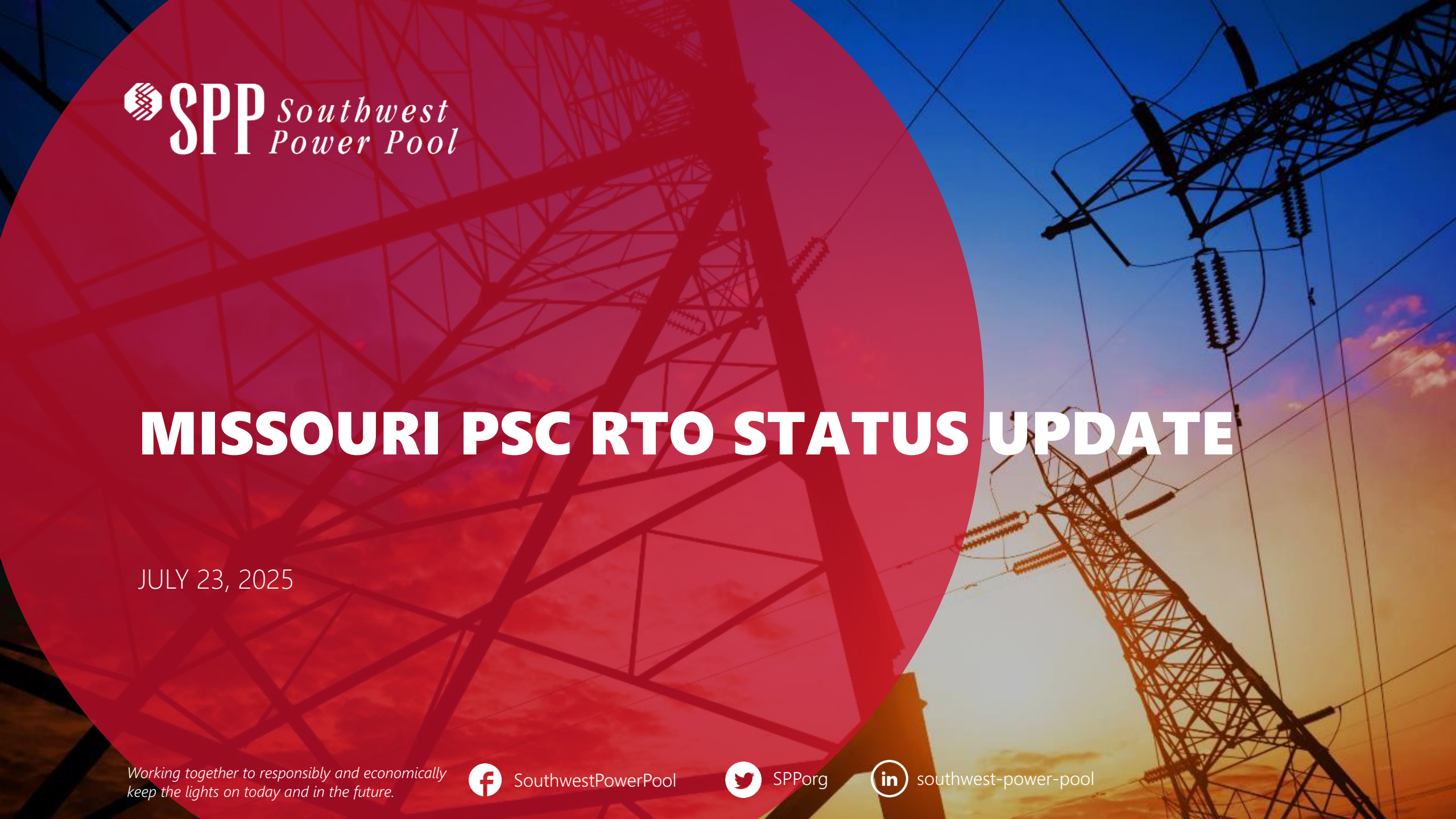


SPP Southwest Power Pool

MISSOURI PSC RTO STATUS UPDATE

JULY 23, 2025

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

SouthwestPowerPool SPPorg southwest-power-pool

TRANSMISSION PLANNING

PURPOSE

- **Define** overarching objectives and approaches for transmission planning
- **Highlight** evaluation of both transmission and generation solutions
- **Explore** redevelopment and rebuilding of existing lines
- **Consider** use of existing rights-of-way, co-location, and reconductoring
- **Identify** practical, noncontroversial improvements to planning along RTO seam

INTEGRATED TRANSMISSION PLAN (ITP) PURPOSE

Regional planning process built to leverage knowledge of the transmission system needs to develop a **cost-effective transmission portfolio** over a **10-year** planning horizon.

Reliability:

- Establishes reliable foundation based on firmly committed network resources
- Addresses constraints that may not be feasibly resolved by the market

Public Policy:

- Solutions facilitate the use of renewable resources as required by policy mandates and goals

Economics:

- Solutions provide cost effective congestion relief and support market efficiency

Operational:

- Solutions address persistent operational issues

Resiliency:

- Solutions address resiliency needs such as extreme weather conditions, extreme pricing, and transferability

New under 2024 and 2025 ITP

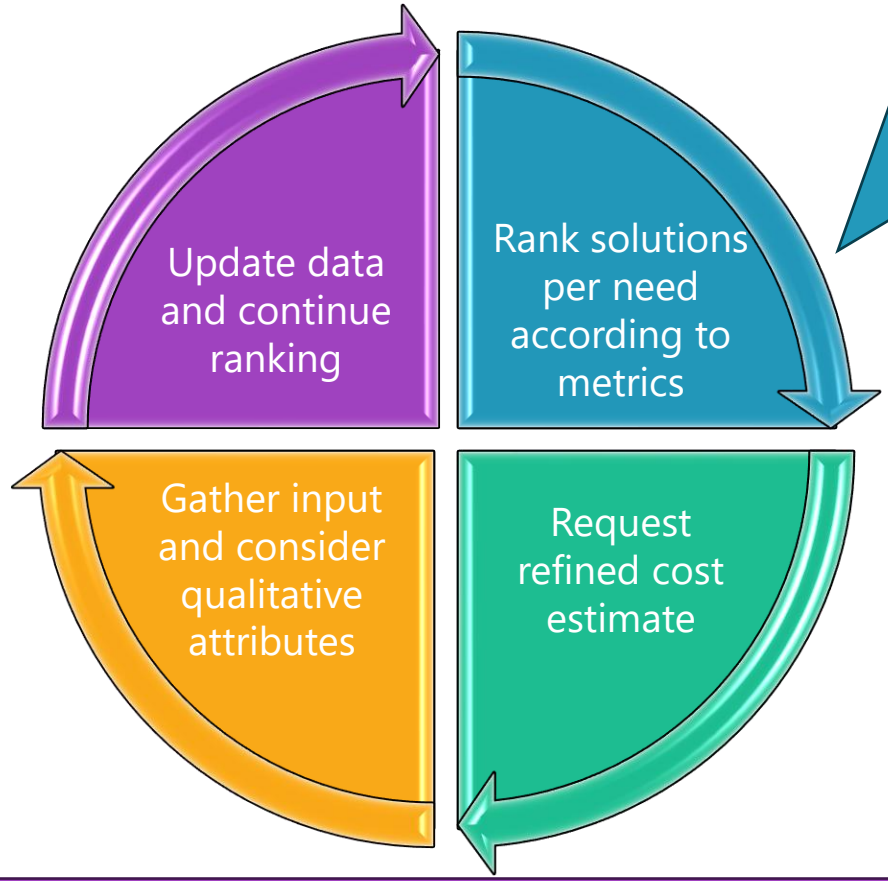
GI:

- Solutions include all necessary upgrades for GI requests per cycle

New under the CPP proposal

PORTFOLIO DEVELOPMENT HIGH LEVEL PROCESS

Qualitative Feedback Opportunity
Transmission Owners and stakeholders can provide qualitative input on projects — including considerations like routing challenges and local constraints.



Stakeholder Participation
Stakeholders have the opportunity to propose solutions — including new transmission projects, non-transmission alternatives, reconductoring, or using existing rights-of-way.

Stakeholders have opportunities to review and provide feedback on portfolio progress through Study Cost Estimate responses, project list reviews, scoping calls, the Planning Summit, and ad-hoc requests through RMS.

SPP ITP PROJECT SELECTION OVERVIEW

Process Flow

Category	Reliability Projects	Economic Projects
Primary Metrics	• Cost per Loading Relief (CLR) Cost per Voltage Relief (CVR)	• Cost per unit of Congestion Relief • Net Benefit = Gross Adjusted Production Benefit – Cost

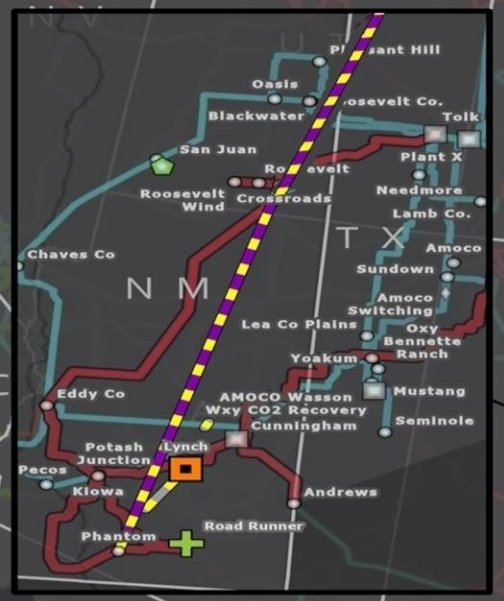
Ranking Process	• Projects ranked by impact vs. cost
	• Rankings updated as cost estimates refine
		• Projects grouped into:
		  • Cost-Effective
		  • Highest Net Benefit
		  • Multi-Variable

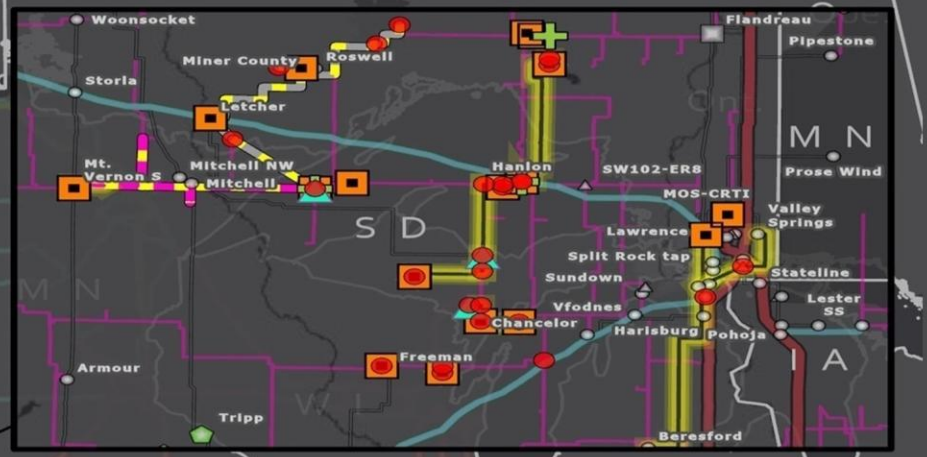
Qualitative Input	• Consider routing, constructability, operational value, and other non-monetized factors	• Include top-ranked projects and those with qualitative value

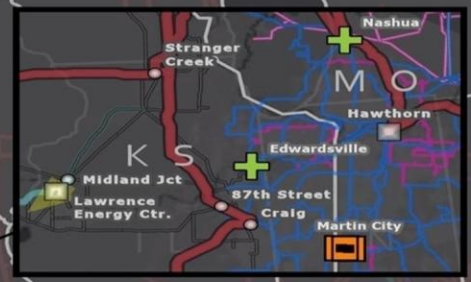
Final Screening	• Portfolio selected based on best overall value and system need	• Must meet:
		  • 1-year B/C ≥ 0.9
		  • 40-year NPV B/C ≥ 1.0

2024 ITP Solutions

SPP Southwest Power Pool







Date Exported 9/9/2024 1 inch equals 189 miles

RECENT SEAMS IMPROVEMENTS

2024 ITP Portfolio

- Targeted 345kV buildout in the Branson, MO area
- Aims to improve transfer capability and strengthen local voltage profile

2024 Coordinated Seams Process (CSP) with MISO

- Expanded scope for the 2025 cycle to support a more robust interregional planning process
- Focus on identifying immediately actionable upgrades that:
  - Improve reliability and resiliency in both SPP and MISO
  - Increase transfer capability between the RTOs
- RTOs requested a FERC waiver to streamline modeling and benefit valuation:
  - Waiver was not accepted
  - MISO and SPP is coordinating on next steps to continue evaluation of multiple models and benefits
- Study work to be conducted in 2025

2025 Mid-Missouri Line Coordination

- Joint evaluation of a potential 345kV line in mid-Missouri
- Collaboration with AECI, Ameren, and MISO through the 2025 ITP or follow-up process
- Goal: Identify cost-sharing opportunities across parties

RESILIENCY PLANNING

PURPOSE

Define how resiliency is currently understood within our RTO framework.

Explore how resiliency is evaluated across the grid and identify greatest needs and opportunities for enhancing reliability and resiliency.

Consider whether a **standardized list of resiliency attributes** should be mandated across all member utilities in the RTO footprint.

WHAT IS RESILIENCY?

NAFT – North American Transmission Forum

EPRI – Electric Power Research Institute

NATF and EPRI collectively defined resiliency as:

- "Resiliency is the ability of the system and its components (both equipment and human) to
  - (1) prepare for,
  - (2) anticipate,
  - (3) absorb,
  - (4) adapt to, and
  - (5) recover from non-routine disruptions, including high impact-low frequency (HILF) events in a reasonable amount of time."

SPP's solution addresses the first four points within the ITP with new resiliency planning features

RESILIENCY PLANNING IN THE ITP

2024 ITP

Create 'Scenarios' to capture extreme conditions using:

- Previous storms
- Potential future storms
- Potential future load growth
- Potential future resource availability situations

2025 ITP

Develop "Resiliency Needs during extreme conditions" to address:

- Available energy during peak events that was ‘stranded’ or unable to be delivered
- Subregional power transfer limitations
- Potential load shed events

2025 ITP RESILIENCY APPROACH

Local Marginal Price (LMP) Assessment

- Assessing transmission surrounding Resources curtailed during high LMP times

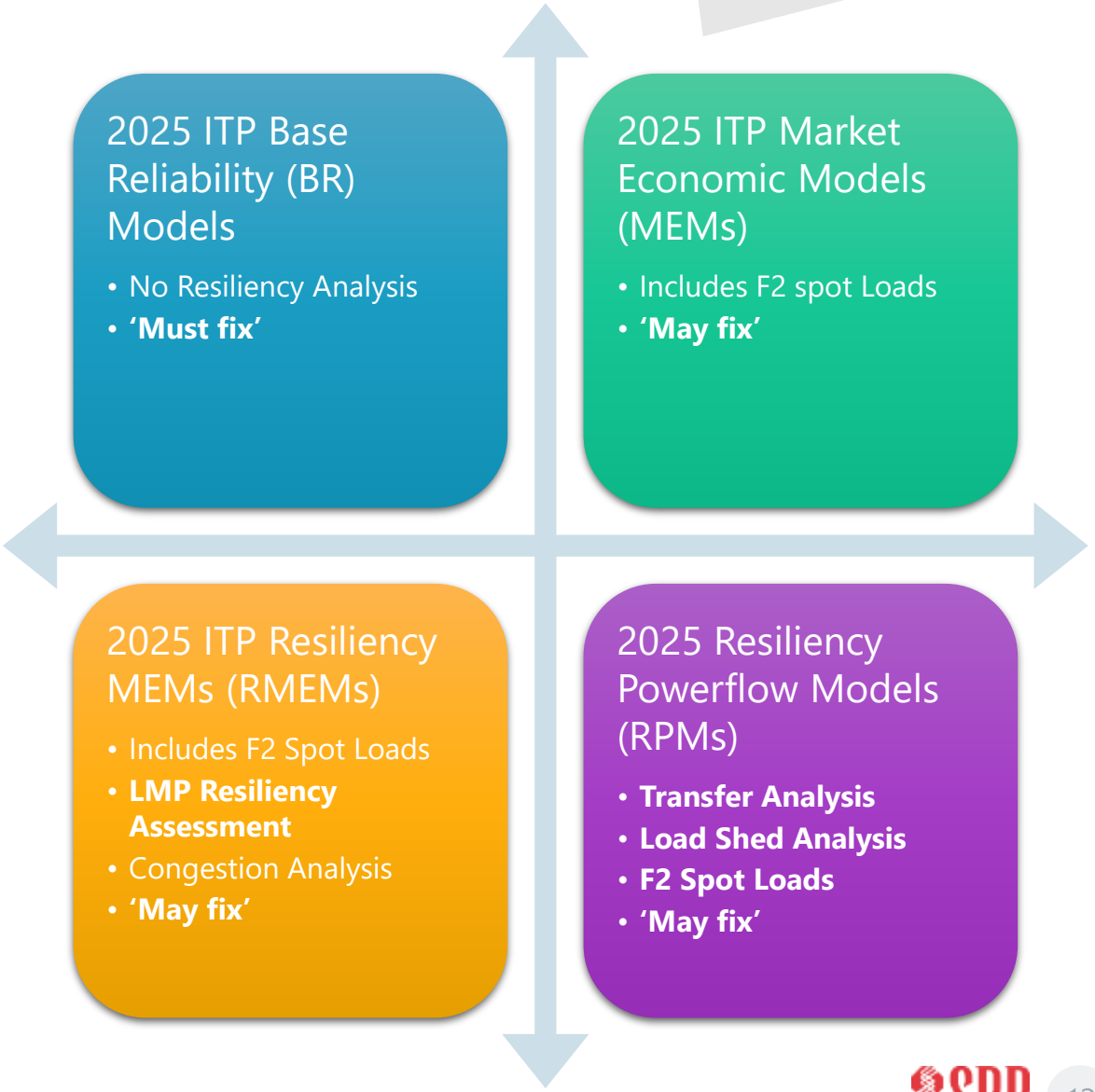
Transfer Analysis

- Analyzing transfer capability into and out of each LOLE Zone

Load Shed Analysis

- Assessing points of voltage collapse

Resiliency analysis only in Futures 1 and 2, Years 5 and 10



GRID ENHANCEMENT TECHNOLOGIES (GETS)

INTRODUCTION

What are Grid-Enhancing Technologies (GETs) ?

- Modern electrical grids require modern infrastructure and **alternative transmission technologies**, or **Grid-Enhancing Technologies (GETs)** to maximize the transmission of electricity. GETs include sensors, power flow control devices, and analytical tools.

FERC NTA

- The term GETs or Non-Transmission Expansion Alternatives (NTAs) or Non-Transmission Expansion Solutions generally encompasses new technology used to enhance the existing grid infrastructure

[1] "Grid-Enhancing Technologies: A Case Study on Ratepayer Impact", US DOE report, Feb. 2022

WHAT DO WE GET WITH GETS?

Advanced Power Flow Control (PFC):

- Hardware and software (e.g, Flexible AC Transmission System (FACTs)) used to push or pull power, helping to balance overloaded lines and underutilized corridors within the transmission network

Dynamic Line Ratings (DLR):

- Hardware and/or software used to appropriately update the calculated thermal limits of existing transmission lines based on real-time and forecasted weather conditions

Topology Optimization:

- Software technology that identifies reconfigurations in the grid to automatically route power flow around congested or overloaded transmission elements, taking advantage of the meshed nature of the bulk-power grid

Current State

Planning:
SPP already evaluates advanced power flow control equipment and long-term topology reconfiguration as part of its long-term transmission planning processes. Currently, DLR are not recognized as long-term transmission solutions.

Operations:
Existing power flow control functionality and reliability-based topology optimization are in use today. Economic topology optimization is currently under development.

Current Transmission Planning Challenges with GETs Justification

Recommending GETs must ensure they don't create downstream system issues and can be difficult to justify when competing with 40-year transmission assets.

INTERMEDIATE PLANNING PROCESS (Q3 2027)

Initiative Overview

- **Purpose:**
  - Strengthen the connection between operations planning (45 days out) and long-term planning (2 years and further) to proactively address emerging reliability risks and infrastructure challenges
    - Reliability risks for intermediate period (year 0 - 2) due to rapid change in forecasts
    - Enhancing mitigation options, such as supplementing the lead time with GETs to accompany key delayed transmission upgrades

Adding to the Role of GETs
In addition to competing with traditional transmission, Grid-Enhancing Technologies (GETs) can **supplement the grid** during the time transmission is being constructed — helping to **improve affordability and reliability** in the near term.

Key Benefits

- **Strategic Outcome:**
  - Support a more adaptable, operational risk-informed planning framework that complements affordability and reliability concerns tied to rapid load growth and transmission project delays.

INVESTMENT ANALYSIS:
INTERMEDIATE PLANNING TEAM

Investment Costs

- Upfront Costs (2026-2027)
  - Establish policy, tools, process and procedures
  - $1.7M for staff and operational budget
- Ongoing Costs
  - $700k/yr (Staff) + cost of the upgrades

At a cost of **$2.4M over 3 years**, the team pays for itself by enabling **$800K per year** in economic savings or by reducing risks such as load shedding and limited operations.

"One well-placed grid enhancement technology recommendation alone could justify the entire investment."

Examples of End User Value	Technology Evaluated	Initial Upgrade Costs	Ongoing Upgrade Costs	Lead Time	Estimated Annual Production Cost Savings
2021 Industry Case Study for the DOE	56 Dynamic Line Ratings (DLRs), 8 Flow Devices	$105.3 million (initial)	$11.7 million/year	~2 years	$175 million/year
EPRI-SPP Partnership	2 Flexible AC Transmission Systems (FACTS) leading up to a 115kV line install	$6.1 million (FACTS) $18.1 million (115kV line)	FACTS: Minimal Line: Higher	FACTS: 2 year Line: 4 years	FACTS: $5 million –$15 million/year Line: Additional APC when in service

FERC ORDER 881

LIMIT EXCHANGE PORTAL- UPDATE

- FERC Order 881 is being implemented by the Limit Exchange Portal (LEP) software from General Electric Vernova
- Vendor providing monthly releases
- Successful installation at SPP
- Preliminary Structured Test Cases posted for SPP stakeholders
- Monthly updates shared at the Ambient Adjusted Ratings Task Force (AARITF)

Link: Meeting Materials

MISSOURI RA & LOAD TRENDS

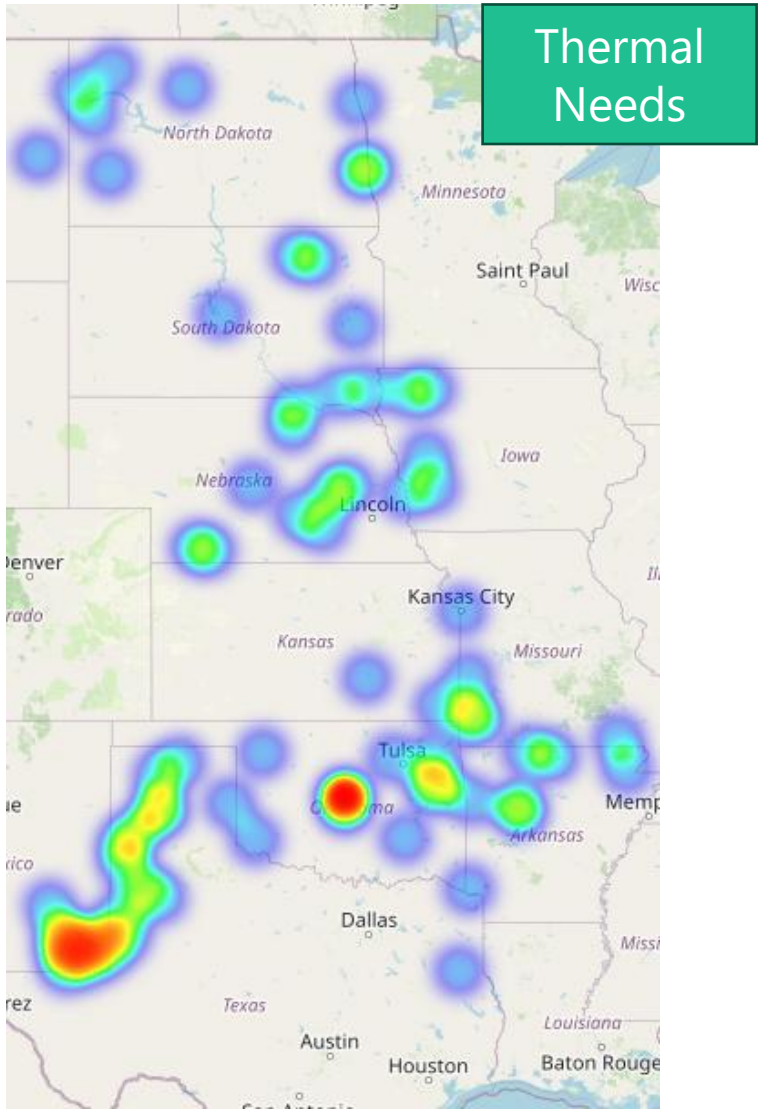
UPCOMING SUMMER SEASON
MISSOURI FORECAST

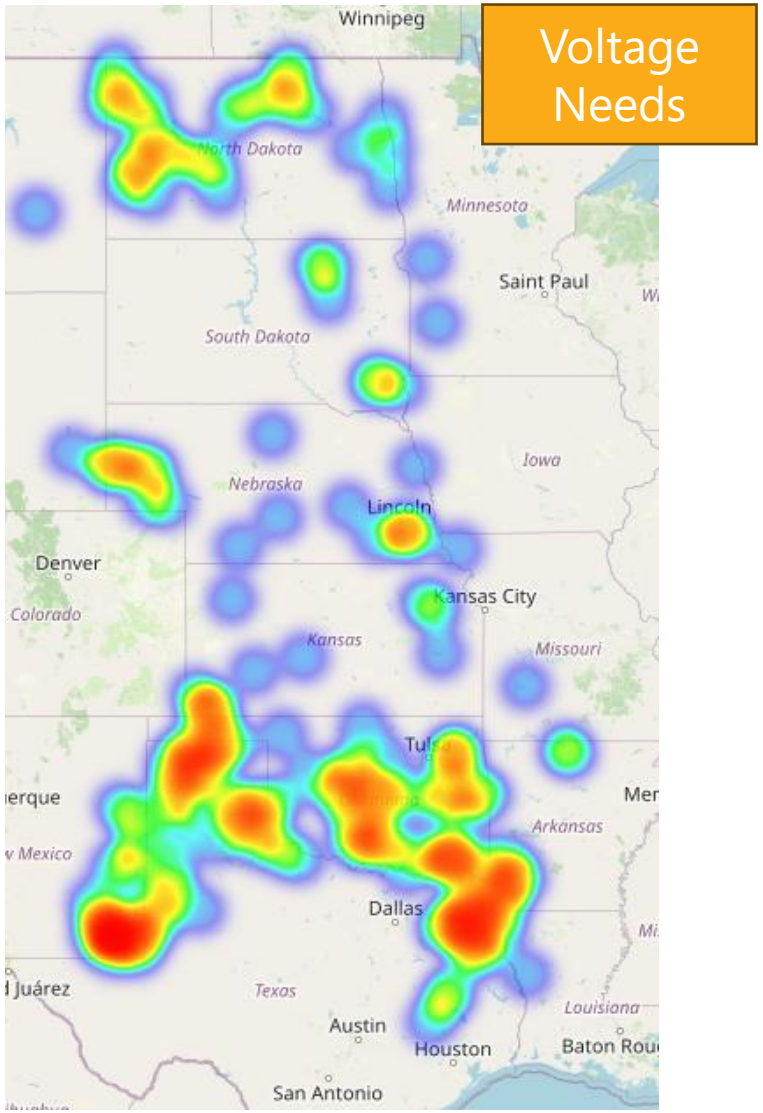
2025 Summer Season Missouri Outlook	
Capacity Resources	9,053.92
Firm Capacity Purchases	1,560.71
Firm Capacity Sales	858.30
External Firm Power Purchases	212.98
External Firm Power Sales	-
Additions	-
Reductions	-
ScheduledOutages	-
TransmissionLimitations	-
Total Capacity	**9,969.31**
Summer Peak Demand	8,602.20
DemandResponseAvailable	126.27
Internal Firm Power Purchases	40.00
Internal Firm Power Sales	-
Net Peak Demand	**8,435.93**
PRM	15%
Resource Adequacy Requirement	9,701.31
Excess or deficient	268.00
LRE Reserve Margin	**18%**

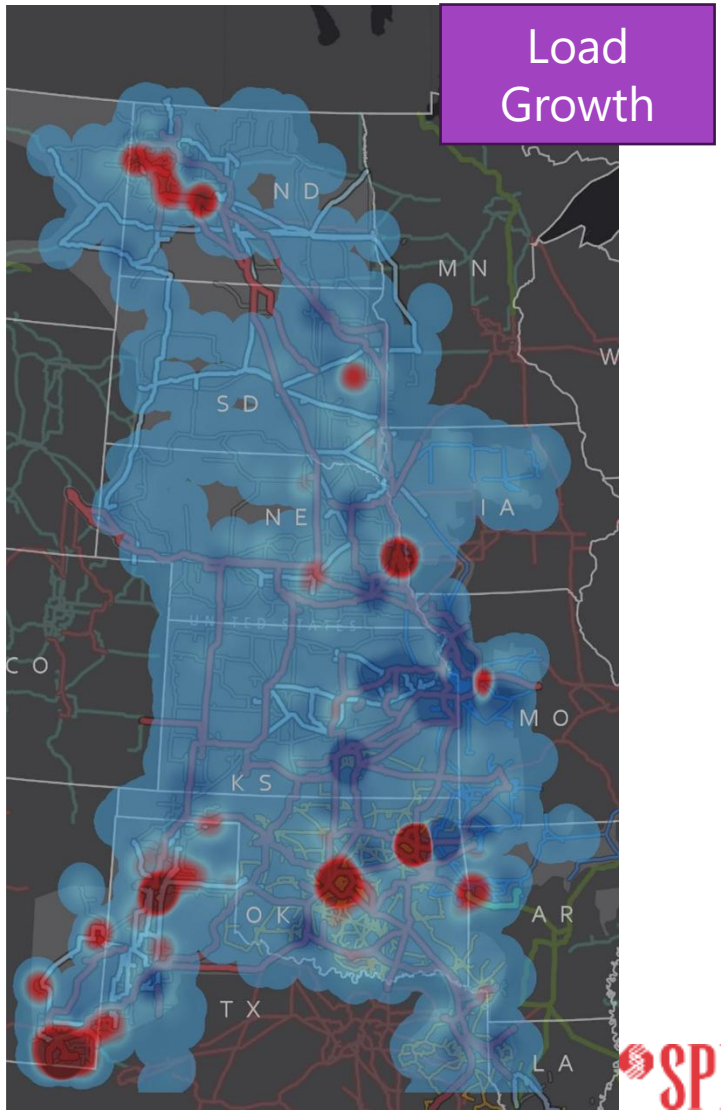
COWP	Carthage Water & Electric Plant, Missouri
EMDE	Empire District Electric Company (Liberty Utilities)
INDN	Independence Power & Light
KCPL	Kansas City Power & Light (Evergy Metro) includes Greater Missouri Operations Company
Kennett BPU	Kennett, Missouri Board of Public Works
Malden BPU	City of Malden Board of Public Works, Missouri
MJMEUC	Missouri Joint Municipal Electric Utility Commission
NIXA	City of Nixa, Missouri
PBEL	City of Poplar Bluff Municipal Utilities, Missouri
Sikeston	City of Sikeston, Missouri
SPRM	City Utilities of Springfield, Missouri
TYRE_CWEP	Carthage Water & Electric Plant, Missouri

OVERLAPS – RELIABILITY NEEDS

As expected, needs overlap areas of load growth





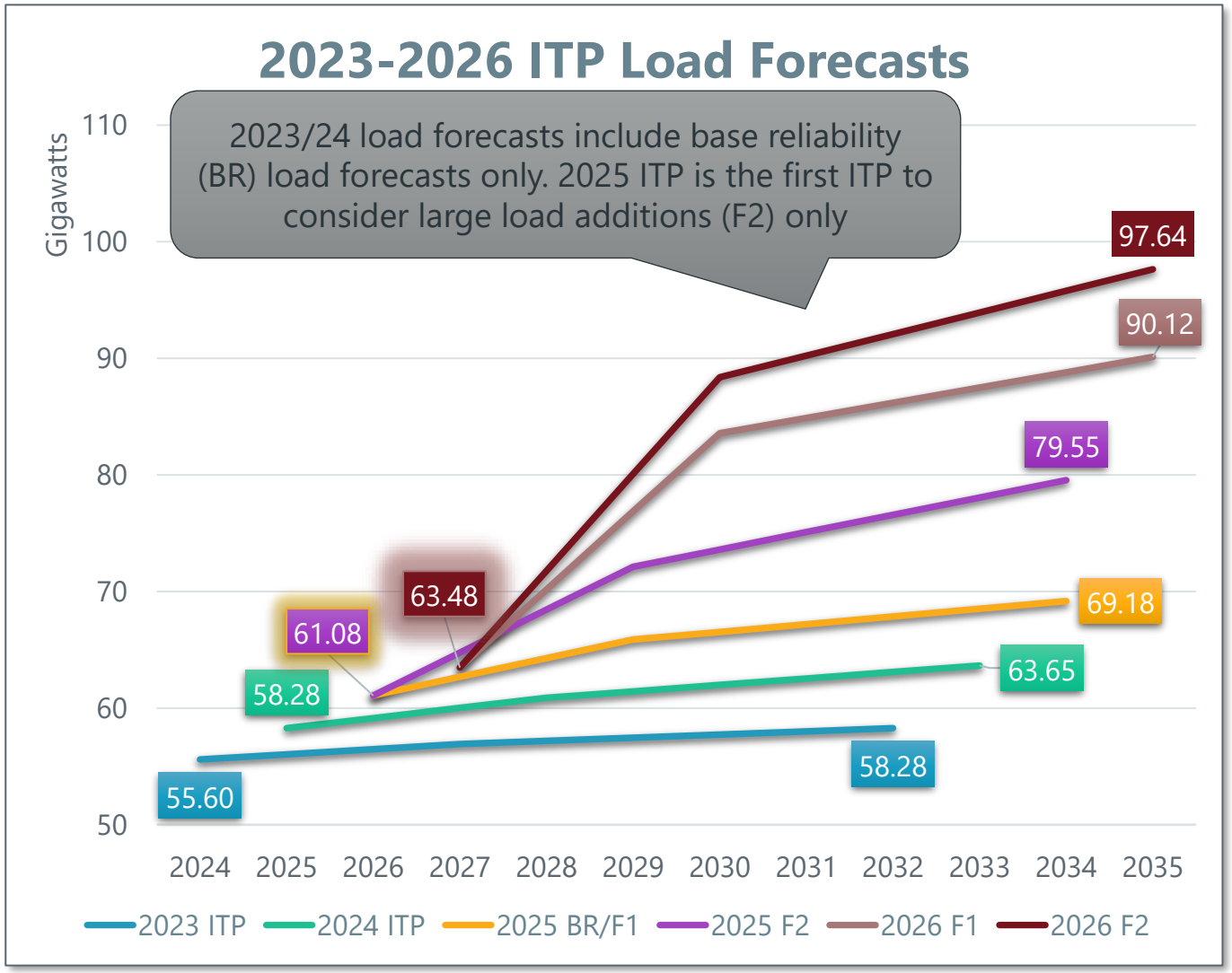


LOADS EVALUATED IN THE ITP
(2023-2026 ITP'S)

Large load additions are only be evaluated in the economic models

Incorporating large load growth in the ITP is needed to get ahead of load growth projections

- 2025 ITP and 2026 ITP includes large load growth in both futures at varying levels
- SPP (and the industry) continue to see large load projections grow
- Proactive transmission investment will ensure SPP is ready to serve this load growth



CONTACT

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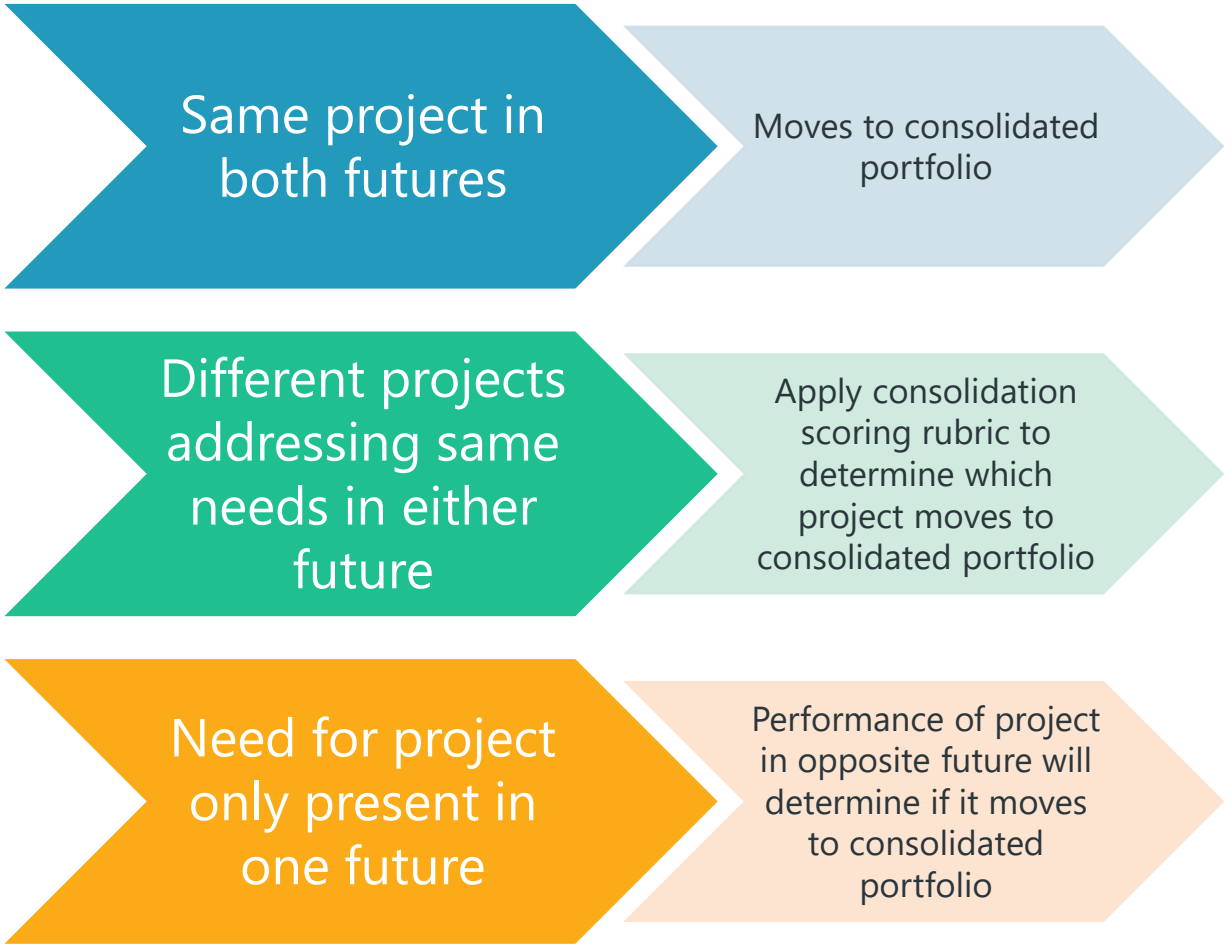
APPENDIX

PORTFOLIO CONSOLIDATION

Portfolio consolidation combines portfolios from each future into a single final portfolio. Methodology is outlined in the ITP Scope document for the respective study.



After posting of the consolidated portfolio, stakeholders are encouraged to review results and confirm that SPP staff followed the appropriate methodology to consolidate the futures, as well as provide feedback and approve the portfolio of projects.

SHOULD THERE BE MINIMUM STANDARDS FOR RESILIENCY?

Resiliency conditions vary significantly by region, making it challenging to define uniform minimum standards

Extreme weather events can differ across the country, requiring tailored approaches

Optional equipment may be needed to expand asset operating ranges

- *Example: Cold weather packages on generation units to enable operation at lower temperatures*

SPP is open to discussions around establishing appropriate minimum standards where feasible

WHAT "GETS" EXISTS TODAY?

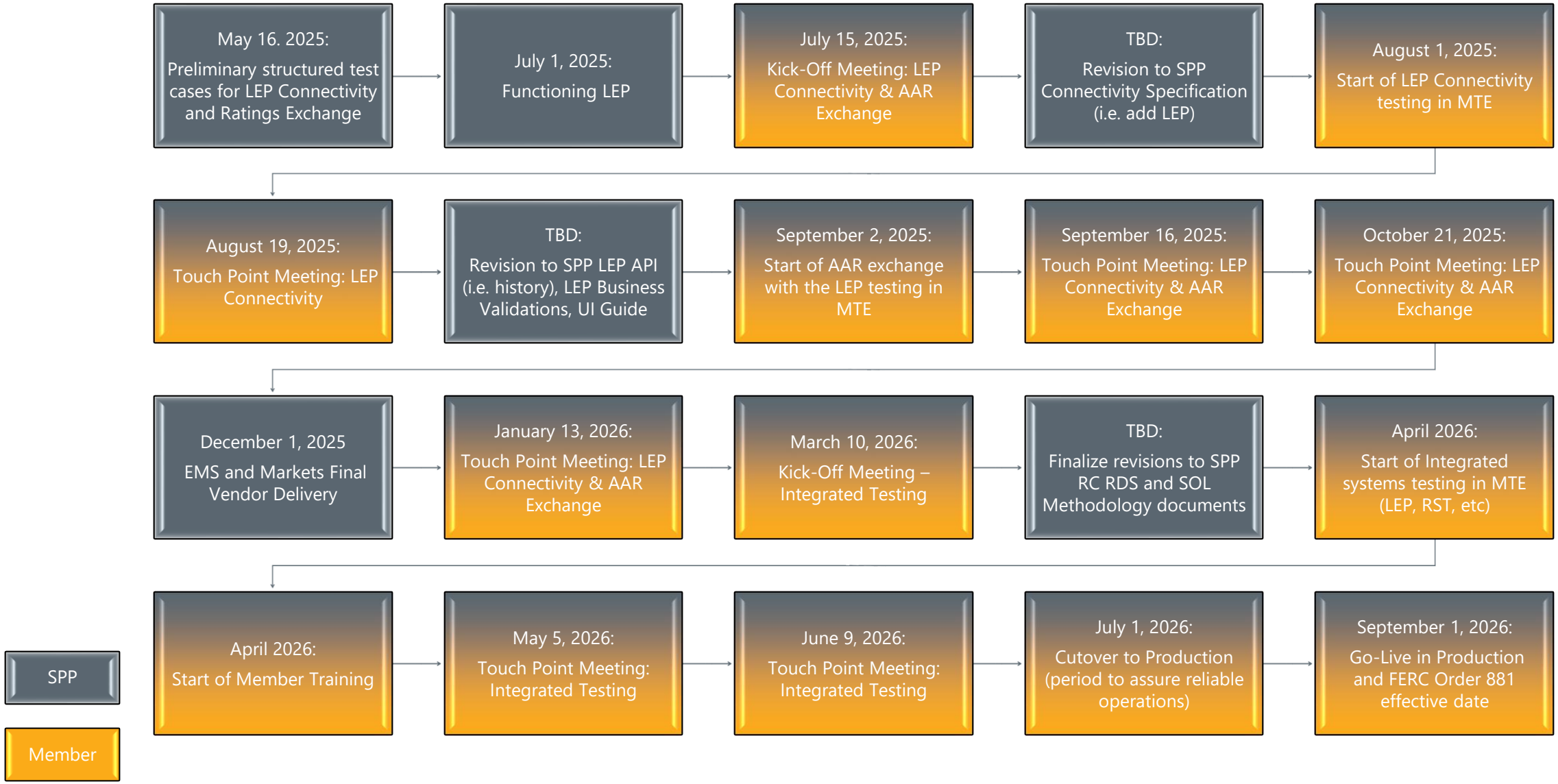
Integrated Transmission Planning (ITP) Examples:

Static Var Compensators in Southwest Texas (SPS area) (An Advanced PFC and a FACTS device)	Texas County and Woodward phase shifting transformer (Conventional PFC)	Synchronous Condenser for retired generators (North Dakota, Texas) (Conventional PFC)

ITP manual was recently **revised** as a result of SCRIPT recommendations expand applicability

ITP Manual: 5.1.1.2 Non-Transmission Solutions
Non-transmission solutions are generally considered technologies and methods that can complement the transmission grid in a predictable way, and provide certainties required for planning purposes. **Flexible AC Transmission Systems (FACTS) and Power Flow Controllers (PFC) are examples of technologies that can be used as non-transmission solutions, and Dynamic Line Rating technologies are examples of technologies that do not meet this definition**.

FERC ORDER 881 IMPLEMENTATION SCHEDULE



BACKGROUND & OVERVIEW

- FERC issued Order No. 881 to improve the accuracy and transparency of transmission line ratings used by **Transmission Providers**
  - Implementation of **Ambient-Adjusted Ratings (AARs)** and seasonal ratings
  - Establishment and implementation of systems and procedures to allow **Transmission Owners** to electronically update transmission line ratings at least hourly
  - **Transmission Providers** must use uniquely determined emergency ratings for contingency analysis in operation horizons
  - **Transmission Owners** must share transmission line ratings and transmission line rating methodologies with their **Transmission Provider** and market monitor, as applicable
  - **Transmission Providers** must maintain a database of each transmission owner's transmission line ratings and transmission line rating methodologies on the transmission provider's OASIS

RELIABILITY PORTFOLIO DEVELOPMENT

How Reliability Projects Are Selected

- Projects are **ranked using reliability screening metrics**, which consider both **impact and cost**
  - **Cost per Loading Relief (CLR):** how much relief a project provides for its cost
  - **Cost per Voltage Relief (CVR):** how much voltage support is provided per dollar
- Rankings are **updated as cost estimates are refined**
- **Qualitative benefits** are also considered to select the **best overall portfolio**

RELIABILITY PORTFOLIO DEVELOPMENT

How Economic Projects Are Selected

- Projects are **ranked using benefit-cost metrics** and grouped into three categories:
  - **Cost-Effective:** Based on **Project Cost per unit of Congestion Relief**
  - **Highest Net Benefit:** Calculated as **Gross APC Benefit minus Project Cost**
  - **Multi-Variable:** Includes **top-ranked projects** from the above categories and those with **qualitative benefits**
- Rankings are **updated as cost estimates are refined**
- Final portfolio is tested to ensure all projects meet minimum thresholds:
  - **1-year B/C ≥ 0.9**
  - **40-year Net Present Value B/C ≥ 1.0**