SOUTHWEST POWER POOL ("SPP") UPDATE

DANA MURPHY
COMMISSIONER
OKLAHOMA CORPORATION COMMISSION

APRIL 9, 2019
Helping our members work together to keep the lights on... today and in the future.
AGENDA

- Oklahoma Corporation Commission ("OCC")
  - SPP Overview
  - Oklahoma Presence
  - OCC Participation
- Public Service Company of Oklahoma ("PSO")
- Oklahoma Gas & Electric ("OGE")
SOUTHWEST POWER POOL ("SPP") 101

• The SPP was established in 1941 when 11 utilities pooled electricity to power the Jones Mill aluminum plant, which was needed for WWII critical defense purposes

• SPP was maintained after WWII to continue benefits of regional coordination

• SPP Corporate Office located in Little Rock, AR

• Approx. 600 employees w/jobs in IT, electrical engineering, operations, legal, regulatory, settlements, and more

• 24x7 operation w/full redundancy and a backup site
## AIR TRAFFIC CONTROL: AN ANALOGY

<table>
<thead>
<tr>
<th>Air Traffic Control</th>
<th>Southwest Power Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td>does not own the airplanes, airlines or airports</td>
<td>does not own the utilities, power generators or transmission lines</td>
</tr>
<tr>
<td>does not own the sky that it monitors</td>
<td>Does not own the land the electricity flows across</td>
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<tr>
<td>directs air routes to ensure airplanes and passengers are safely transported from one destination to the next</td>
<td>Monitors and directs the bulk power grid in our region to ensure electricity gets from where it’s made to where it’s needed</td>
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REGULATORY ENVIRONMENT

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

• 1998: Implemented tariff administration
• 2004: Became FERC-approved Regional Transmission Organization (“RTO”)
• 2007: Launched Energy Imbalance Service (“EIS”) market
• 2009: Integrated Nebraska Utilities (NPPD, OPPD, LES)
• 2010: FERC approved Highway/Byway cost allocation methodology and Integrated Transmission Planning (“ITP”) Process
SPP TIMELINE & MILESTONES

• 2012: Moved to new Corporate Center

• 2014: Launched Integrated Marketplace ("IM") which replaced the EIS market and became the Balancing Authority for the footprint

• 2015: Integrated System ("IS") joins SPP: consists of utilities in the following states: IA, MN, MT, ND, SD, & WY
OKLAHOMA STATUTES AND RULES GOVERNING SPP PARTICIPATION

- **SENATE BILL NO. 827: 2009 LEGISLATIVE SESSION**
  - Promote development of transmission infrastructure to support expansion of wind energy facilities, authorizes employment of one person to advise the OCC, and shall attend and participate in meetings of the SPP.

- **TITLE 17 CHAPTER 13A SECTION 287 - LEGISLATIVE DECLARATION - PROMOTION OF WIND-ENERGY DEVELOPMENT-PLAN TO EXPAND TRANSMISSION CAPACITY IN STATE: 2010 LEGISLATIVE SESSION**
  - A. Develop robust transmission grid to facilitate delivery of renewable energy, improve reliability of the grid, promote wind energy to be utilized in every part of the state and exported to other states.
  - B. Work with SPP to develop transmission expansion plan with final report due January 1, 2020.
SPP’S 97 MEMBERS: INDEPENDENCE THROUGH DIVERSITY

- 16 Investor-Owned Utilities
- 14 Municipal Systems
- 20 Generation and Transmission Cooperatives
- 8 State Agencies
- 14 Independent Power Producers
- 12 Power Marketers
- 11 Independent Transmission Companies
- 1 Federal Agency
- 1 Large Retail Customer

97 Members
SPP MEMBER BREAKDOWN

Transmission Owner ("TO")/Transmission User ("TU")

- TOs w/more than 500 miles of transmission: 18
- TOs w/less than 500 miles of transmission: 27
- TU: 52
- Total Members: 97
OKLAHOMA SPP MEMBERS: TOs w/MORE THAN 500 MILES OF TRANSMISSION

- OKLAHOMA GAS & ELECTRIC: INVESTOR-OWNED UTILITY
- PUBLIC SERVICE COMPANY OF OKLAHOMA: INVESTOR-OWNED UTILITY
- EMPIRE DISTRICT ELECTRIC: INVESTOR-OWNED UTILITY
- WESTERN FARMERS ELECTRIC COOPERATIVE: COOPERATIVE
- GRAND RIVER DAM AUTHORITY: STATE AGENCY
OKLAHOMA SPP MEMBERS: TOs w/LESS THAN 500 MILES OF TRANSMISSION

- OKLAHOMA MUNICIPAL POWER AUTHORITY ("OMPA"): MUNICIPAL
- AEP OKLAHOMA TRANSMISSION COMPANY: INVESTOR-OWNED UTILITY
- ITC–GREAT PLAINS: INDEPENDENT TRANSMISSION COMPANY
- GRIDLiANCE HIGH PLAINS: INDEPENDENT TRANSMISSION COMPANY
OKLAHOMA SPP MEMBERS: TUs

- CPV RENEWABLE ENERGY COMPANY: INDEPENDENT POWER PRODUCER
- EDP RENEWABLES NORTH AMERICA: INDEPENDENT POWER PRODUCER
- ENEL GREEN POWER NORTH AMERICA: INDEPENDENT POWER PRODUCER
- NEXTERA ENERGY RESOURCES: INDEPENDENT POWER PRODUCER
- NEXTERA ENERGY TRANSMISSION: INDEPENDENT TRANSMISSION COMPANY
OKLAHOMA SPP MEMBERS: TUs

- OGE TRANSMISSION: INVESTOR-OWNED UTILITY
- PLAINS AND EASTERN CLEAN LINE: INDEPENDENT TRANSMISSION COMPANY
- TRI-COUNTY ELECTRIC COOPERATIVE: COOPERATIVE
- WALMART INC.: LARGE RETAIL CUSTOMER
OKLAHOMA LOAD SERVING ENTITIES ("LSE") AND THEIR REGIONAL LOAD RATIO SHARE ("LRS")

- OKLAHOMA GAS & ELECTRIC: 12.23%
- PUBLIC SERVICE COMPANY OF OKLAHOMA: 7.67%
- WESTERN FARMERS ELECTRIC COOPERATIVE: 3.30%
- GRAND RIVER DAM AUTHORITY: 2.00%
- OKLAHOMA MUNICIPAL POWER AUTHORITY: 1.20%
- TRI-COUNTY ELECTRIC COOPERATIVE: 0.30%
- EMPIRE DISTRICT ("OK CUSTOMERS"): 0.0675%
- TOTAL OK REGIONAL LRS: 26.77%
MEMBERS IN 14 STATES

- Arkansas
- Kansas
- Iowa
- Louisiana
- Minnesota
- Missouri
- Montana
- Nebraska
- New Mexico
- North Dakota
- Oklahoma
- South Dakota
- Texas
- Wyoming
STATE REGULATORS’ ROLE

- Regional State Committee — Retail regulatory commissioners from:
  - Arkansas  Missouri  Oklahoma
  - Iowa  Nebraska  South Dakota
  - Kansas  New Mexico  Texas
  - Louisiana  North Dakota

- Membership: Open to all government entities that:
  - Regulate retail electricity or distribution rates of SPP Members; or
  - Primary regulatory agency responsible for siting electric transmission facilities of SPP Members
STATE REGULATORS’ ROLE

- Primary responsibility for:
  - Cost allocation for transmission upgrades
  - Approach for regional resource adequacy
  - Allocation of transmission rights in SPP’s markets
OKLAHOMA CORPORATION COMMISSION INVOLVEMENT AND PARTICIPATION IN SPP

- COMMISSIONER DANA L. MURPHY: OKLAHOMA RSC MEMBER AND SENIOR RSC MEMBER – 2011
- BRANDY WREATH: DIRECTOR OF THE PUBLIC UTILITY DIVISION
  - JASON CHAPLIN: OKLAHOMA COST ALLOCATION WORKING GROUP (“CAWG”) MEMBER
  - MARYDORIS CASEY: FUEL ADJUSTMENT CLAUSE MONTHLY & ANNUAL INTEGRATED MARKETPLACE ACTIVITY AND ANNUAL SPP COST TRACKER RE-DETERMINATIONS
- COMMITTEE & WORKING GROUP COVERAGE: FC, SPC, MOPC, CAWG, PCWG, SAWG, TWG, ESWG, RTWG, RARTF, MWG, CWG, SUG
RSC TIMELINE & MILESTONES

• FEB. 10, 2004: SPP APPROVED AS AN RTO
• APRIL 26, 2004: RSC ADOPTS SPP RSC BYLAWS
• OCT. 2004: RSC APPROVES BASE PLAN FUNDING COST ALLOCATION
• JAN. 2007: RSC APPROVES ATTACHMENT Z CREDITING PROCESS
• JAN. 2008: RSC APPROVES BALANCED PORTFOLIO COST ALLOCATION
• APRIL 2009: RSC APPROVES INTEGRATED TRANSMISSION PLANNING (“ITP”)

RSC TIMELINE & MILESTONES

• JUNE 2009: RSC APPROVES WIND COST ALLOCATION
• OCT. 2009: RSC APPROVES HIGHWAY/BYWAY COST ALLOCATION
• OCT. 2010: RSC APPROVES COST ALLOCATION WORKING GROUP’S (“CAWG”) TRANSMISSION CONGESTION RIGHTS (“TCR”) RECOMMENDATION
• APRIL 2012: RSC DENIES PROPOSED HUB AND SPOKE WIND PROJECT
• OCT. 2012: RSC APPROVES ORDER 1000 INTERREGIONAL COST ALLOCATION
RSC TIMELINE & MILESTONES

• April 2014: RSC approves guidelines for providing long-term TCRS
• Oct. 2014: RSC approves non-order 1000 cost allocation
• Oct. 2016: RSC approves new member cost allocation review process
• Jan. 2017: RSC approves resource adequacy requirement
• April 2017: RSC approves SPP/AECI interregional project
SPP FAST FACTS
OPERATING REGION

- Service territory: 546,000 square miles
- Population served: 17.5 million
- Generating plants: 818*
- Substations: 5,054*

*In SPP’s reliability coordination footprint
- Miles of transmission: 66,892
  - 69 kV: 17,340
  - 115 kV: 15,846
  - 138 kV: 9,367
  - 161 kV: 5,567
  - 230 kV: 7,534
  - 345 kV: 11,146
  - 500 kV: 92
GENERATING CAPACITY* BY FUEL TYPE (89,999 MW TOTAL)

- Gas (40.3%)
- Coal (28.6%)
- Wind (22.9%)
- Hydro (3.8%)
- Nuclear (2.3%)
- Fuel Oil (1.8%)
- Solar (0.2%)
- Other (0.1%)

*Figures refer to nameplate capacity as of 1/1/19
GENERATING CAPACITY BY FUEL MIX OVER TIME
2018 ENERGY PRODUCTION BY FUEL TYPE (275,887 GWH TOTAL)

- Coal (42.4%)
- Wind (23.5%)
- Gas (23.4%)
- Nuclear (5.4%)
- Hydro (4.8%)
- Fuel Oil (0.2%)
- Solar (0.2%)
- Other (0.1%)
ENERGY PRODUCTION
BY GENERATION TYPE OVER TIME

![Energy Production Graph](image-url)
GENERATOR INTERCONNECTION REQUESTS UNDER STUDY (BY FUEL TYPE): 84,099 MW TOTAL

- **Wind**: 54,625 MW (30%)
- **Solar**: 24,753 MW (15%)
- **Storage**: 4,405 MW (2.5%)
- **Gas**: 312 MW (0.2%)
- **Other**: 4 MW (0.0%)

*As of February 5, 2019*
MARKETS
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 THAT ARE 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.
TRANSMISSION MARKET
TRANSMISSION MARKET

- PROVIDES “ONE-STOP SHOPPING” FOR USE OF REGIONAL TRANSMISSION LINES
- CONSISTENT RATES, TERMS, CONDITIONS FOR ALL USERS
- INDEPENDENT
- APPROXIMATELY 7,900 TRANSACTIONS PER MONTH ON AVERAGE IN 2018
- 2018 TRANSMISSION CUSTOMER TRANSACTIONS = $4.47 BILLION

AS A “SALES AGENT,” SPP ADMINISTERS A TRANSMISSION TARIFF GREATER THAN 6,500 PAGES IN LENGTH ON BEHALF OF ITS MEMBERS AND CUSTOMERS.
HOW TRANSMISSION SERVICE WORKS

• RESERVING TRANSMISSION SERVICE = RESERVING A SEAT ON A PLANE
  • CUSTOMER SPECIFIES PRIORITY, TIME, SOURCE/SINK, CAPACITY
  • TARIFF ADMINISTRATOR APPROVES IF CAPACITY EXISTS
• ISSUANCE OF NERC TAG = RECEIVING BOARDING PASS
  • WON’T BE APPROVED IF IMPROPER USE OF RESERVATION
• CREATION OF SCHEDULE FROM TAG = SITTING ON THE PLANE
  • GENERATORS RAMP TO PROVIDE ENERGY FOR TRANSACTION
  • MAY BE CURTAILED IF TRANSMISSION SYSTEM OVERLOADED
WHOLESALE ENERGY MARKET
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
MARKETPLACE BENEFITS

- SPP’s markets provide participants $422M 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
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 PLANNING AT SPP
TRANSMISSION PLANNING CONSIDERATIONS

MUST TAKE INTO ACCOUNT A NUMBER OF CONSIDERATIONS, INCLUDING:

• RELIABILITY
• ECONOMICS
• PUBLIC POLICY
TRANSMISSION INVESTMENT
DIRECTED BY SPP

$6.9B IN COMPLETED PROJECTS
$3.0B IN SCHEDULED PROJECTS
TRANSMISSION IN SPP

- In 2018, SPP members completed 36 transmission projects totaling more than $779 million.
- More than $10 billion in transmission upgrades were planned and approved from 2004-2018.
- 66,892 miles of transmission lines in SPP’s footprint would circle the Earth more than twice!
- SPP’s transmission owning members have approximately $13.6B in net transmission investment.
HOW SPP MAKES TRANSMISSION DECISIONS

• INTEGRATED TRANSMISSION PLANNING PROCESS

• GENERATION INTERCONNECTION STUDIES
  • DETERMINES TRANSMISSION UPGRADES NEEDED TO CONNECT NEW GENERATION TO ELECTRIC GRID

• AGGREGATE TRANSMISSION SERVICE STUDIES
  • DETERMINES TRANSMISSION UPGRADES NEEDED TO TRANSMIT ENERGY FROM NEW GENERATION TO LOAD
  • SHARES COSTS OF STUDIES AND NEW TRANSMISSION

• SPECIFIC TRANSMISSION STUDIES
TRANSMISSION BUILD CYCLE IN SPP

Planning Study (12-18 mo.)

TO Selection (3-12 mo.)

Design, ROW Acquisition, & Construction (2-6 yr.)

Responsible Party
- SPP
- Transmission Owner

3 ½ YR.

8 ½ YR.
INTEGRATED TRANSMISSION PLANNING (ITP) PROCESS

- **ANNUAL PLANNING CYCLE** assesses near- and long-term economic and reliability needs.

- **PRODUCES A 10-YEAR TRANSMISSION EXPANSION PLAN** each year, combining near-term, 10-year, and TPL-001-4 assessments into one study.

- **20-YEAR ASSESSMENT** performed no more than once every five years except when directed by the SPP Board of Directors.

- **30 STUDY MODELS** assess a variety of potential scenarios.
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

<table>
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<tr>
<th>Voltage</th>
<th>Region Pays</th>
<th>Local Zone Pays</th>
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<tbody>
<tr>
<td>300 kV and above</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Above 100 kV and below 300 kV</td>
<td>33%</td>
<td>67%</td>
</tr>
<tr>
<td>100 kV and below</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Projects Constructed or with NTCs
(2005 - 2017)

Southwest Power Pool

115 kV
138 kV
161 kV
230 kV
345 kV

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Date Exported: 3/13/2017

1 inch equals 173 miles
RENEWABLES
IN SPP
WIND IN SPP’S SYSTEM

- WIND INSTALLED TODAY: 21,500 MW
  - 11,100 TURBINES AT 200 WIND RESOURCES (MOST ARE 80M HUB HEIGHT)
  - LARGEST WIND RESOURCE: 478 MW (HALE WIND FARM IN HALE COUNTY, TX)

- UNBUILT WIND W/SIGNED INTERCONNECTION AGREEMENTS: ~10 GW

- WIND IN ALL STAGES OF STUDY AND DEVELOPMENT: ~64 GW

- FORECAST WIND INSTALLATION IN 2020: >23 GW (MORE THAN SPP’S CURRENT MINIMUM LOAD)

- FORECAST WIND INSTALLATION IN 2025: 28-33 GW
WIND PENETRATION

• MAXIMUM WIND OUTPUT: 16,382 MW (12/20/2018)

• MINIMUM WIND OUTPUT (LAST 12 MOS.): 147 MW (8/9/18 @ 10:47)

• MAXIMUM WIND PENETRATION: 63.96% (4/30/18)

• AVERAGE WIND PENETRATION (2018): ~25%

• MAX WIND SWING IN ONE DAY: >10 GW (12.5 GW TO 2 GW BACK TO 12 GW)

• MAX 1-HOUR RAMP: 3,700 MW
INSTALLED WIND CAPACITY BY YEAR
Wind Resources Registered In SPP Market

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Date Exported 7/26/2018 1 inch equals 182 miles
SOLAR IN SPP’S SYSTEM

- SOLAR IN SERVICE: 215 MW
- SOLAR IN ALL STAGES OF STUDY AND DEVELOPMENT: ~25 GW
RENEWABLES IN OKLAHOMA
OKLAHOMA WIND FACTS – 2018

- STATE RANKING FOR INSTALLED CAPACITY: 2ND
- NUMBER OF WIND TURBINIES: 3,984
- INSTALLED WIND CAPACITY (MW): 8,072
- WIND PROJECTS ONLINE: 47
- WIND IS 31.83% OF OKLAHOMA’S TOTAL ENERGY PRODUCTION
- SINCE AUGUST 25, 2016, THE OKLAHOMA CORPORATION COMMISSION HAS RECEIVED 59 NOTICES OF INTENT TO CONSTRUCT A WIND ENERGY FACILITY IN THE STATE
OKLAHOMA SOLAR DATA

SOLAR INSTALLED (MW): 31.2

- WFEC: 18.0 MW
- OGE: 12.5 MW
- CEC: 0.5 MW
- PSO: 0.3 MW
- OEC: 0.2 MW
LOW-COST, ABUNDANT ELECTRICITY

2nd-lowest electricity costs in U.S.
Average retail price: 8.2 cents/kWh

Top 20 in net generation in U.S.
73.7 gigawatt hours in net generation

Source: EIA 01/08/2019
QUESTIONS?