# SPP 101

## AN INTRODUCTION TO SOUTHWEST POWER POOL

SPP Southwest Power Pool

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

SouthwestPowerPool

SPPorg

southwest-power-pool


**OUR MISSION:** Working together to responsibly and economically keep the lights on today and in the future.

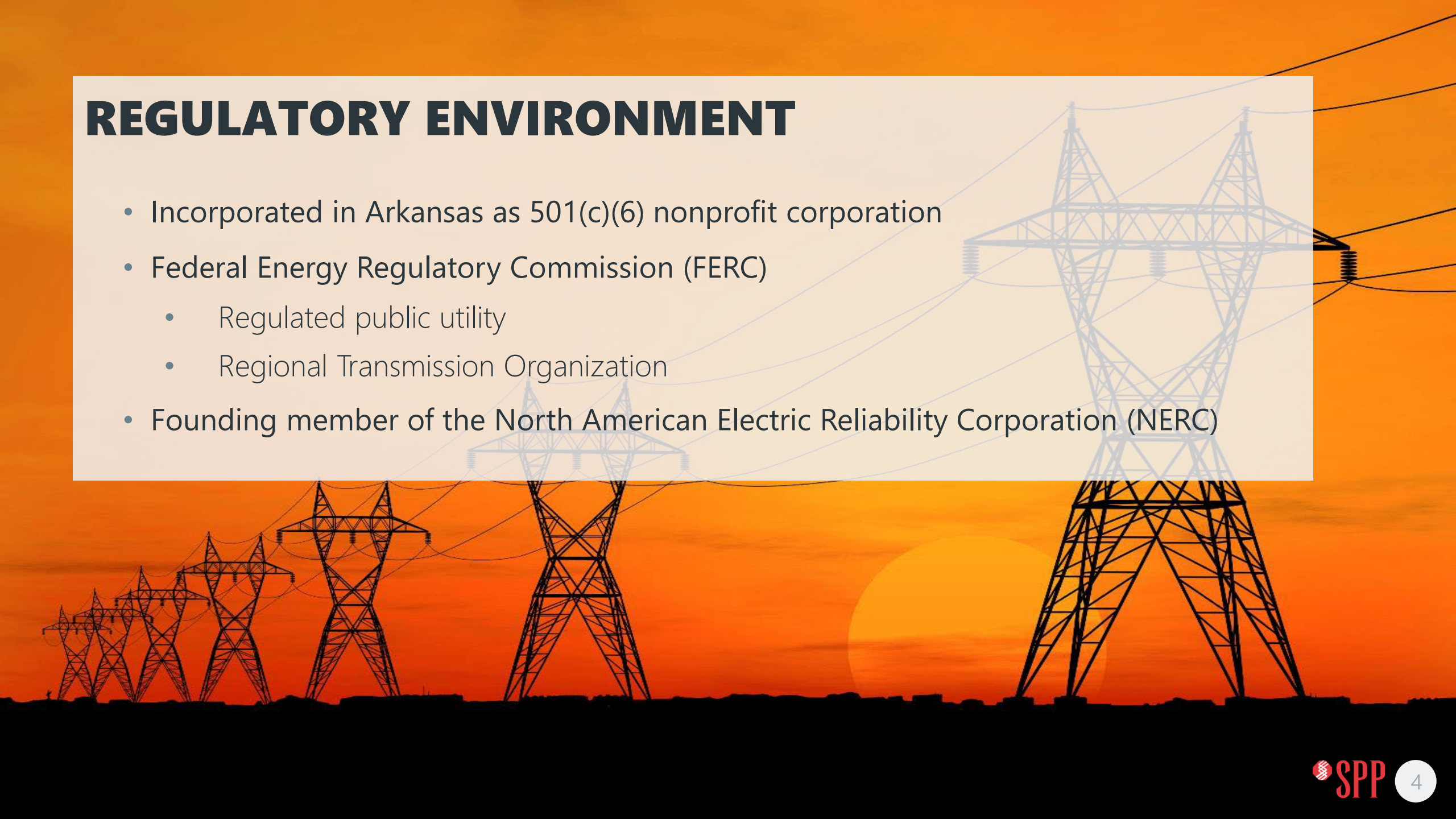
**OUR VISION:** Leading our industry to a brighter future while delivering the best energy value.

# SPP AT A GLANCE

- Located in Little Rock
- Approx. 600 employees
- Jobs in IT, electrical engineering, operations, settlements and more
- 24x7 operation
- Full redundancy and backup site

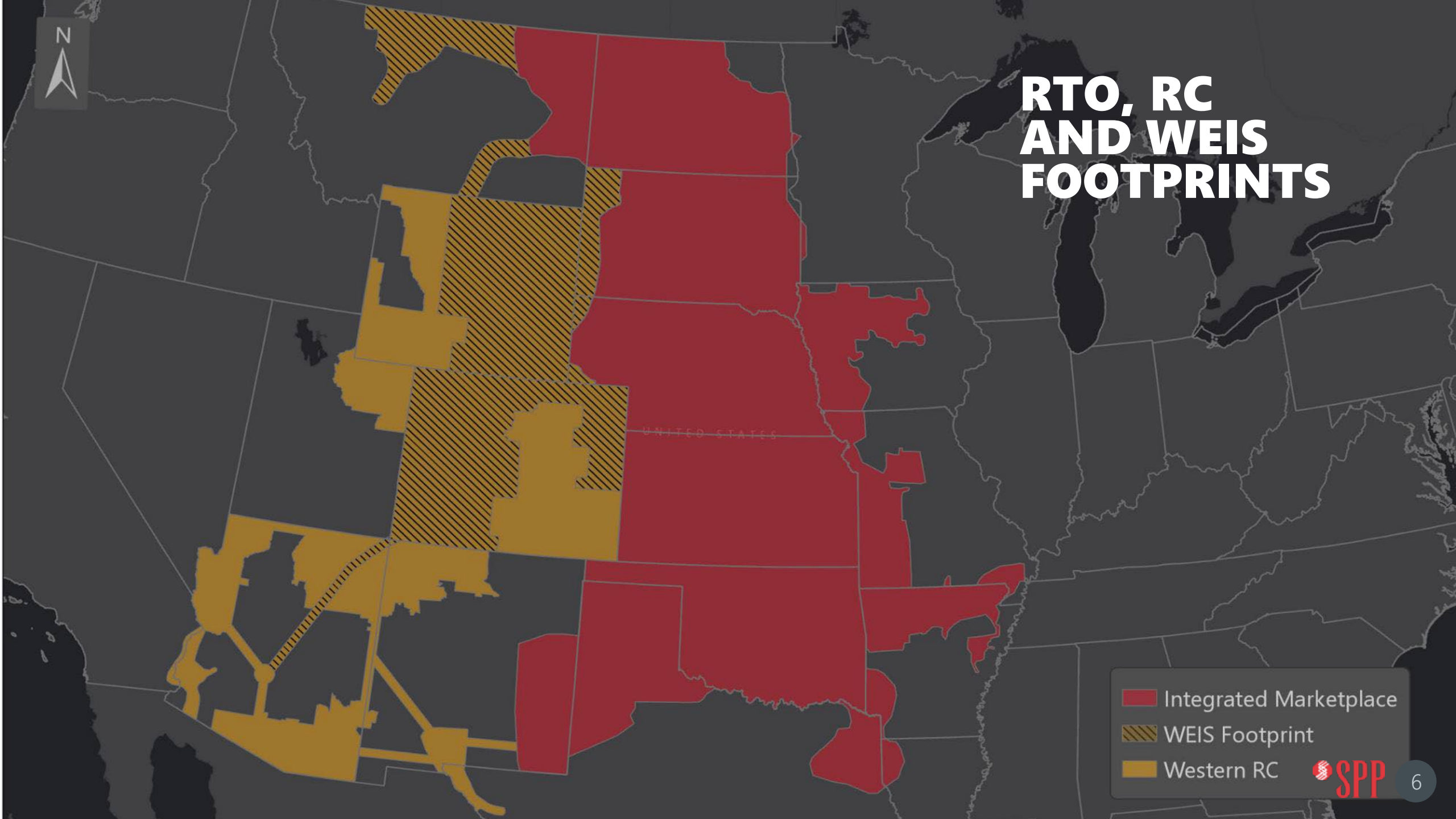
# REGULATORY ENVIRONMENT

- Incorporated in Arkansas as 501(c)(6) nonprofit corporation
- Federal Energy Regulatory Commission (FERC)
  - Regulated public utility
  - Regional Transmission Organization
- Founding member of the North American Electric Reliability Corporation (NERC)

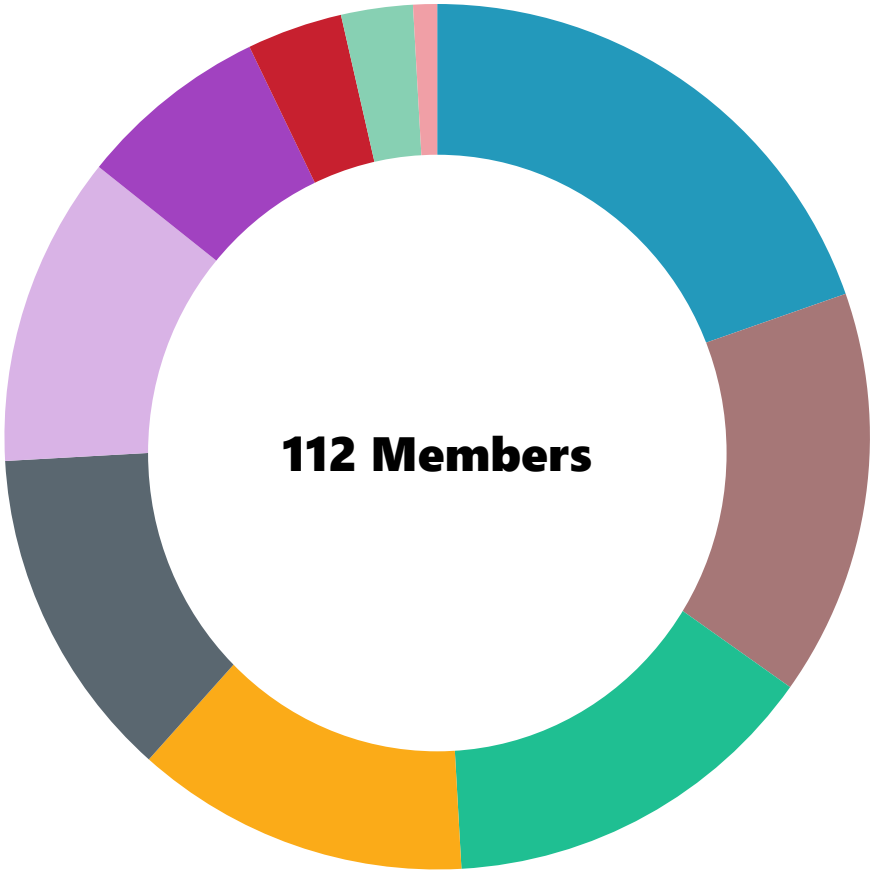


# NORTH AMERICAN INDEPENDENT SYSTEM OPERATORS (ISO) AND REGIONAL TRANSMISSION ORGANIZATIONS (RTO)

# RTO, RC AND WEIS FOOTPRINTS

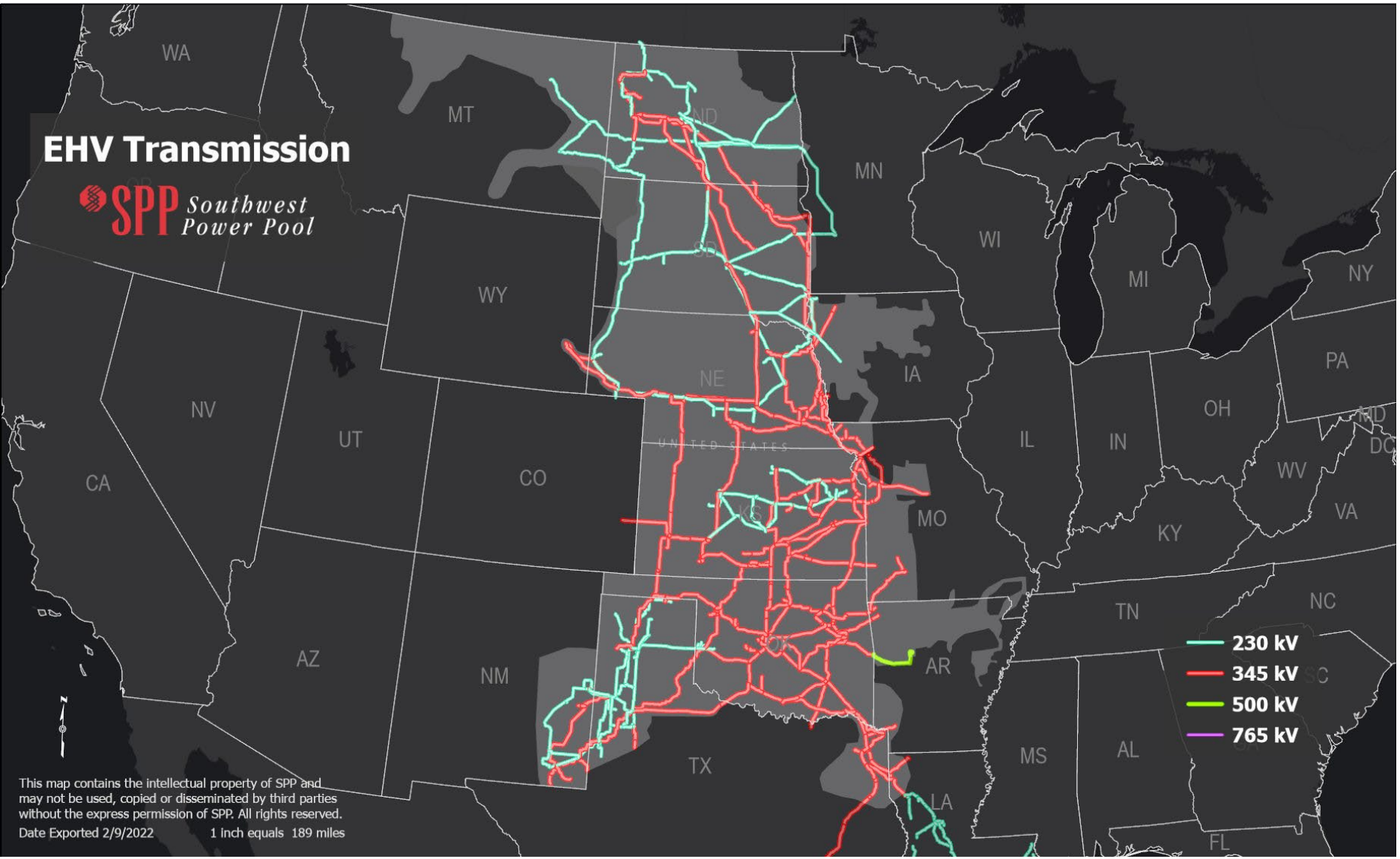


# SPP'S 112 MEMBERS: INDEPENDENCE THROUGH DIVERSITY




- 22 Generation and Transmission Cooperatives
- 17 Independent Power Producers
- 16 Investor-Owned Utilities
- 14 Municipal Systems
- 14 Independent Transmission Companies
- 13 Power Marketers
- 8 State Agencies
- 4 Large Retail Customers
- 3 Alternative Power/Public Interest
- 1 Federal Agency

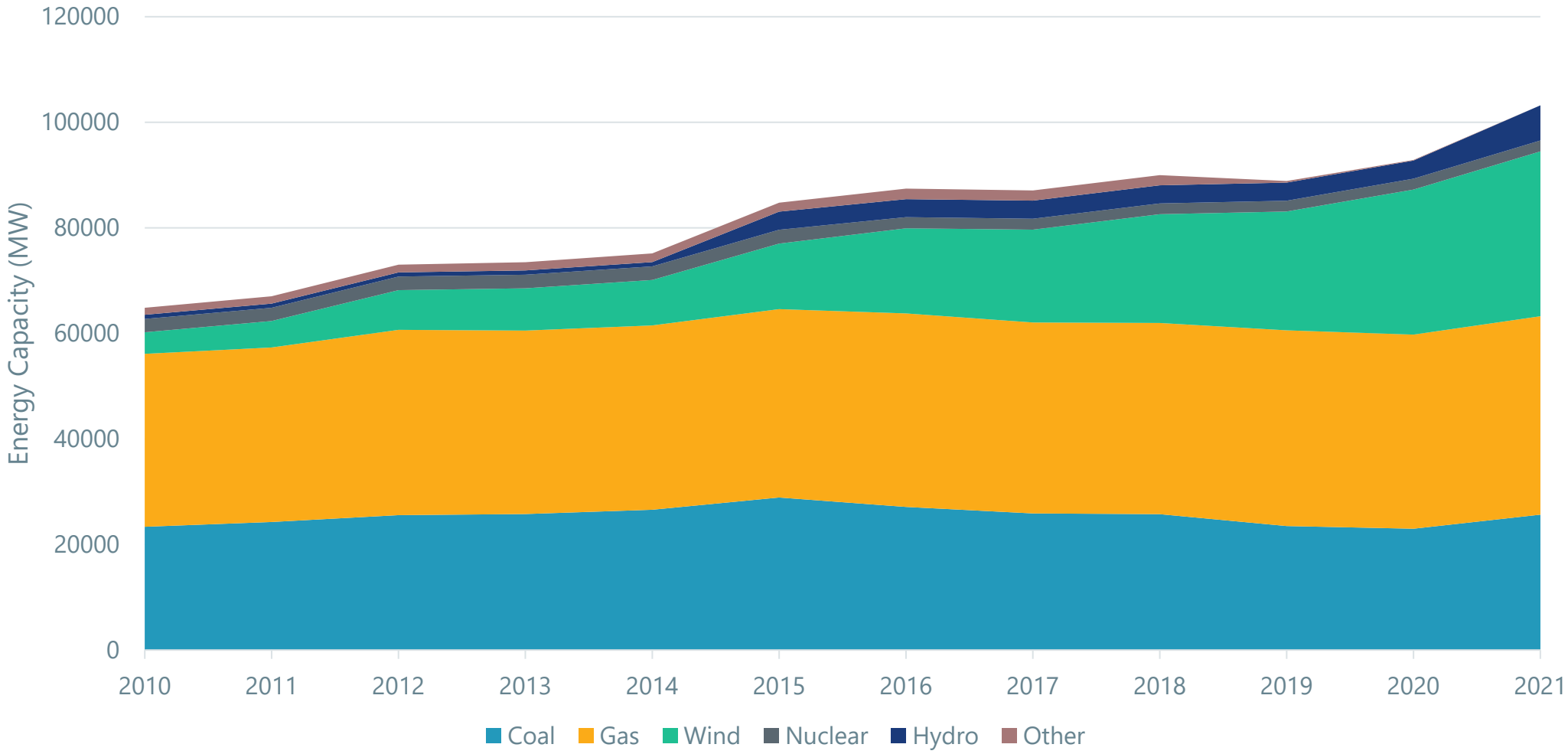
*June 2022*



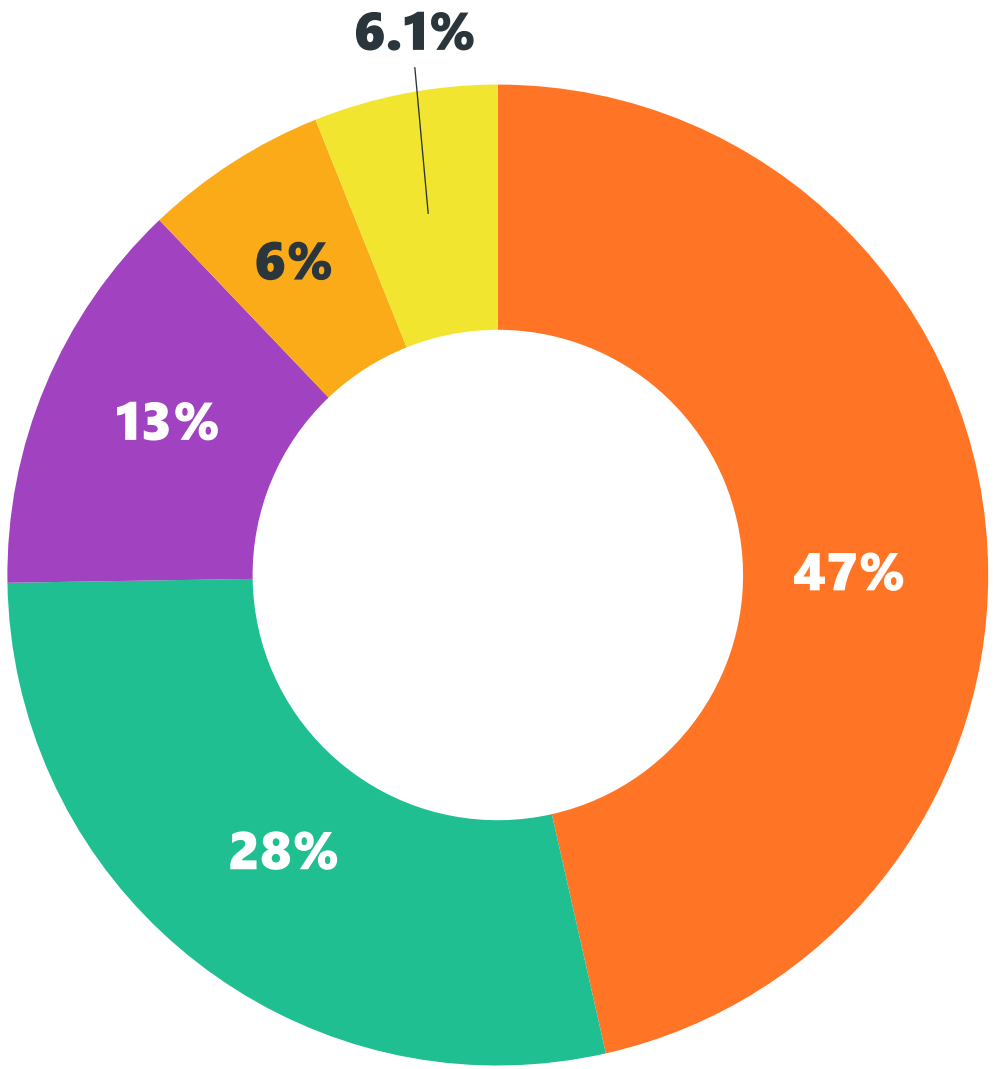

## MILES OF TRANSMISSION: 70,025

- 69 kV 17,982
- 115 kV 16,677
- 138 kV 9,942
- 161 kV 5,677
- 230 kV 7,604
- 345 kV 12,052
- 500 kV 91

# NAMEPLATE GENERATING CAPACITY
## BY FUEL MIX OVER TIME



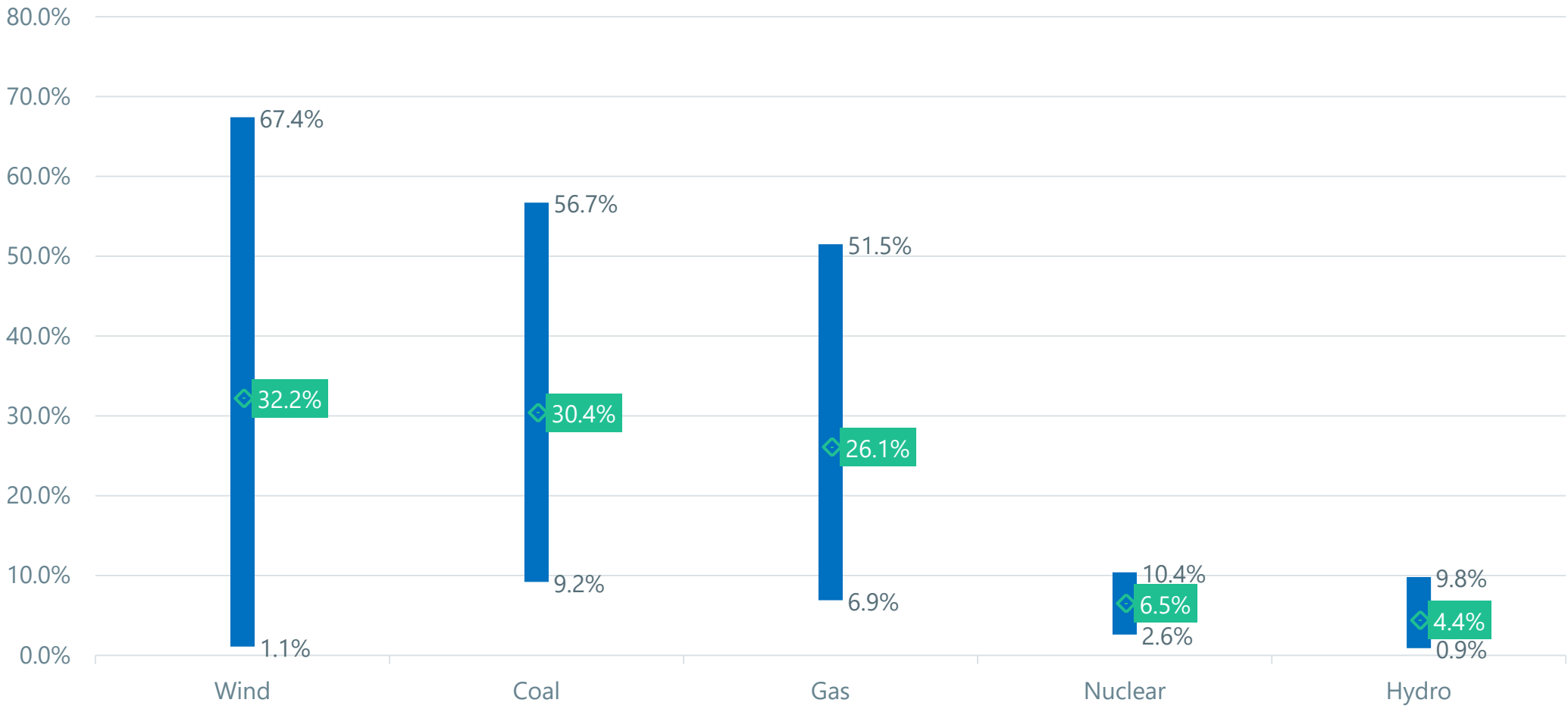
# GENERATOR INTERCONNECTION REQUESTS UNDER STUDY (BY FUEL TYPE): 99.6 GW TOTAL




- Solar (45,492 MW)
- Wind (28,123 MW)
- Storage (13,643 MW)
- Gas/Thermal (6,250 MW)
- Hybrid: renewables + storage (5,393 MW)

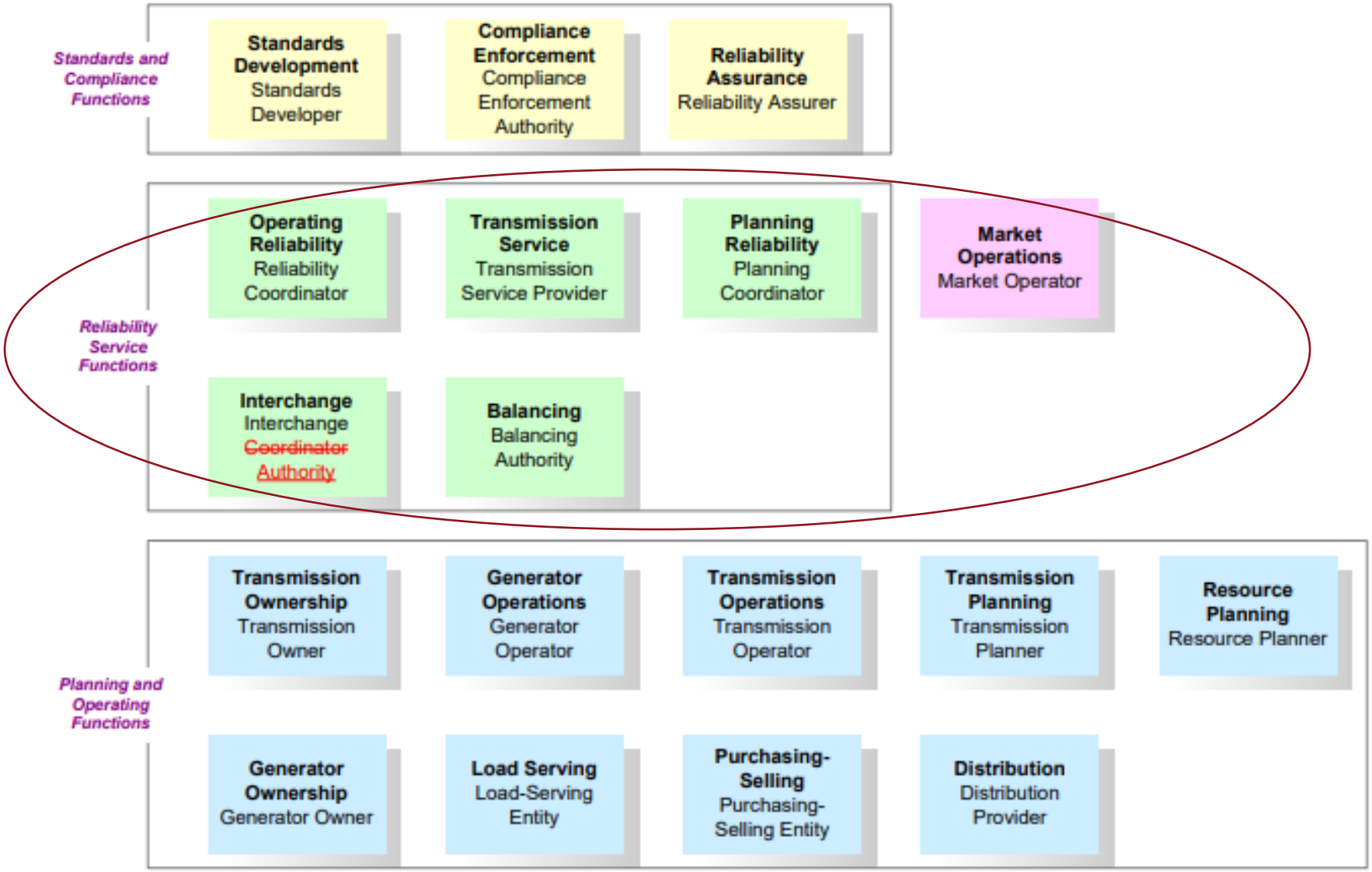
*July 2022*

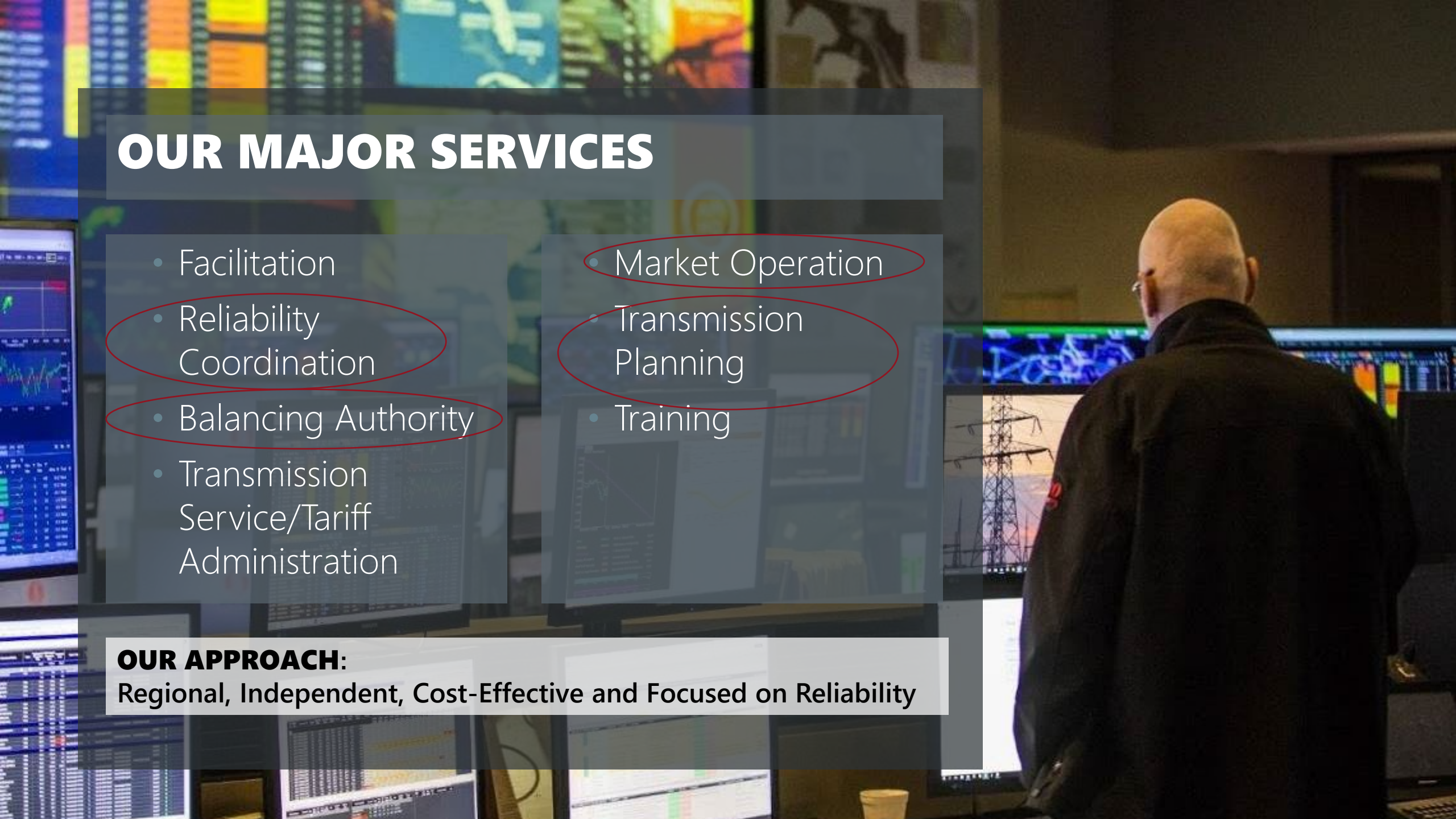
# MIN AND MAX PERCENT OF GENERATION MIX BY FUEL TYPE




*Jan. 1 – Dec. 31, 2020*

# NERC FUNCTIONAL MODEL

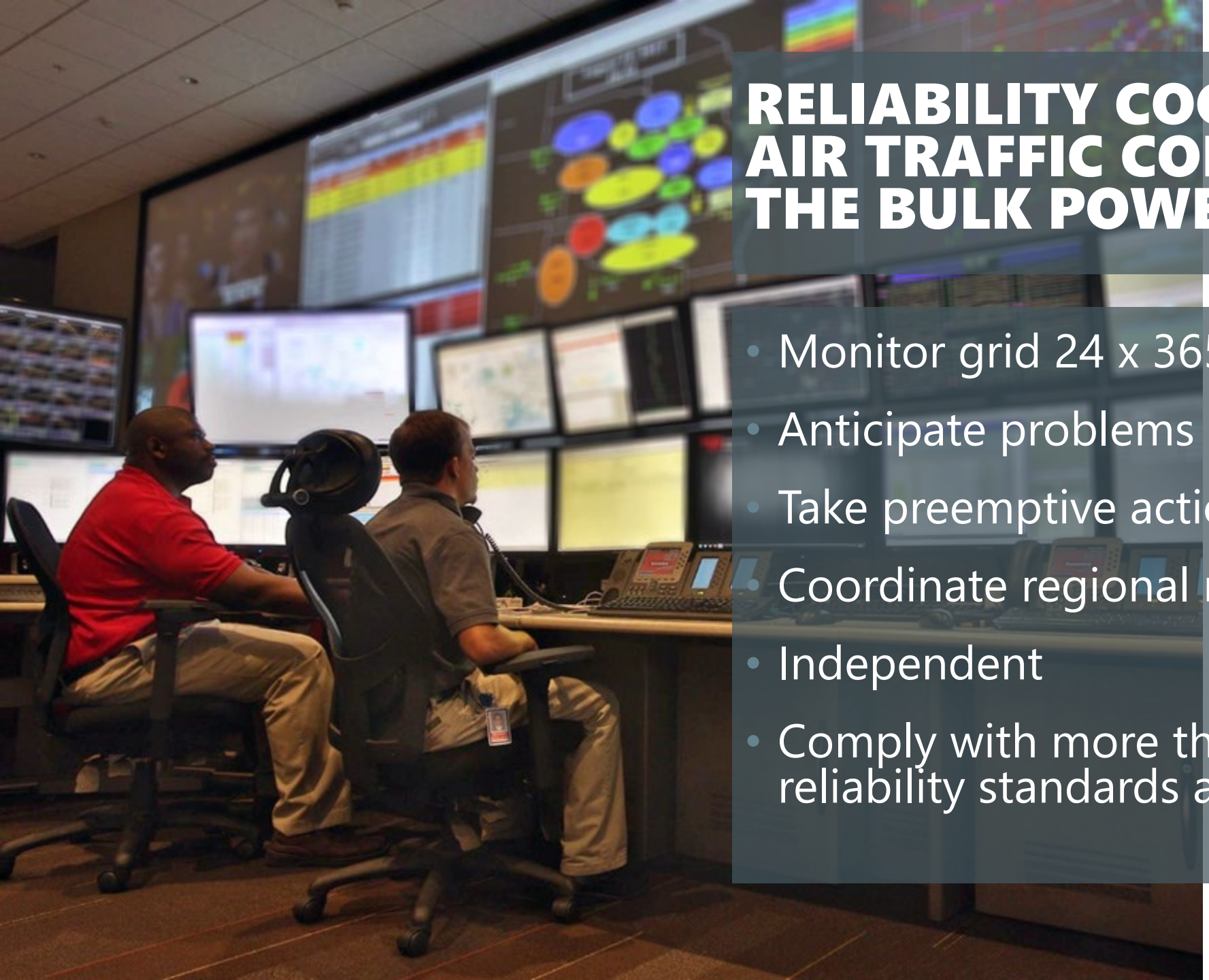




# OUR MAJOR SERVICES

- Facilitation
- Reliability Coordination
- Balancing Authority
- Transmission Service/Tariff Administration
- Market Operation
- Transmission Planning
- Training

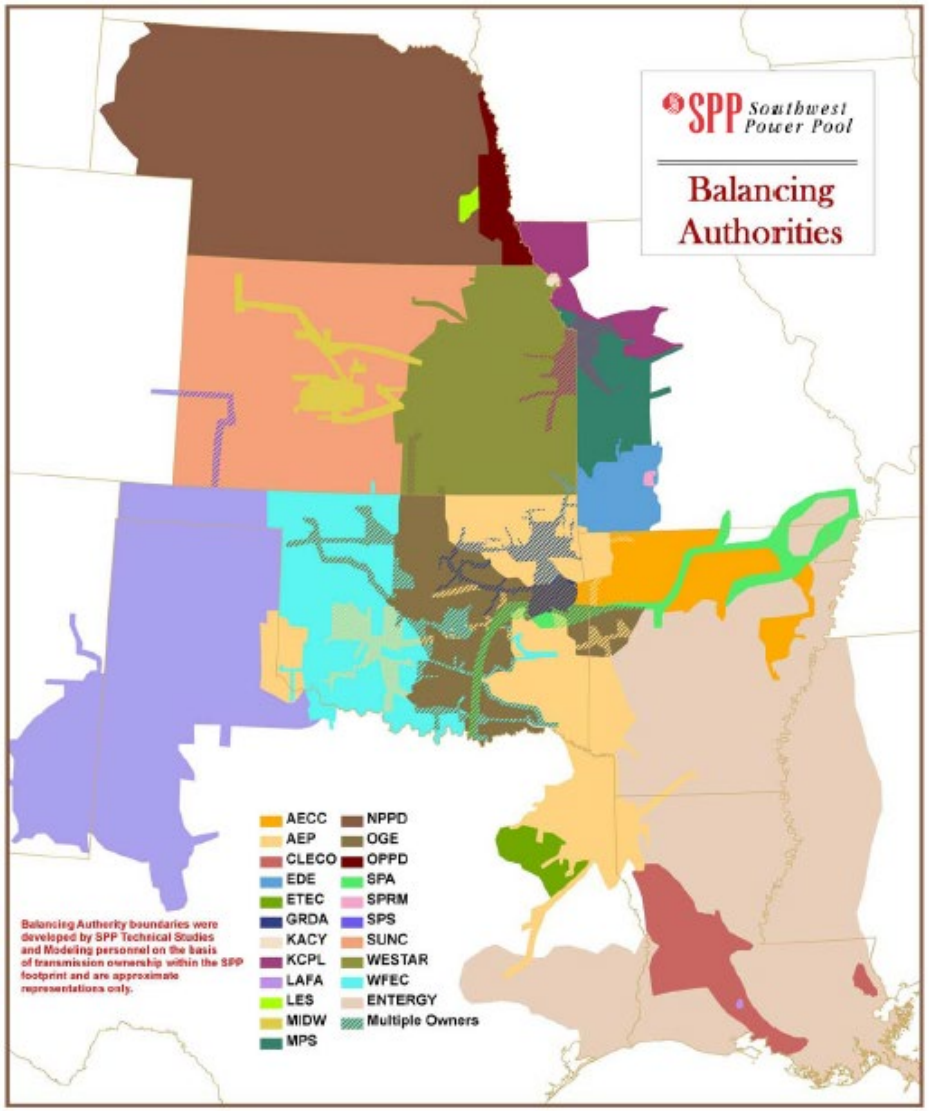
**OUR APPROACH**:
**Regional, Independent, Cost-Effective and Focused on Reliability**



# RELIABILITY COORDINATION: AIR TRAFFIC CONTROLLERS OF THE BULK POWER GRID

- Monitor grid 24 x 365
- Anticipate problems
- Take preemptive action
- Coordinate regional response
- Independent
- Comply with more than 5,500 pages of reliability standards and criteria

# SPP BALANCING AUTHORITIES



# WHOLESALE ENERGY MARKET

# ELECTRICITY MARKET BASICS

Like any market, SPP's electricity markets feature:

- Sellers/producers with a product and buyers/consumers who want to buy it
- Prices driven by supply and demand

# WHAT KIND OF MARKETS DOES SPP OPERATE?

- Transmission Service: Participants buy and sell use of regional transmission lines that are owned by different parties.
- Integrated Marketplace: Participants buy and sell wholesale electricity in day-ahead and real-time.
  - Day-Ahead Market commits the most cost-effective and reliable mix of generation for the region.
  - Real-Time Balancing Market economically dispatches generation to balance real-time generation and load, while ensuring system reliability.
- Western Energy Imbalance Service (WEIS) Market: Contract-based, real-time balancing market in the western interconnection (as of Feb. 1, 2021).

# MARKET FACTS

- 280 market participants
- 5,180 generating resources
  (inc. distributed demand response)
- 2021 marketplace settlements = $59 billion
- 2021 transmission service transactions = $5.2 billion
- 53,243 MW coincident peak load (7/19/22)
  - Winter peak: 43,661 MW (2/15/21)

# WHAT IS A WHOLESALE ENERGY MARKET?

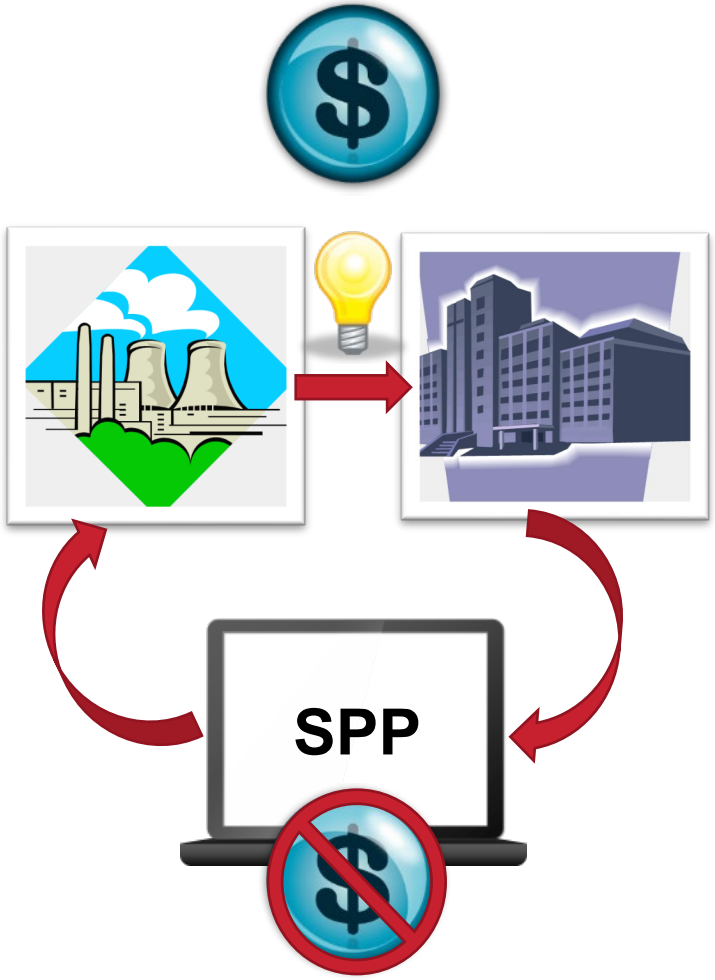
| Sellers/ Producers | Buyers/ Consumers | Locational Prices | Products |
|---|---|---|---|
| • Utilities<br>• Municipals<br>• Independent Power Producers<br>• Generators<br>• Power Marketers | • Utilities<br>• Municipals<br>• Load Serving Entities (LSEs)<br>• Power Marketers | • Driven by supply and demand at defined locations | • Energy<br>• Operating Reserves<br>• Congestion Rights |

# SPP'S INTEGRATED MARKETPLACE

SPP financially settles the marketplace

- Calculates prices
- Captures wholesale energy production and consumption
- Collects from market participants (MP) who owe the market
- Pays MPs who are owed by the market
- Remains revenue neutral

SPP has an independent market monitor



# INTEGRATED MARKETPLACE OVERVIEW

## Key Components

- Day-Ahead (DA) Market
- Real-Time Balancing Market (RTBM)
- Transmission Congestion Rights (TCR) Market

## Products

- Energy
- Operating Reserve (Regulation Up, Regulation Down, Spinning, Supplemental)
- Congestion Rights

# THE INTEGRATED MARKETPLACE DAY-AHEAD AND REAL-TIME COMMITMENT SCHEDULE

| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

**OCTOBER 7**
Day-Before Operating Day (OD-1)

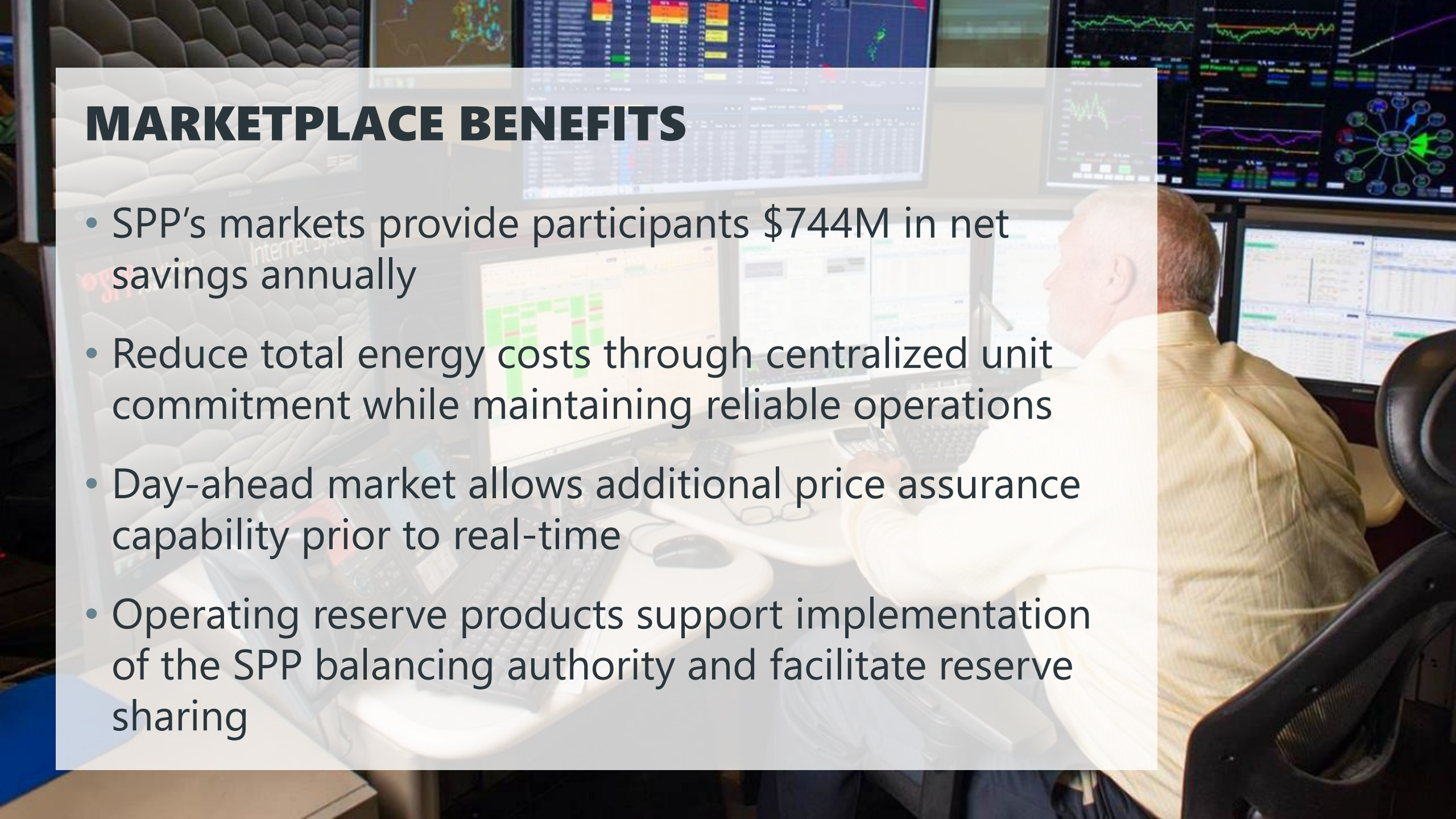
DAY-AHEAD MARKET

**OCTOBER 8**
Operating Day (OD)

REAL-TIME BALANCING MARKET (RTBM)

**OCTOBER 9**
Post Operating Day (OD+1, 2, etc.)

FINANCIAL SETTLEMENT of all MARKET ACTIVITES



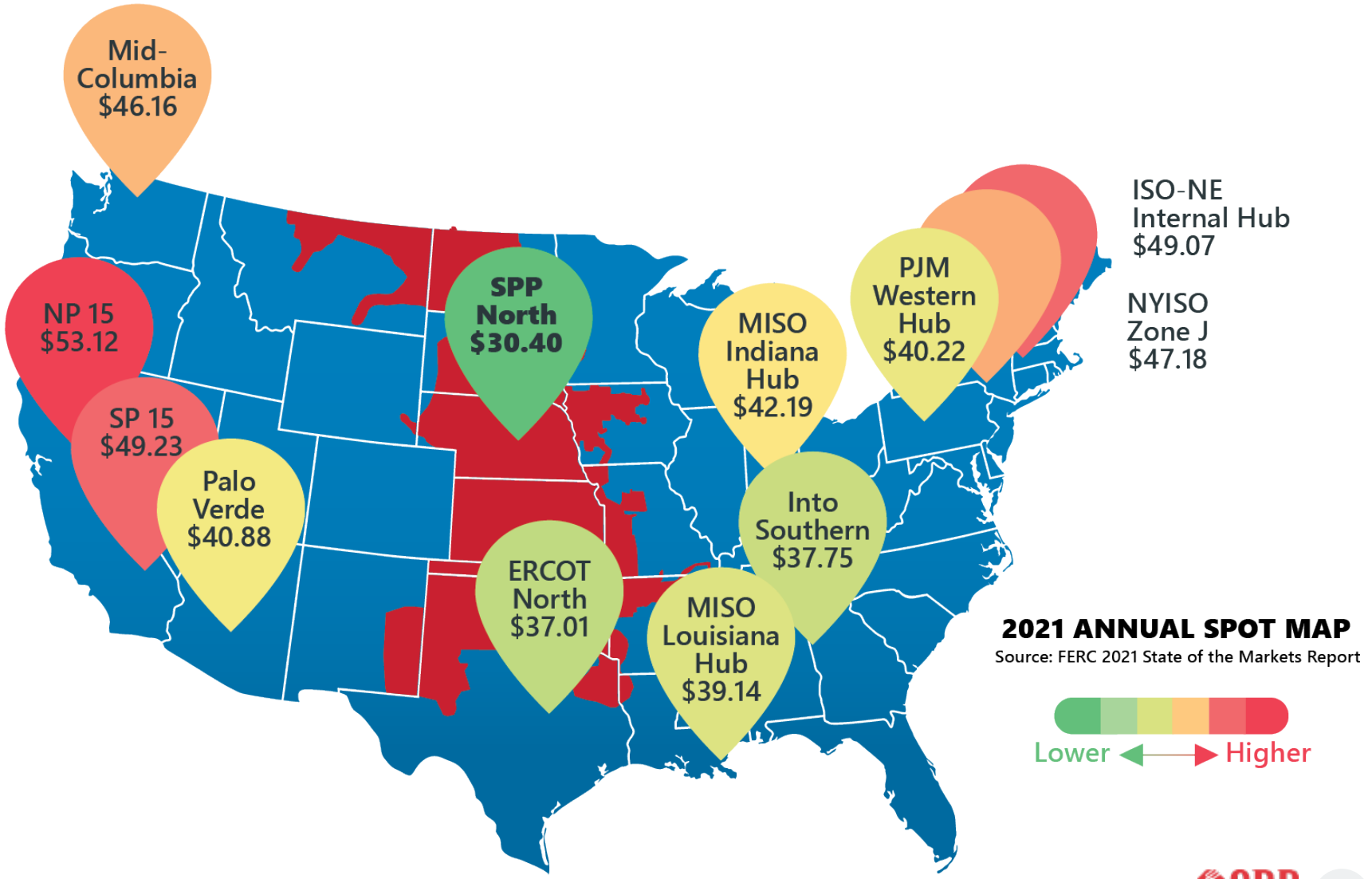
# MARKETPLACE BENEFITS

- SPP's markets provide participants $744M in net savings annually
- Reduce total energy costs through centralized unit commitment while maintaining reliable operations
- Day-ahead market allows additional price assurance capability prior to real-time
- Operating reserve products support implementation of the SPP balancing authority and facilitate reserve sharing

# 2021 ANNUAL AVERAGE SPOT PRICES

In 2021, SPP's average wholesale market prices remained the lowest of any organized market in the U.S.

*Adapted from FERC's 2021 State of the Markets Report. Sources: Nodal prices from ABB Velocity Suite. ISO hub prices from SNL's Day-Ahead On-Peak Prices data. Mid-Columbia, Palo Verde, and Into Southern prices from SNL's S&P Global Market Intelligence Day-Ahead—Annual OnPeak Prices data.*



# DAY-AHEAD MARKET

- Determines least-cost solution to meet energy bids and reserve requirements
- Participants submit offers and bids to purchase and/or sell energy and operating reserve:
  - Energy
  - Regulation-Up
  - Regulation-Down
  - Spinning Reserve
  - Supplemental Reserve

# REAL-TIME BALANCING MARKET (RTBM)

- Balances real-time load and generation committed by the day-ahead market and reliability commitment processes
- Operates on continuous 5-minute basis
  - Calculates dispatch instructions for energy and clears operating reserve by resource
- Energy and operating reserve are co-optimized
- Settlements based on difference between results of RTBM process and day-ahead market clearing
- Charges imposed on market participants for failure to deploy energy and operating reserve as instructed

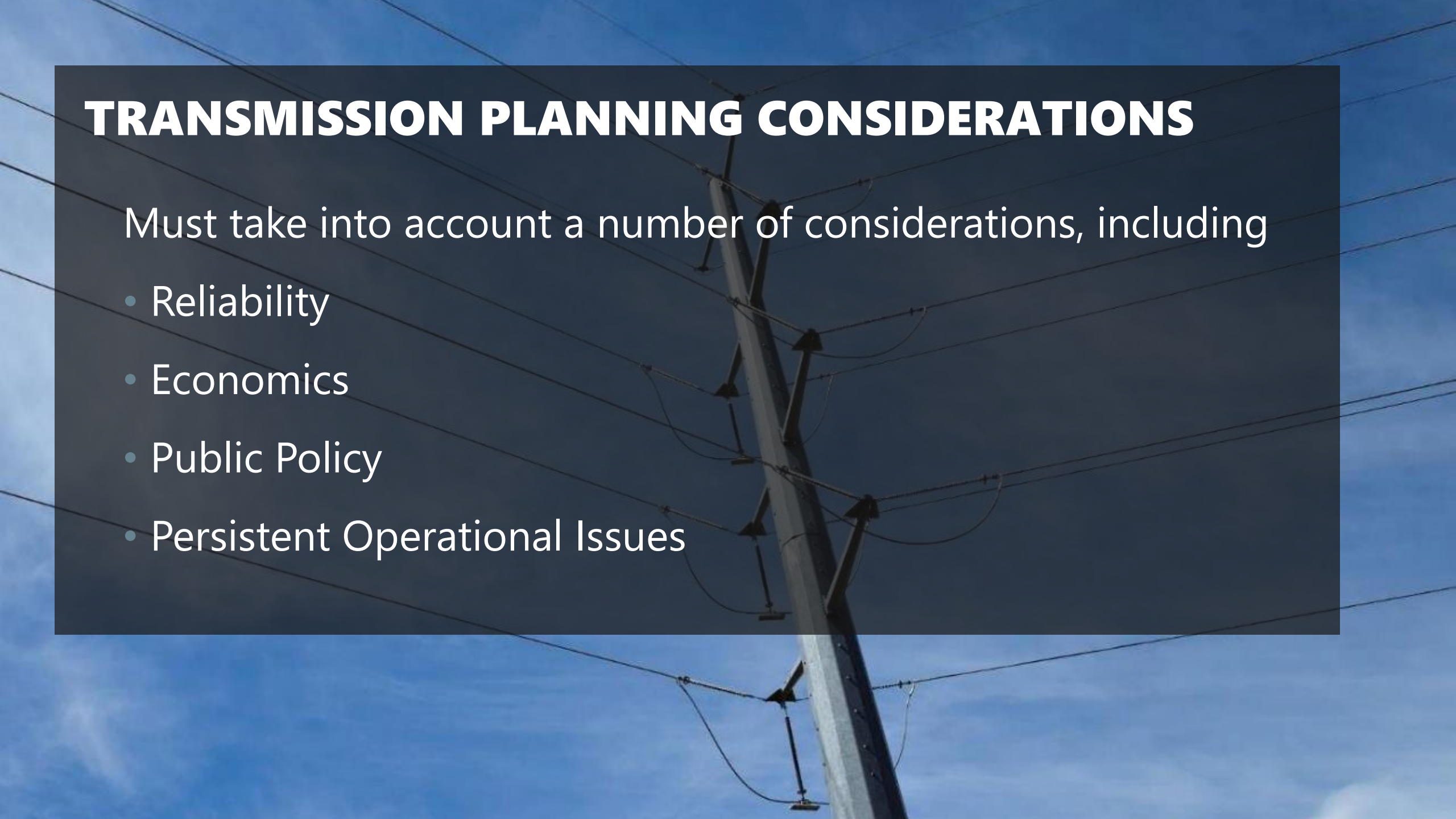
# TRANSMISSION CONGESTION RIGHTS (TCR) MARKET

- In the day-ahead market, price separation of market participant's resource to load may occur due to congestion leaving the market participant exposed to high prices
- A TCR can be used as hedge against congestion that allows market participants to reduce exposure to high market prices and potentially receive lower-priced deliverable energy
- TCR market has annual and monthly auction processes related to two products:
  - Auction Revenue Rights (ARRs)
  - Transmission Congestion Rights (TCRs)

# TRANSMISSION PLANNING: BASIC CONCEPTS

SERVICES

If you fail to plan, you are planning to fail
– Benjamin Franklin

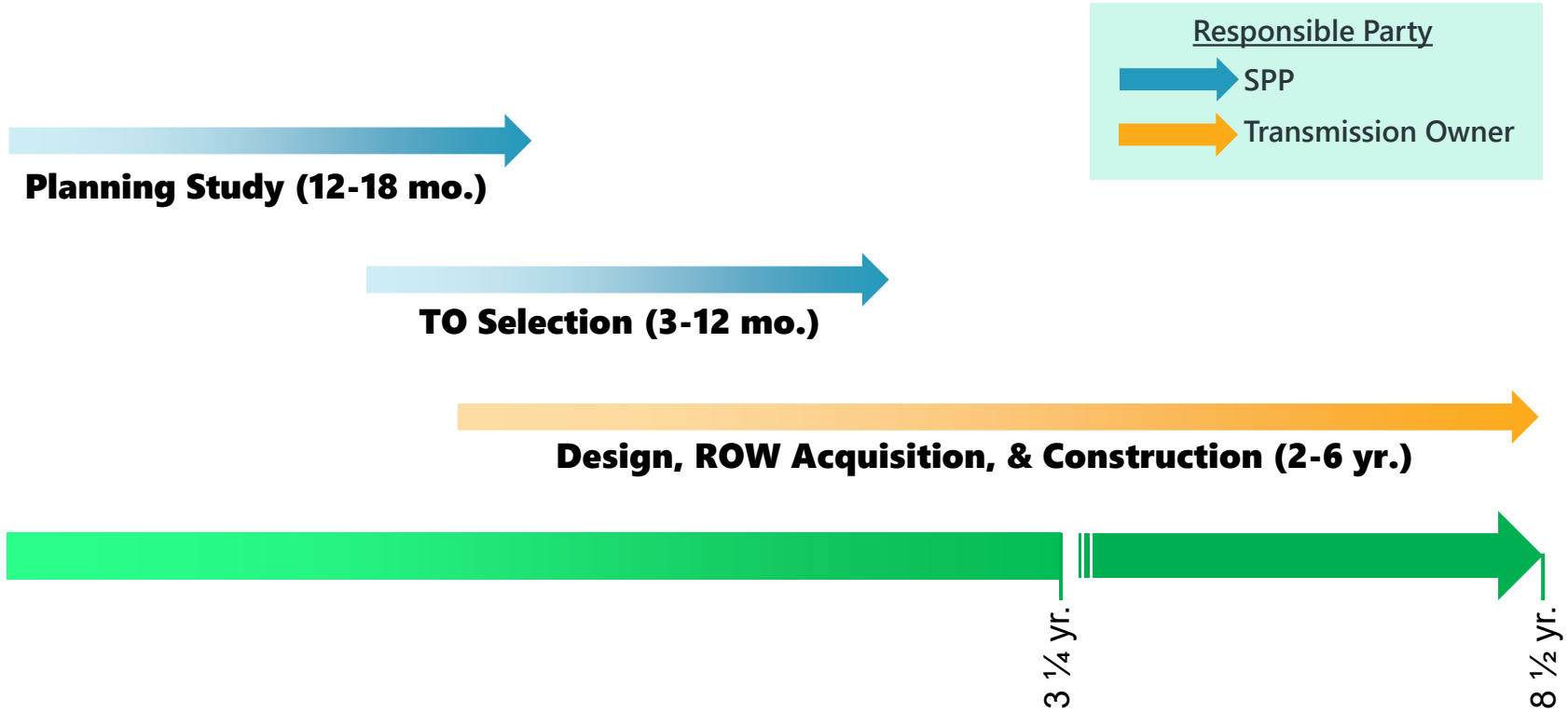


# TRANSMISSION PLANNING CONSIDERATIONS

Must take into account a number of considerations, including

- Reliability
- Economics
- Public Policy
- Persistent Operational Issues

# TRANSMISSION BUILD CYCLE IN SPP

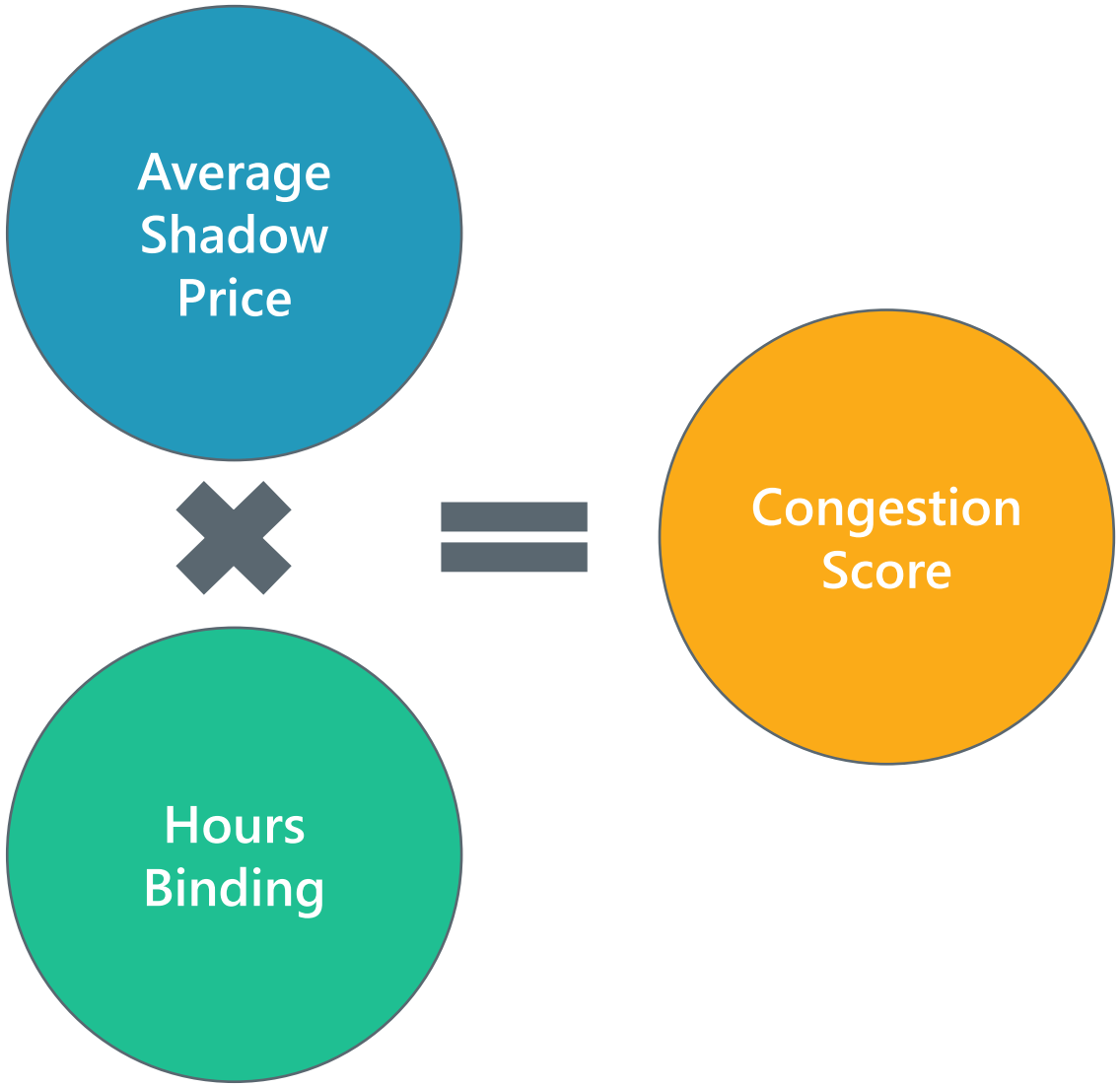


# FUTURES ASSUMPTIONS

| | Year 2 | Reference Case | | Emerging Technologies | |
|---|---|---|---|---|---|
| | | Year 5 | Year 10 | Year 5 | Year 10 |
| Energy growth | Current projections | Current projections | | Increase due to EVs | |
| Fossil fuel retirements | Current forecast | Coal 56, Gas 50+ subject to Generator Owner Review | | Coal 56, Gas 50+ Subject to repowering or emissions upgrades | |
| Energy Storage | None | 20% of projected solar | | 35% of projected solar | |
| Utility Solar (GW) | .23 | 4 | 7 | 5 | 9 |
| Wind (GW) | 21.7 | 26 | 28 | 30 | 33 |

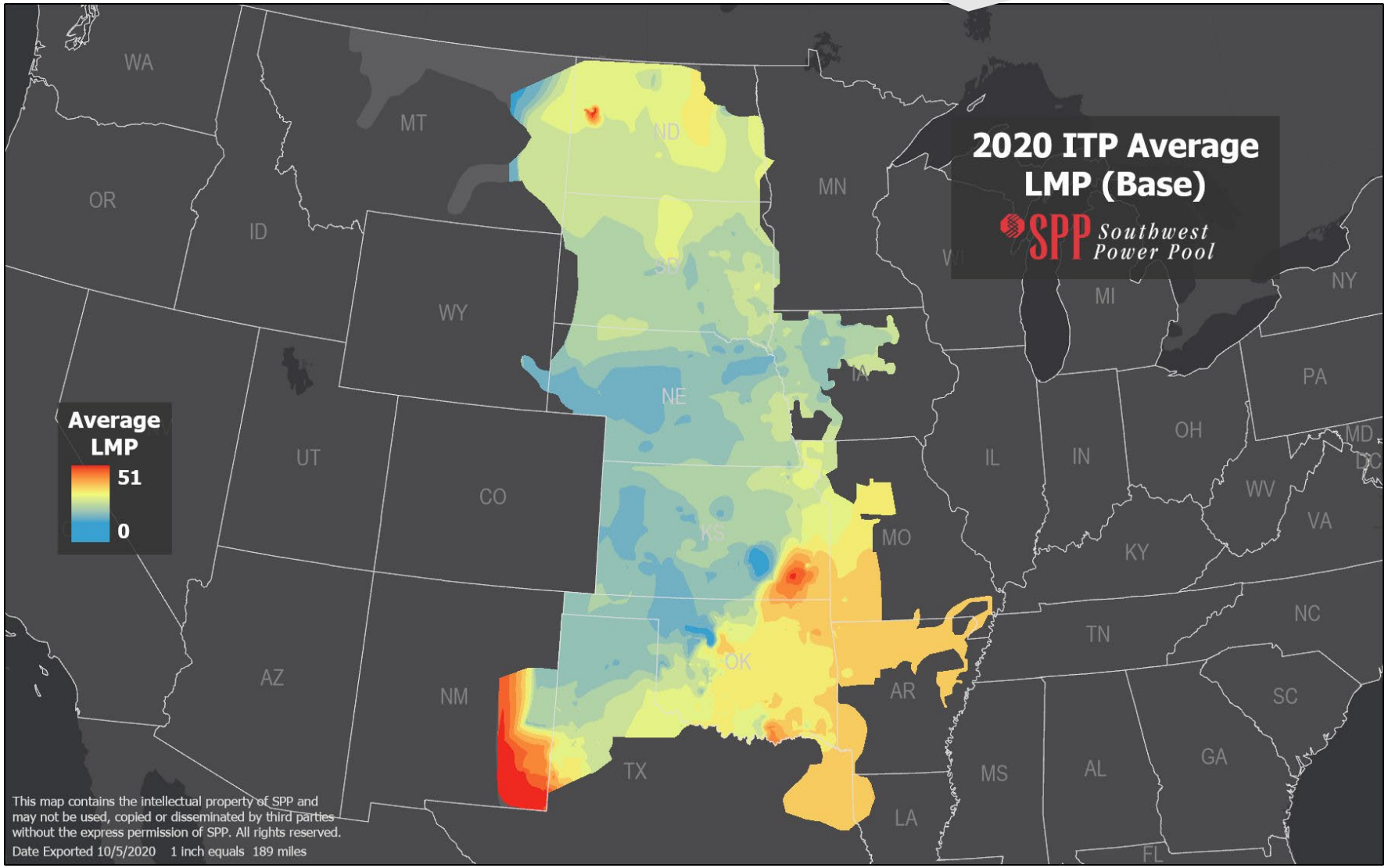
# ECONOMIC NEEDS ASSESSMENT

1. Rank constraints by economic need criteria
2. Constraints that meet congestion score & other criteria are identified as economic needs
3. Consider constraints that don't meet criteria for possible inclusion



# ADDRESSING CONGESTION

Consolidated portfolio will reduce regional LMP price separation, create more reliable transfer capability, & deliver lower cost energy to load

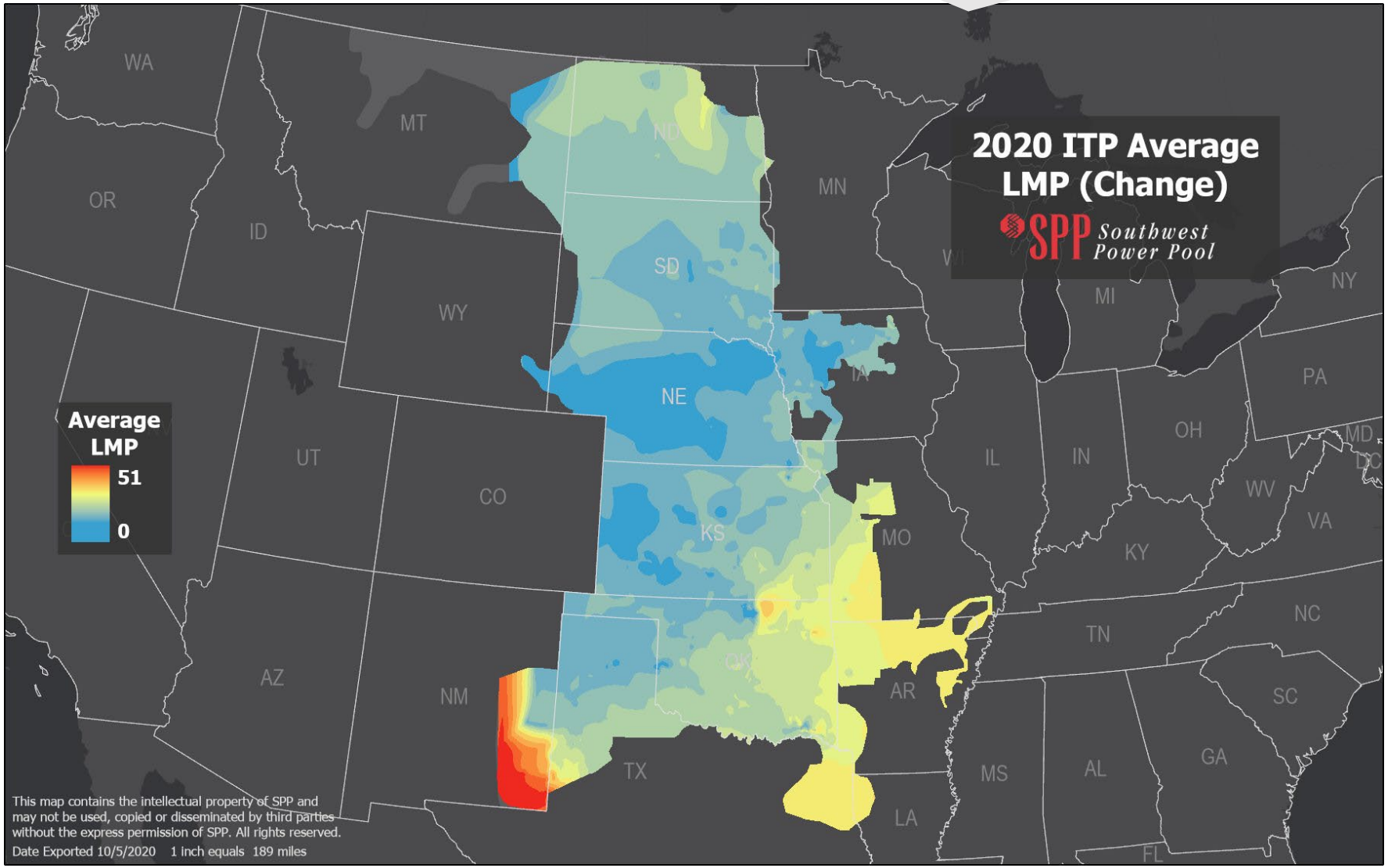



Higher prices

Lower prices

# ADDRESSING CONGESTION

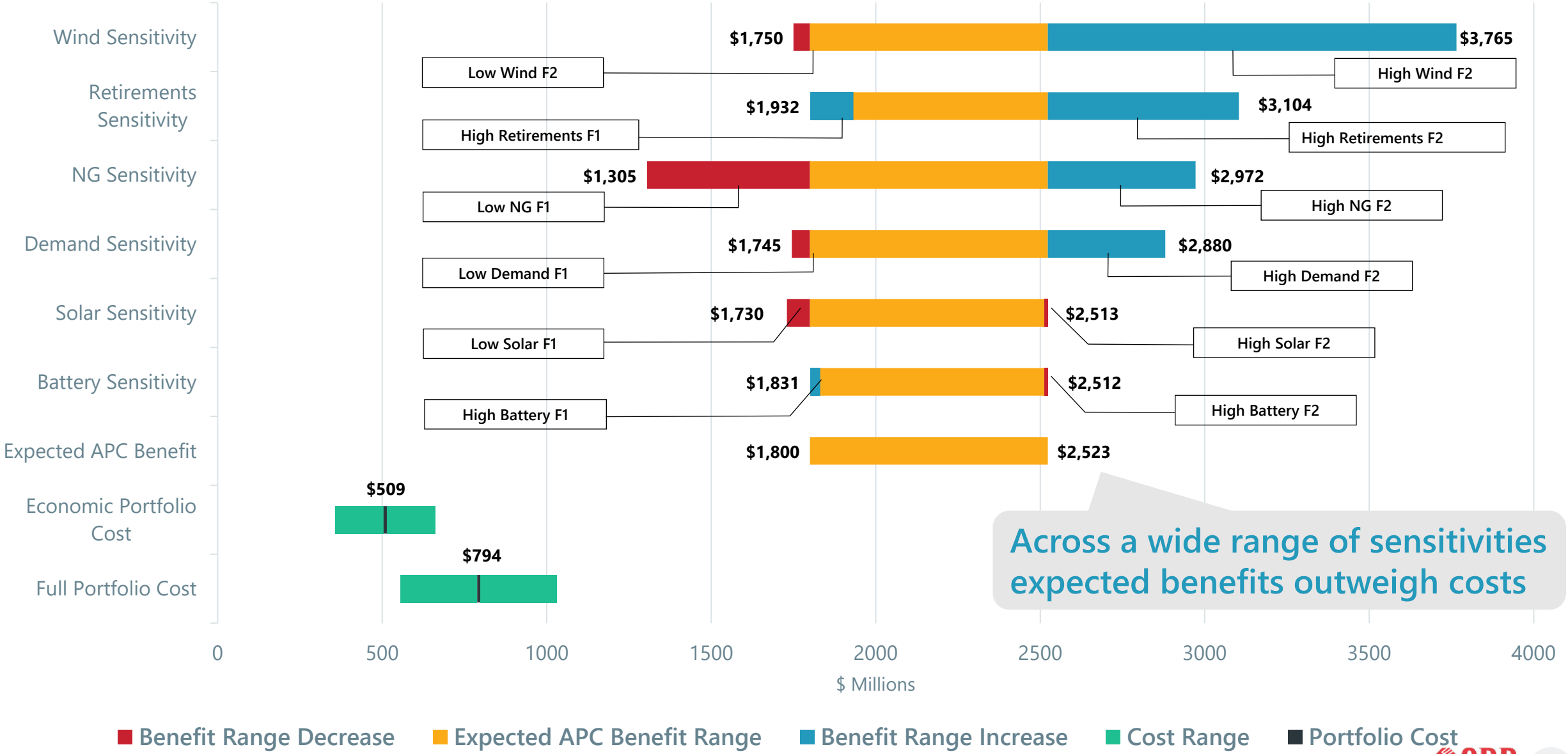
Consolidated portfolio will reduce regional LMP price separation, create more reliable transfer capability, & deliver lower cost energy to load




Higher prices

Lower prices

# 40 Year APC Benefit and Cost Ranges




Across a wide range of sensitivities expected benefits outweigh costs

# WHO PAYS FOR TRANSMISSION PROJECTS?

- **Sponsored**: Project owner builds and receives credit for use of transmission lines
- **Directly-assigned**: Project owner builds and is responsible for cost recovery and receives credit for use of transmission lines
- **Highway/Byway**: Most SPP projects paid for under this methodology

| Voltage | Region Pays | Local Zone Pays |
|---|---|---|
| 300 kV and above | 100% | 0% |
| above 100 kV and below 300 kV | 33% | 67% |
| 100 kV and below | 0% | 100% |

# RESOURCE ADEQUACY

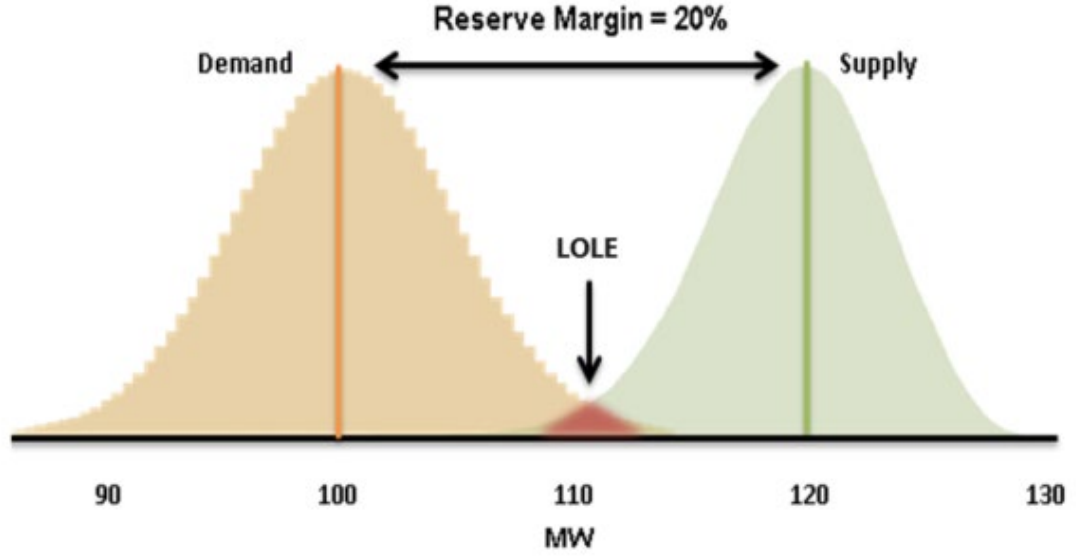
# SPP'S RESOURCE ADEQUACY APPROACH

- Requirements imposed on load responsible entities
- Regional requirements for resource adequacy
- Bilateral capacity market
- Compliance measured through data submission and enforced by SPP tariff
- PRM requirement established through biennial Loss of Load Expectation (LOLE) analyses
- Forward looking 6 months to 5 years


Capacity
All team members' ability to play
Energy
Output of players on field
Reserve margin
Ability of bench members to play

# LOSS OF LOAD EXPECTATION (LOLE)

- An LOLE Study is performed by SPP biennially (every two years) to assess the Planning Reserve Margin (PRM)
  - Probabilistic Study that analyzes the ability to reliably serve the SPP Balancing Authority Area's forecasted Peak Demand
    - SPP currently utilizes a 1 day in 10 years metric at assess minimum PRM
    - Evaluates each hour of the year using multiple sequential Monte-Carlo simulations
  - Inputs and assumptions are developed by SPP's stakeholder driven Supply Adequacy Working Group
  - Results give insight to SPP stakeholders and respective state commissions when making policy decisions related to resource adequacy



# THIS ISN'T OUR PARENTS' ELECTRIC GRID

Smart meters

Advanced technologies

Generator retirements

Environmental constraints

Compliance

Cybersecurity

Microgrids

Wind

Energy efficiency

Prosumers

Evolving grid

Electric vehicles

Fuel prices

Battery storage

Solar

Consumer demand

Distributed generation

Extreme weather events

Demand response

# PLANNING FOR AN UNCERTAIN FUTURE