SPP Southwest Power Pool

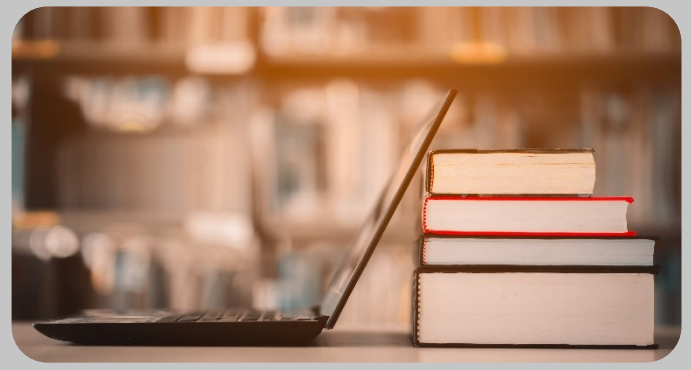
2024 ITP

2024 ITP EDUCATION SESSION

SUNNY RAHEEM – DIRECTOR, SYSTEM PLANNING

KIRK HALL – MANAGER, TRANSMISSION PLANNING

OBJECTIVE AND OVERVIEW



MARKETS AND OPERATIONS POLICY COMMITTEE MEETING

October 15, 2024: 8:00 a.m. - 5:00 p.m. CT | October 16, 2024: 8:00 a.m. - 12:00 p.m. CT
Southwest Power Pool Corporate Campus – Little Rock, Arkansas

AGENDA

Agenda items may be taken out of order and could conclude earlier or later than estimated time. MOPC could take action on any of the agenda items, including informational.
Will go to Board of Directors for review or approval
Will go to Regional State Committee for review or approval
Related to Winter Storm Recommendations

ADMINISTRATIVE

1. **Call to Order**.....Chair Alan Myers (ITC Great Plains) and Staff Secretary Lanny Nickell (SPP) 10
   a. Call to Order, Welcome, Proxies, Safety Briefing, and Meeting Principles
   b. Action Items, Revision Request (RR) Summary and Motions

APPROVAL ITEMS (2-6)

2. **Consent Agenda**.....Alan Myers (ITC Great Plains) 15

Objective

- Educate MOPC members and other stakeholders on major inputs and outputs of the 24 ITP study ahead of the Oct. 15th MOPC.

Ask Questions

- This is to help stakeholders understand the 2024 ITP better!

Agenda

- Study Drivers
  - Regional load growth
  - Winter Weather
- High-level Portfolio Review
  - Key projects and benefits
  - Coordination efforts

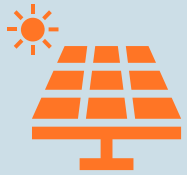
STUDY DRIVERS AND IMPACT

WHAT'S NEW AND WHAT HAS CHANGED IN THE 2024 ITP?

While SPP's typical renewable growth trends continue, the **main drivers** of projects in the 2024 ITP are **rapid load growth** and **extreme winter weather analysis**

2023 ITP
- F1 Y5: 37 GW
- F1 Y10: 41 GW
- F2 Y5: 38 GW
- F2 Y10: 46 GW

2024 ITP
- F1 Y5: 48.2 GW
- F1 Y10: 54.9 GW
- F2 Y5: 52.3 GW
- F2 Y10: 59.1 GW



2023 ITP
- F1 Y5: 4.4 GW
- F1 Y10: 11 GW
- F2 Y5: 5.9 GW
- F2 Y10: 15 GW

2024 ITP
- F1 Y5: 9.4 GW
- F1 Y10: 19.1 GW
- F2 Y5: 19.1 GW
- F2 Y10: 24.1 GW

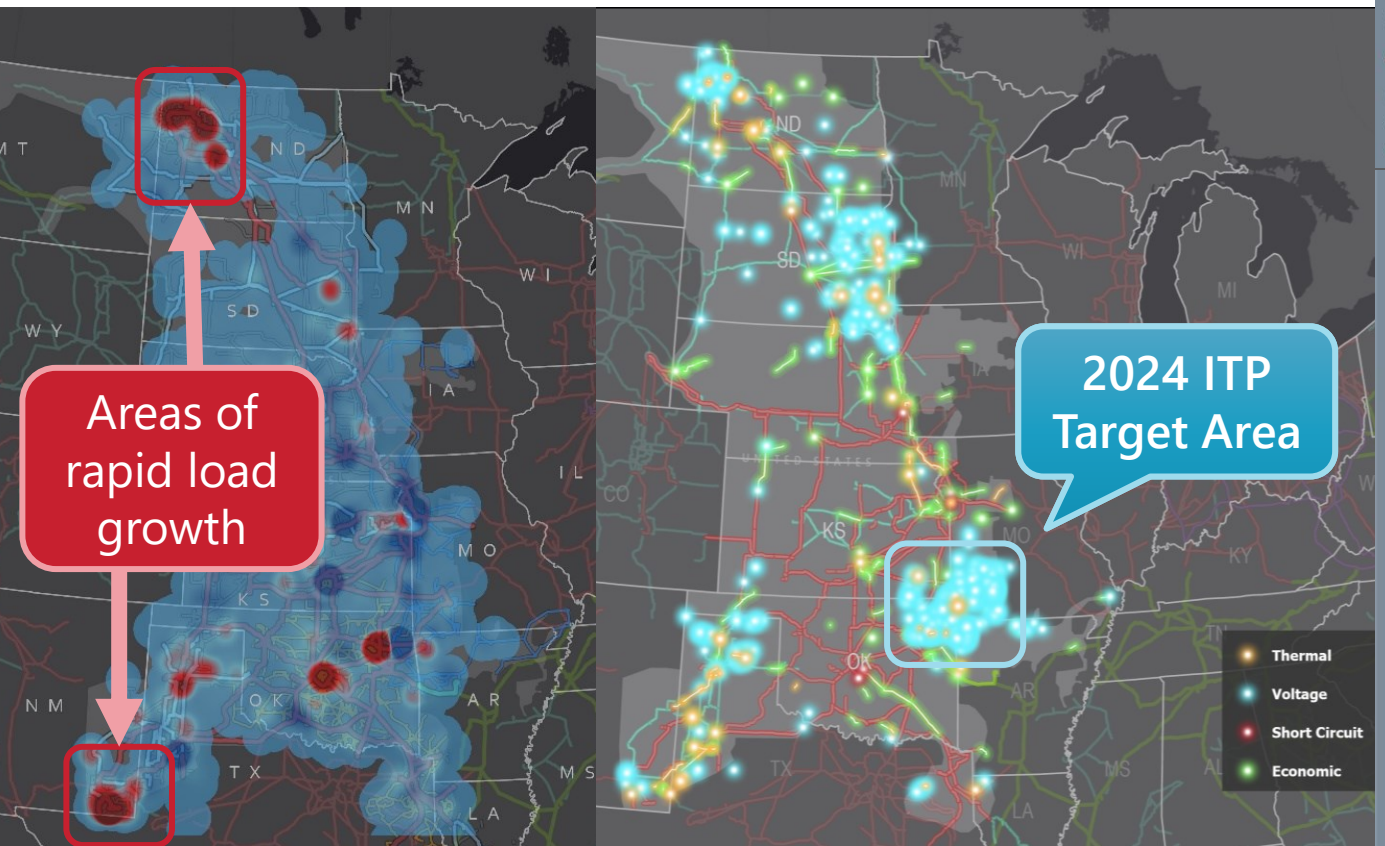
Load Growth Across the footprint

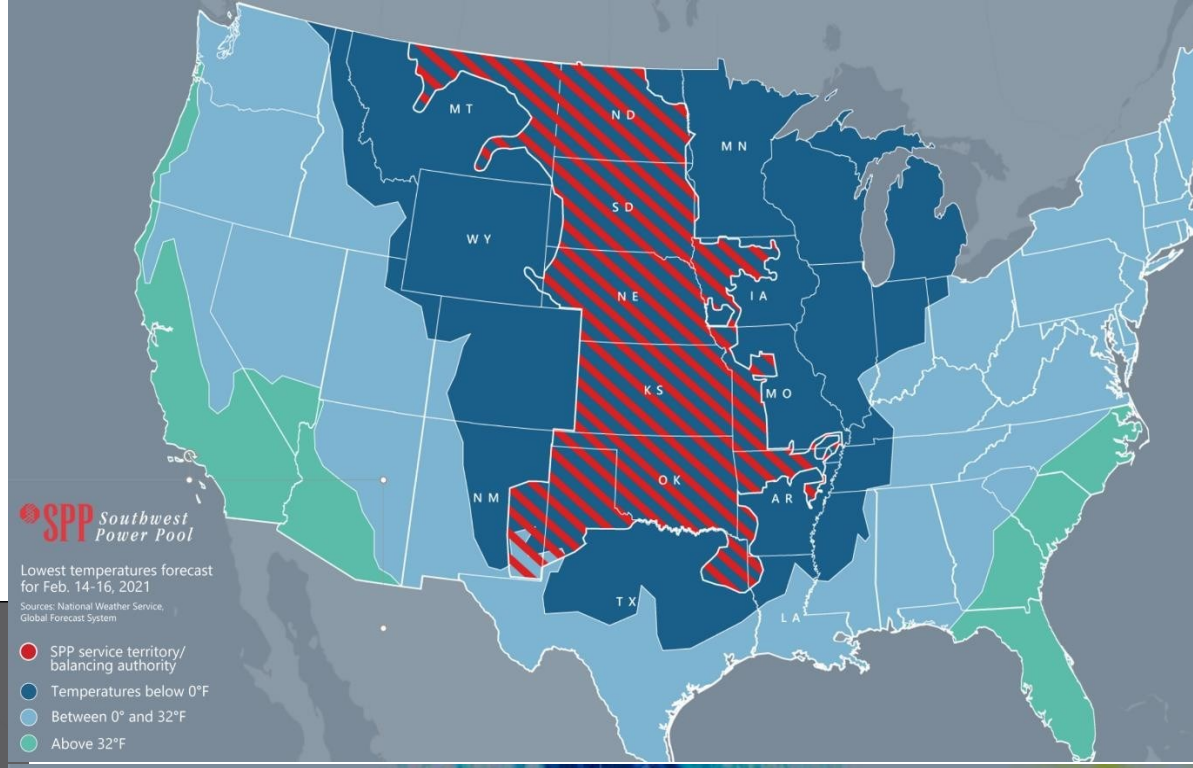
Rapid Load Growth in specific zones (Upper Missouri Zone, Southwestern Public Service)

Elliott Model

Uri-Based Model

Rapid load growth, extreme winter weather analysis, new persistent operational needs criteria led to the 2024 ITP Needs list increasing 4x compared to the 2023 ITP.





2024 ITP STUDY DRIVERS – LOAD

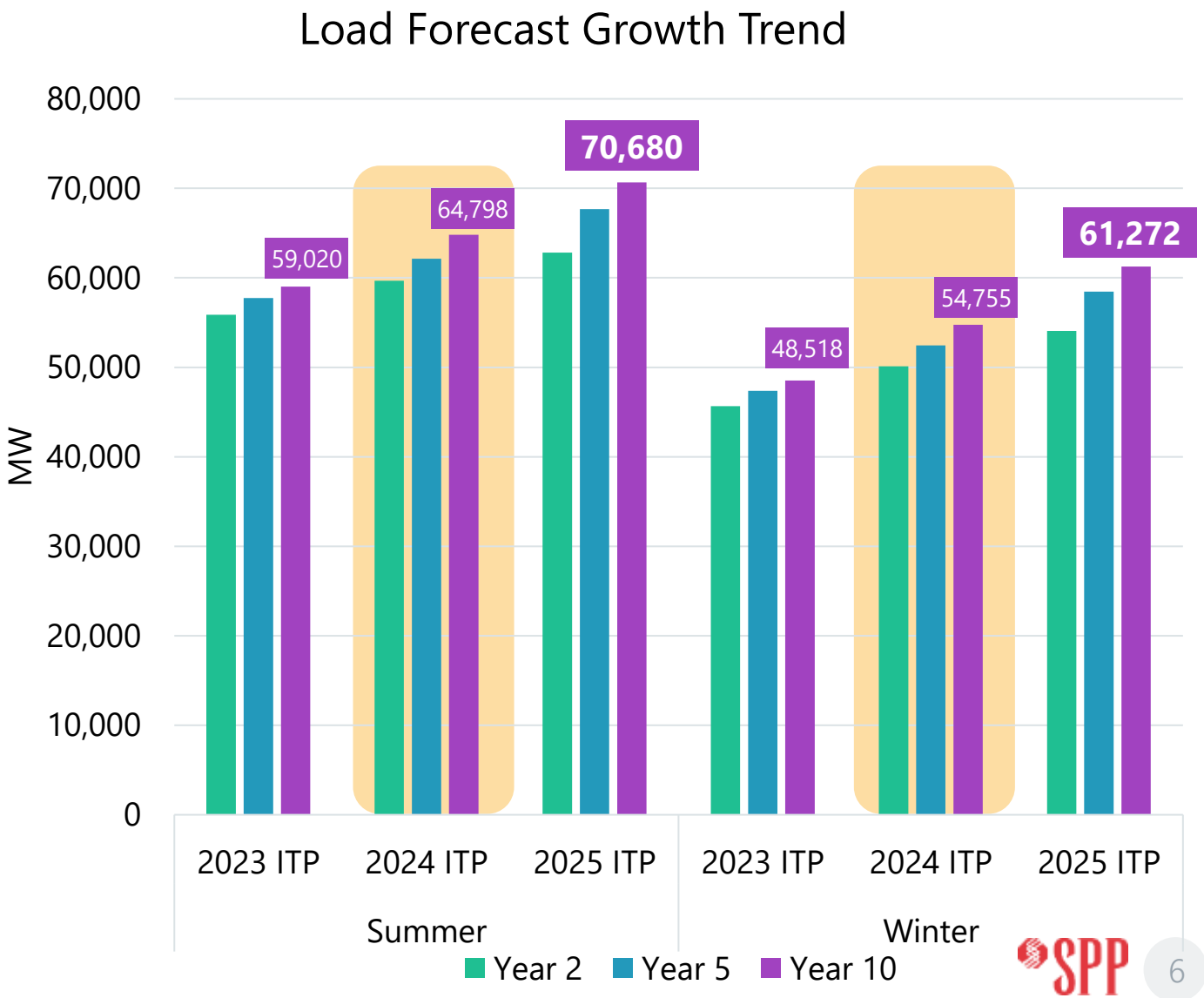
With load additions, SPP is seeing loads cross the **70 GW** and **60 GW** threshold for **summer** and **winter**, respectively

2024 ITP Y2 load is **higher** than 2023 ITP Y10 for both seasons

- +9.7% Y10 S, +12.9% Y10 W

Load growth can result in

- Higher transmission line loading
- Increased voltage violations, including collapse
- Increased economic congestion and emergency energy
- Shortfall concerns



WINTER WEATHER MODEL DEVELOPMENT

Three (3) Elliott models:
Dec. 2022 , Year 2, and Year 5 (2028)

- Dec 2022: Replicates system conditions and during or near the time of load shed
- Year 2: Created to assist in transmission staging
- Year 5: Same system conditions while considering NTC projects not yet in-service during winter storm

Three (3) Uri-based Winter Models:
Years 2/5/10

- Model extreme conditions developed and approved by stakeholders
- Conditions may include: low temps, load, wind output, gen/trans outages, fuel supply issues, etc.

NEED IDENTIFICATION & SOLUTION DEVELOPMENT

N-0* and N-1 Contingency Analysis

- Applicable to Elliott and Uri-based scenarios
- Identify N-0* issues as Needs
- N-1 evaluated for informational purposes

Develop solutions only for N-0* needs

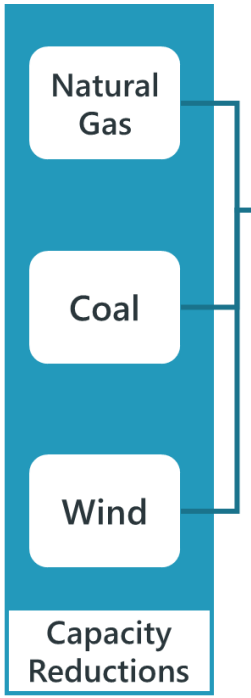
- Solutions for N-0* recommended for both scenarios
- N-1 analysis used to support solution development for N-0* needs

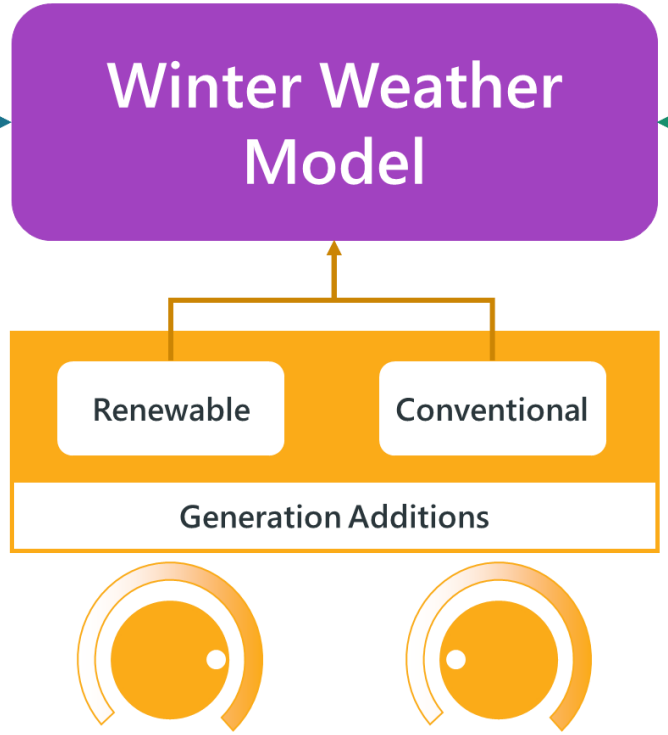
**It is assumed in both scenarios, transmission and or generation outages will be included in the models.*

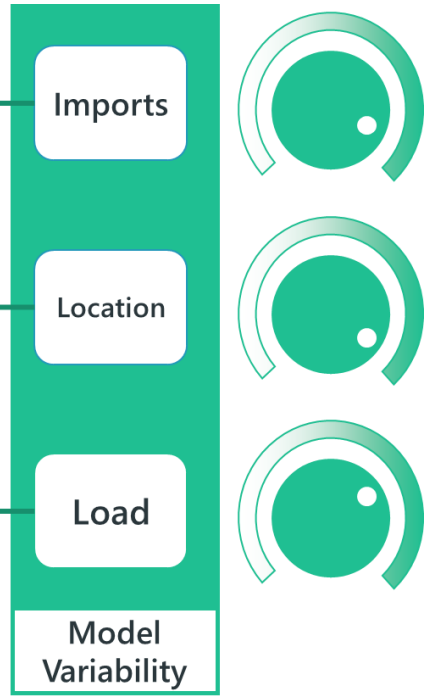
Building an extreme winter weather model is similar to tuning an engine. Expected performance is achieved by fine-tuning various settings.

Building the Uri-based model was challenge. SPP staff and stakeholder utilized a data-driven approach based upon real-time information from the to create assumptions to build the model

Capacity reductions were based upon Ops data during the EEA3 hours



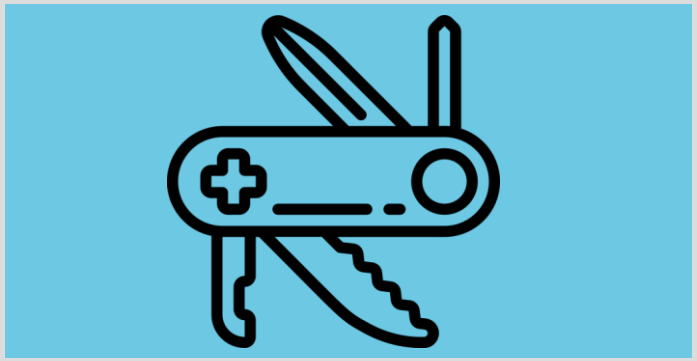


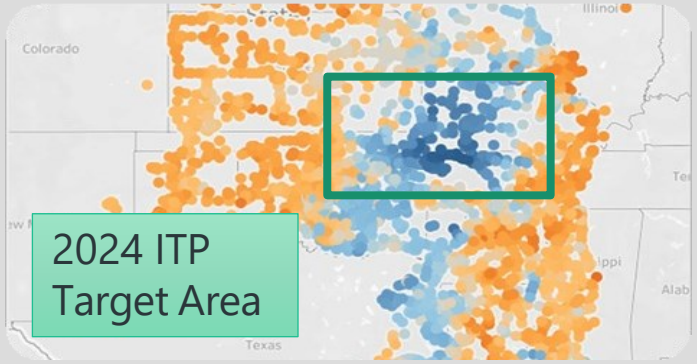


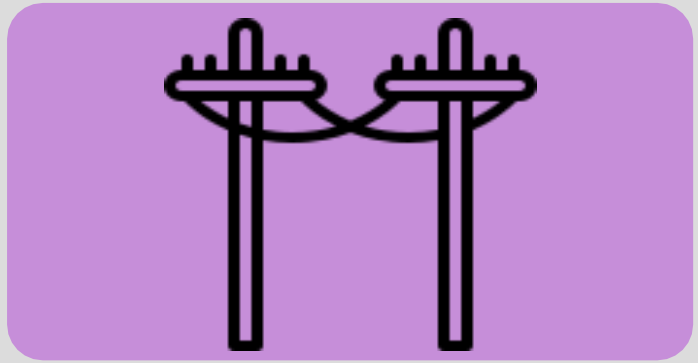
Imports were derived from Ops data while the load forecast was based on 2024 ITP loads

Generation from the 2024 ITP resource plan (wind) and high confidence conventional resources from the GI Queue were added to the model to serve load through year 10

GUIDING PRINCIPLES FOR WINTER WEATHER ANALYSIS







Identify **versatile** solutions that can address **multiple issues**

Elliott Model: **Improve voltage profile** of the target area

Uri-based: Increase **transfer capability** and **prevent load shed**

ADDITIONAL ANALYSIS

Additional analysis expected to support recommended winter weather solutions

Assess transfer capability assessment under extreme conditions

Benefits

- New analysis technique developed for winter weather analysis
- Evaluate impact of solutions on **key system bottlenecks**

Evaluate ability of solutions to prevent load loss

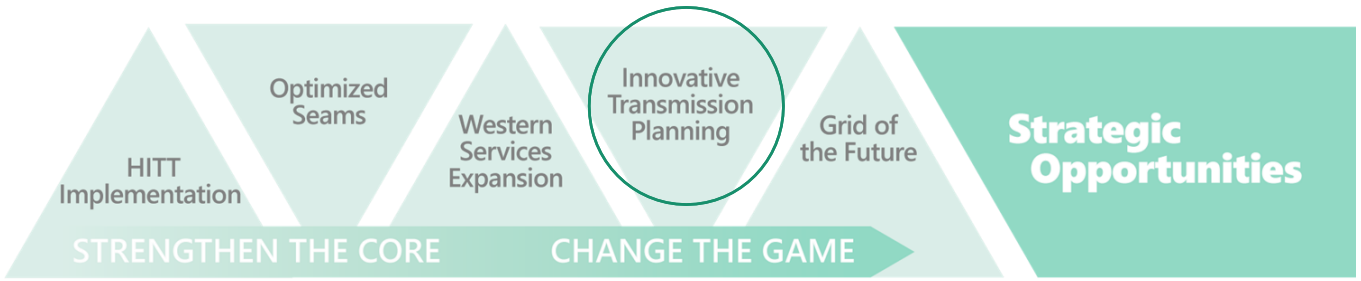
Benefits

- Identify projects that **enhance reliability**, **mitigate congestion**, or **release trapped generation**

Map solutions against real-time storm issues

Benefits

- Identify ability of solutions to address issues **observed in previous winter storms**



PORTFOLIO DEVELOPMENT, KEY PROJECTS, AND BENEFITS

ECONOMIC GROUPINGS

Multi-variable grouping is not always evaluated. 2024 ITP utilized this grouping technique and selected it as the recommended economic grouping

Cost-Effective (CE)

- Lowest project cost/flowgate congestion cost relief
- Projects evaluated and ranked for each need individually

Highest Net APC Benefit (HN)

- Project benefit minus project cost
- Projects evaluated and ranked by Need

Econ: Multi-Variable (MV)

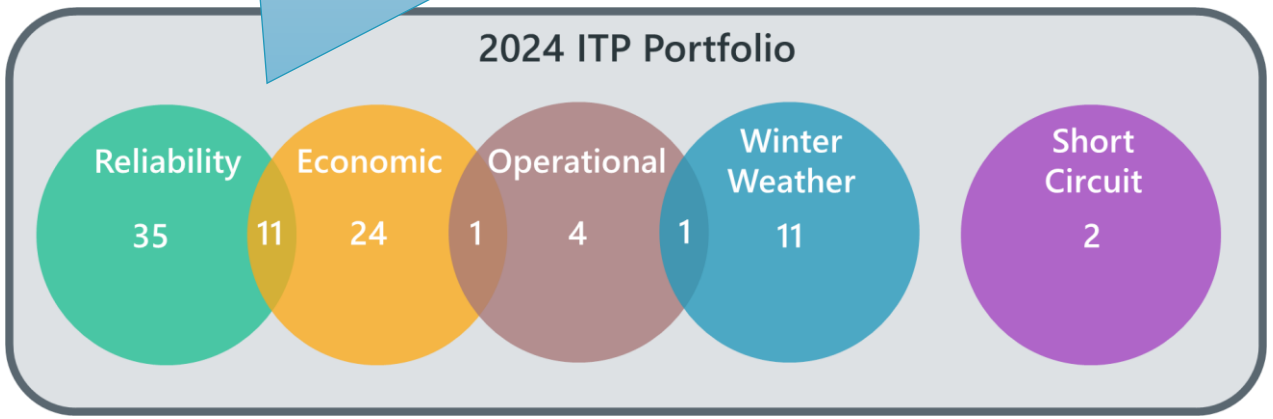
- Optimize the CE and HN groupings and include projects providing additional forms of value to the SPP membership

2024 ITP MULTI-VARIABLE GROUPING

INCREASING ECONOMIC BENEFITS TO LOAD WHILE PROVIDING…

ITP studies need overlap indicated the economic grouping process should consider the multi-variable grouping

The final portfolio shows highlights projects that are solving multiple need types



APC Benefit

Projects from Highest Net groupings are base consideration for Multi-Variable grouping

Reliability

Projects from Reliability grouping have sizable impact on system flows AND provide economic benefit

Resiliency

Projects boost voltage support and reduce the load shed that was observed during recent winter storms

Optimizing Seams

Projects enable imports and exports to reduce overall cost to SPP load with two potential new EHV ties with neighboring entities

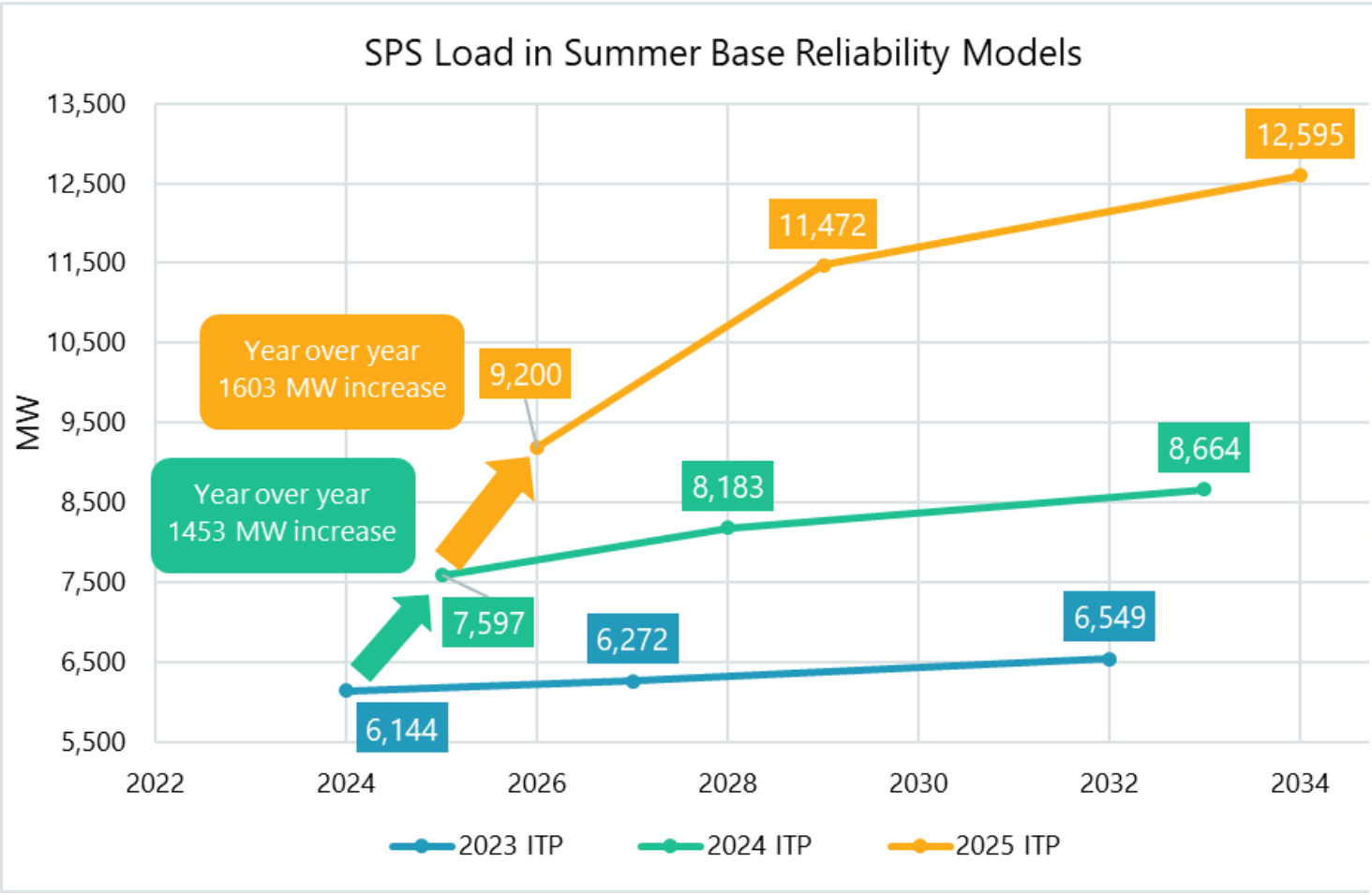
Energy Equity

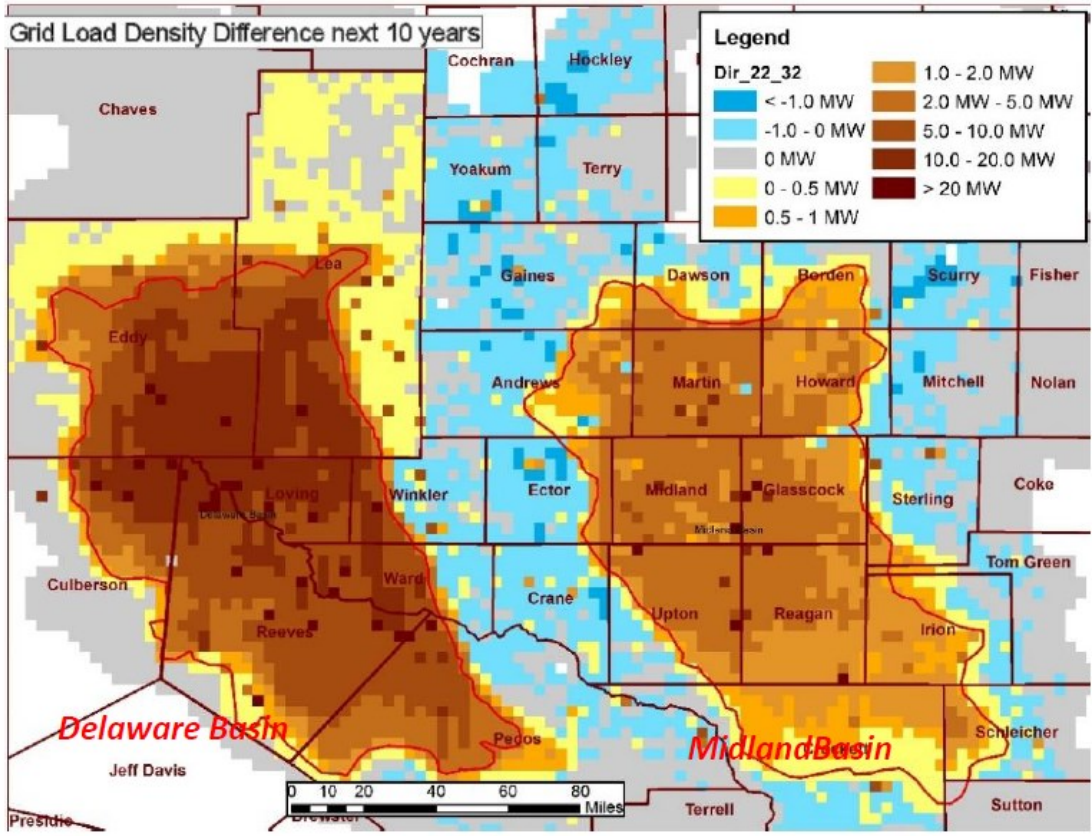
Grouping expands the EHV footprint to areas designated by DOE in National Interest Electric Transmission Corridors

SPS LOAD GROWTH

Load in SPS is expected to grow very rapidly over the next 5 years. Most of the load growth is concentrated in SE New Mexico.

Drilling load in the Permian Basin forecasted to increase New Mexico load forecast by 5.3 GW by 2032





Next 10 years incremental changes – Projected Load Demand Forecast

2024 ITP Projects & Interfaces

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PHANTOM – CROSSROADS - POTTER 765 KV NEW LINE &

POTTER – BECKHAM COUNTY 345 KV NEW LINE

$2,133,540,732

This project parallels all interfaces to the SPS region

Reliability

- **Fully resolve** low voltage violations and voltage collapse

Economic

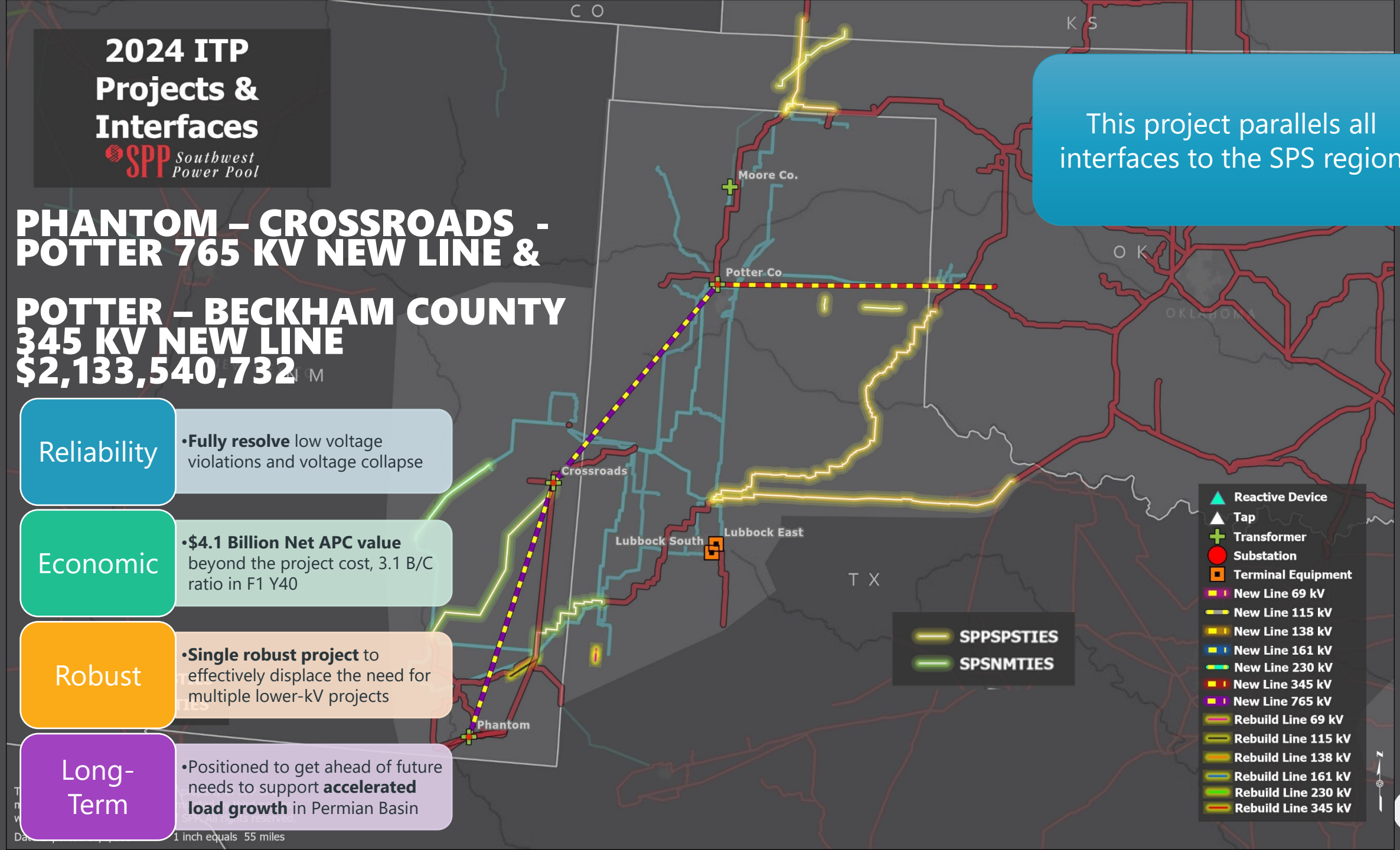
- **$4.1 Billion Net APC value** beyond the project cost, 3.1 B/C ratio in F1 Y40

Robust

- **Single robust project** to effectively displace the need for multiple lower-kV projects

Long-Term

- Positioned to get ahead of future needs to support **accelerated load growth** in Permian Basin



BENEFITS OF 765 KV INFRASTRUCTURE

Nearly 3x the capacity of a 500 kV line or a double-circuit 345 kV line and 6x the capacity of a 345 kV line[1]

The MW-mile cost is less than one-third of 345 kV lines[1]

Require about half as much right-of-way (ROW) as double-circuit 345 or 500 kV[2] to deliver equivalent power

Lower line losses than lower EHV lines

Typical tower heights are 20-30 feet shorter than double-circuit 345 kV[2]

Capable of transmitting more energy over longer distances than lower voltage lines

[1]MISO Long-Range Transmission Planning LRTP Tranche 2
[2]SPP 765 kV Transmission Overlay Study

2024 ITP Solutions

SPP Southwest Power Pool

LARAMIE – NEW UNDERWOOD – MAURINE – BELFIELD 345 KV NEW LINE $1,114,609,566

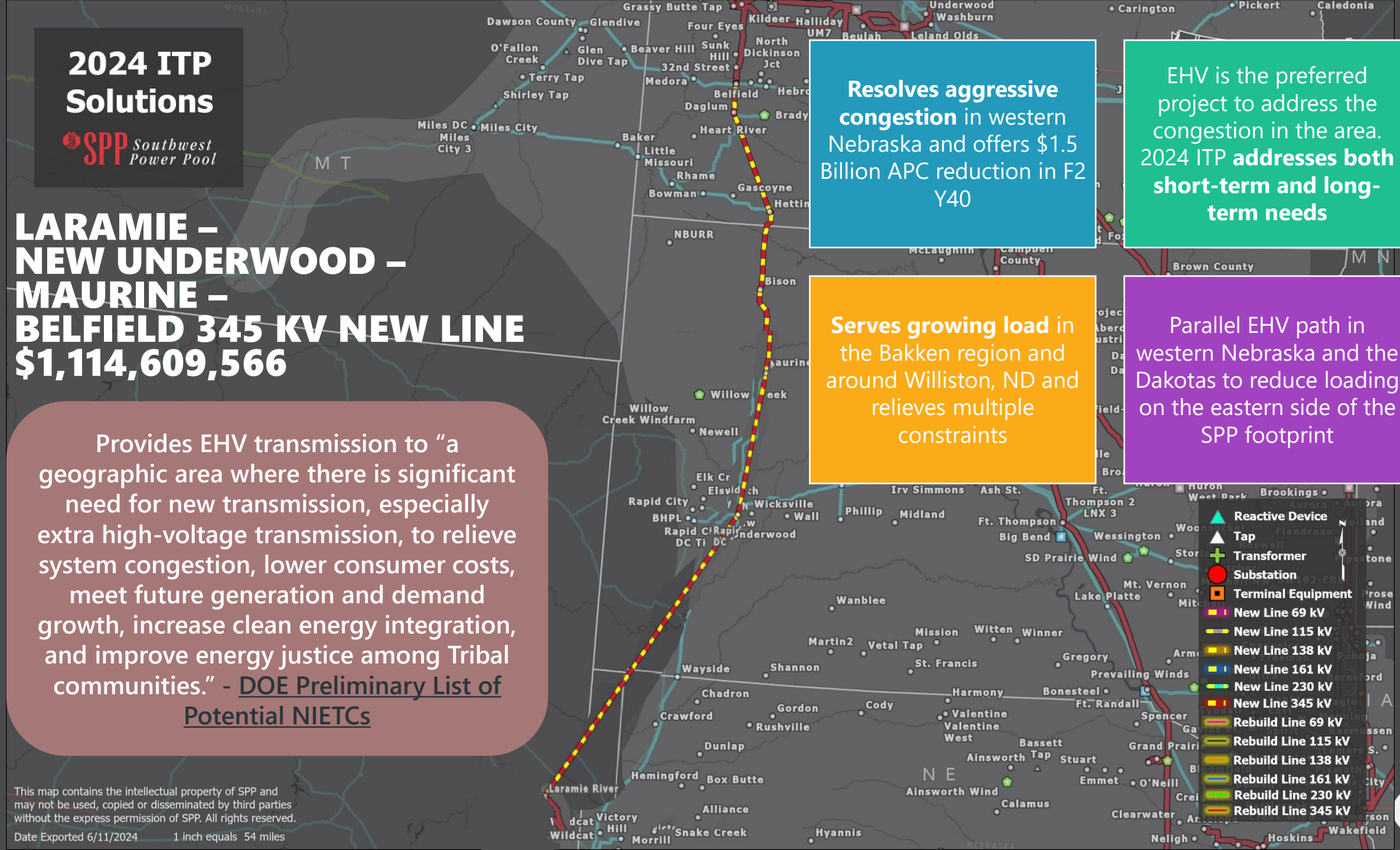
Provides EHV transmission to "a geographic area where there is significant need for new transmission, especially extra high-voltage transmission, to relieve system congestion, lower consumer costs, meet future generation and demand growth, increase clean energy integration, and improve energy justice among Tribal communities." - DOE Preliminary List of Potential NIETCs

Resolves aggressive congestion in western Nebraska and offers $1.5 Billion APC reduction in F2 Y40

EHV is the preferred project to address the congestion in the area. 2024 ITP **addresses both short-term and long-term needs**

Serves growing load in the Bakken region and around Williston, ND and relieves multiple constraints

Parallel EHV path in western Nebraska and the Dakotas to reduce loading on the eastern side of the SPP footprint



Date Exported 6/11/2024 1 inch equals 54 miles

2024 ITP Winter Weather Projects

SPP Southwest Power Pool

Sidney – Holcomb 345 kV reduces load shed by an additional **175 MW** relative to the full 2024 ITP portfolio

The TWG and ESWG voiced strong support to recommend NTCs for projects addressing Winter Weather needs

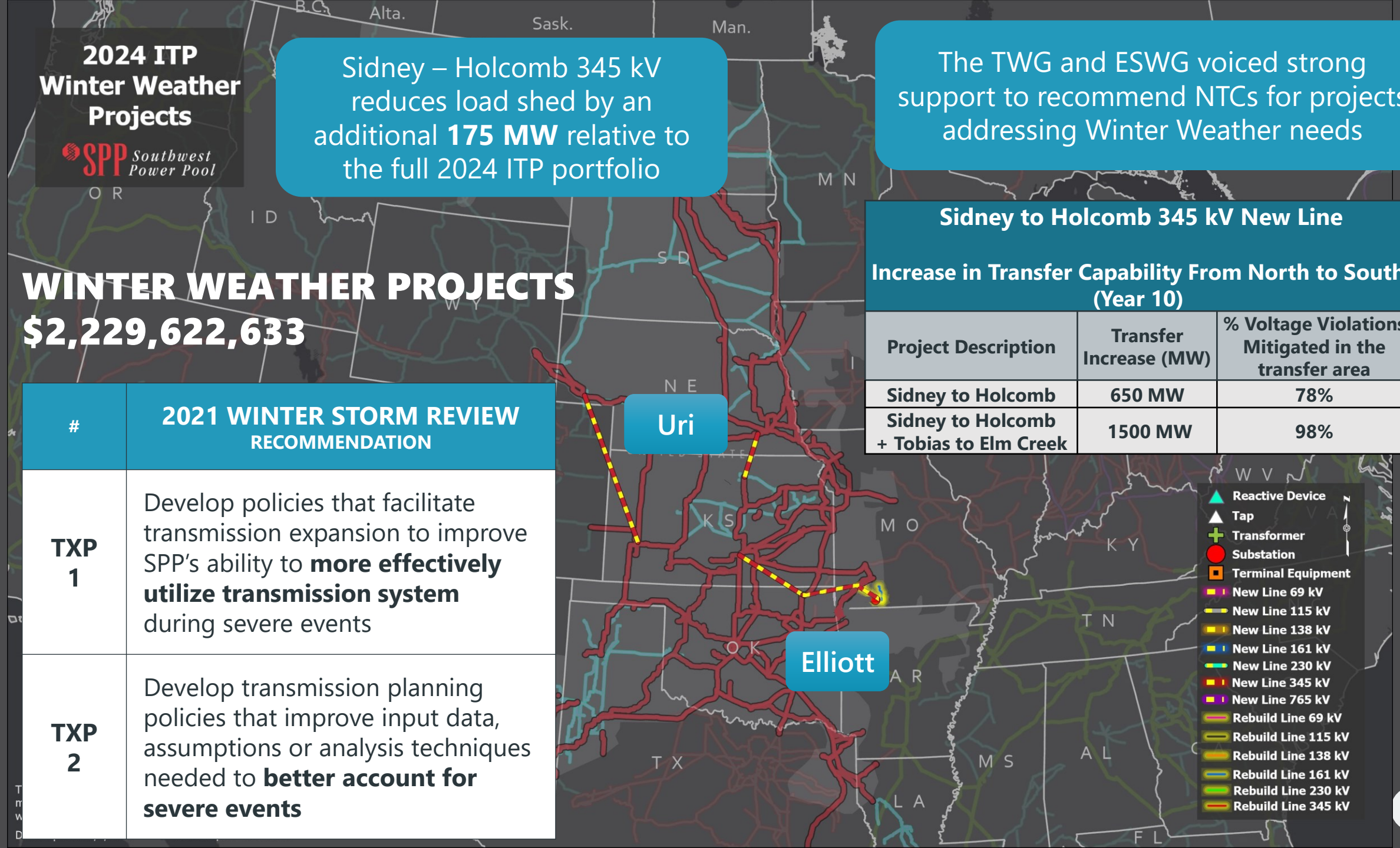
WINTER WEATHER PROJECTS
$2,229,622,633

#	2021 WINTER STORM REVIEW RECOMMENDATION
TXP 1	Develop policies that facilitate transmission expansion to improve SPP's ability to **more effectively utilize transmission system** during severe events
TXP 2	Develop transmission planning policies that improve input data, assumptions or analysis techniques needed to **better account for severe events**

Sidney to Holcomb 345 kV New Line

Increase in Transfer Capability From North to South (Year 10)

Project Description	Transfer Increase (MW)	% Voltage Violations Mitigated in the transfer area
Sidney to Holcomb	650 MW	78%
Sidney to Holcomb + Tobias to Elm Creek	1500 MW	98%



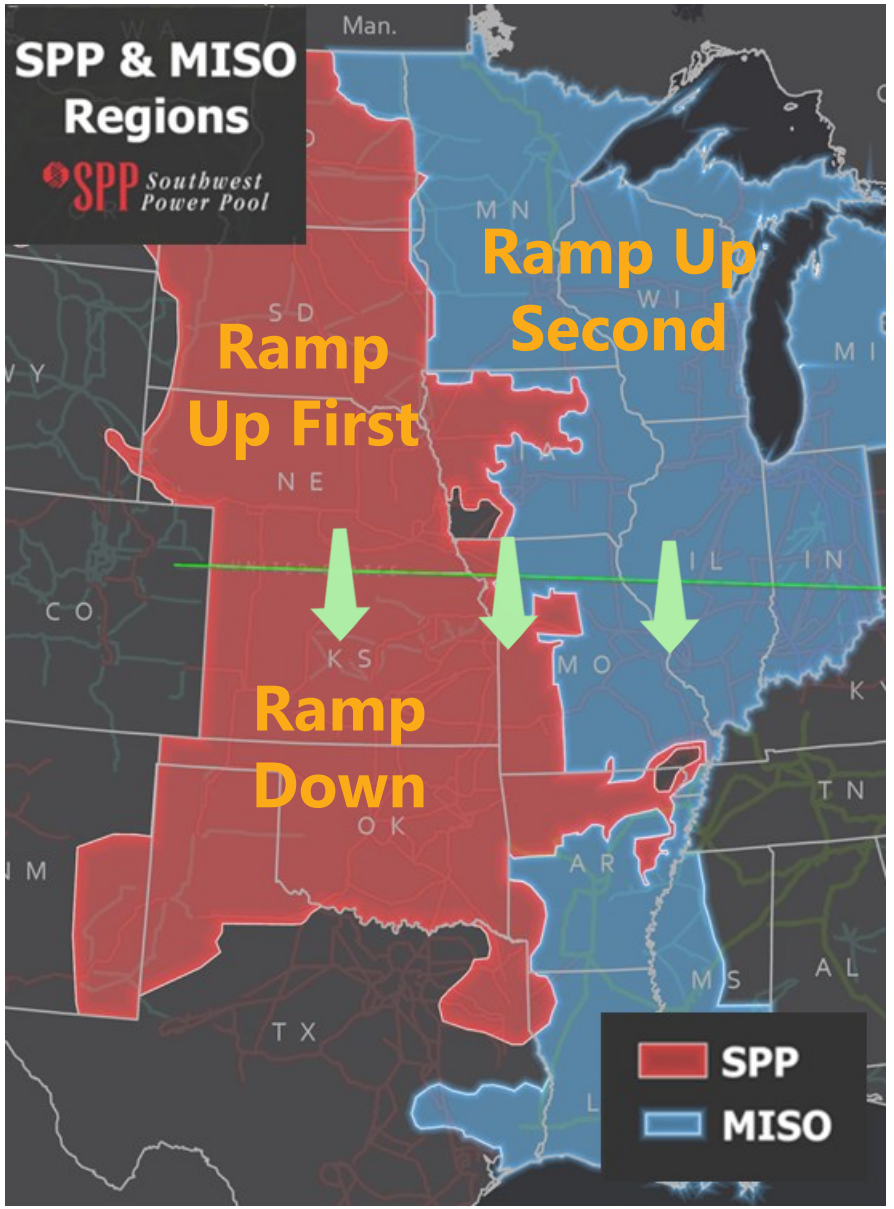
OVERVIEW

TWG and ESWG supported the evaluation of projects that increase inter/intra regional transfer capability

The identification of base case and N-1 violations in the central and western KS areas are indicative of the North-South limit seen during Winter Storm Uri and in real-time

The winter weather transfer analysis assesses the increase in transfer capability from SPP North to SPP South across the Nebraska-Kansas border

Purpose is to addresses EHV congestion observed high transfer periods during extreme winter weather scenarios



2024 INTEGRATED TRANSMISSION PLAN

COLLABORATION

INPUTS

- 11 Organizational Groups, 138+ meetings
- Evaluated >2,100 solutions
- 27-month study

RESULTS

OUTPUTS

- 2,333 miles of new transmission
  - 1,495 miles 345 kV
  - 293 miles 765 kV
- 495 miles of rebuilt transmission
- 89 new transmission projects

VALUE

IMPACT

- More reliable and resilient grid
- Cost levelization across SPP footprint
- Relief of operational congestion
- Facilitation of generation interconnection, resource adequacy and delivery point load additions

BENEFITS

OUTCOMES

Final Portfolio Benefits

- $7.67B E&C costs
- $10.76B 40-year PV cost
- $88.7B - $95.7B Lower 40-year APC
- 8.30 - 8.94 40-year B/C ratio range

2024 ITP Solutions

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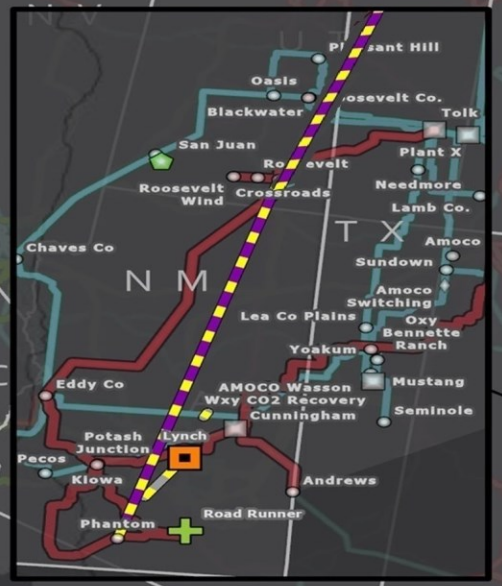
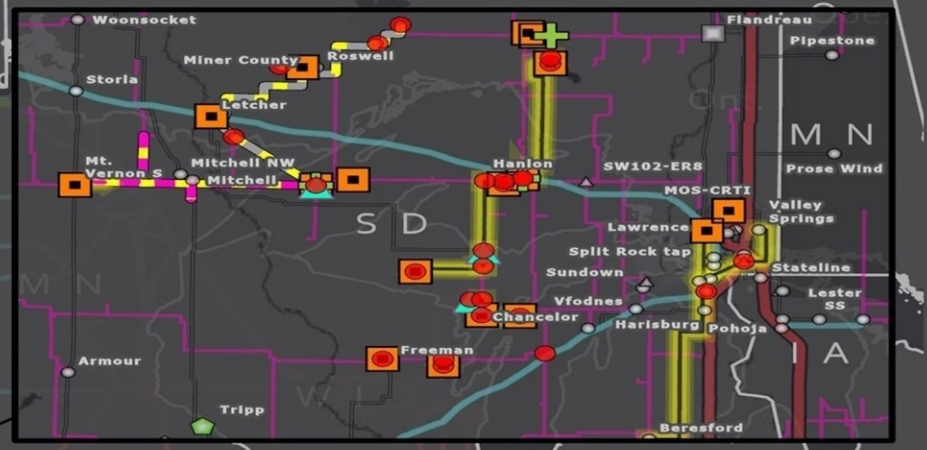




- 20-Yr Assessment Corridors
- Reactive Device
- Tap
- Transformer
- Substation
- Terminal Equipment
- New Line 69 kV
- New Line 115 kV
- New Line 138 kV
- New Line 161 kV
- New Line 230 kV
- New Line 345 kV
- New Line 765 kV
- Rebuild Line 69 kV
- Rebuild Line 115 kV
- Rebuild Line 138 kV
- Rebuild Line 161 kV
- Rebuild Line 230 kV
- Rebuild Line 345 kV

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

COST AND BENEFIT

E&C Costs by Grouping

Reliability:	$ 3,086,351,028
Short Circuit:	$ 1,873,928
Winter Weather:	$ 2,229,622,633
Operational:	$ 297,636,782
+ Economic:	$ 2,056,051,186

$7,671,535,557

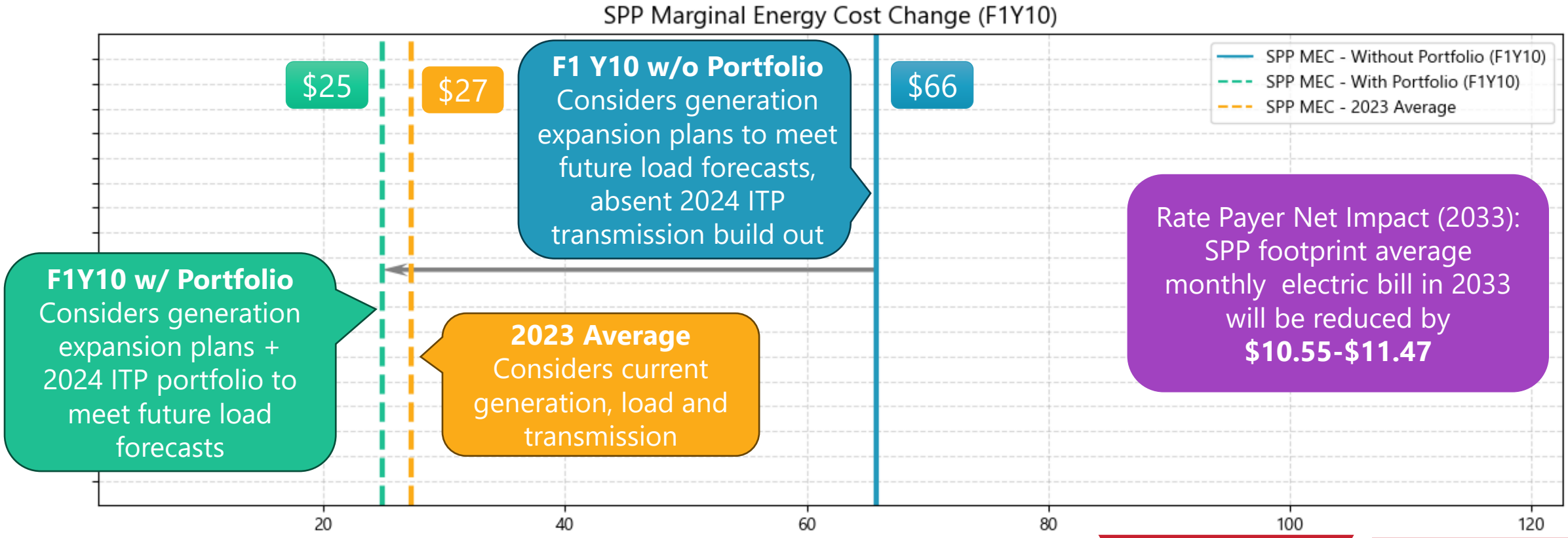
Portfolio optimizes reliability, resiliency and economics to bring substantial benefits to the region

	40-Year Present Value (PV) in 2024$		
Project Type	**Total ATRR Cost**	**APC Benefit (F1)**	**APC Benefit (F2)**
Reliability & Short Circuit	$4,346,170,635	$71,277,068,721	$77,376,064,711
Winter Weather	$3,126,780,923	$429,228,481	$711,538,753
Operational	$417,400,235	$1,053,148,278	$1,383,881,658
Economic	$2,865,437,690	$4,214,329,803	$4,657,719,268
Full Portfolio	$10,758,417,445	$88,684,811,346	$95,656,590,933

Note: Economic projects that addressed Reliability or Operational need types were included in the other need type's calculation

FINANCIAL IMPACT OF 2024 ITP PORTFOLIO

SPP F1Y10 Marginal Energy Cost (MEC) is reduced from ~$66/MWh to ~$25/MWh



F1 Y10 w/o Portfolio Considers generation expansion plans to meet future load forecasts, absent 2024 ITP transmission build out

F1Y10 w/ Portfolio Considers generation expansion plans + 2024 ITP portfolio to meet future load forecasts

2023 Average Considers current generation, load and transmission

Rate Payer Net Impact (2033): SPP footprint average monthly electric bill in 2033 will be reduced by **$10.55-$11.47**

Marginal Energy Cost - Represents the average cost, SPP system wide, of producing one additional unit of energy

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

Leading our industry to a brighter future while delivering the best energy value.

Mission & Vision