of SPP's wind on the 15th but dropped to about 12% of SPP's wind on the 16th

GENERATING CAPACITY IN SPP – COAL



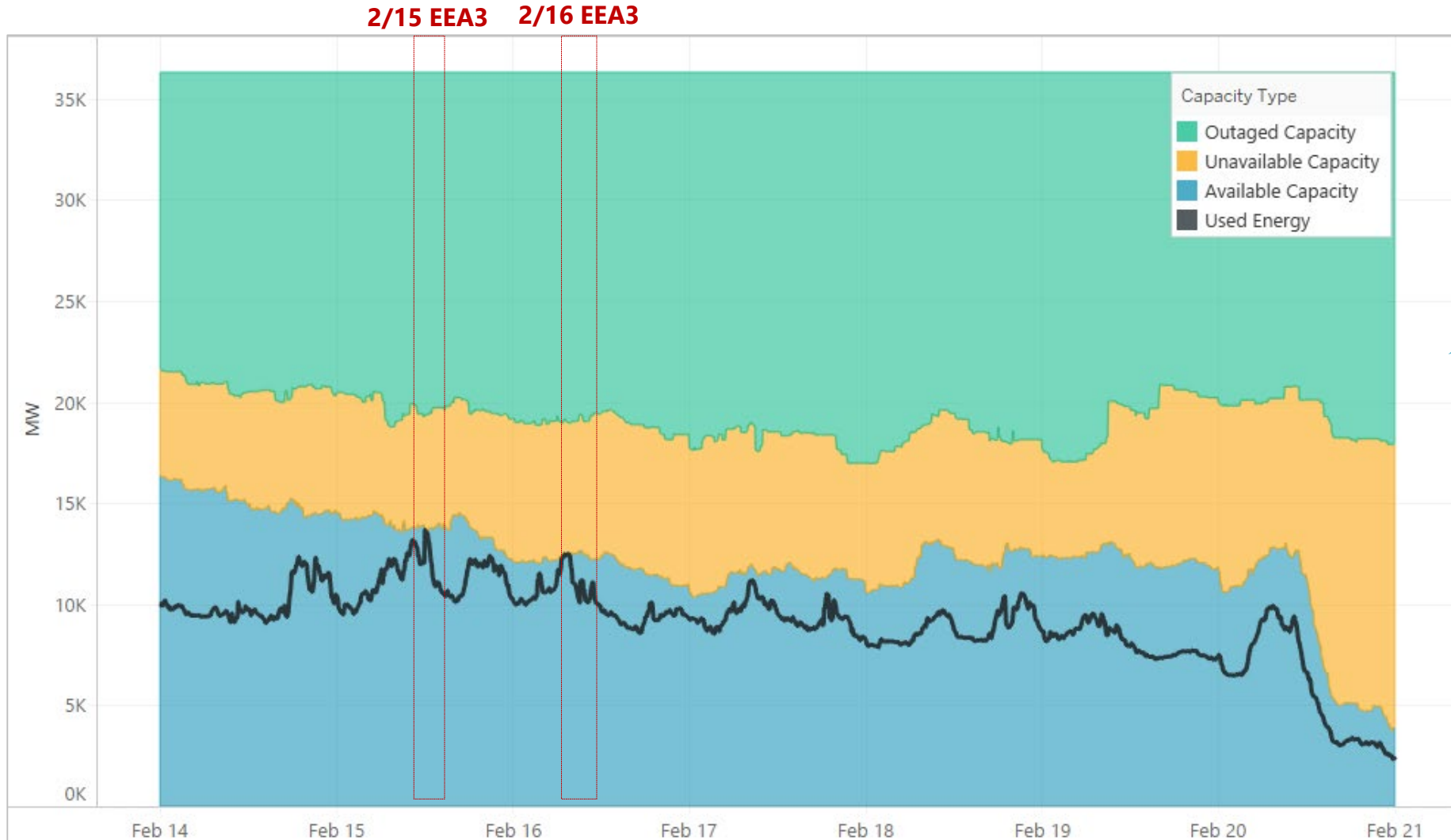
For coal generation in SPP, 71-75% of accredited capacity was available during EEA3 periods

GENERATING CAPACITY – COAL – OKLAHOMA



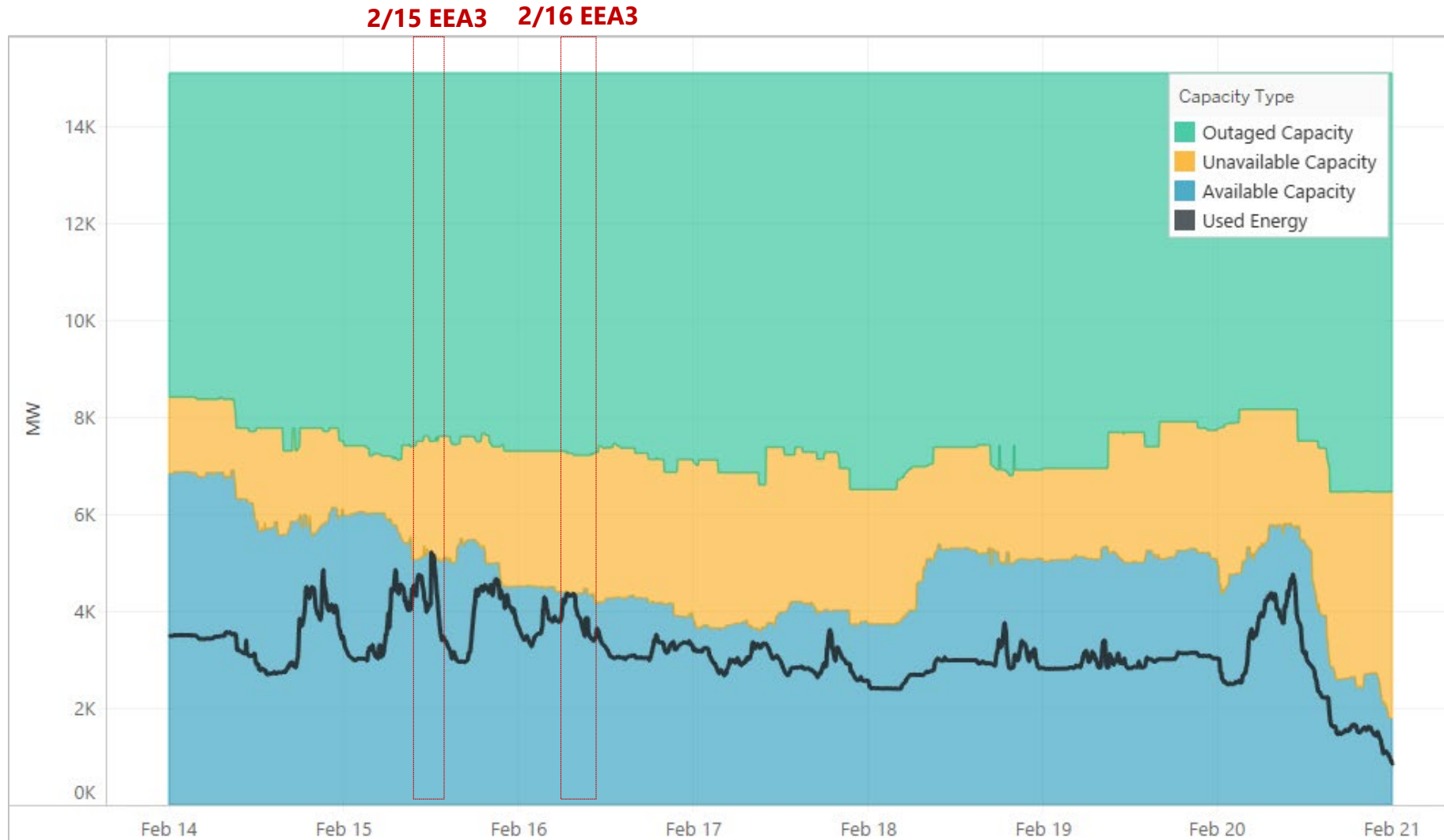
During the EEA3 events, coal gen. in OK supplied 8% of available coal gen in SPP on the 15th and 14% of available coal gen in SPP on the 16th

GENERATING CAPACITY IN SPP – GAS



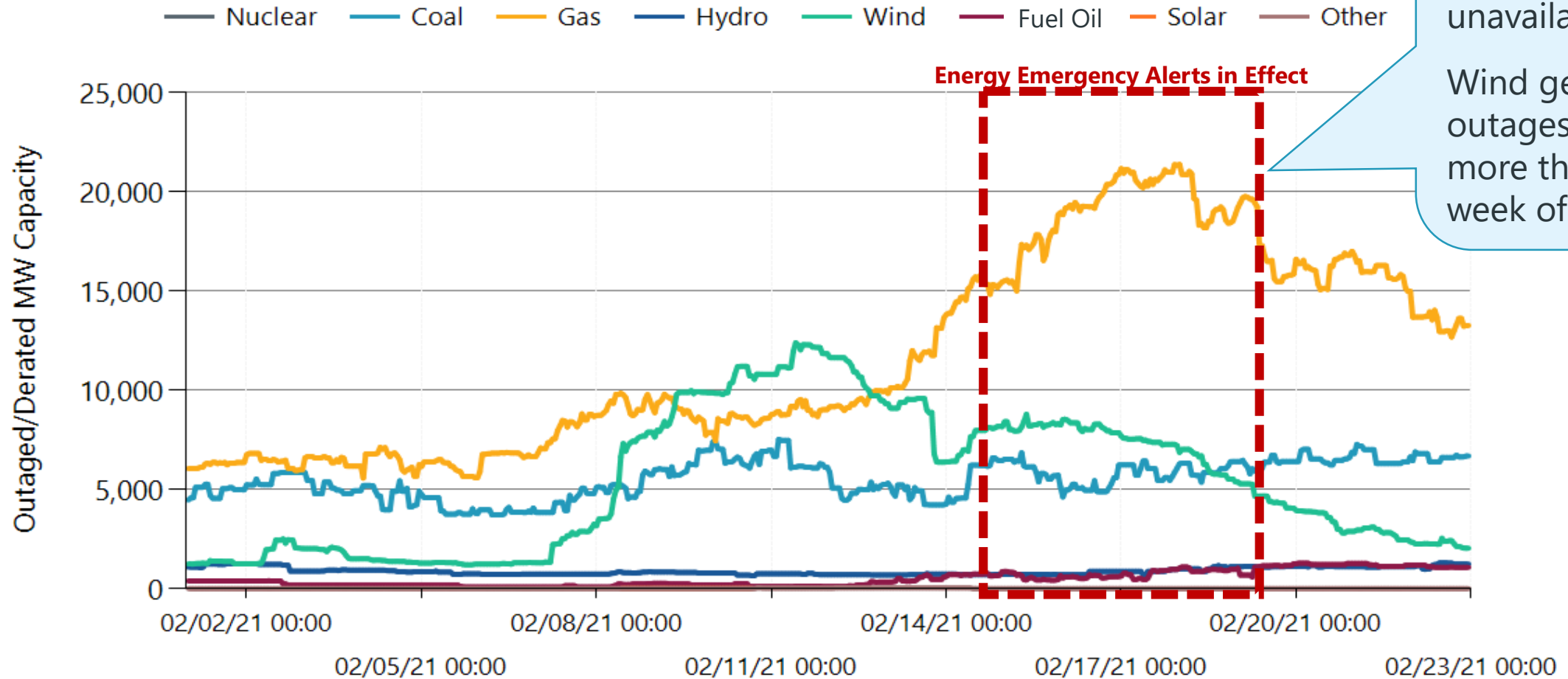
For gas generation in SPP, 45-50% of accredited capacity was available during EEA3 periods

GENERATING CAPACITY – GAS – OKLAHOMA



During the EEA3 events, gas gen. in OK supplied 36% of available gas gen in SPP on both the 15th and 16th

GENERATING CAPACITY OUTAGES

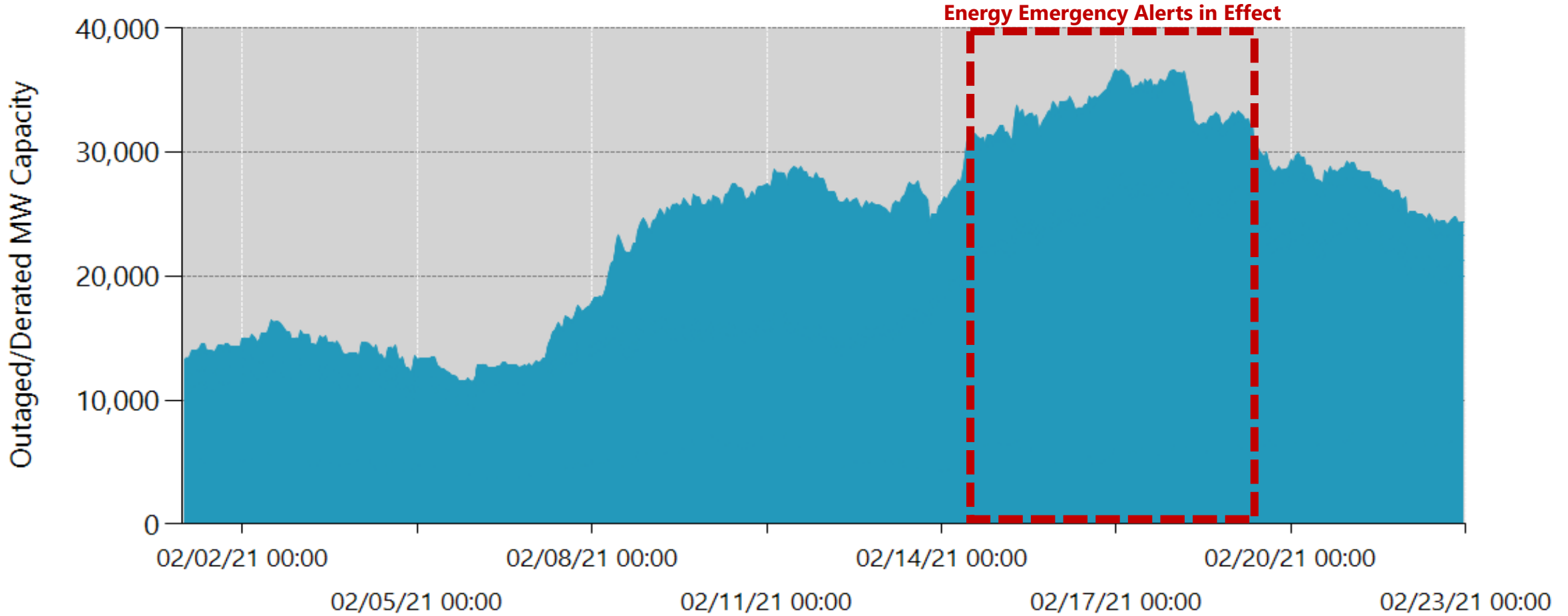


During peak conditions, gas generation contributed to ~60% of total unavailability

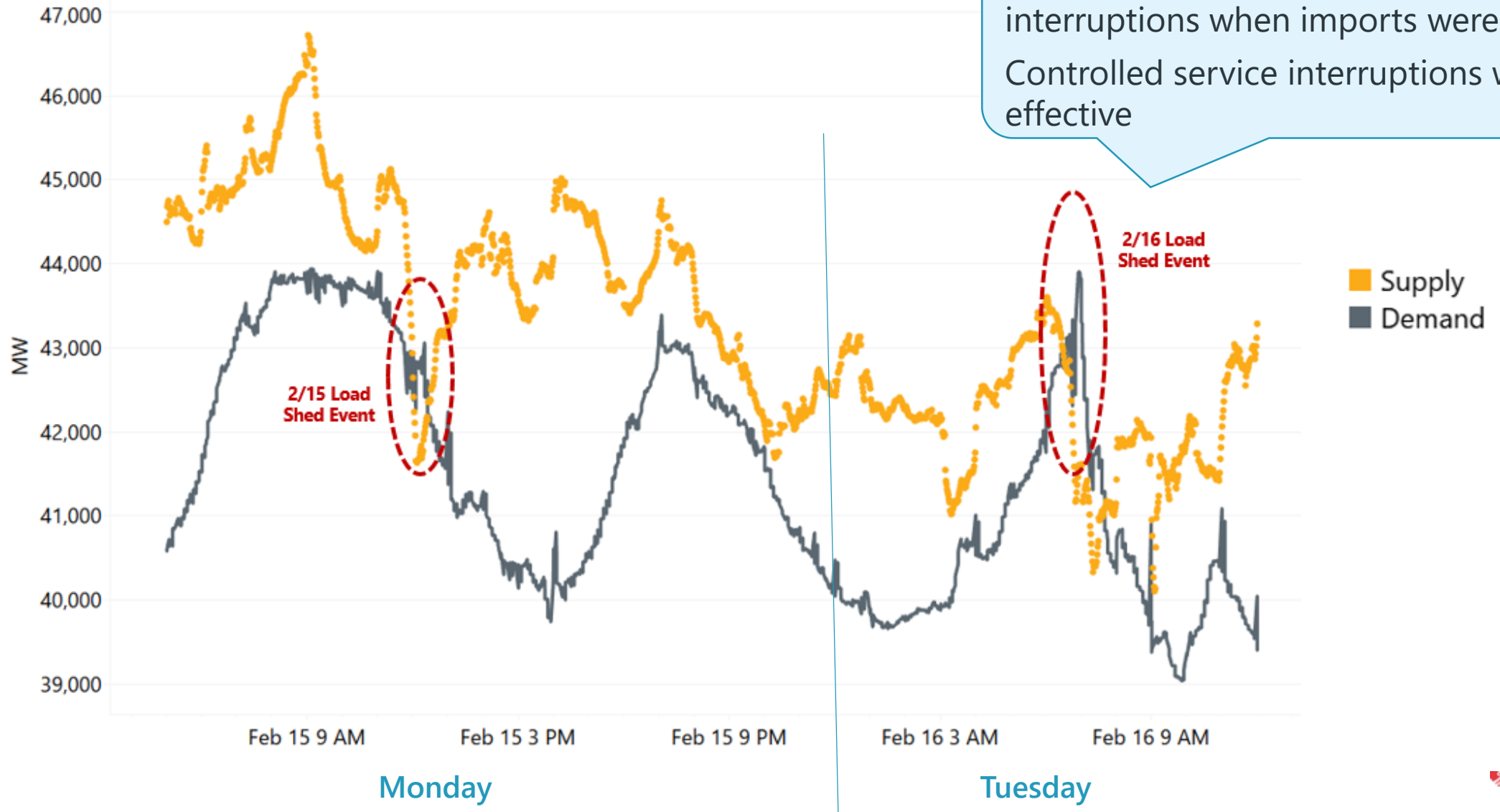
Wind generation outages ~5x more than first week of Feb.

TOTAL GENERATION OUTAGES

Up to 35,000 MW of generating capacity unavailable to meet demand
Nearly 2.5x more outages than first week of Feb.



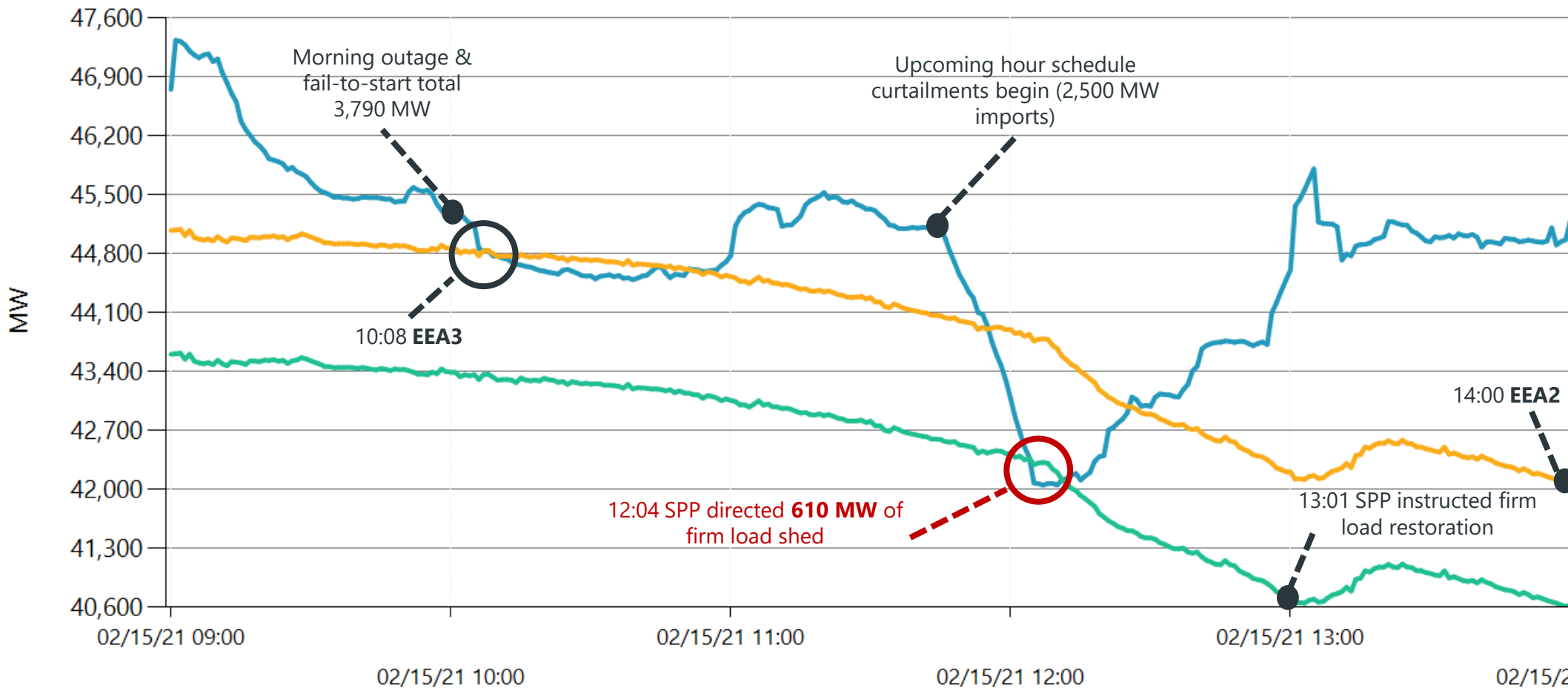
GENERATION SUPPLY VS. DEMAND



2/15 LOAD & ONLINE GENERATION WITH NET ENERGY IMPORTS

SPP issued EEA3 when unable to maintain required reserves
 Reduced imports created supply vs. demand imbalance

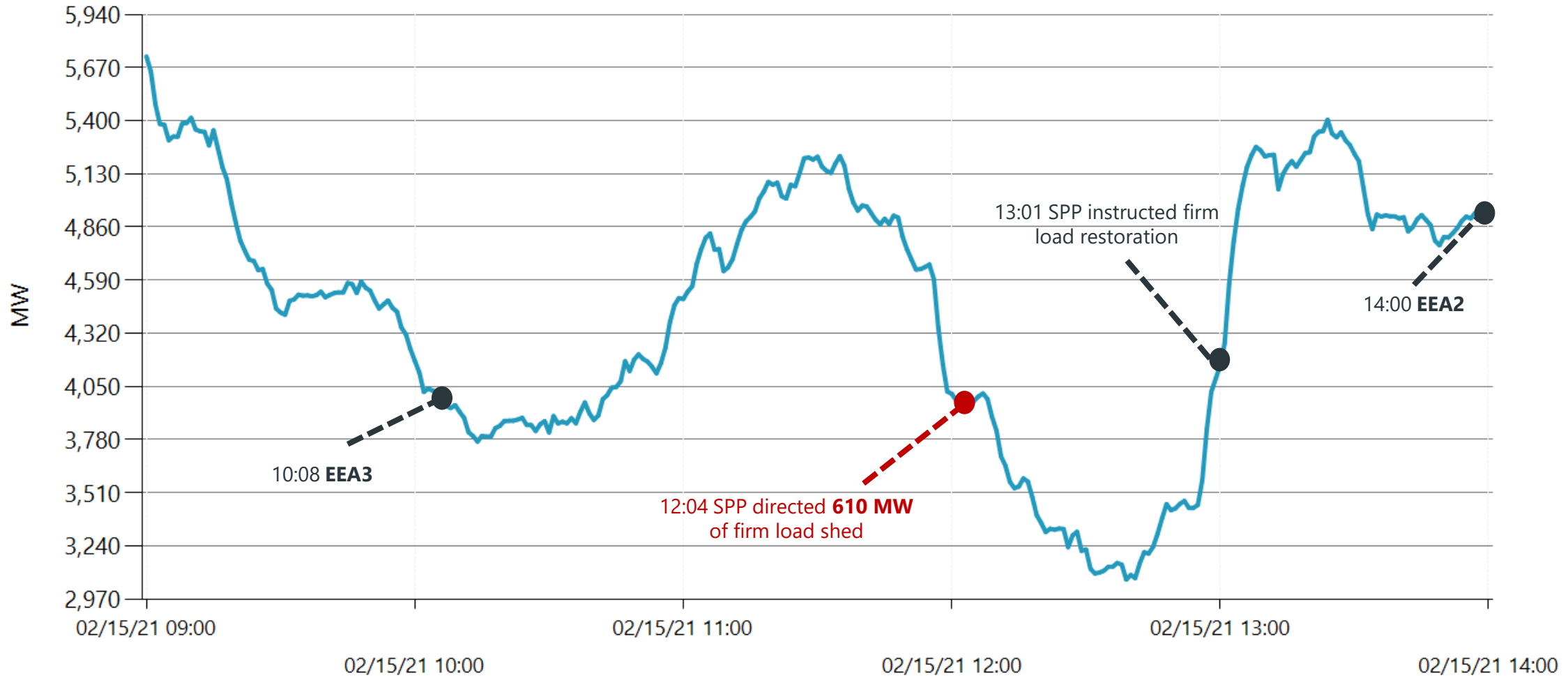
— Online Generation & Scheduled Interchange — BA Load — BA Load & Contingency Reserves



2/15 NET ENERGY IMPORTS

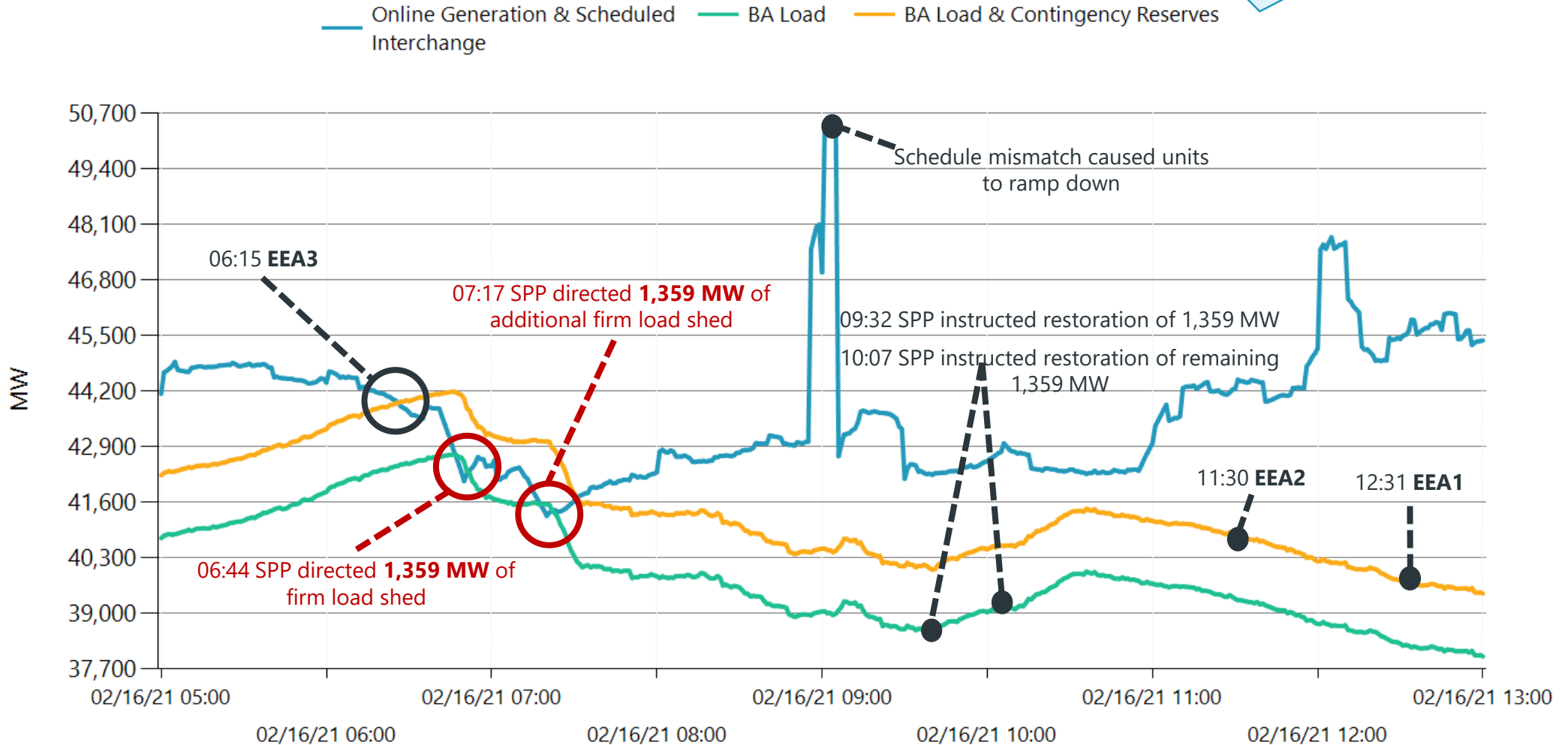
At times, SPP was importing significant amounts of energy

— Net Energy Imports



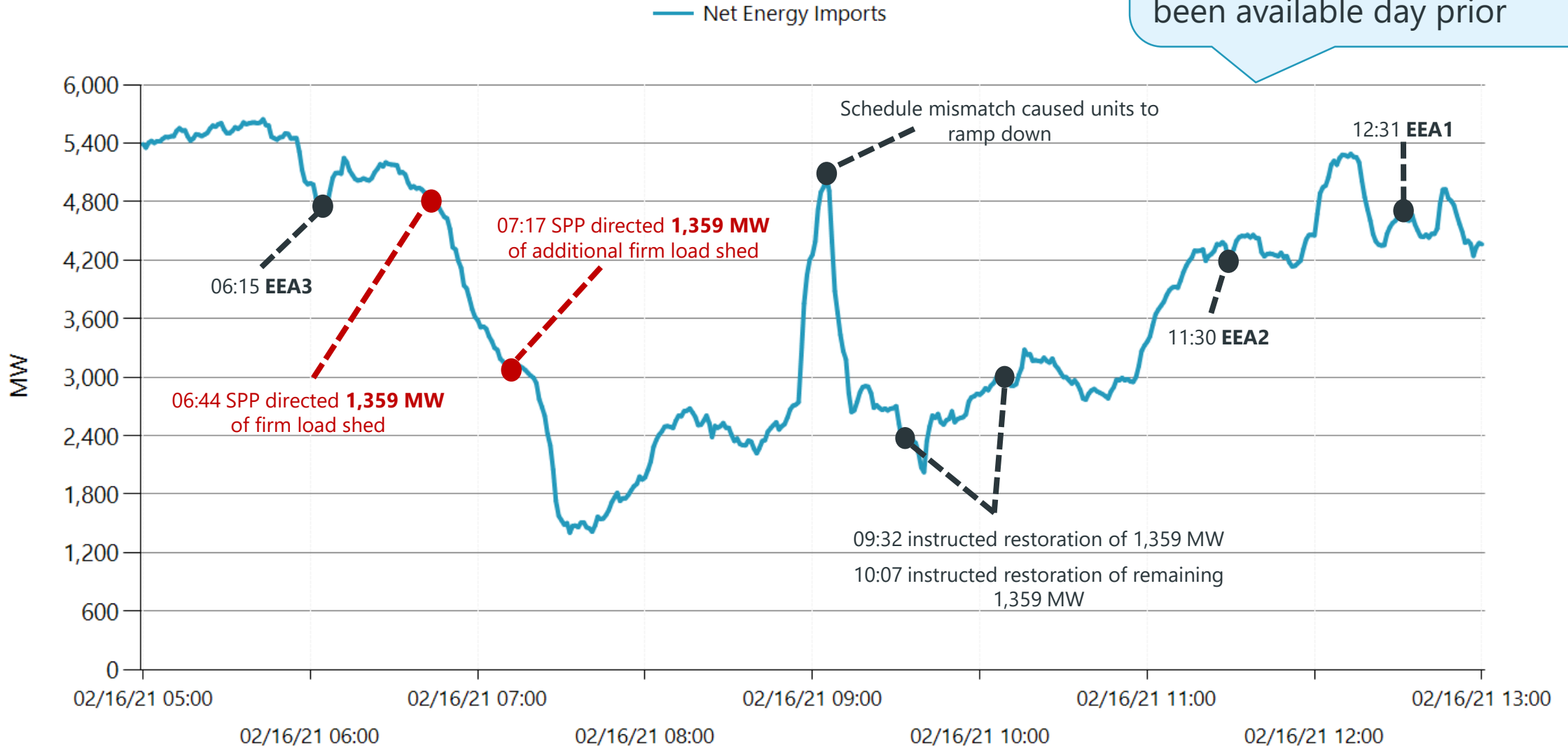
2/16 LOAD & ONLINE GENERATION WITH NET ENERGY IMPORTS

SPP issued EEA3 when unable to maintain required reserves, caused by dwindling supply and higher demand



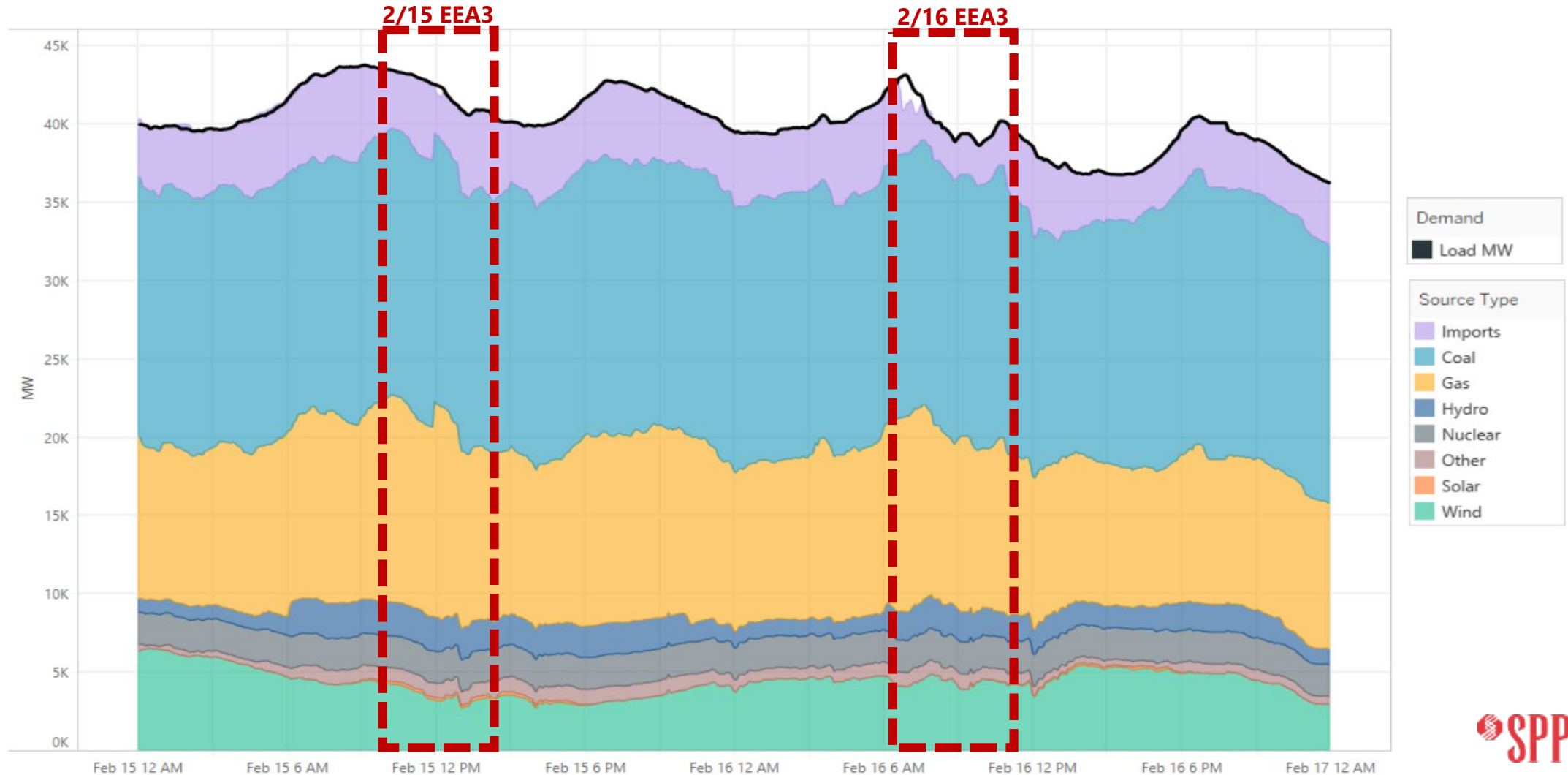
2/16 NET ENERGY IMPORTS

At times, SPP was importing significant amounts of energy, although less than what had been available day prior

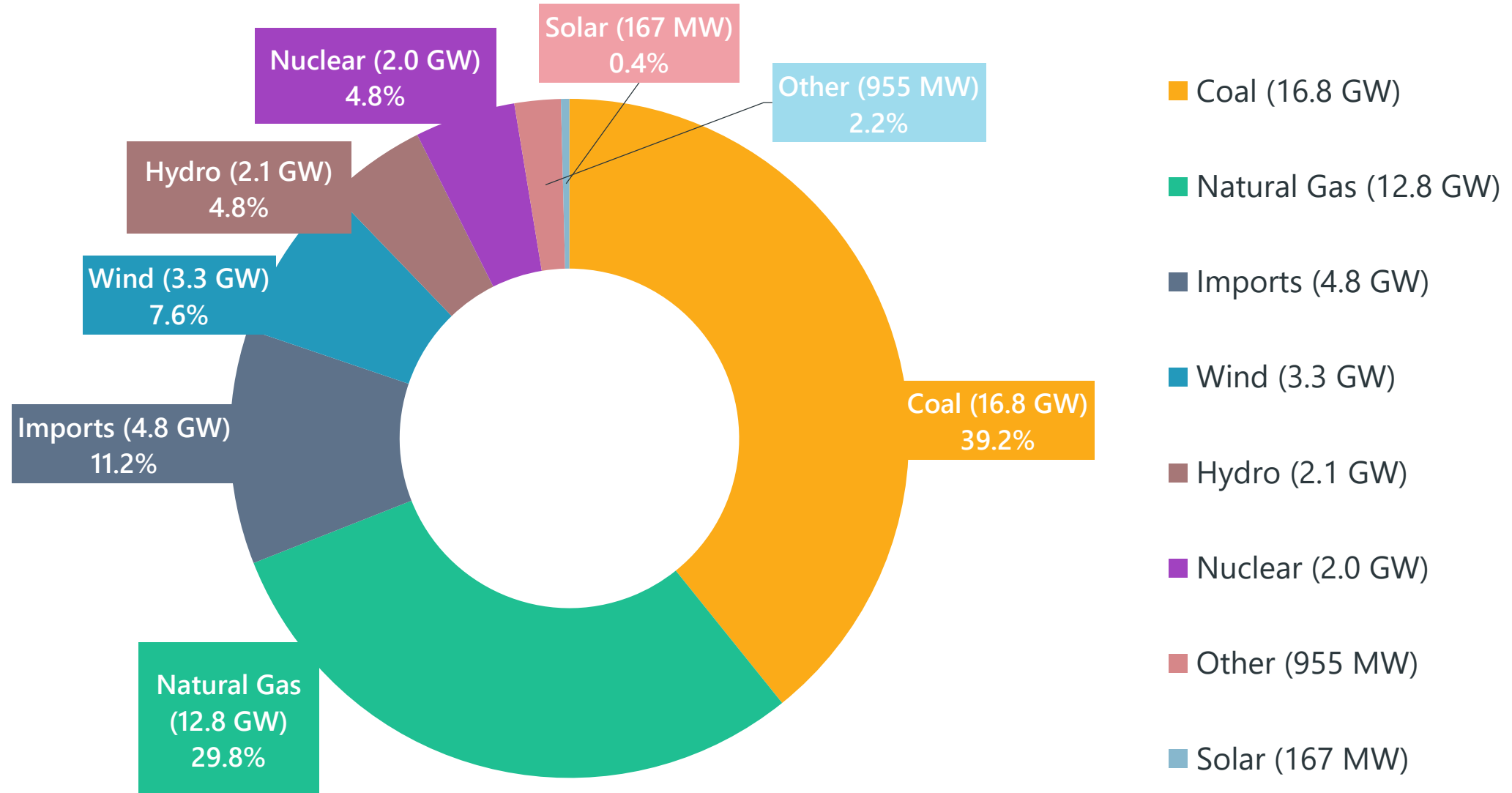


ENERGY THAT MET DEMAND IN REAL-TIME MARKET

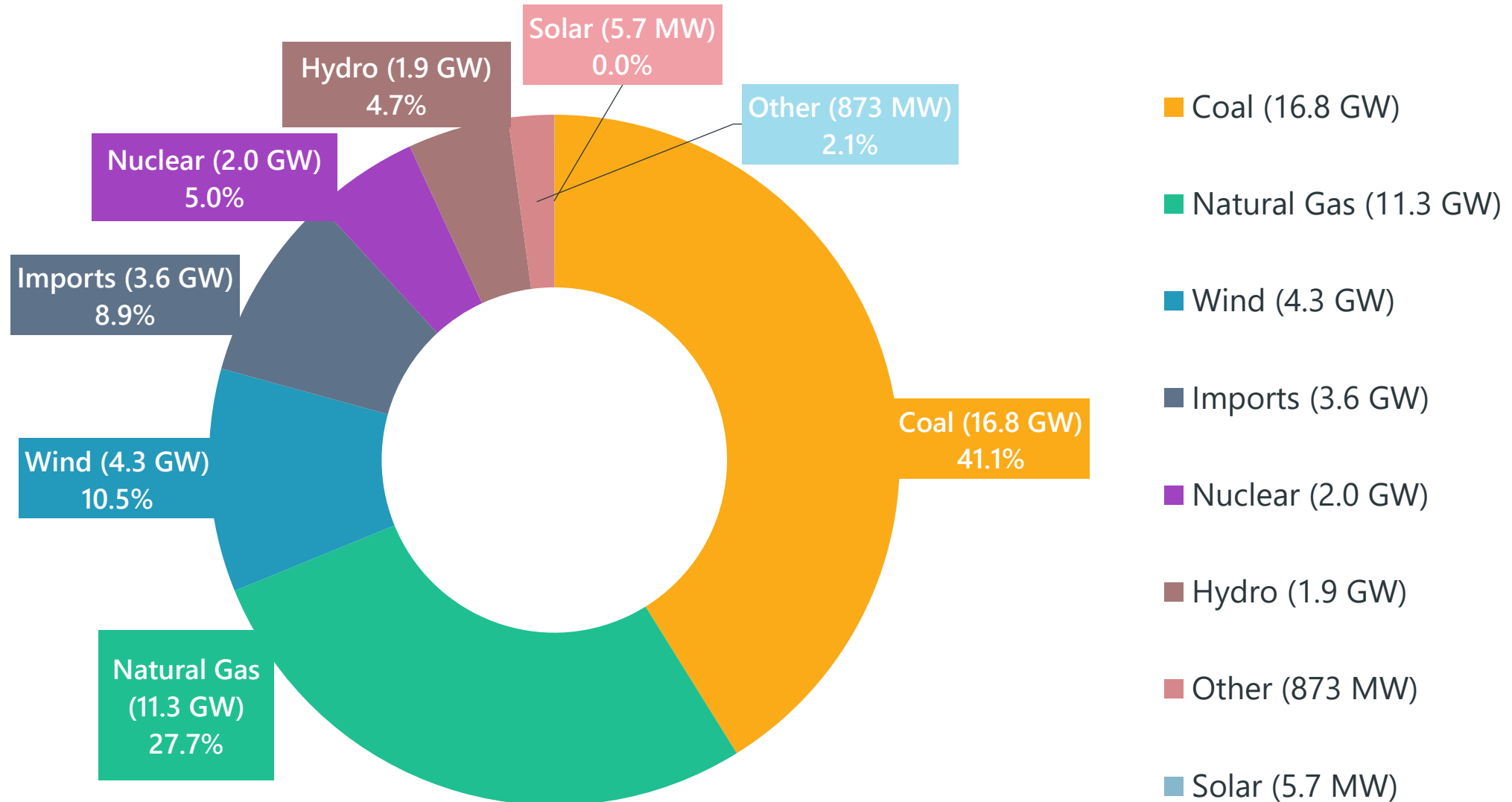
SPP relied on energy from multiple sources, including imports from neighbors



AVERAGE SUPPLY MIX DURING FEBRUARY 15 CONTROLLED SERVICE INTERRUPTIONS

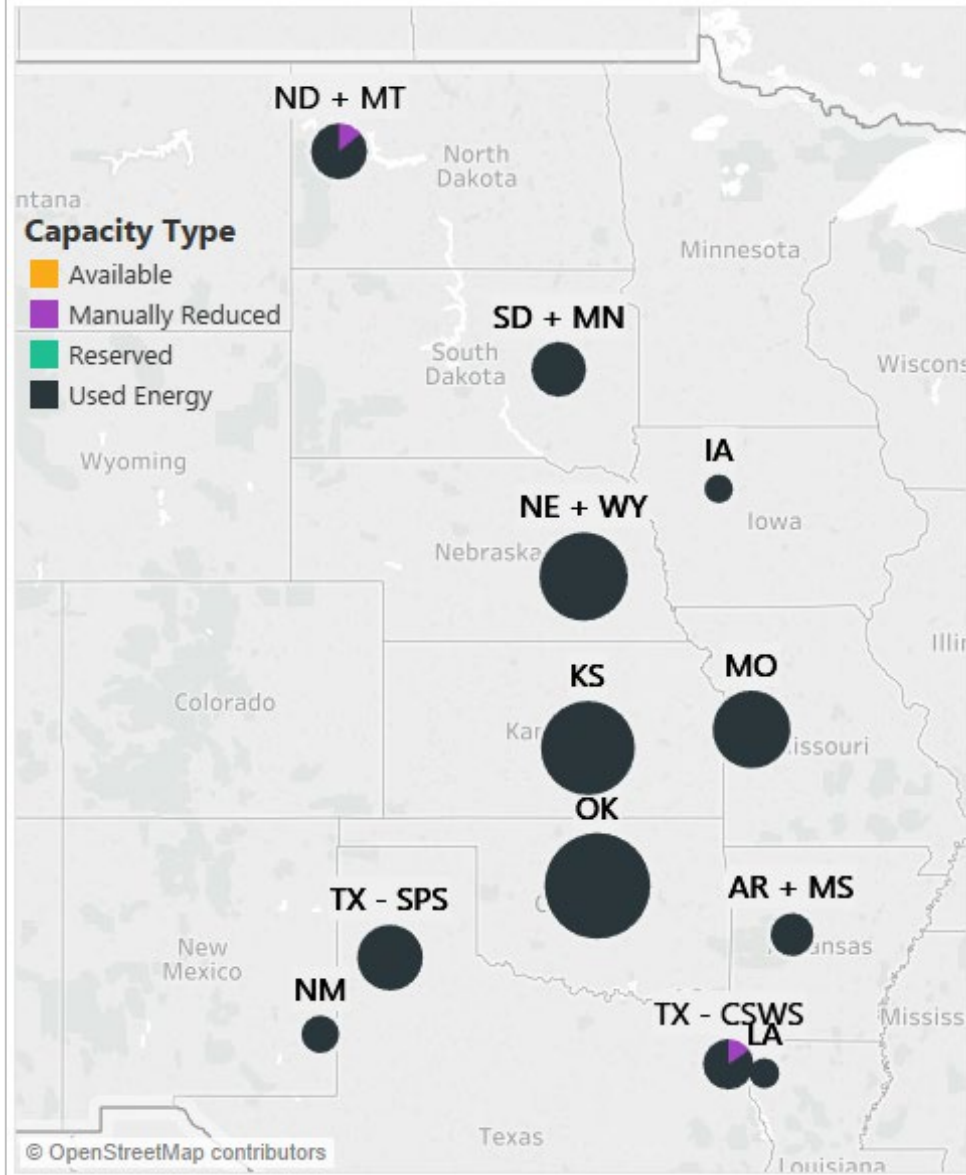


AVERAGE SUPPLY MIX DURING FEBRUARY 16 CONTROLLED SERVICE INTERRUPTIONS

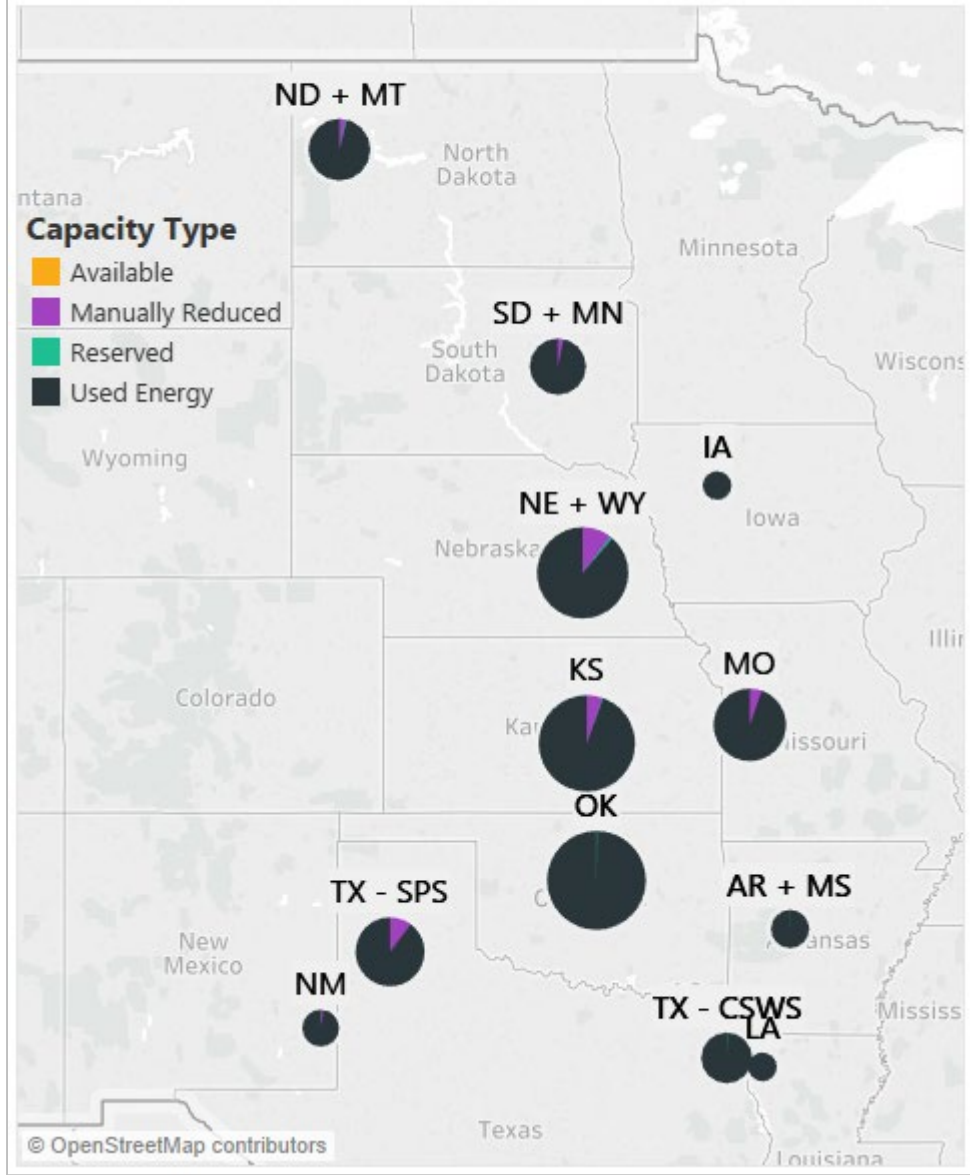


SPP CAPACITY – BEGINNING OF DEMAND REDUCTION

Online Capacity by State/Zone
February 15, 2021 12:05 PM

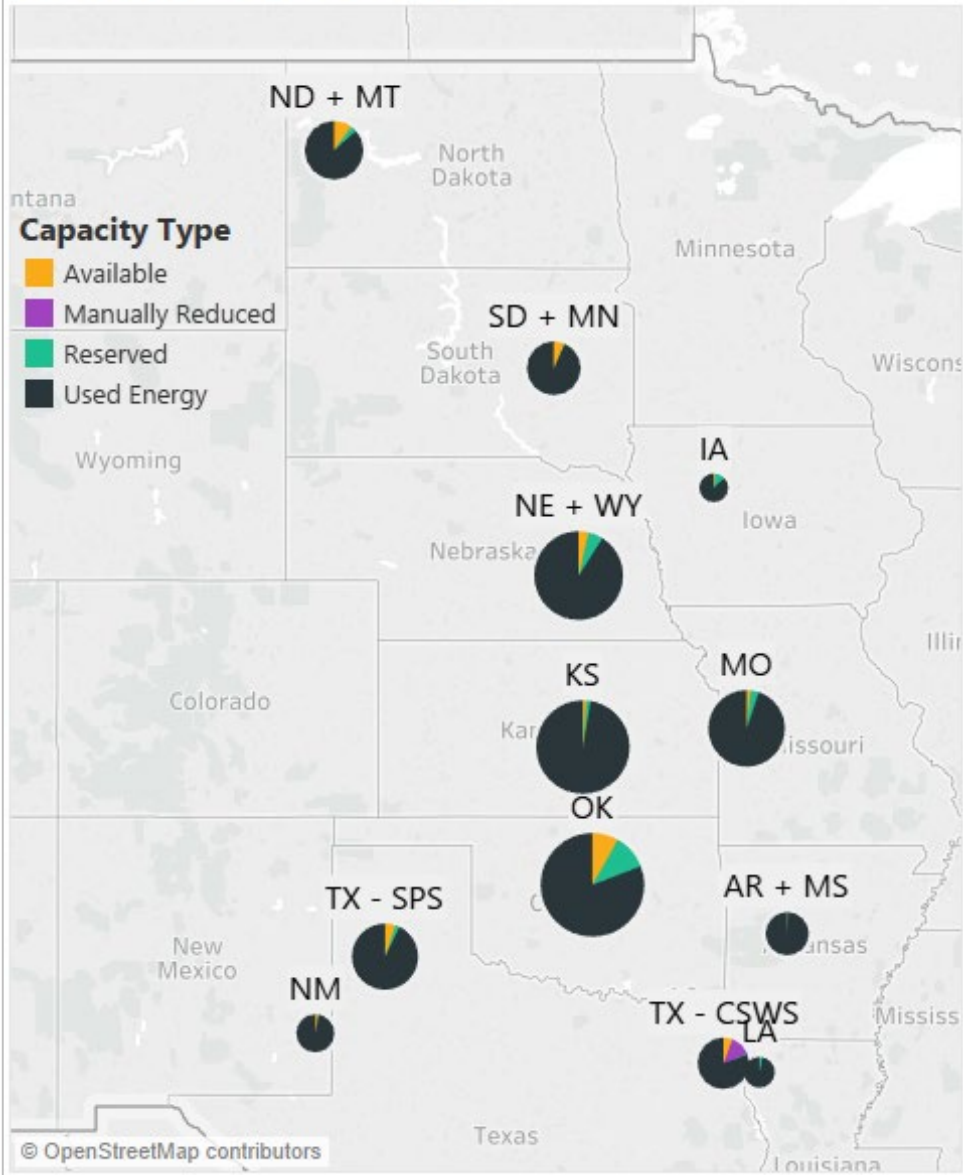


Online Capacity by State/Zone
February 16, 2021 6:45 AM

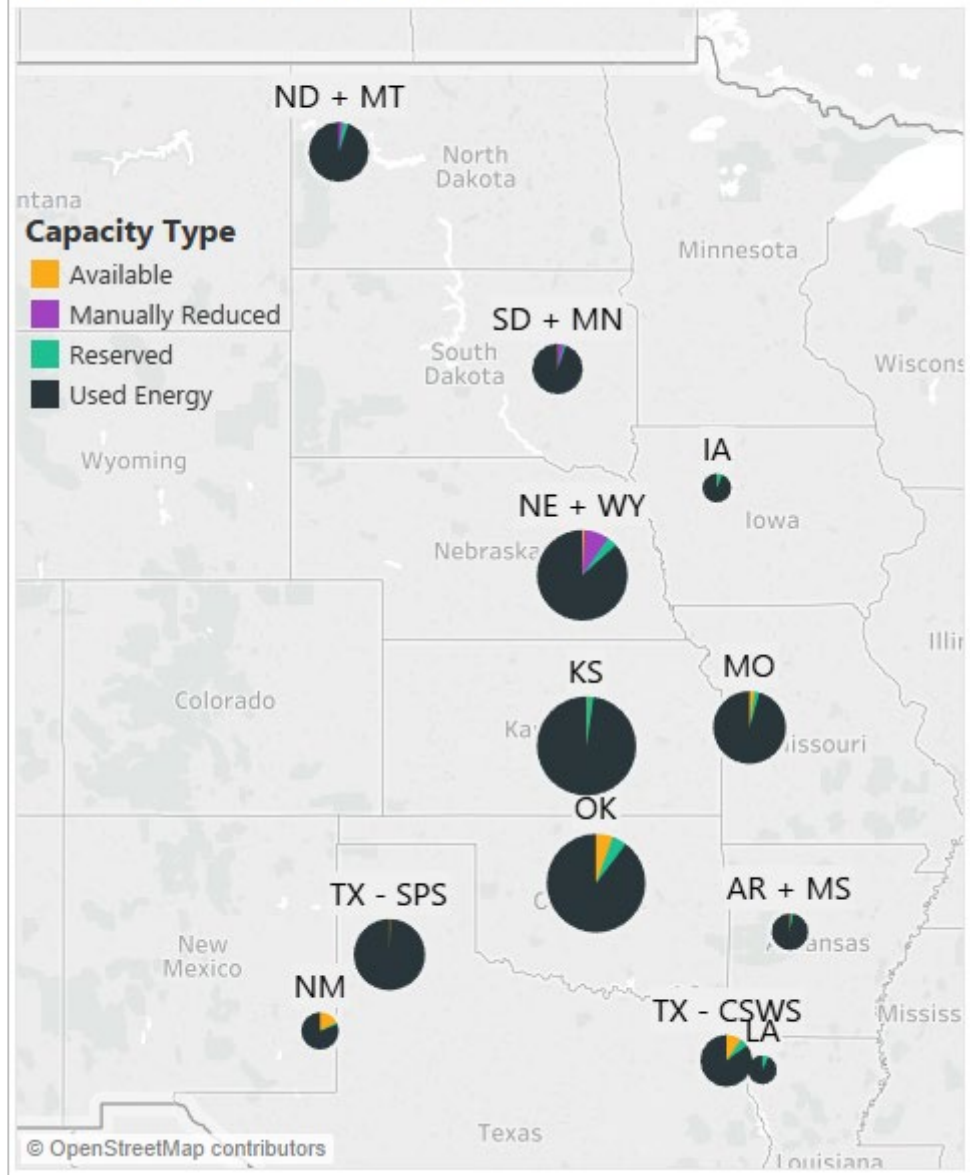


AVERAGE SPP CAPACITY – DURING HOUR OF LOAD RESTORATION

Online Capacity by State/Zone
February 15, 2021 1 PM



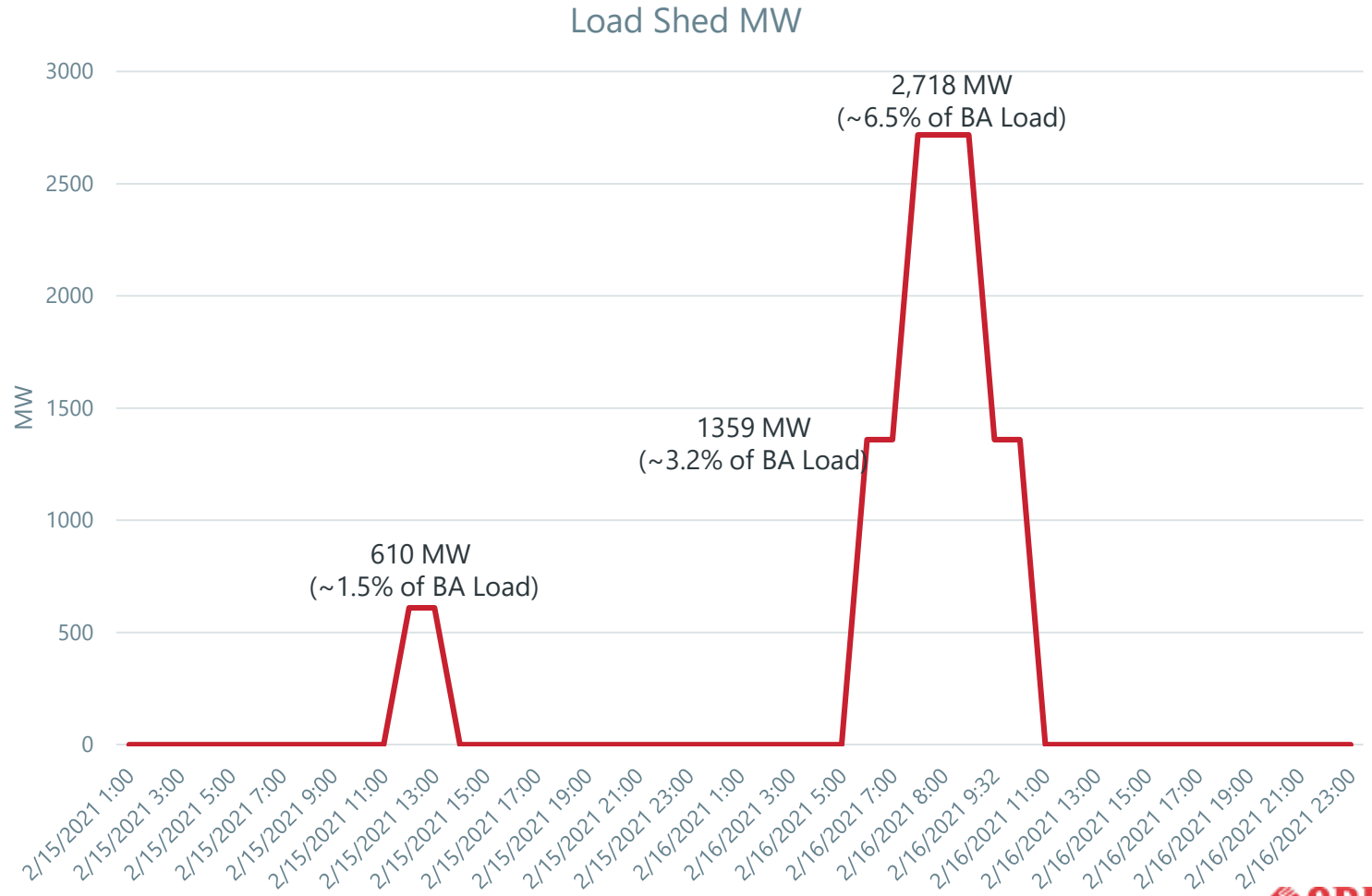
Online Capacity by State/Zone
February 16, 2021 10 AM



INTERRUPTIONS BY ENTITY

Directed interruptions allocated to transmission operators on pro-rata basis

Participating Entity	% of MW
CSWS	16.8
WAPA	13.5
SPS	12.4
OKGE	12.4
KCPL	9.68
WR	8.49
NPPD	6.57
OPPD	4.6
WFEC	3.78
GRDA	2.22
SECI	2.22
EDE	2.19
LES	1.36
SPRM	1.22
KACY_N	0.92
CBPC	0.83
INDN	0.38
SPA	0.28
TSGT	0.13
SPP Total	100%



Notes: 1) Transmission operators with significant load in Oklahoma are highlighted. 2) CSWS includes PSO and SWEPCO. 3) Allocation percentages are predetermined based on pro-rata share of previous winter season's energy consumption



CONTACT SLIDE

Communications

Please feel free to contact us at communication@spp.org if you need help with the PPT, need modifications or would like to add a slide to the template.