

MARKETS



RELIABILITY WEBINAR



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



SouthwestPowerPool



SPPorg



southwest-power-pool



Southwest Power Pool
**WESTERN
ENERGY
SERVICES**

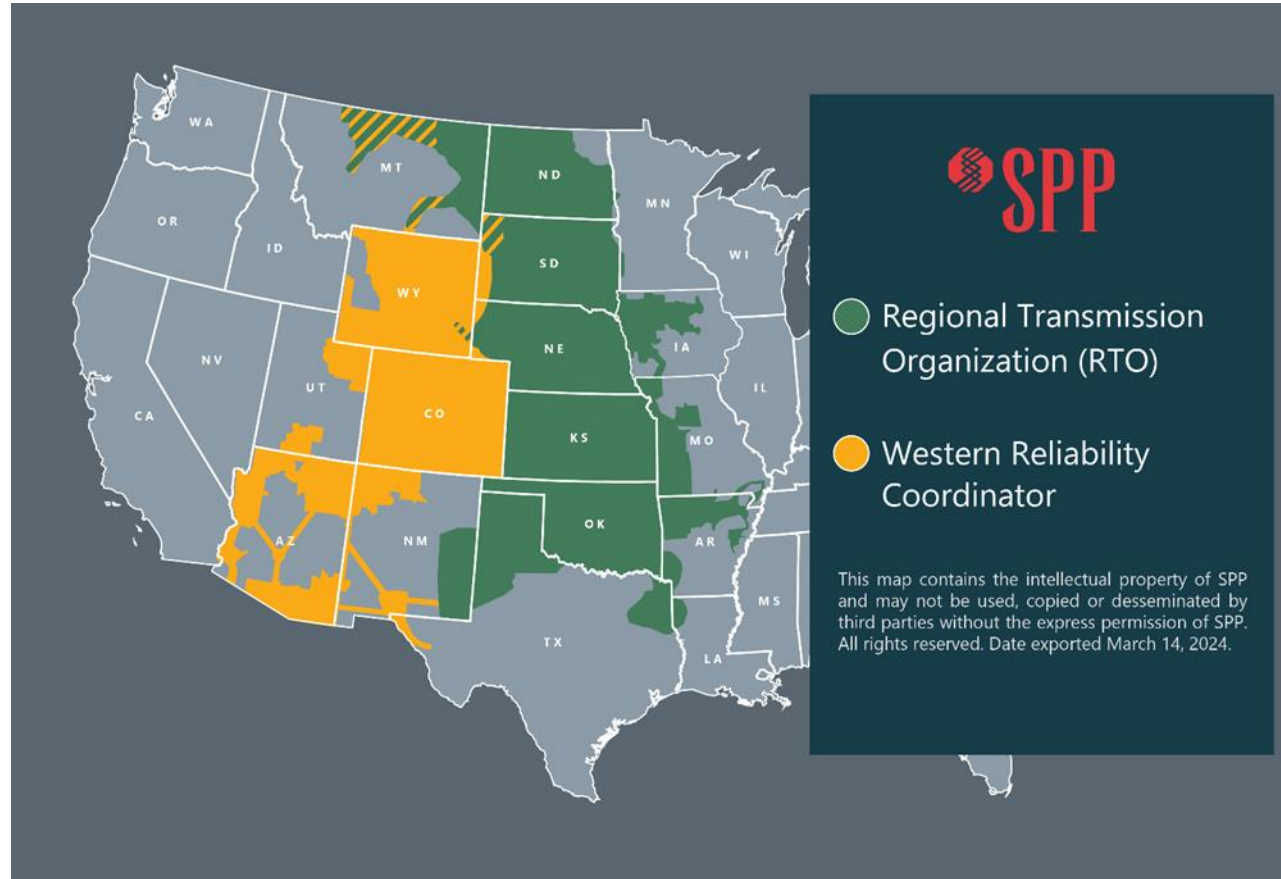
AGENDA

- SPP's Experience in Reliability
- Markets+ and Reliability
- Diversity Vision

SPP'S EXPERIENCE IN RELIABILITY

SPP RELIABILITY SERVICES

- 1968 NERC Regional Council
- 1991 Reserve Sharing
- 1997 Reliability Coordination
- 2004 RTO Status
- 2014 Balancing Authority
- 2018 Western Unscheduled Flow Mitigation Administrator
- 2019 Western Reliability Coordinator
- 2020 WRAP Operator
- 2007-present: Market Operator



SPP'S ROLE IN RELIABILITY

Effectively and equitably ensures a reliable Bulk Electric System

Maintains situational awareness and wide-area view through its expanded interconnections modeling and advanced applications and **tools**

Deploys tools and procedures to prevent or mitigate emergency situations in day-ahead and real-time operations

Established procedures for both Eastern and Western Interconnections, including different congestion management methodologies

Facilitates communications between operating areas and issues system alerts to raise awareness of system conditions

SPP coordinates with neighboring RCs and entities to address potential reliability issues

SPP's IT group maintains cyber attack awareness and takes proactive mitigation measures, including notification processes for potential threats

SPP notifies neighboring entities to monitor its RC Areas when necessary

RELIABILITY COORDINATION SYSTEM AND TECHNOLOGY

Energy Management System with expanded Interconnection Modeling

Real-time Contingency Analysis Apps and Other Innovative Study Apps

Advanced Hosted Applications

CROW – Outage Management System

Rating Submission Applications

Stability Applications – VSAT and TSAT

SPP Developed Communication Applications Integrated with External Entities

Advanced Generation Re-dispatch Applications.

Phase Shifter Optimization Tool

Reserve Sharing Group and BA monitoring

Integrated Simulation and Geospatial Capable Applications

DISTINCT CONGESTION MANAGEMENT METHODOLOGIES

East

- Congestion management in the east is driven by SPP Tariff, criteria and NERC Standards support of interconnection-wide coordination congestion management IRO-006-East-2.
- Interchange Distribution Calculator
- Congestion Management Event (CME) in the Market
- OOME process – Out of Merit Energy directives when market is unable to resolve an issue

West

- Successfully implemented coordinated, equitable congestion management methodologies
- Coordinated mitigation steps, such as UFMP and generation re-dispatch, using innovative tools - Generation Re-dispatch Application and Phase Shifter Optimization tool
- Driving discussions about utilizing the Enhanced Curtailment Calculator for interconnection-wide coordinated congestion management.

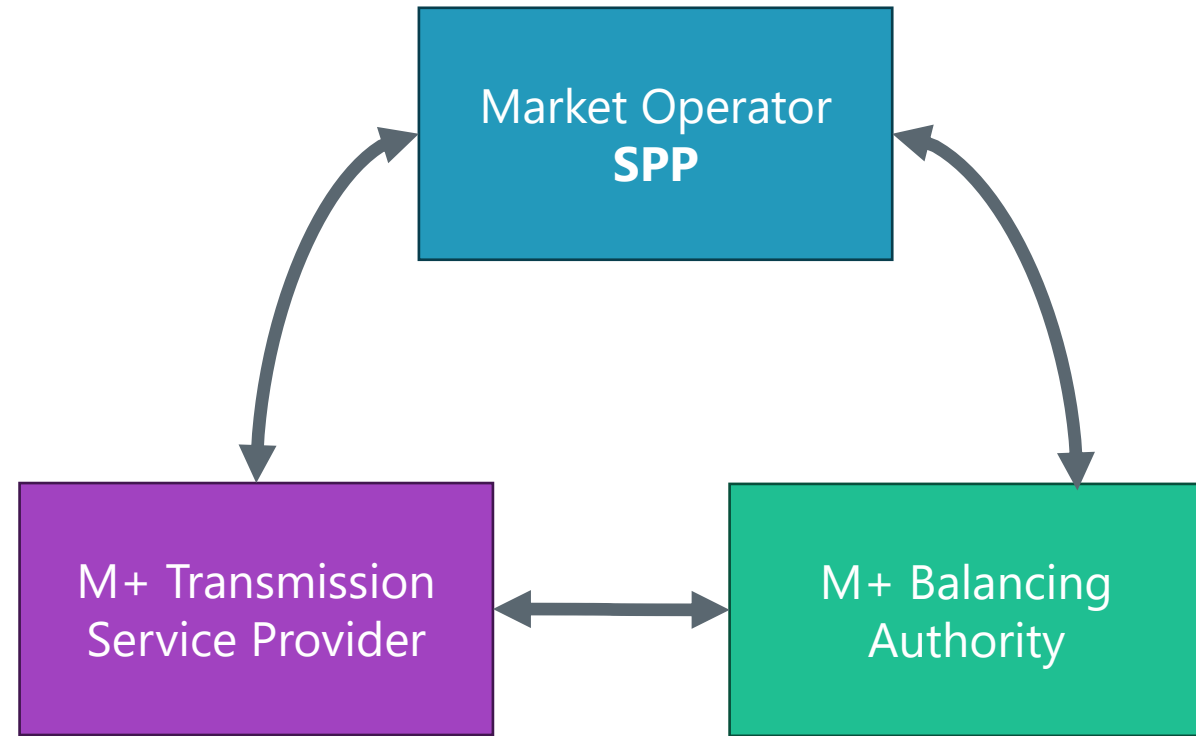
MARKETS+ AND RELIABILITY

MARKETS+ SUPPORTS RELIABILITY

- Balancing Authority and Transmission Operator Roles
- Uniform Resource Adequacy
- Must Offer Requirement
- Reliability Back-Stop Option
- Reliability Unit Commitment
- Flex Reserve Zones

MARKET OPERATOR ROLE IN MARKETS+

- SPP functions as Market Operator for Markets+
- Markets+ includes features that enhance reliability for participating reliability entities
 - Flow-based dispatch while respecting transmission constraints and balancing authority requirements
 - Facilitation of Resource Adequacy deliveries



Existing Balancing Authority Areas, Transmission Service Providers, and Transmission Operators remain, including compliance obligations.

UNIFORM RESOURCE ADEQUACY

- Markets+ requires all load serving entities in the footprint to be part of the Western Resource Adequacy Program.
- Framework ensures each entity is contributing a fair share to the resource needs of the region.
- Balancing Authorities retain ancillary services obligations



MUST OFFER REQUIREMENT & RELIABILITY BACK STOP

- Markets+ includes a WRAP informed must offer requirement for all participants into the DA, RUC, and Real-Time markets
- Markets+ includes flexibility for capacity to be committed (that is not offered pursuant to the must offer rules) for reliability needs.



FLOW-BASED APPROACH IN MARKETS+

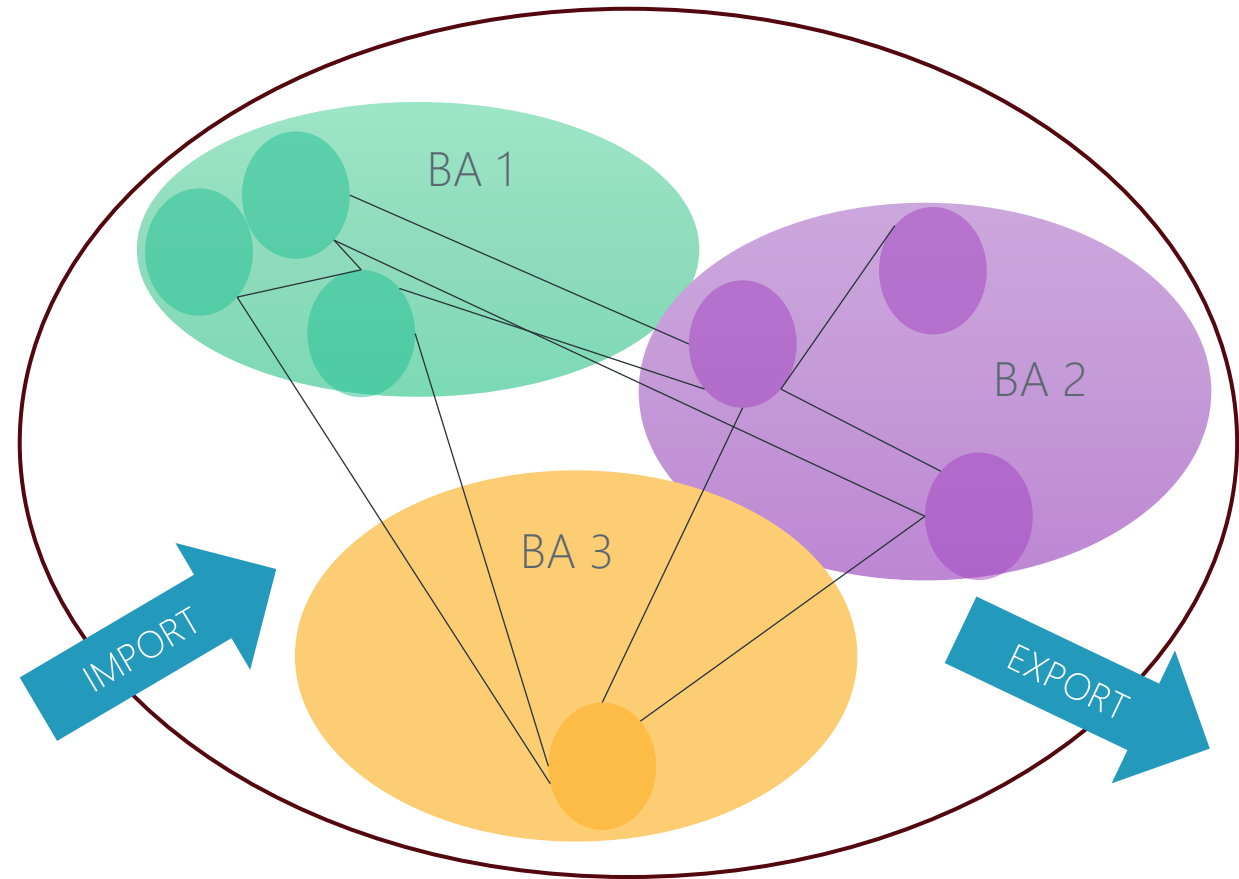
SPP optimizes the dispatch across all participating BAs and TSPs using the full capability of the transmission system: flow-based, centralized dispatch.

Market design implemented by independent operator based on balanced stakeholder governance

Reduces BA seams by optimizing the system more like an RTO/single BA area. Transfers can be full capability of the system less what is carved out for opt-outs or non-participating TSPs

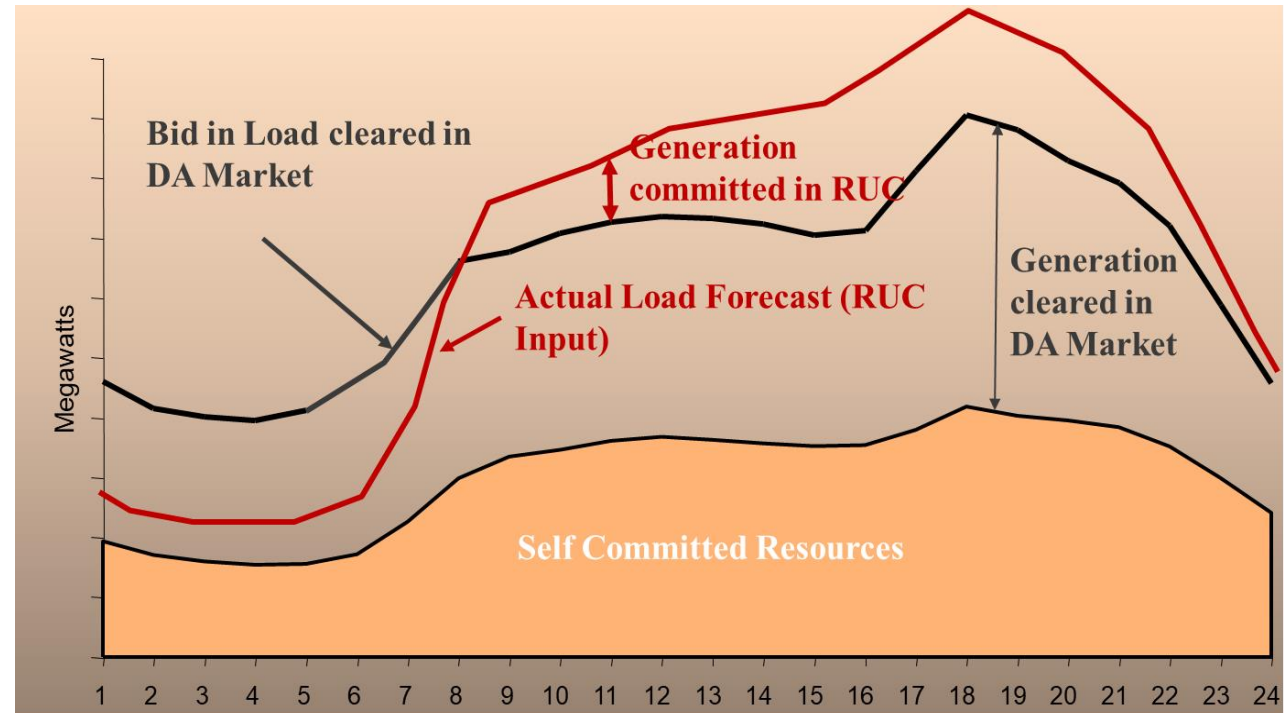
Congestion pricing is determined based on actual limitations of the system. RC and interconnection-wide congestion management methodologies apply

Import and exports to the market are priced on footprint need as a whole and not individual BA areas



RELIABILITY UNIT COMMITMENT PROCESS

- After the DA market runs, the Reliability Unit Commitment process runs to commit resources needed for the operating day.
- RUC solutions are based on real-time resource offers, load, and wind forecasts and do NOT include virtual transactions



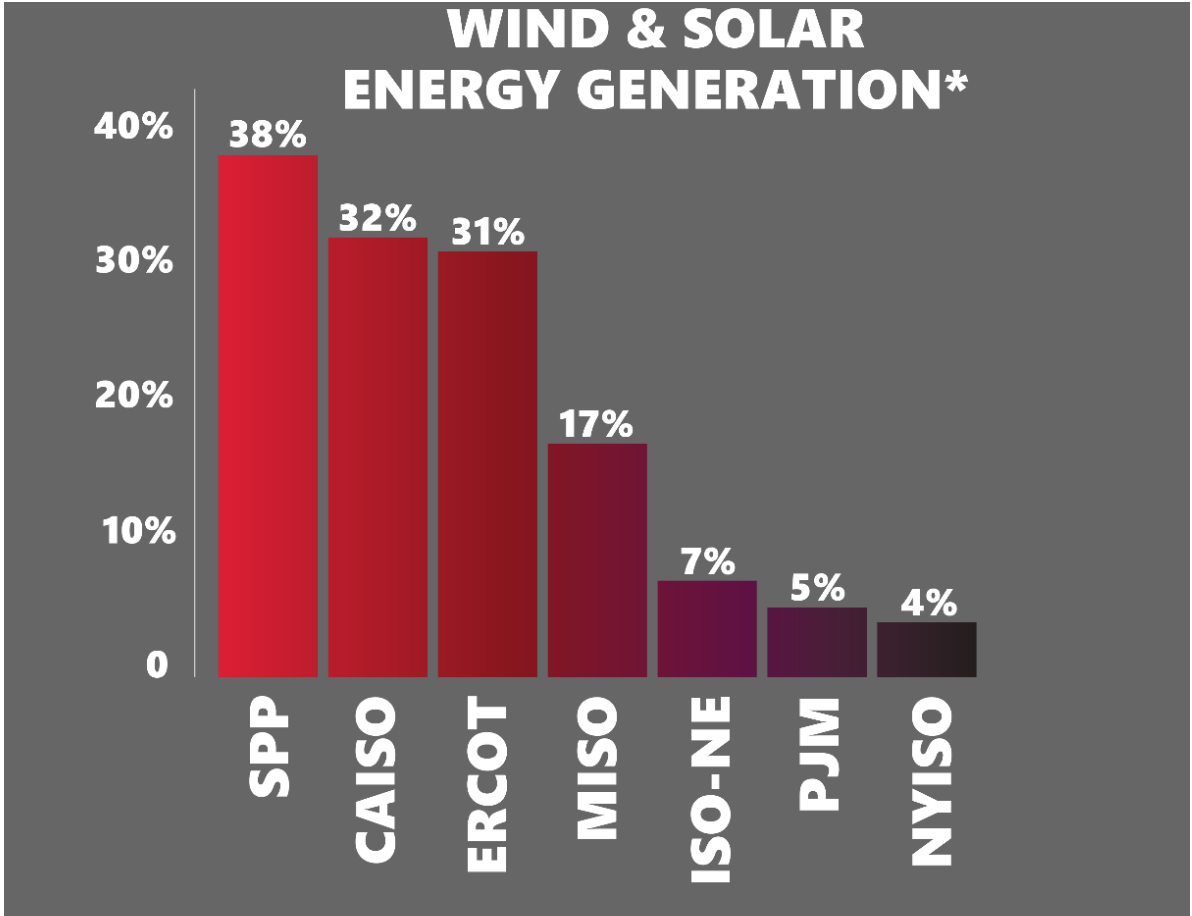
Markets+ includes the flexibility to execute RUC solutions as needed to support reliability requirements.

FLEX RESERVE ZONES

Markets+ includes flexibility reserves and deliverability zone limitations to ensure that flex reserves are deliverable when needed.



DIVERSITY VISION



SPP LEADS IN RENEWABLE INTEGRATION

Markets+ will utilize the same foundational market design as the SPP Integrated Marketplace that facilitates this significant integration of renewables.

408
million

metric tons of CO2 displaced by wind in SPP's footprint since 2014

30%

reduction of overall CO2 emissions in SPP's footprint since launch of Integrated Marketplace in 2014

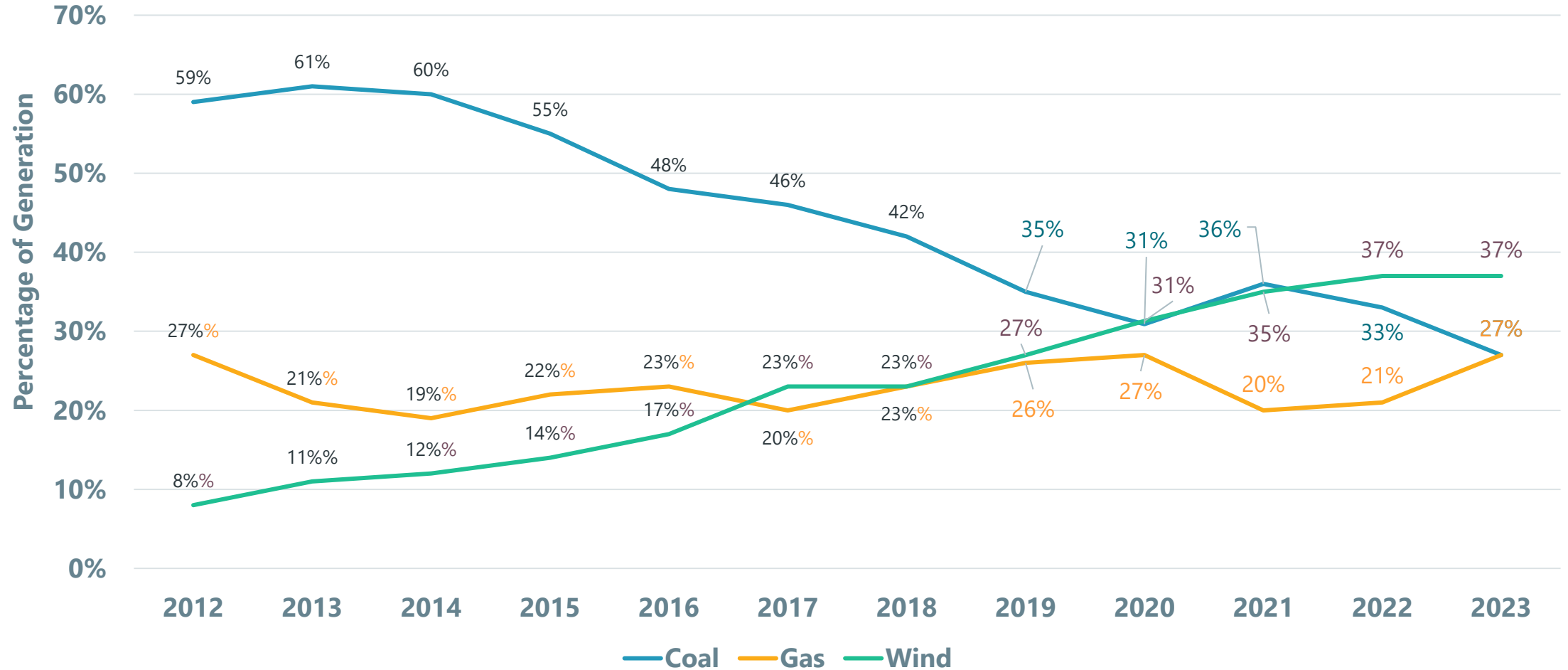
90%

renewable penetration record set by SPP in March 2022.

**based on 2022 wind and solar data collected from FERC report and RTO/ISO websites*

SPP'S EVOLVING ENERGY MIX

Trend By Year



INSTALLED WIND CAPACITY

Wind capacity increased dramatically between 2001-2023

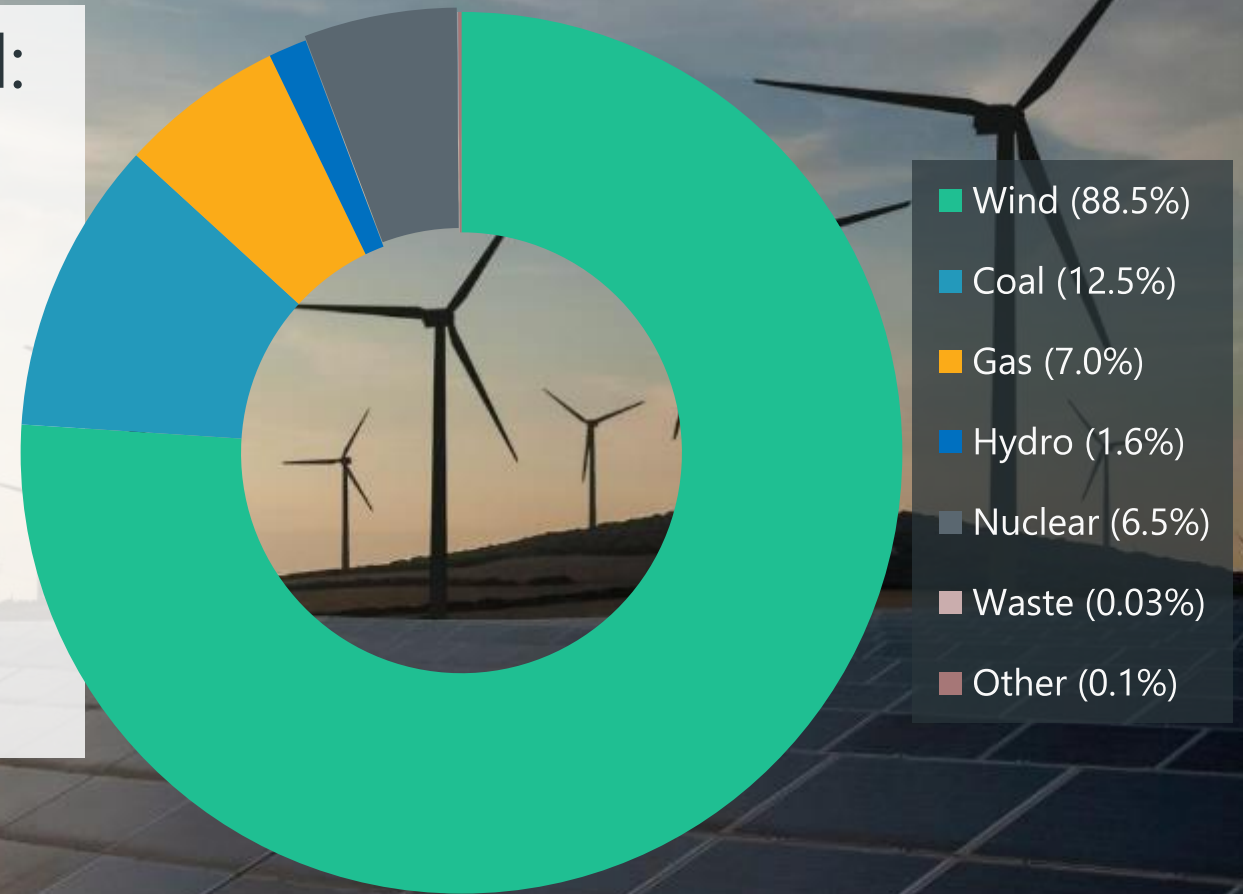


WIND IN SPP'S SYSTEM

- **33,725 MW** Wind installed today
 - 15,225 turbines at 250 wind resources in the eastern interconnection (most are 80m hub height)
- **23,838 MW** Maximum wind output (3/16/23)
- **503 MW** Minimum wind output (last 12 mos.): (10/16/23 @ 6:11 p.m.)
- **88.51%** All-time maximum wind penetration (3/29/22)
- **38.6%** Average wind penetration (2023)

RENEWABLE PENETRATION

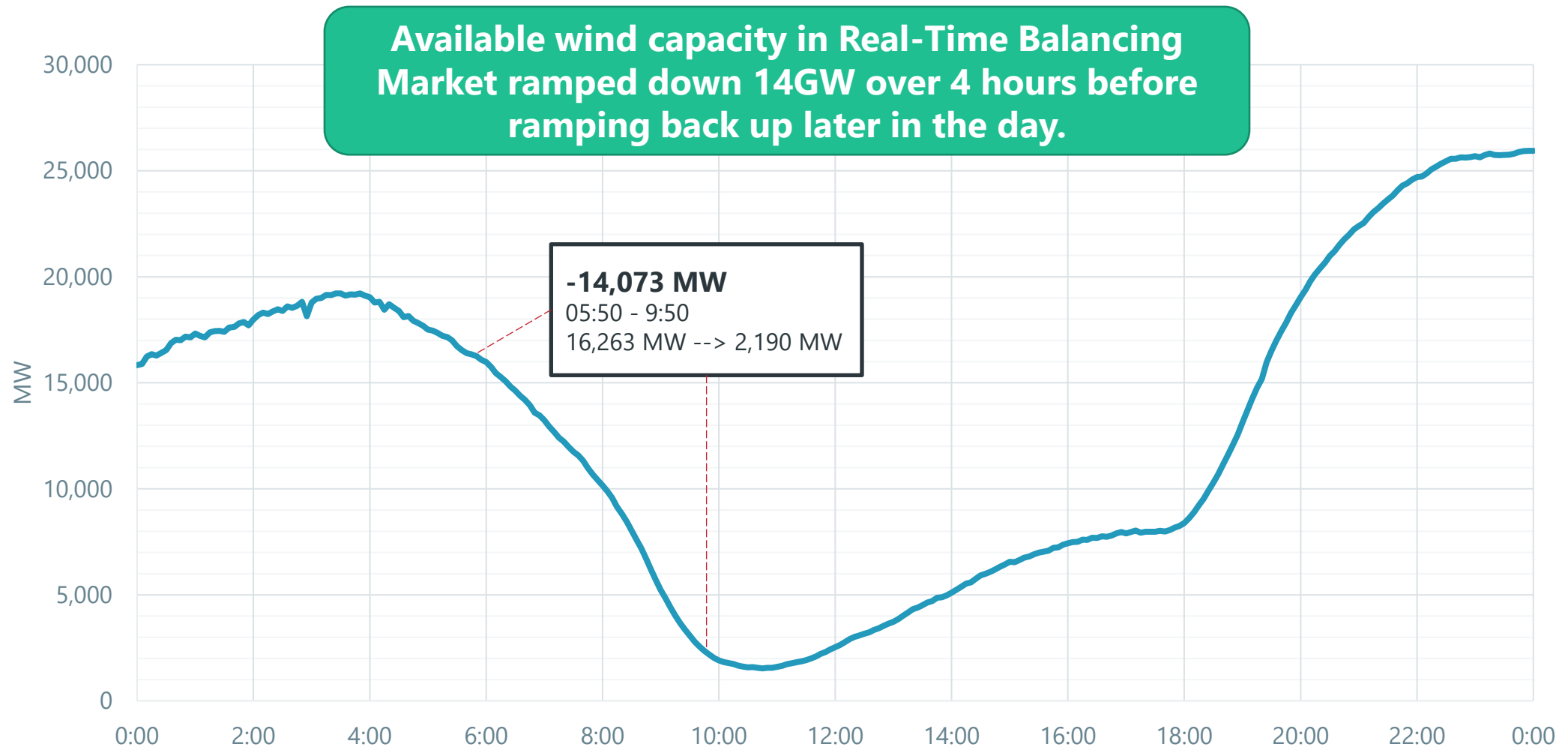
- Renewable penetration record: **90.2%** of load
 - 2:42 a.m. on 3/29/22
 - **22,351 MW** of 24,787 MW of load served by renewables
 - **90.17%** of total generation at that time was renewables



Percentages of pie chart add up to more than 100% because SPP served neighbors at the time.

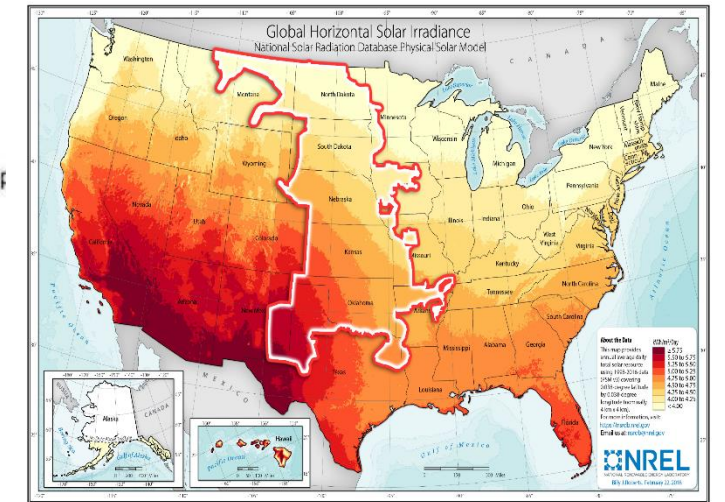
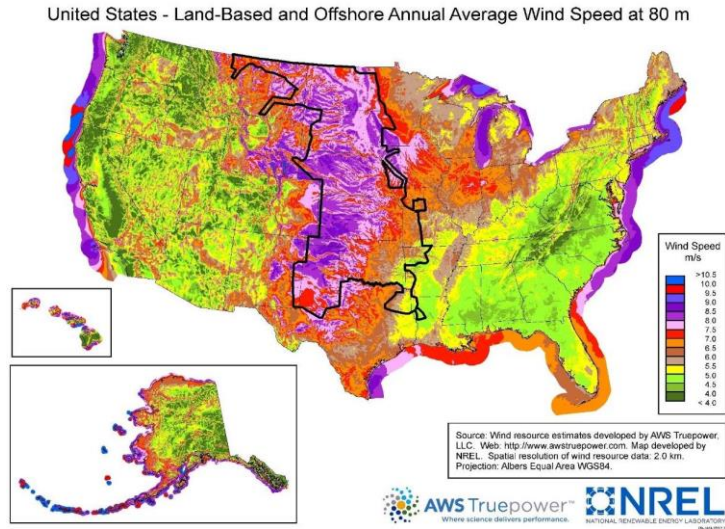
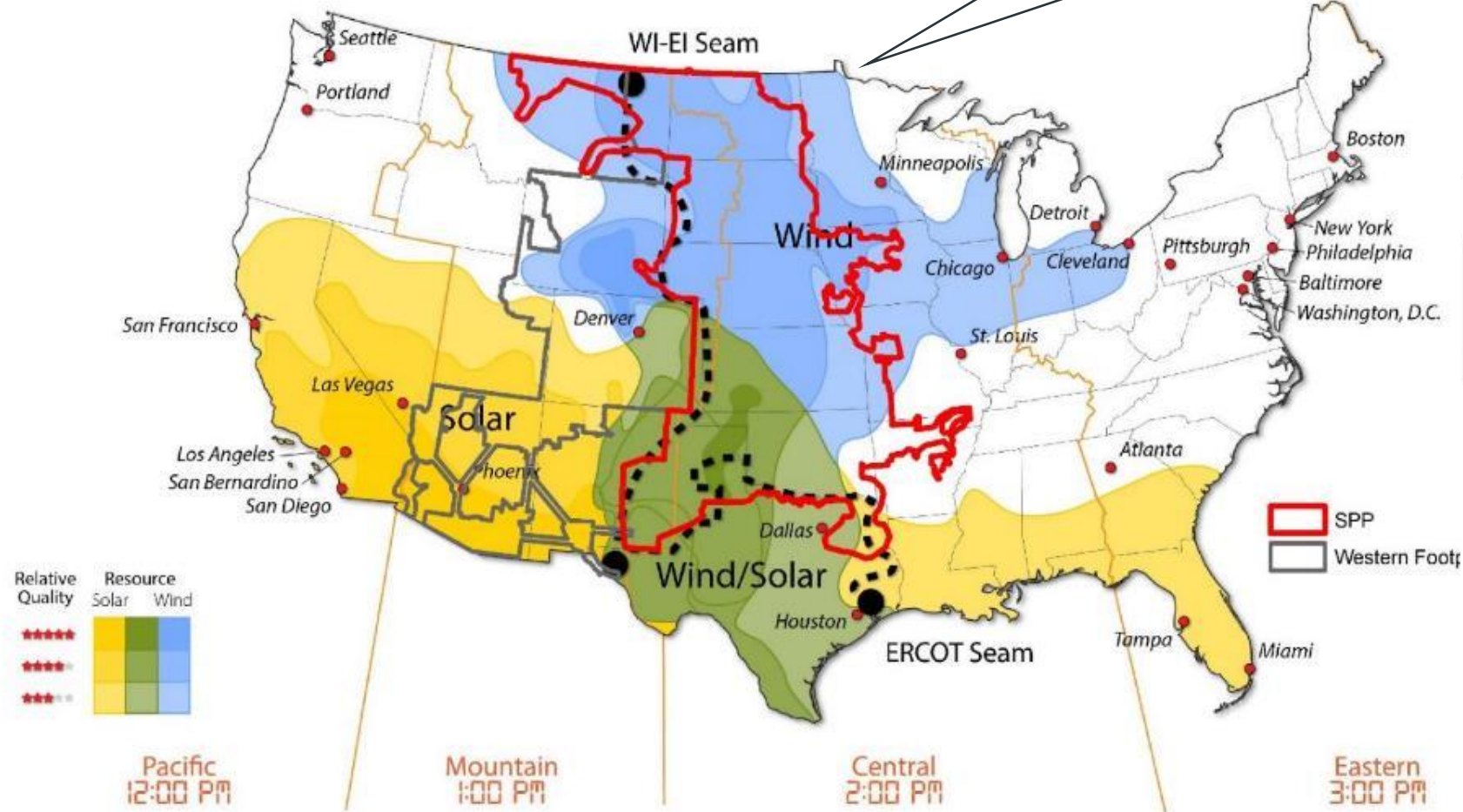
Penetration of Load by Fuel Type

WHY FUEL DIVERSITY MATTERS: RECORD DOWN WIND RAMP IN 4 HOURS (2/18/24)



LEVERAGING DIVERSITY

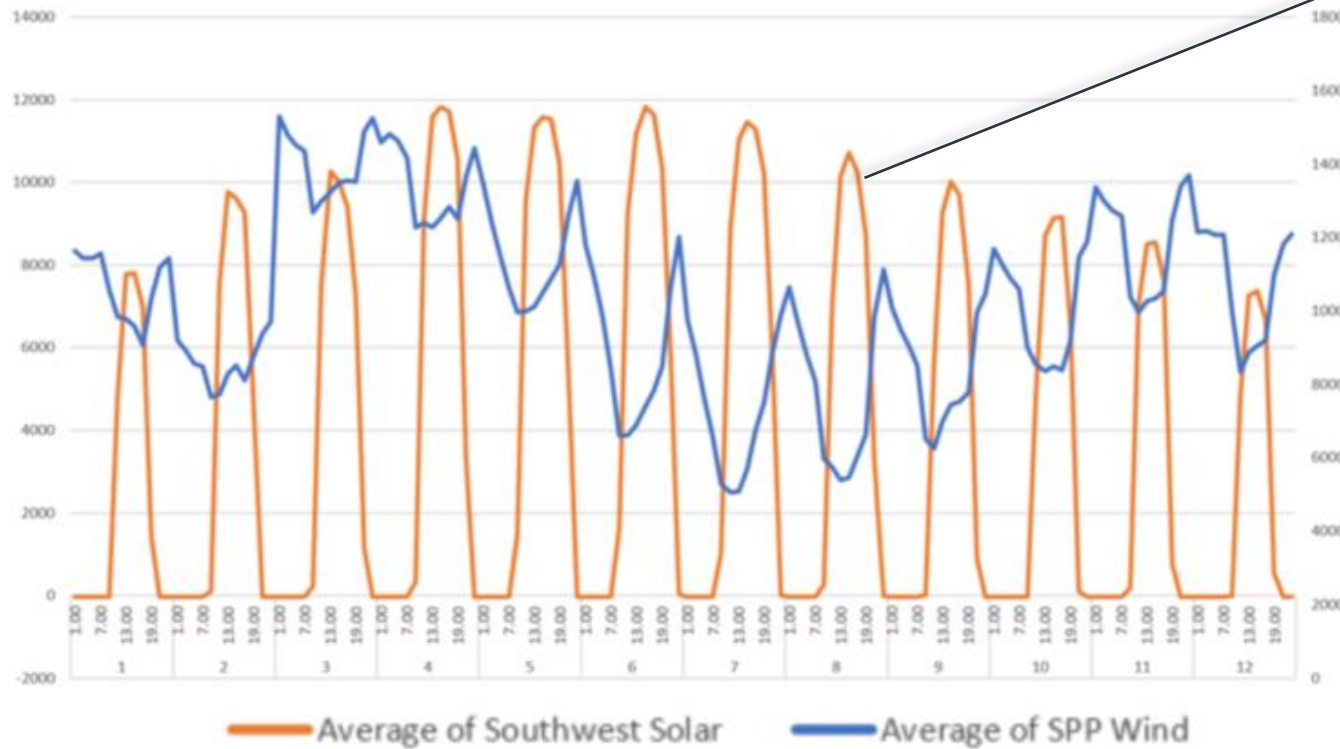
Resource mix and time zone diversity can be leveraged across a larger footprint.



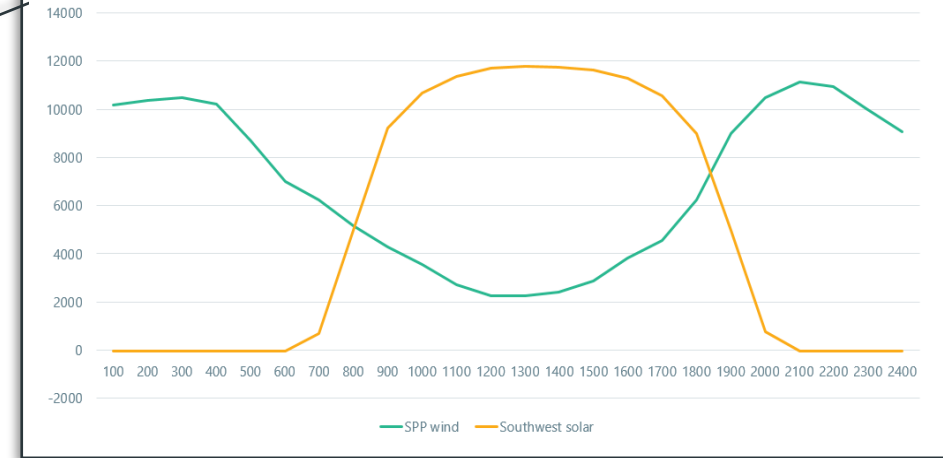
*Areas not shaded have annual average wind speeds less than 7.0 m/s and solar production less than 4.75 kWh/m2/day (from NREL data)

LEVERAGING DIVERSITY

Jan-June 2021 and July-Dec 2020
Hourly Average Output



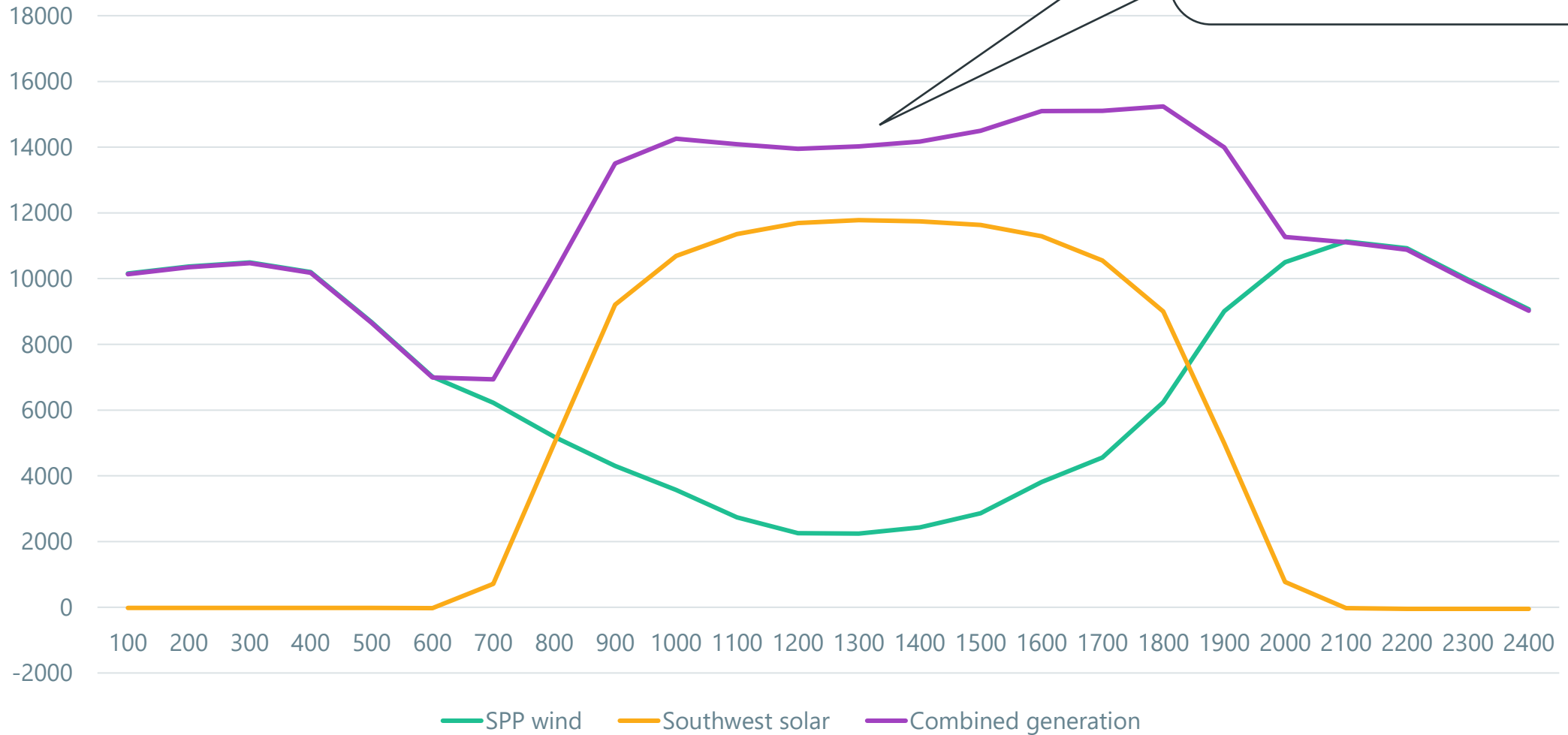
August 5, 2020



Midwest wind and southwest solar are extremely complimentary, especially with time zone diversity.

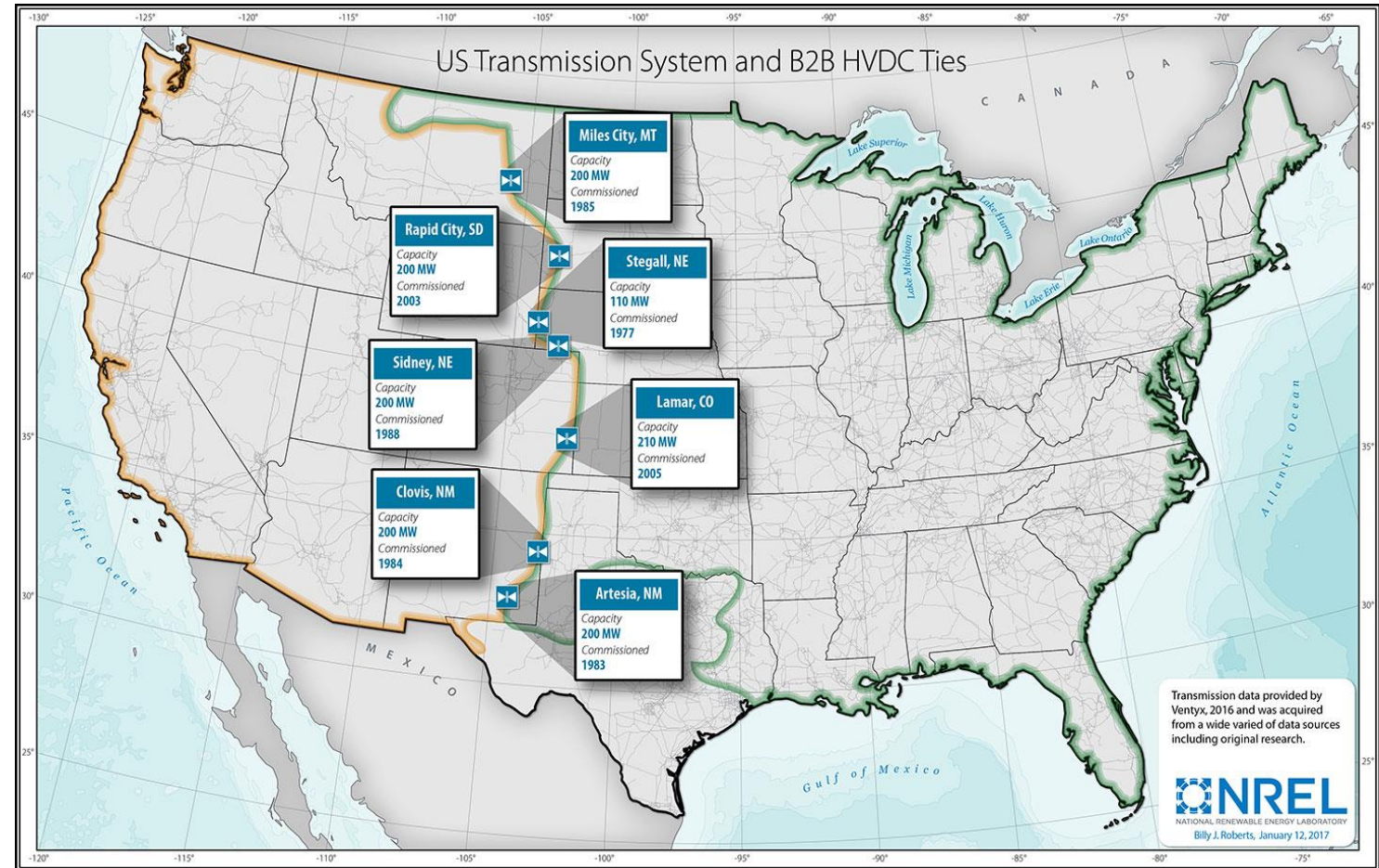
LEVERAGING DIVERSITY

Combining solar and wind mitigates ramping issues and provides more consistent generation in both footprints.



ECONOMIC & RELIABILITY VALUE OF OPTIMIZING DC TIES

- DC ties provide 1,320 MW of transfer capability between Eastern and Western Interconnections.
- Optimizing and expanding DC ties can provide beneficial energy transfers and increased resilience to both east and west participants.
- RTO West will initially bring three of the seven ties into SPP.
- Additional expansion could bring all seven ties into SPP.



SUMMARY

- SPP has extensive experience and technical expertise performing reliability services across a variety of platforms and regions
- Markets+ is designed to support and enhance reliability
- Diversity of time zones, fuel sources and connectivity supports reliability and the integration of renewables

QUESTIONS