



EESI
Environmental and Energy
Study Institute



WIRES University Overview of ISO/RTOs

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OUR MISSION

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

Northeast Blackout of 1965

LIFE

5:28 P.M., NOV. 9th
THE LIGHTS
WENT
OUT



In view looking east from Times Square during blackout, moon reflects in windows of Empire State Building.

NOVEMBER 19, 1965 • 35¢



LIFE

POWER FAILURE BLACKS OUT NEW YORK; THOUSANDS TRAPPED IN THE SUBWAYS; LOOTERS AND VANDALS HIT SOME AREAS

State Troopers Sent Into City As Crime Rises

Some Civilians Assist - 65 Blackout Peaceful in Contrast

By LAWRENCE VAN COTTEN
Thousands of homes, unattended by sleeping and vacationing people through the city last night and early today in a total darkness, lying in wait for the return of power, were the scene of a peaceful but somewhat chaotic scene. Some looting and vandalism were reported in some areas, but the city as a whole was quiet.



A view of the darkened New York City skyline taken from Westchester during blackout last night.

Westchester Is Also Darkened After Lightning Hits Line

By ROBERT D. McFARLANE
A power failure plunged New York City, its surrounding metropolitan area and Westchester County into darkness last night, disrupting the lives of nearly four million people. The cause of the blacked-out power was a lightning bolt that struck a power line near the town of Westchester, N. Y., about 100 miles from New York City. The lightning bolt caused a power line to snap, and the power line was cut. The power line was cut, and the power line was cut.

By FRANK R. MCGEE
In a quiet but somewhat chaotic scene, some looting and vandalism were reported in some areas, but the city as a whole was quiet.

Some Led Others by Flashlight, Lightning Bolt Some Knocked on Doors to Help

By ROBERT D. McFARLANE
The blacked-out city was a scene of chaos and confusion. Some people were using flashlights to see, and some were knocking on doors to help.

To Our Readers
This is a special blacked-out edition of the New York Times. It is a special edition of the New York Times, and it is a special edition of the New York Times.



Northeast Blackout of 1965

Electric Reliability Act of 1967 & North American Electric Reliability Corporation (NERC)

- Tuesday, November 9, 1965
- Affected parts of **Ontario** in **Canada** and **Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont** in the **United States**
- Over 30 million people and 80,000 square miles without electricity for up to 13 hours

Northeast Blackout of 2003



NORTHEAST BLACKOUT 2003

Led to the Energy Policy Act of 2005

Our Major Services

- Reliability Coordination
- Market Operation
- Transmission Planning
- Transmission Service/Tariff Administration

- Balancing Authority
- Facilitation
- Standards Setting
- Compliance Enforcement
- Training

OUR APPROACH:

Regional, Independent, Cost-Effective and Focused on Reliability

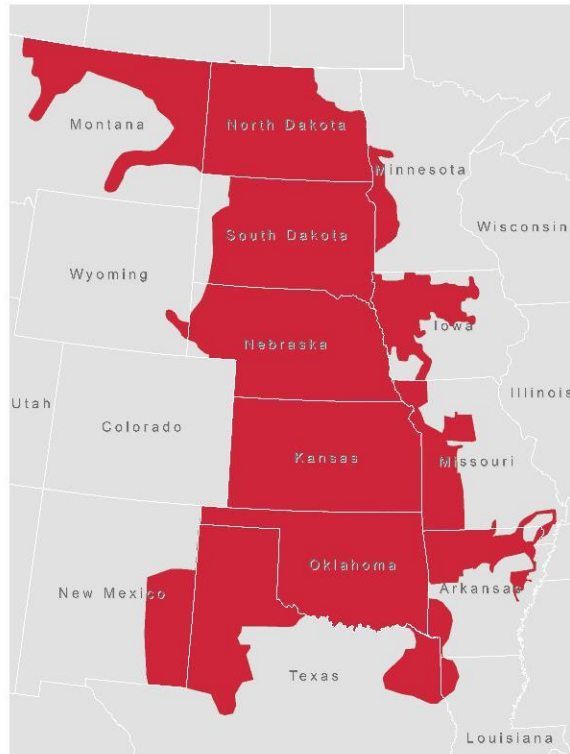
Some Activities Outside of SPP's Responsibility

- Transmission Siting
- Generation Planning/Siting
- Transmission/Generation Construction
- Transmission/Generation Permitting
- Credit/Allowance Trading Oversight

Independent System Operator (ISO) / Regional Transmission Organization (RTO) Map

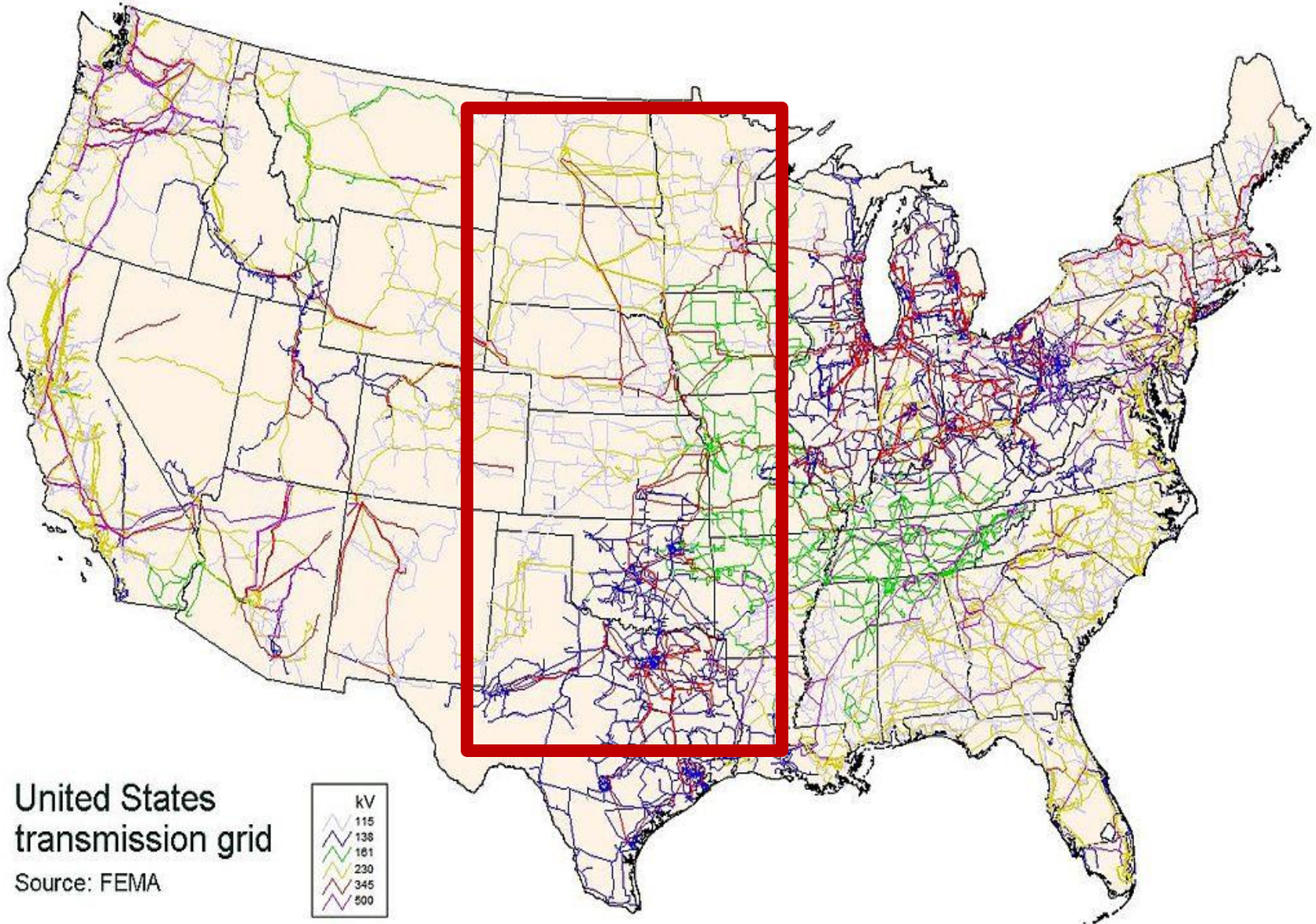


The SPP Footprint: Members in 14 States



- **Arkansas**
- **Kansas**
- **Iowa**
- **Louisiana**
- **Minnesota**
- **Missouri**
- **Montana**
- **Nebraska**
- **New Mexico**
- **North Dakota**
- **Oklahoma**
- **South Dakota**
- **Texas**
- **Wyoming**

United States Electric Grid

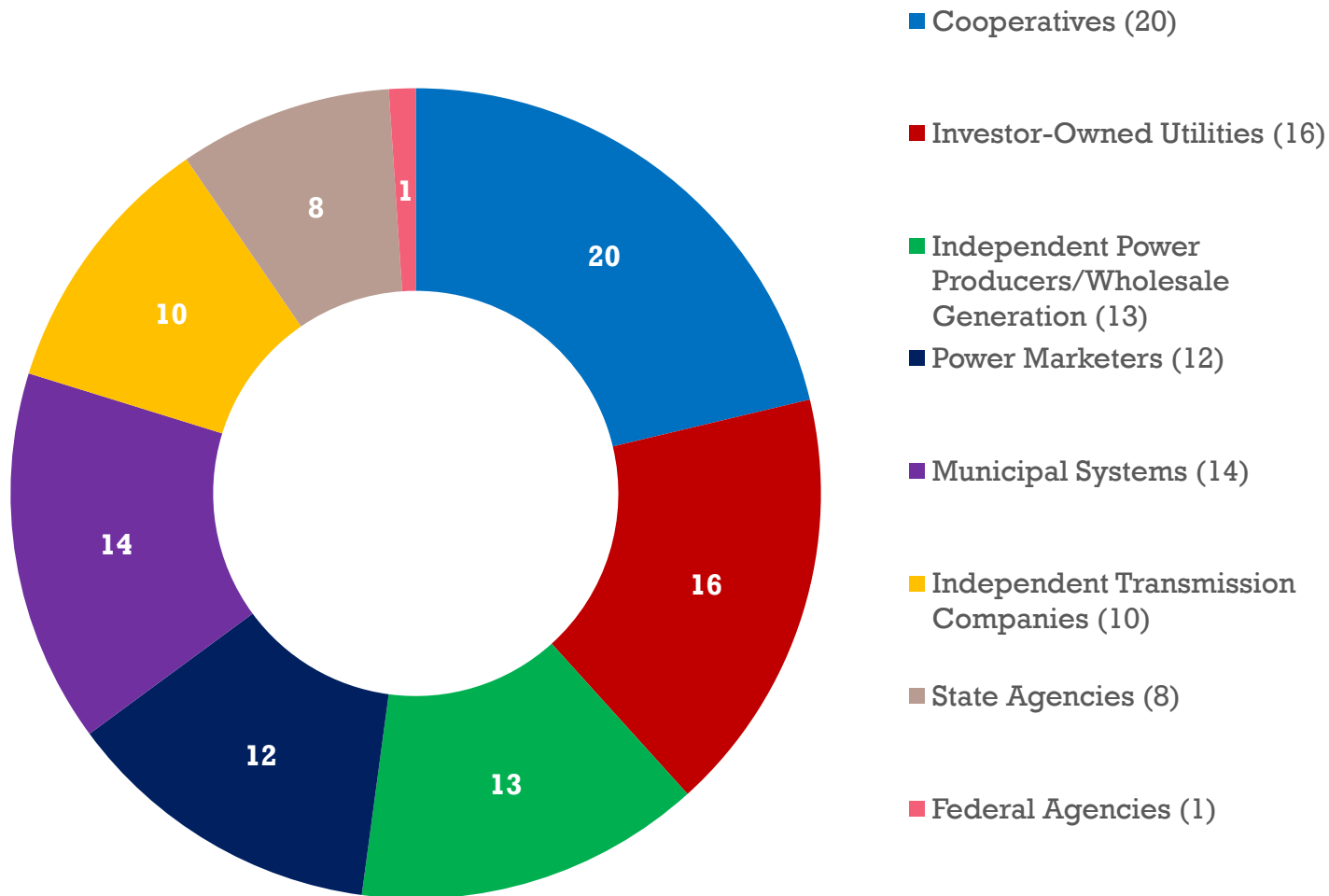


Operating Region



- Miles of service territory: 575,000
- Population served: 18M
- Generating Plants: 703
- Substations: 4,757
- Miles of transmission:
60,944
 - 69 kV 13,532
 - 115 kV 14,269
 - 138 kV 9,117
 - 161 kV 5,647
 - 230 kV 7,608
 - 345 kV 10,772

SPP's 94 Members: Independence Through Diversity



As of August 11, 2016

REGULATORY ENVIRONMENT

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

GOVERNANCE

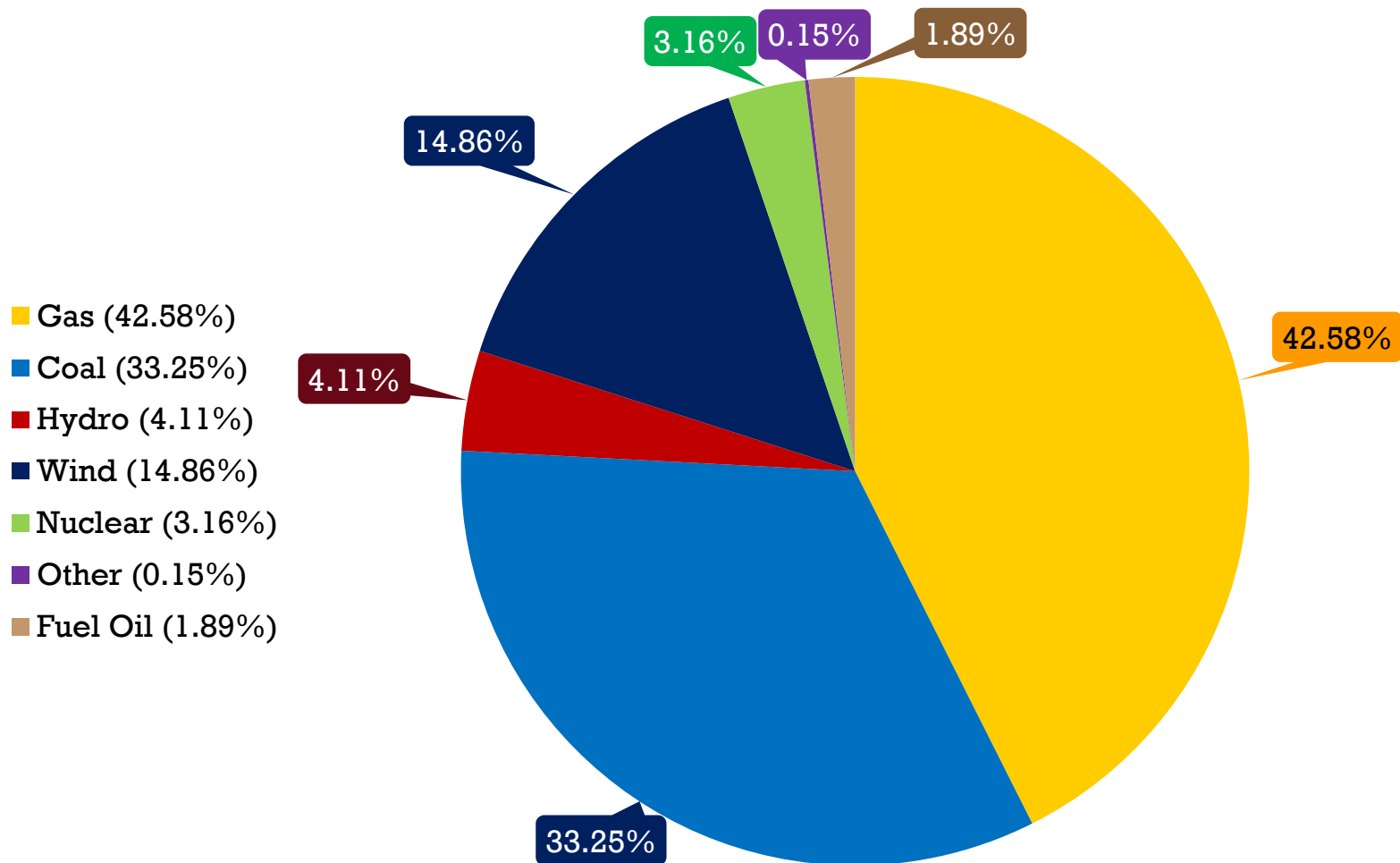
- Independent Board of Directors
- Members Committee
- Regional State Committee
- Working Groups



Reliability Coordination: air traffic controllers of the bulk power grid

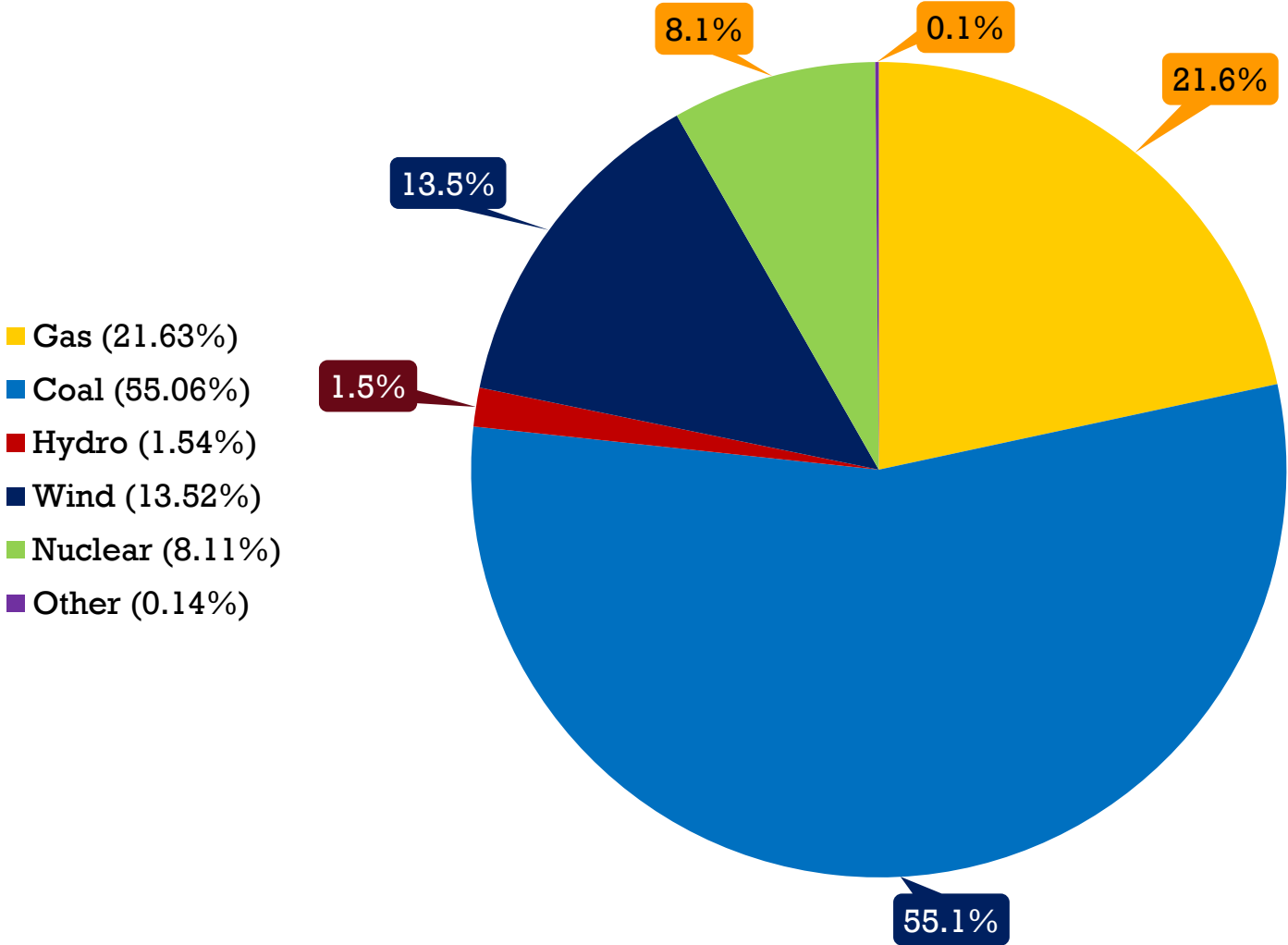
- Monitor grid 24 x 365
- Anticipate problems
- Take preemptive action
- Coordinate regional response
- Independent
- Comply with more than 5,500 pages of reliability standards and criteria

2015 Energy Capacity* by Fuel Type



* Figures refer to nameplate capacity

2015 Energy Consumption by Fuel Type



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.

Integrated Marketplace Savings

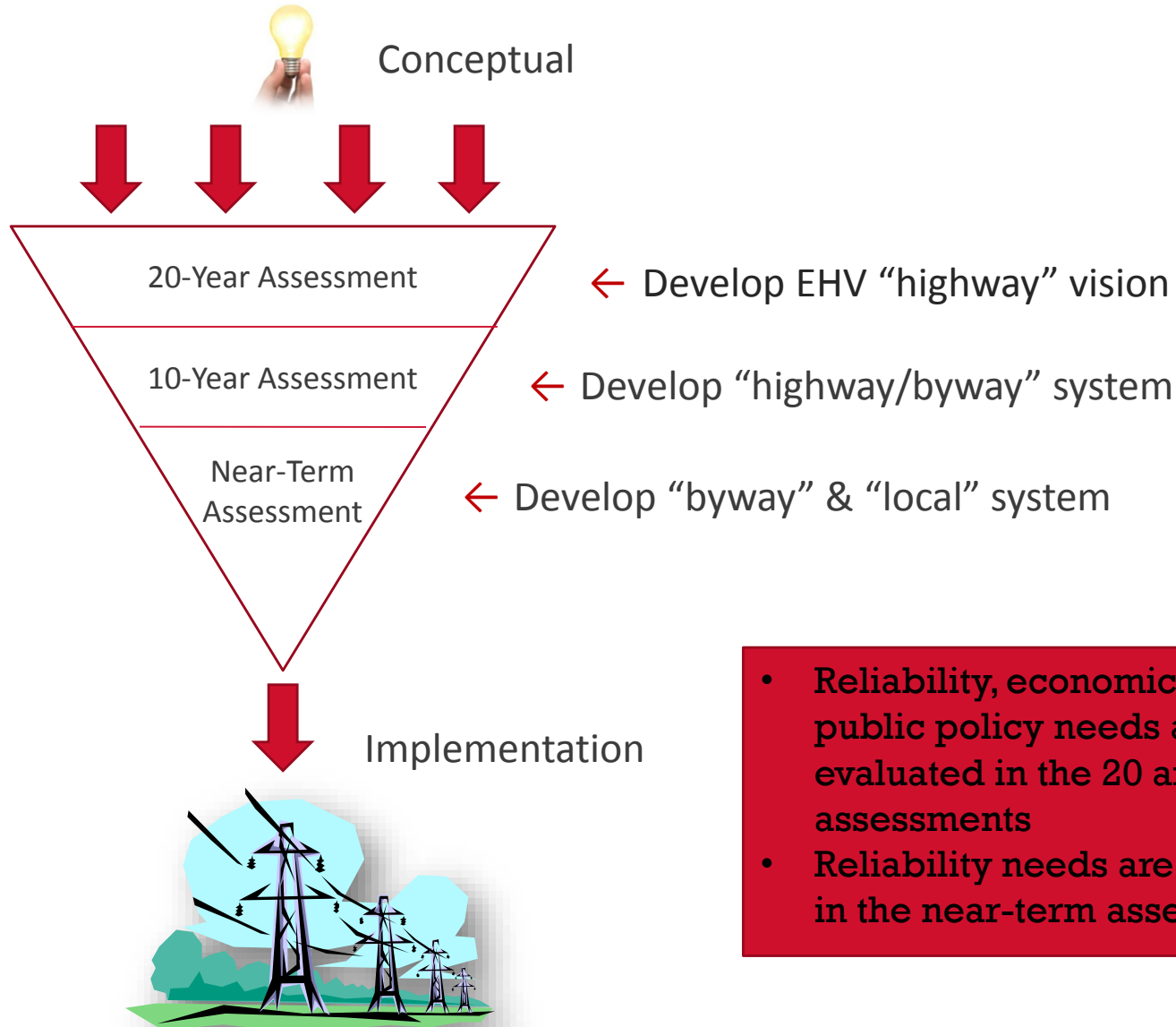
- Market continues to provide savings even with extremely low natural gas prices
- First year net savings calculated to be \$380 million
- 2015 annual net savings calculated to be \$422 million
- At the end of September, 2016 the savings amount was over \$1 Billion from the Integrated Marketplace

Transmission Planning

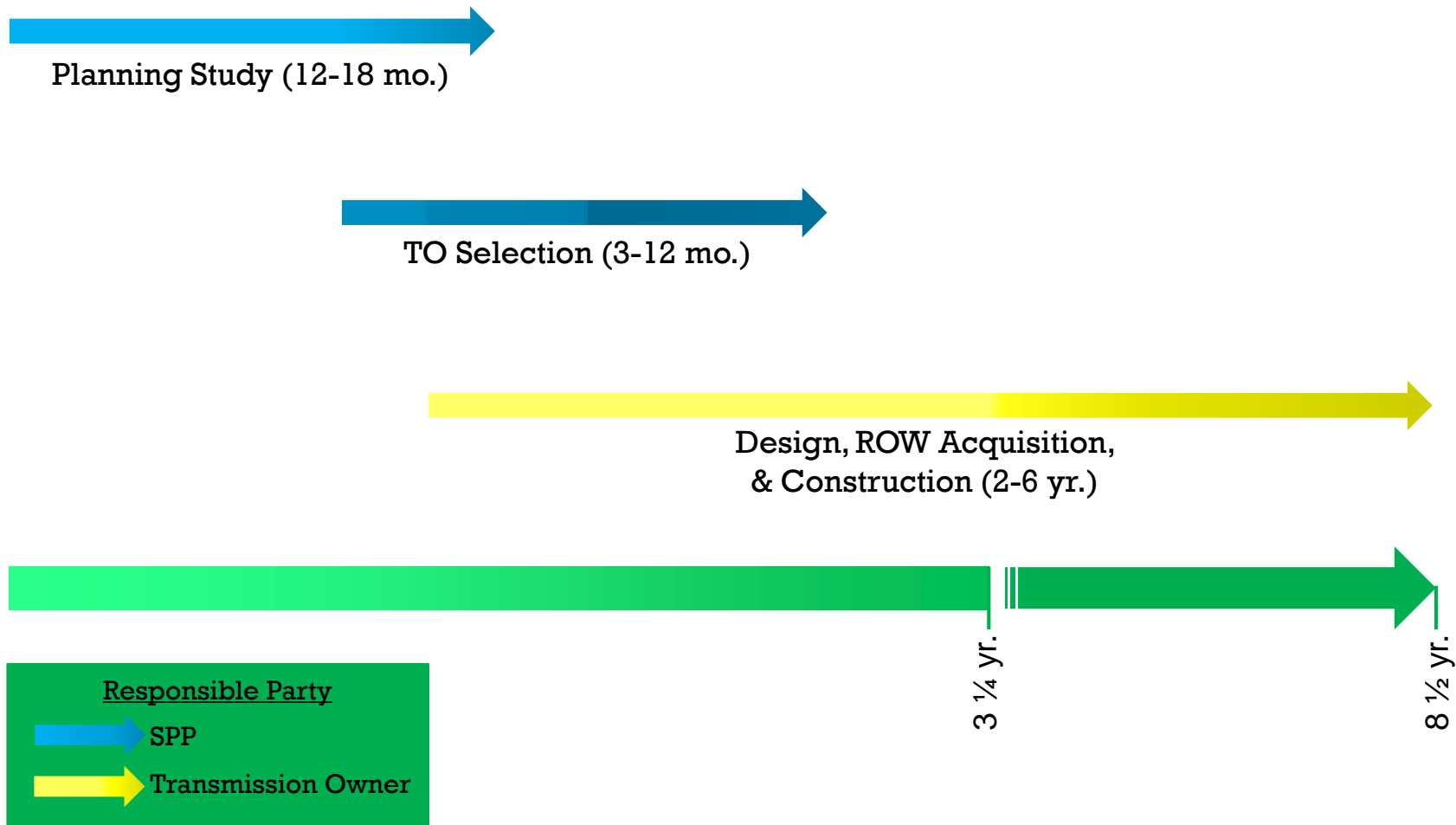
- Reliability
- Economics
- Public Policy



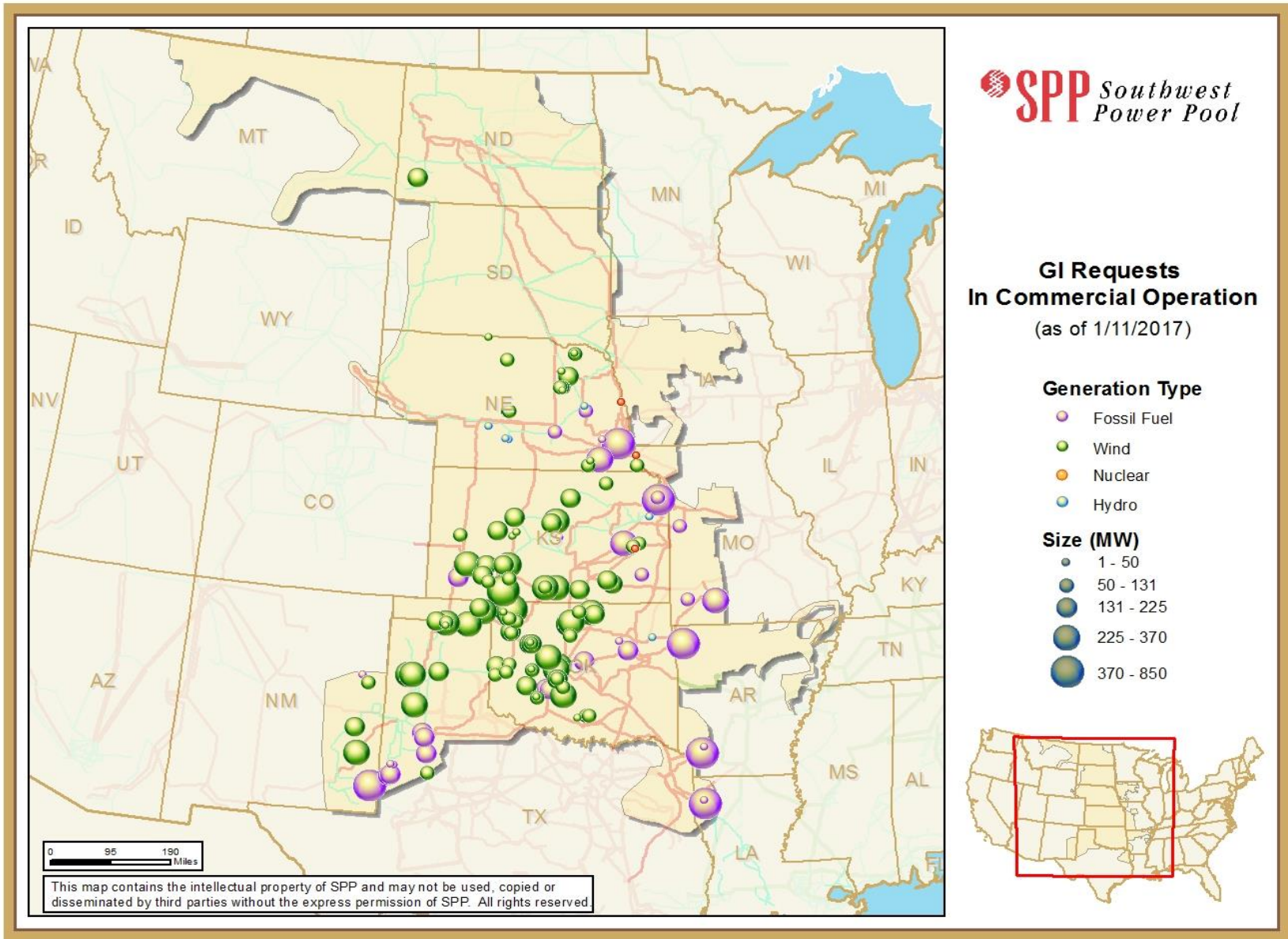
Integrated Transmission Planning (ITP)



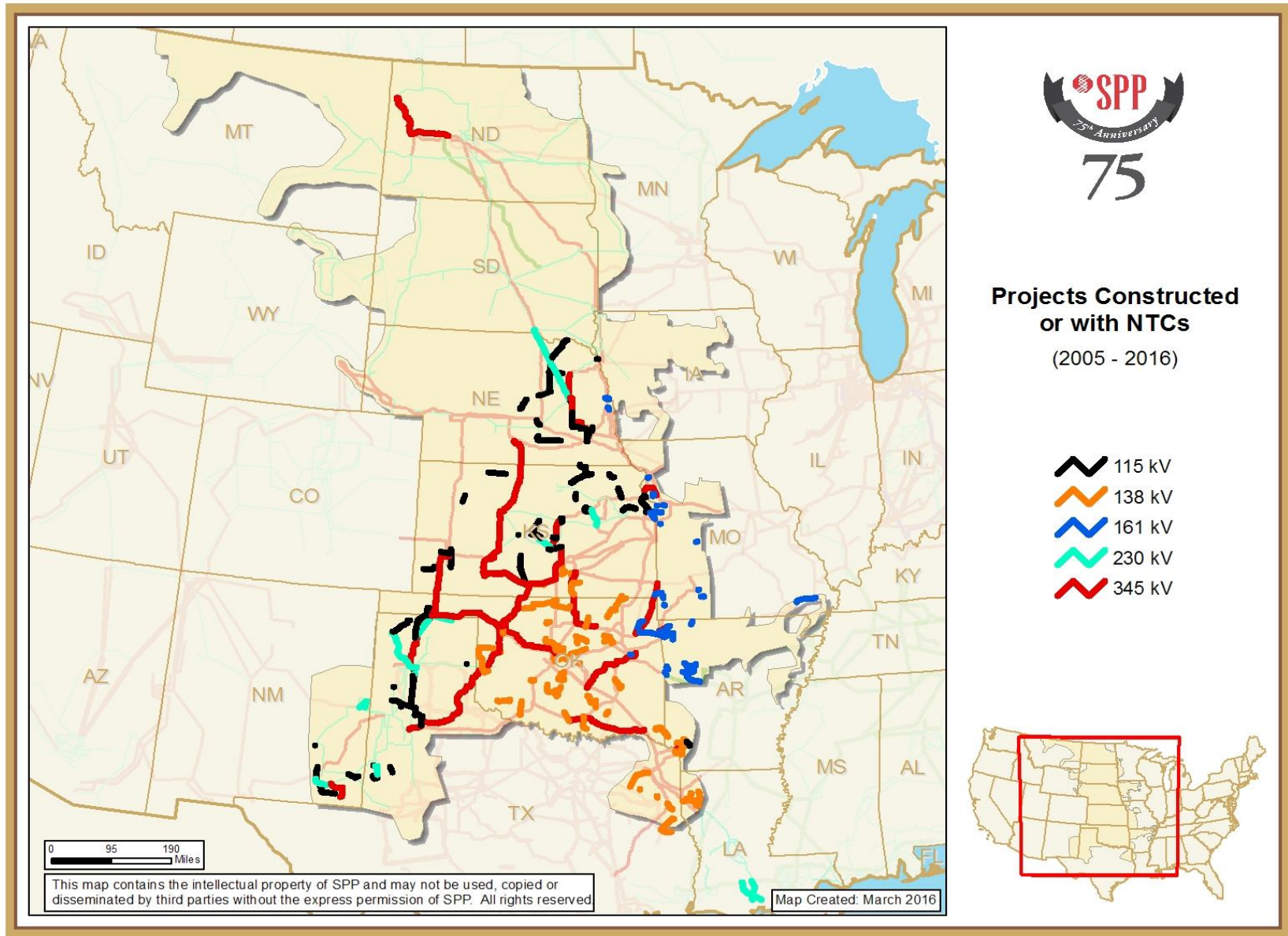
Transmission Build Cycle in SPP



Generation Expansion in SPP Over the Last Decade

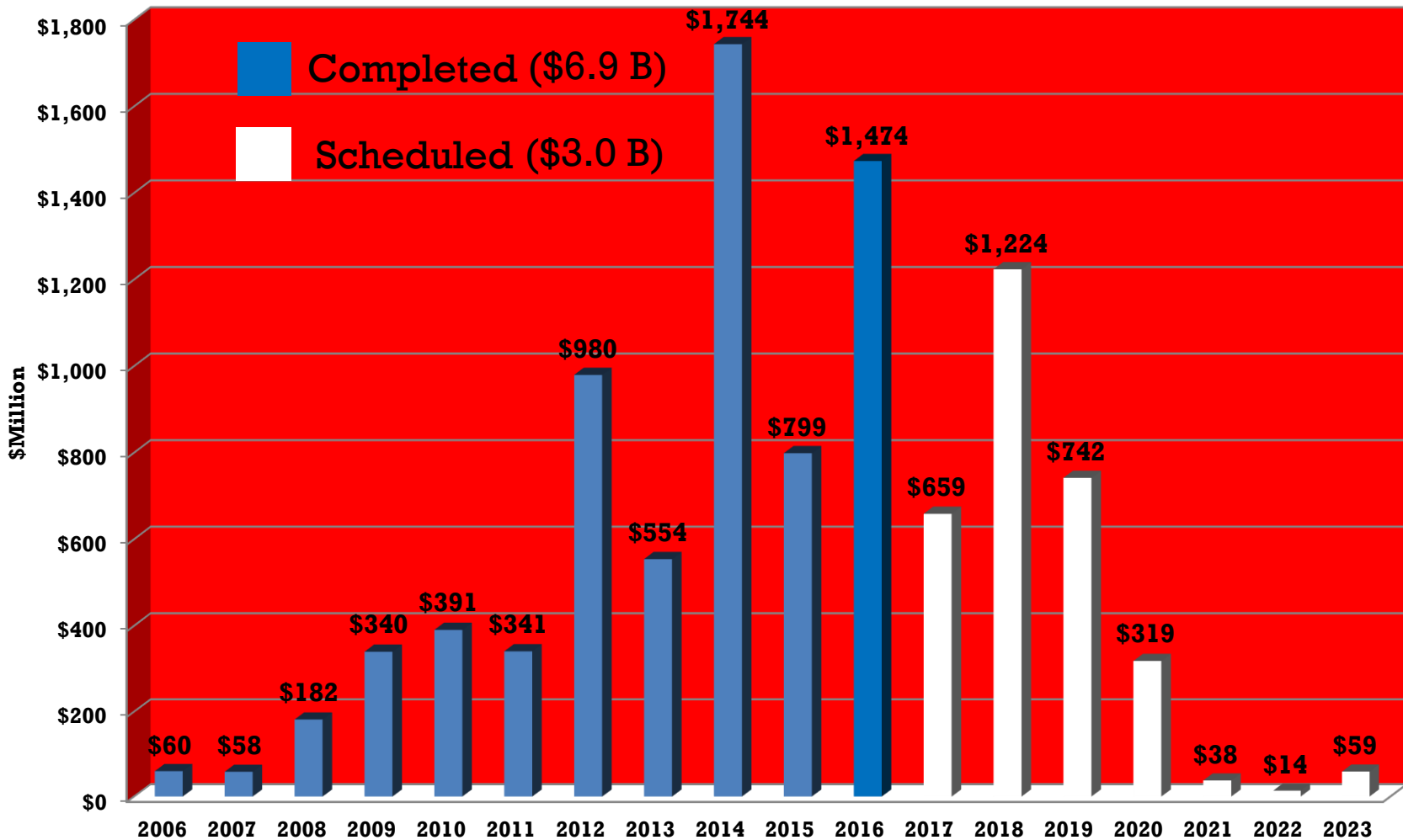


Transmission Expansion in SPP Over the Last Decade



Transmission Investment Directed By SPP

Annual Transmission Investment Directed By SPP



Who Pays for Transmission Projects?

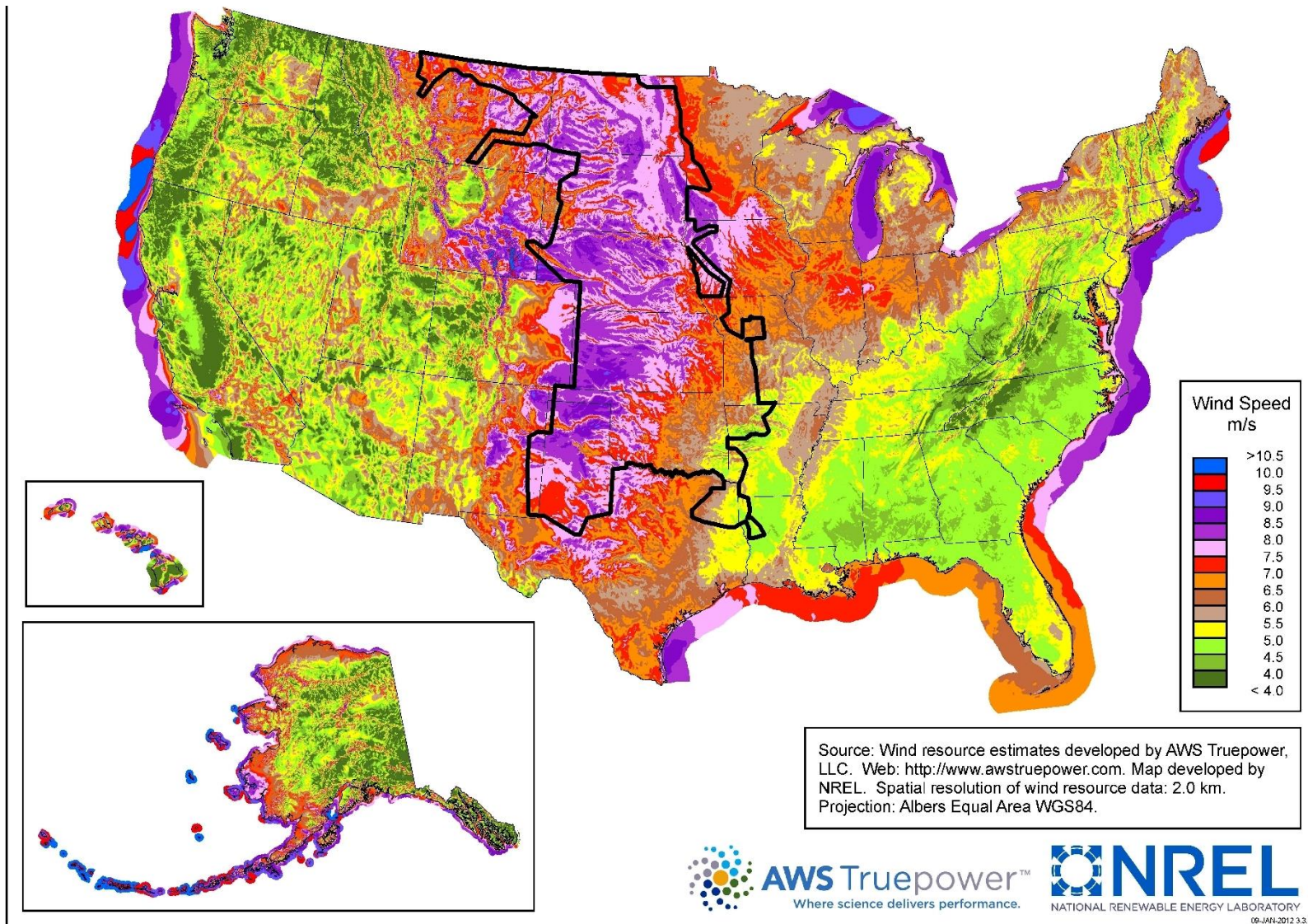
- **Sponsored**: Project owner builds and receives credit for use of transmission lines
- **Directly-assigned**: Project owner builds and is responsible for cost recovery and receives credit for use of transmission lines
- **Highway/Byway**: Most SPP projects paid for under this methodology

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%

Renewables in SPP



The highest wind speed in the country is within SPP Balancing Authority

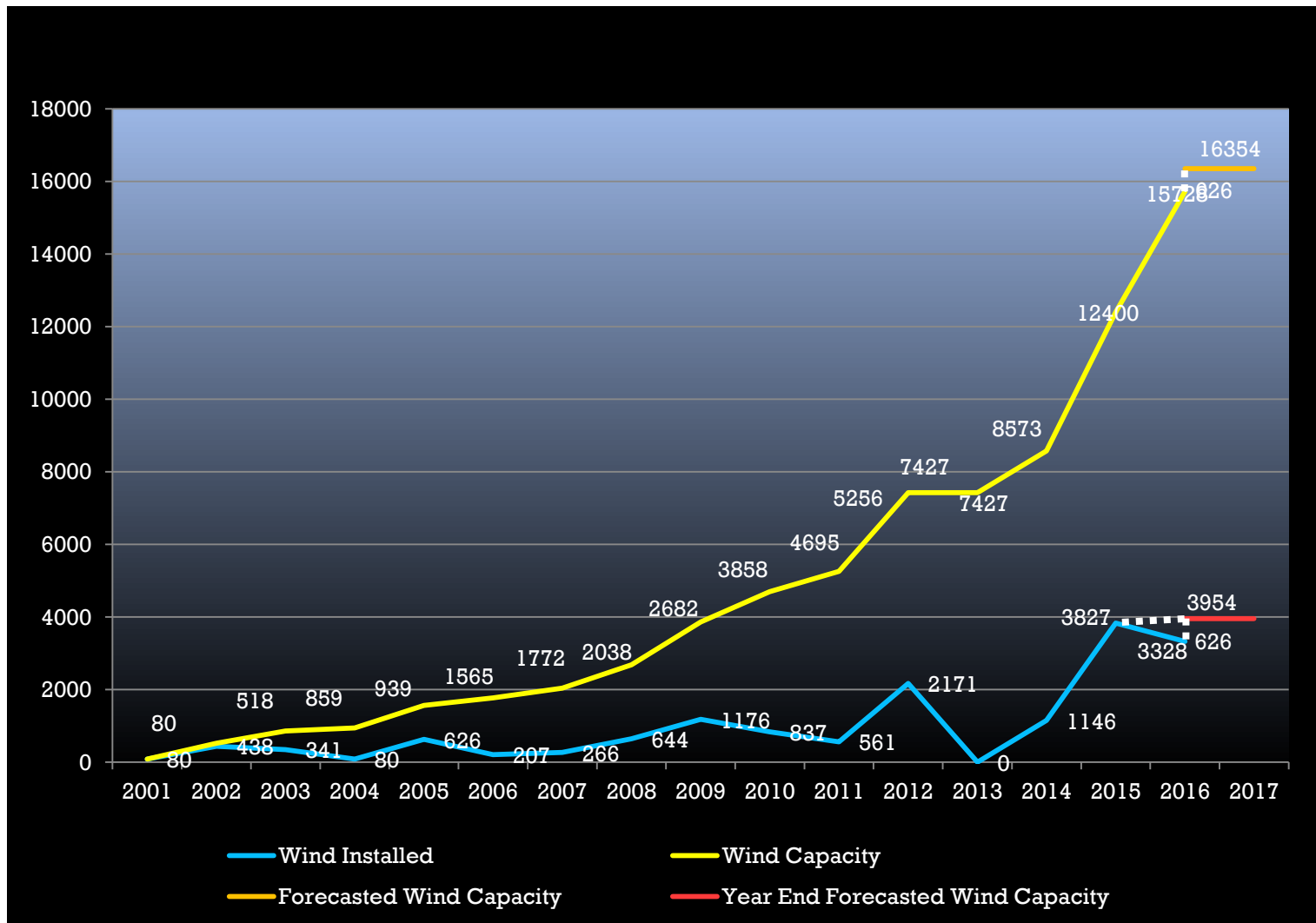


Wind Energy Development

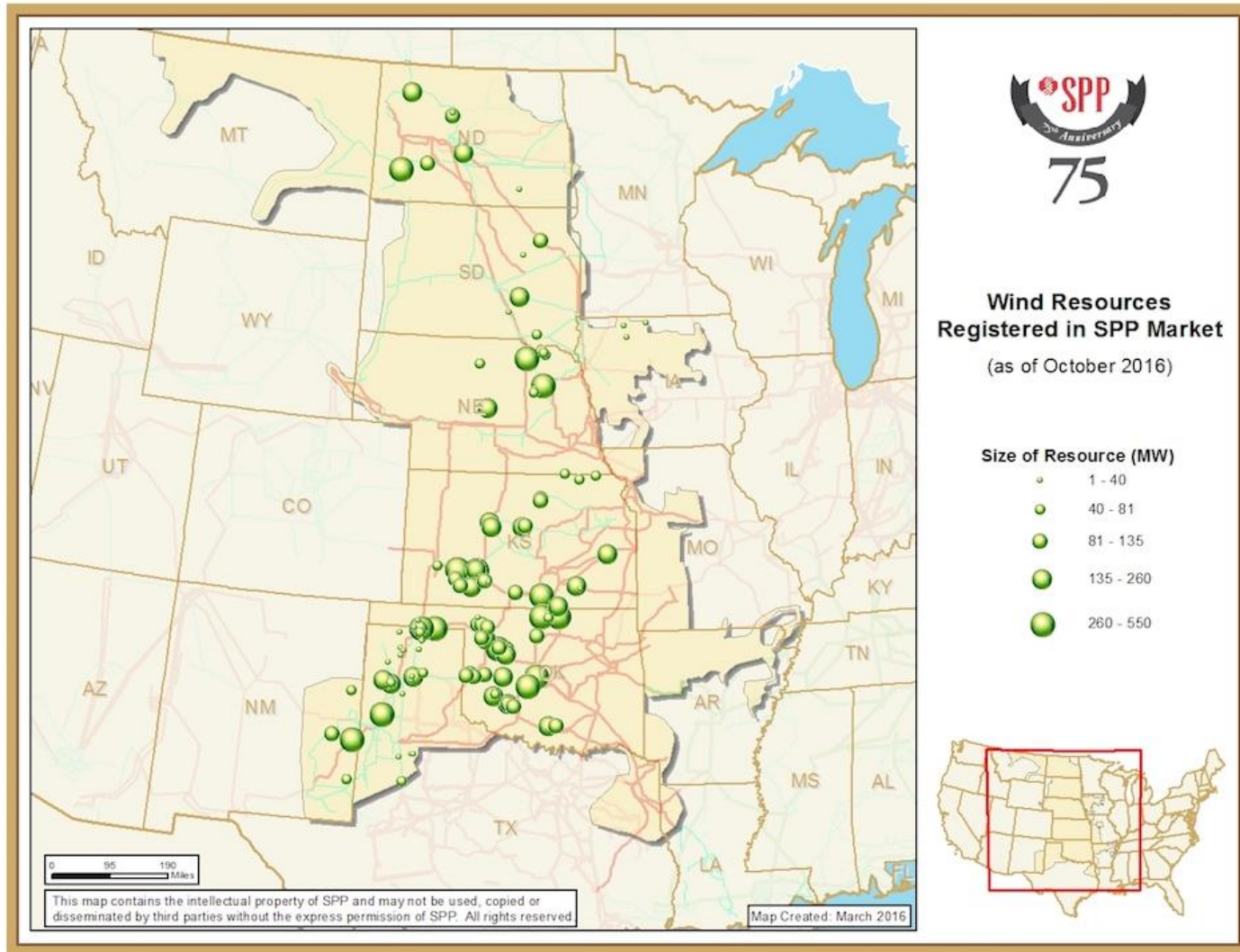
- SPP's "Saudi Arabia" of wind: Kansas, Oklahoma, Nebraska, Texas Panhandle, and New Mexico
 - 60,000-90,000 MW potential
 - More wind energy than SPP uses during peak demand
- 15,782 MW capacity of in-service wind*
- 34,730 MW wind in all stages of development*
 - Includes Generation Interconnection queue and executed Interconnection Agreements

* December 2016

Wind Capacity has grown significantly



Wind units are concentrated in the middle of the footprint



Renewables impacts to SPP

- Peak Wind Penetration level: **49.17%** April 2016
- Peak instantaneous Wind generation: **12,336 MW** December 2016
- High impact on congestion and loading of the transmission system
- Wind can cause capacity issues by
 - Not showing up during times of high demand, contributing to capacity shortages
 - Showing up too high during times of low demand, contributing to “Min Gen” issues
 - Uncertainty complicating unit commitments
- Short-term, intra-hour changes in wind also require reserves to maintain balance between generation and obligations
- Wind forecast is crucial for SPP to have the right generation online at the right time, while maintaining the reliability and economic efficiency of the regional transmission grid.

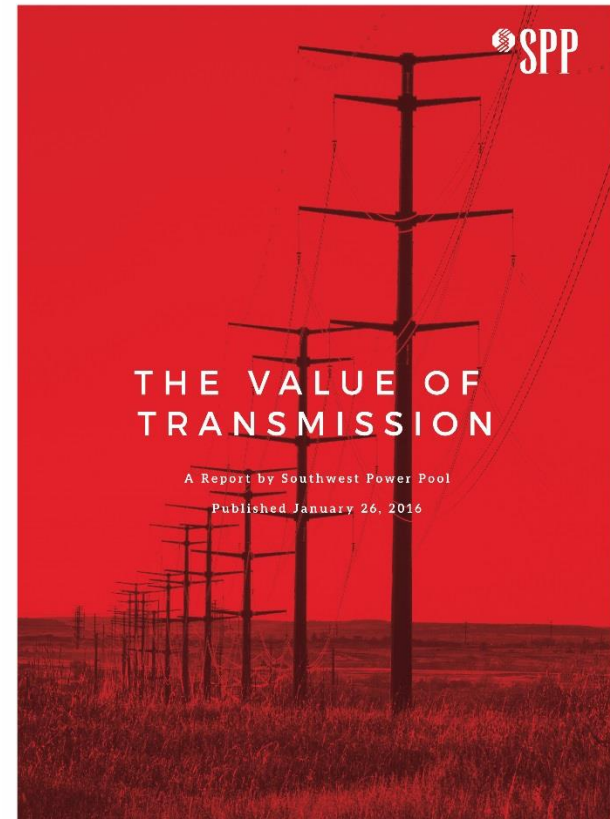
MODERNIZING THE GRID

THE VALUE OF TRANSMISSION

www.SPP.org/value-of-transmission

SPP's Value of Transmission Study

- Evaluated 348 projects from 2012-14, representing \$3.4B of transmission investment
- Evaluated benefit metrics
 - Adjusted Production Cost (APC) Savings
 - Reliability and Resource Adequacy Benefits
 - Generation Capacity Cost Savings
 - Market Benefits
 - Other industry and SPP-accepted metrics
- APC Savings alone calculated at more than \$660k/day, or \$240M/year.
- Overall NPV of all benefits for considered projects are expected to exceed \$16.6B over 40 years.



For every \$1 of transmission investment made in 2012-2014, SPP expects at least \$3.50 of benefit to be provided to rate-payers