SPP Southwest Power Pool

2022 **20YA**

2022 20-YEAR ASSESSMENT

CALVIN DANIELS, ESWG CHAIR

NATASHA HENDERSON, DIRECTOR OF SYSTEM PLANNING

ESWG/TWG recommends MOPC:

- Approve the 2022 20-Year Assessment report as documentation SPP has completed the requirements in SPP Open Access Transmission Tariff Attachment O, Section 4.2

Goals of the 20 Year Assessment (20 YA)

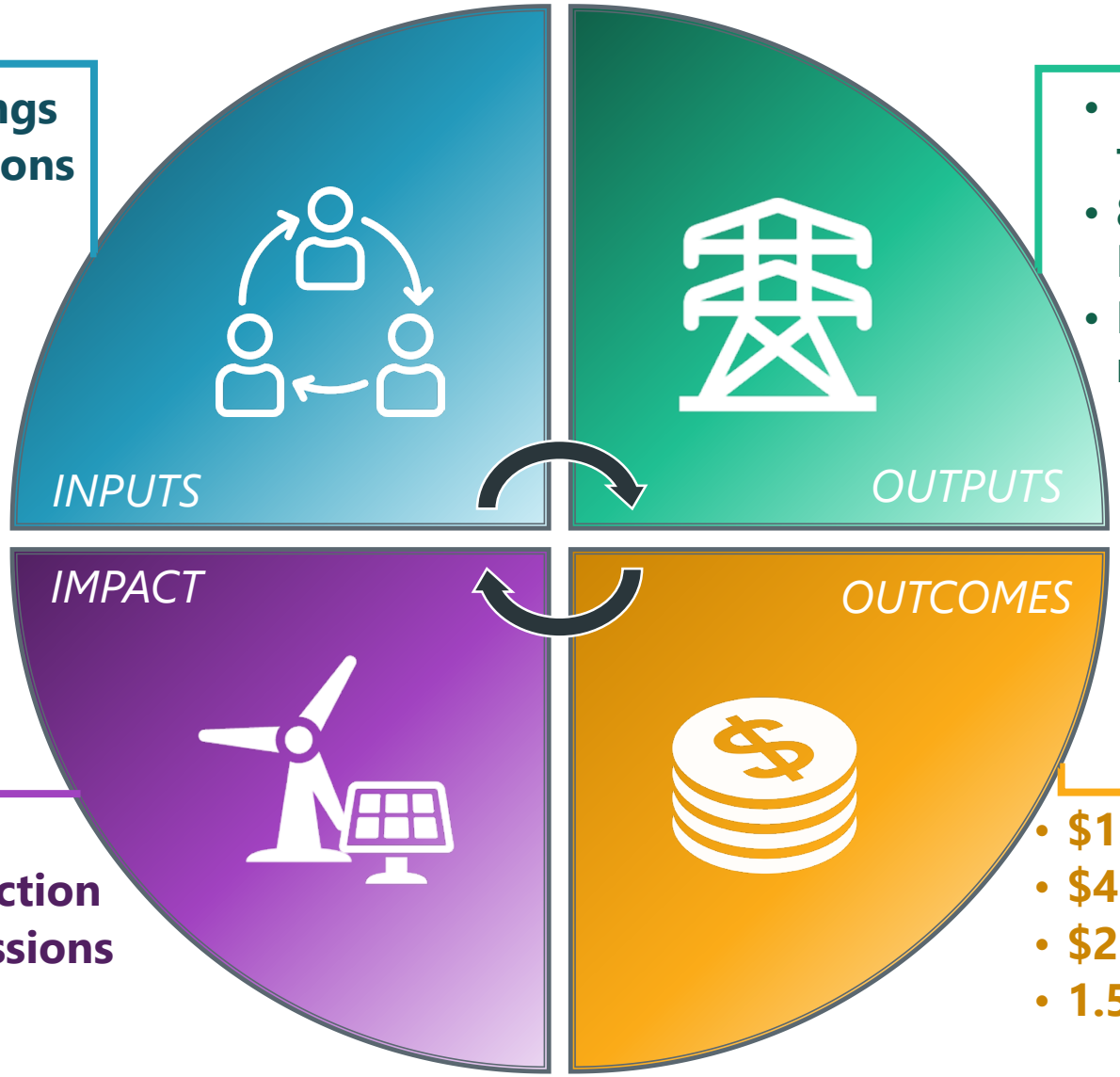
- Develop a long-range extra high voltage (EHV, 300 kV+) transmission road map for the SPP region
- Identify projects* that economically deliver energy within the SPP region while addressing a reasonable range of future industry uncertainty
- Provide a source of candidate projects that will inform shorter-term planning assessments for the purpose of injecting longer-term vision

*Note: No Notices to Construct are issues as a result of the 20 YA

SPP'S 20-YEAR ASSESSMENT

Collaboration

- 8 groups, 100+ meetings
- Evaluated > 463 solutions
- 35-month study



Results

- 1,206 miles of new EHV for Future 1 & Future 2
- 896 miles of new EHV for Future 3 & Future 4
- Enables up to 93% CO_2 reduction

Value

- More reliable grid
- Generation interconnection
- Decreased carbon emissions

Benefits

- $1.37B-$1.55B E&C cost
- $457M-$1.17B 1-year benefits
- $269M-$292M 1-year costs
- 1.57-4.35 B/C ratio range

2021 **ITP**

FUTURES OVERVIEW

FUTURES OVERVIEW

F1/2 : Reference Case & Emerging Technologies

- Follow expectations aligned with 2023 ITP F1/F2
- Utilize current forecasts and industry trends for load growth, fuel prices
- Increased renewable penetration
  (higher penetration levels in F2)
- Age-based retirements for coal/oil/gas
  (ages reduced for F2 leading to more retirements)
- Electrification considered in Future 2

F3/4: Accelerated Decarbonization & Hurdle Rate Sensitivity

- Targeting carbon reduction of 93%-95%
  (from 2017 levels)
- Increased natural gas prices
- All coal and oil resource retired
- Increased renewable penetrations
- Utilized carbon capture CC's to meet carbon reduction goals
- Load profile modifications for energy efficiency, electric heating, and increased electrification
- SPP/MISO hurdle rate removed in F4

MODELING LIMITATIONS

Discovered early on a software limitation with PROMOD

- Dispatch algorithm did not result in expected operation of energy storage
- Storage drove congestion and conventional resource usage, in opposition of the carbon reduction efforts in F3

Energy storage used sparingly to meet energy and peak demand load

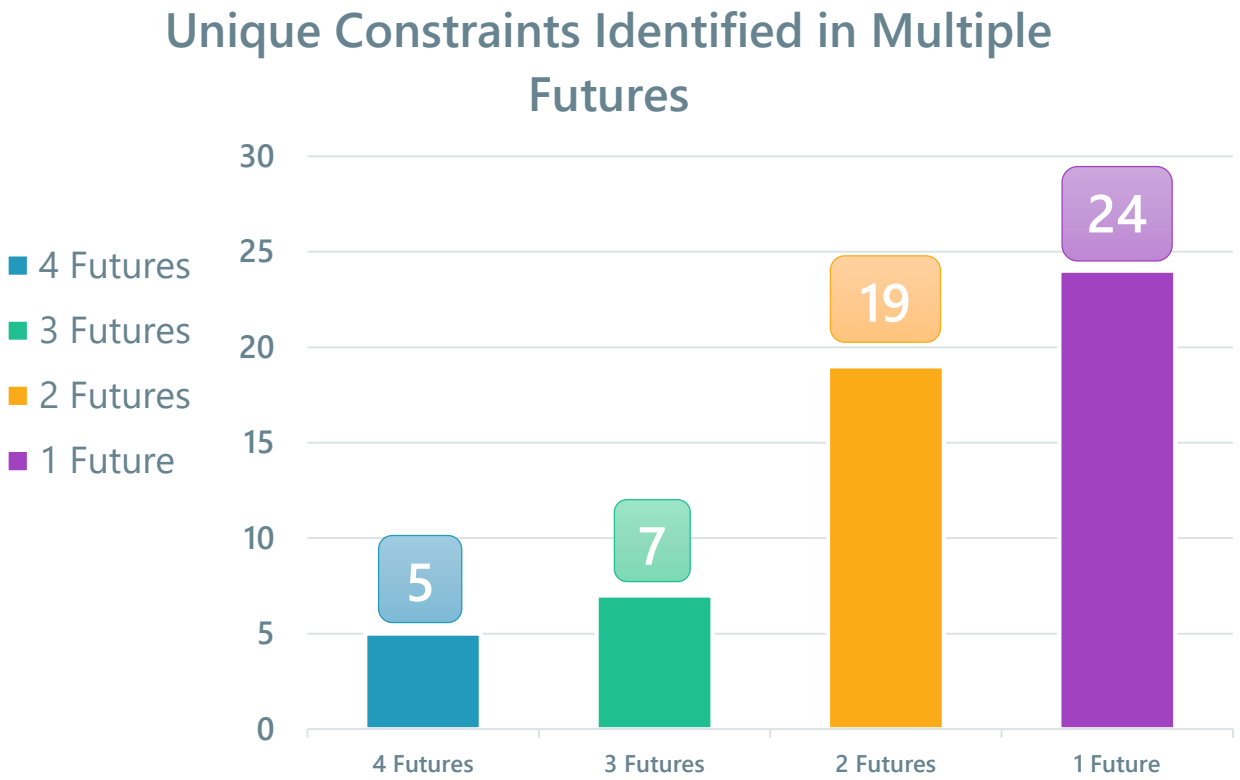
- Some uncertainty in needs, congestion scores, and solution results

2022 **20YA**

NEEDS ASSESSMENT REVIEW

NEEDS ASSESSMENT SUMMARY

- Performed economic and policy needs assessment
- Limited to top 25 constraints for each future
  - Only 55 unique constraints across all futures



Common Economic Needs to 2023 ITP		
20 YA Future	2023 ITP	
	F1	F2
F1	12	13
F2	10	11
F3	4	5
F4	6	7

PORTFOLIO DEVELOPMENT

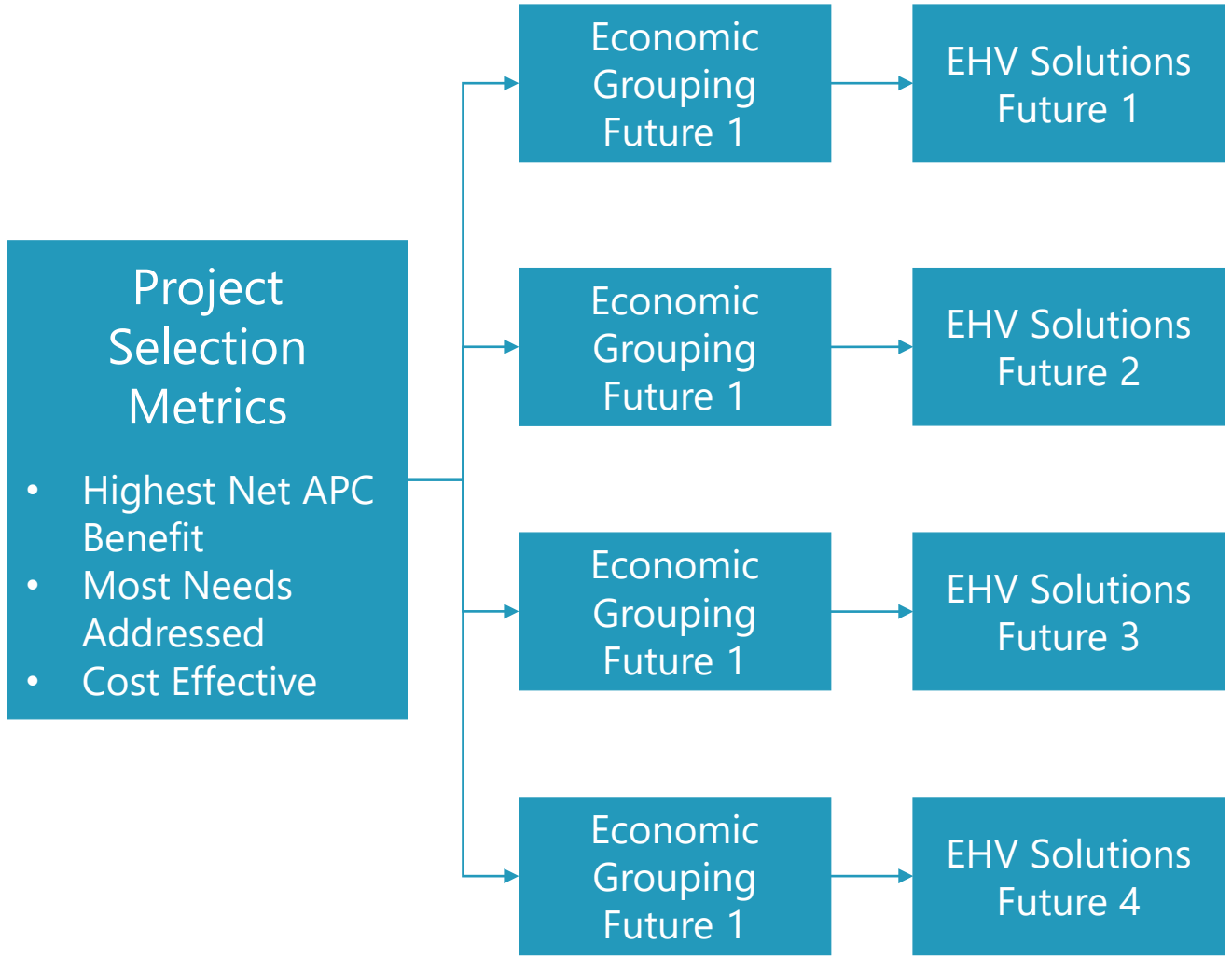
PORTFOLIO DEVELOPMENT

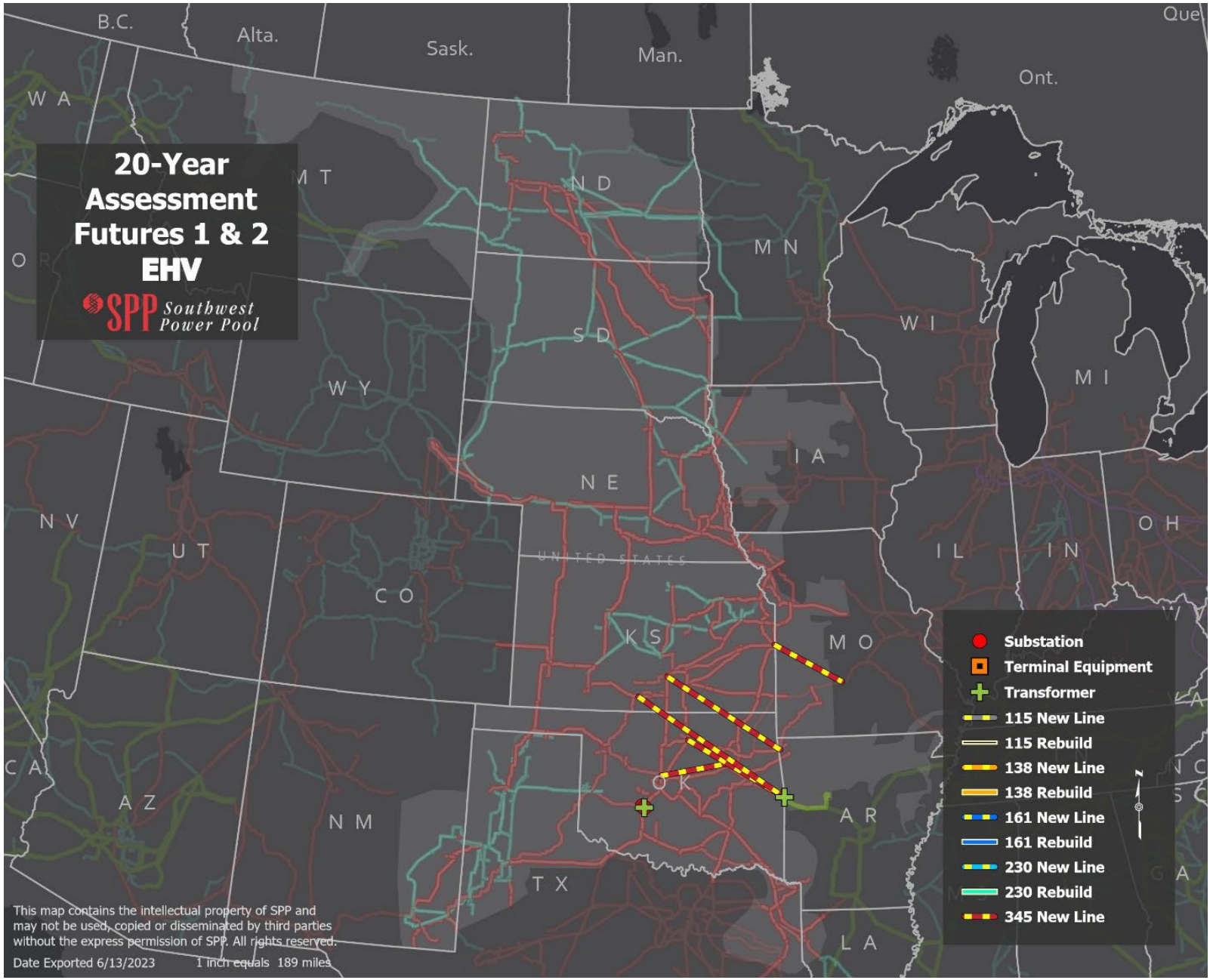
ITP vs. 20 YA difference

- 20 YA: **Individual** EHV project performance
- ITP: **Optimized portfolio** of projects at all kV levels

No subtraction runs in 20YA

- Used to optimize all projects together



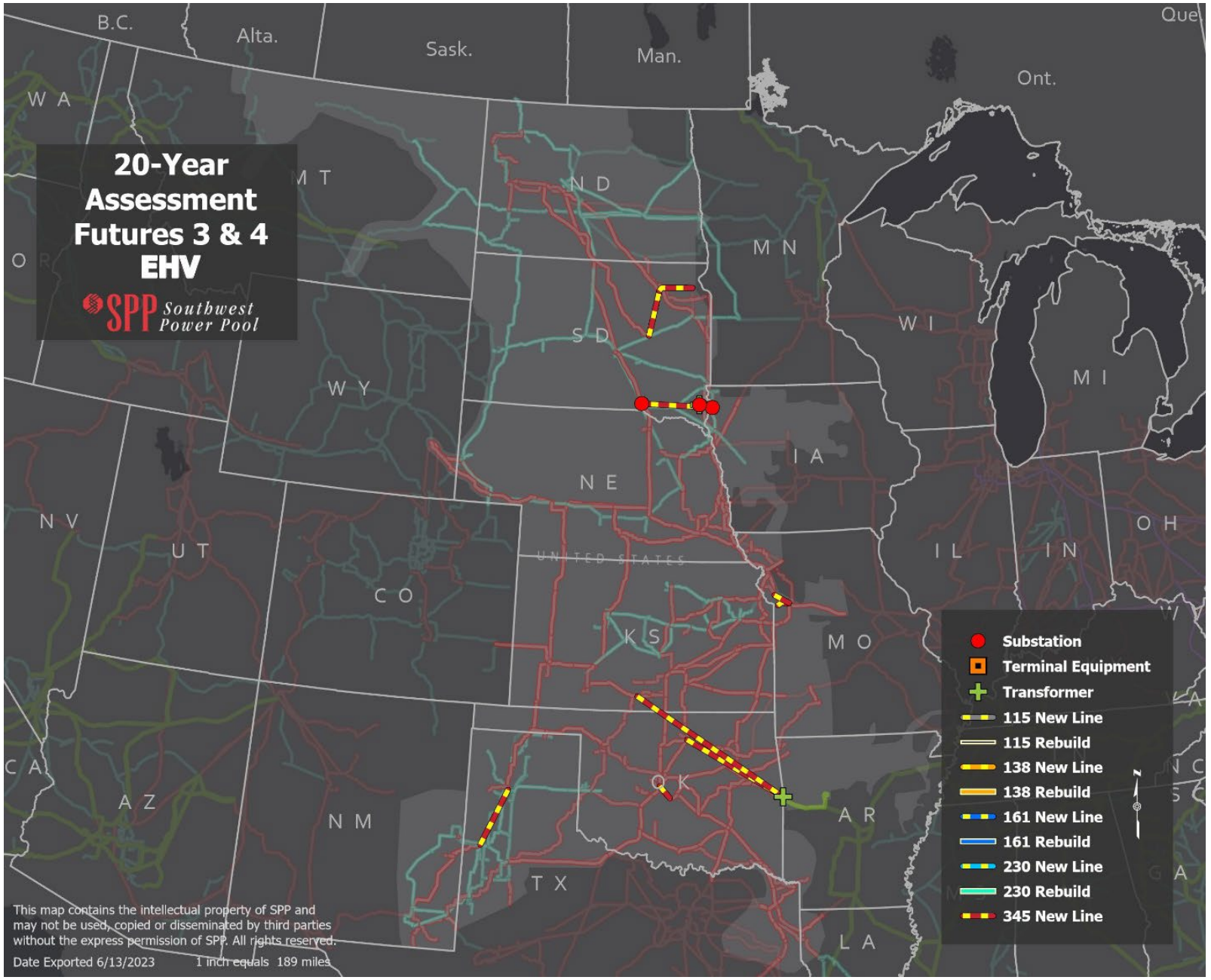


2022 **20YA**

FUTURE 1 & 2 EHV PORTFOLIO

8 Projects ~$1.55B E&C cost

- Ft. Smith-Thistle 345 kV
- Ft. Smith-Sooner 345 kV
- Ft. Smith 500/345 kV XFMR
- Flint Creek-Buffalo Flatts 345 kV
- LaCygne-Huben 345 kV
- Matthewson-Riverside Station 345 kV
- Gracemont-Anadarko 345 kV + Anadarko XMFR



2022 **20YA**

FUTURE 1 & 2 EHV PORTFOLIO

8 Projects ~$1.37B E&C costs

- Ft. Smith-Thistle 345 kV
- Ft. Smith-Sooner 345 kV
- Potter-Tolk 345 kV
- Nashua-Sibley 345 kV
- Hawthorne-Sibley Ckt 2 345 kV
- Cimarron-Normal Hill Ckt 2 345 kV
- Broadland-Groton-*Groton Tap 345 kV*
- *Eagle*-Beresford-*White Swan* + Beresford 345/115 kV XFMR

**Italics denotes a station is tapping an existing line*

WHAT DID WE LEARN?

Future 1/2

- West → East congestion expected to continue to move renewable energy to the east
- High concentration of new wind sited in central and western Kansas/OK
- Conventional resources retired near load centers replaced with conventional resource prototypes

Future 3/4

- Lower EHV project cost with higher benefits overall driven by additional lower voltage solutions
- Incremental wind sited more to the east, limiting the need for west→east transfers

At extreme renewable levels, hurdle rate removal not impactful

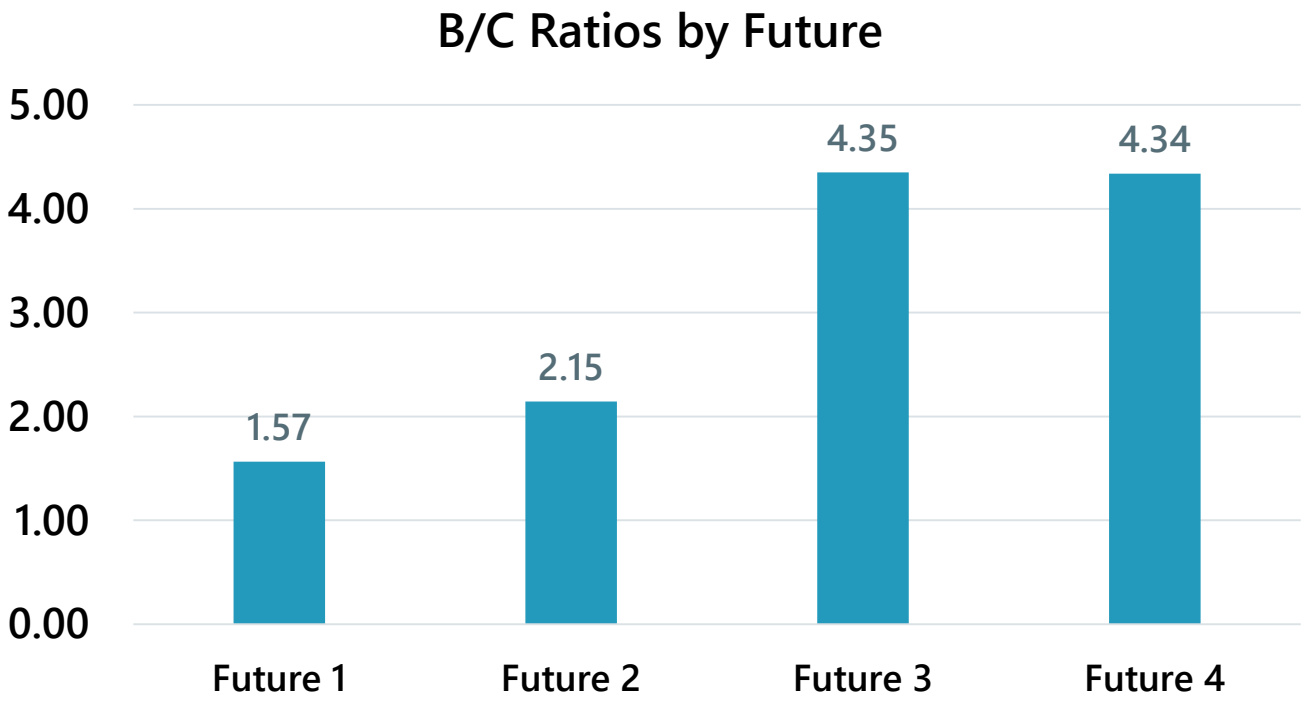
- Likely due to high % of negative LMPs
- System LMPs went negative ~40% of the time, as renewable installations increased

2022 **20YA**

BENEFITS

BENEFIT METRICS

	F1	F2	F3	F4
Benefit ($M)	$457	$627	$1,172	$1,168
Cost ($M)	$292	$292	$269	$269
Net Benefit ($M)	$165	$335	$903	$899
B/C	1.57	2.15	4.35	4.34



2022 **20YA**

One model year simulated, 40 year numbers unavailable

- Net benefit = 1-year benefit minus 1-year cost
- B/C ratio = 1-year benefit divided 1-year cost

STAKEHOLDER CONSENSUS

- The 20 YA was approved unanimously by the TWG and ESWG

Group	Date	Action	Abstained	Opposed
TWG	6/28/2023	Unanimous approval	0	0
ESWG	6/28/2023	Unanimous approval	1	0

2022 **20YA**

FINAL RECOMMENDATION

ESWG/TWG recommends MOPC:

- Approve the 2022 20-Year Assessment report as documentation SPP has completed the requirements in SPP Open Access Transmission Tariff Attachment O, Section 4.2

2021 **ITP**

APPENDIX

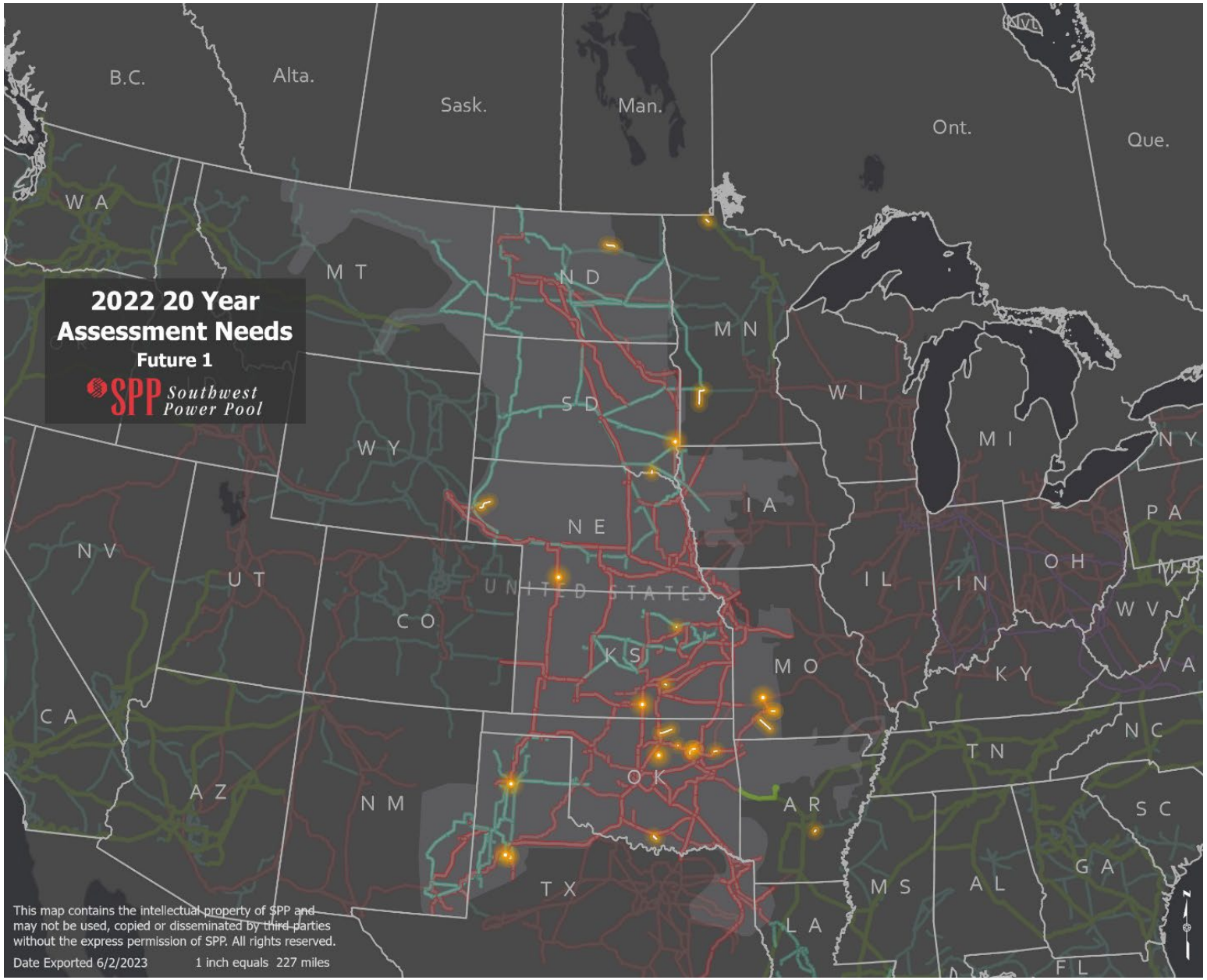
	DRIVERS			
KEY ASSUMPTIONS	Future 1	Future 2	Future 3	Future 4
Peak Demand Growth Rates	As submitted in load forecast	As submitted in load forecast	Moderate increase due to switching to electric home heating and increased electric transportation, potential shift to a winter peaking SPP	Moderate increase due to switching to electric home heating and increased electric transportation, potential shift to a winter peaking SPP
Energy Demand Growth Rates	As submitted in load forecast	Increase due to electrification growth	Higher demand due to electrification compared to F2 due to aggressive policy	Higher demand due to electrification compared to F2 due to aggressive policy
Natural Gas Prices	Current industry forecast	Current industry forecast	Increase prices influenced by emissions pricing policy	Increase prices influenced by emissions pricing policy
Coal Prices	Current industry forecast	Current industry forecast	Increase prices influenced by emissions pricing policy	Increase prices influenced by emissions pricing policy
Emissions Prices	Current industry forecast	Current industry forecast	Emission prices based on new policy	Emission prices based on new policy
Fossil Fuel Retirements	Coal age-based 56+, Gas/Oil age-based 50+, subject to generator owner (GO) review	Coal age-based 52+, Gas/Oil age-based 48+, subject to GO review and ESWG approval	All Coal and Oil retired. More Gas retirements, driven by higher emission reduction levels relative to F2 driven by new policy	All Coal and Oil retired. More Gas retirements, driven by higher emission reduction levels relative to F2 driven by new policy

	DRIVERS			
Environmental Regulations	Current regulations	Current regulations	Federal Policy, mandated carbon cuts, carbon tax	Federal Policy, mandated carbon cuts, carbon tax
Demand Response	As submitted in load forecast	As submitted in load forecast	Increase from F2 assumed to reduce peak demand associated with electric space heating by 10%	Increase from F2 assumed to reduce peak demand associated with electric space heating by 10%
Distributed Generation (Solar)	As submitted in load forecast	900 MW	950 MW	950 MW
Energy Efficiency	As submitted in load forecast	As submitted in load forecast	Assumed increase in energy efficiency resulted in a 3.8% reduction in energy from forecasted levels	Assumed increase in energy efficiency resulted in a 3.8% reduction in energy from forecasted levels
Storage (MW)	3,800	9,450	9,500	9,500
Total Renewable Capacity				
Solar (GW)	19	27	65	65
Wind (GW)	41	50	62	62

FUTURE 1 NEEDS

Top 5 congested constraints:

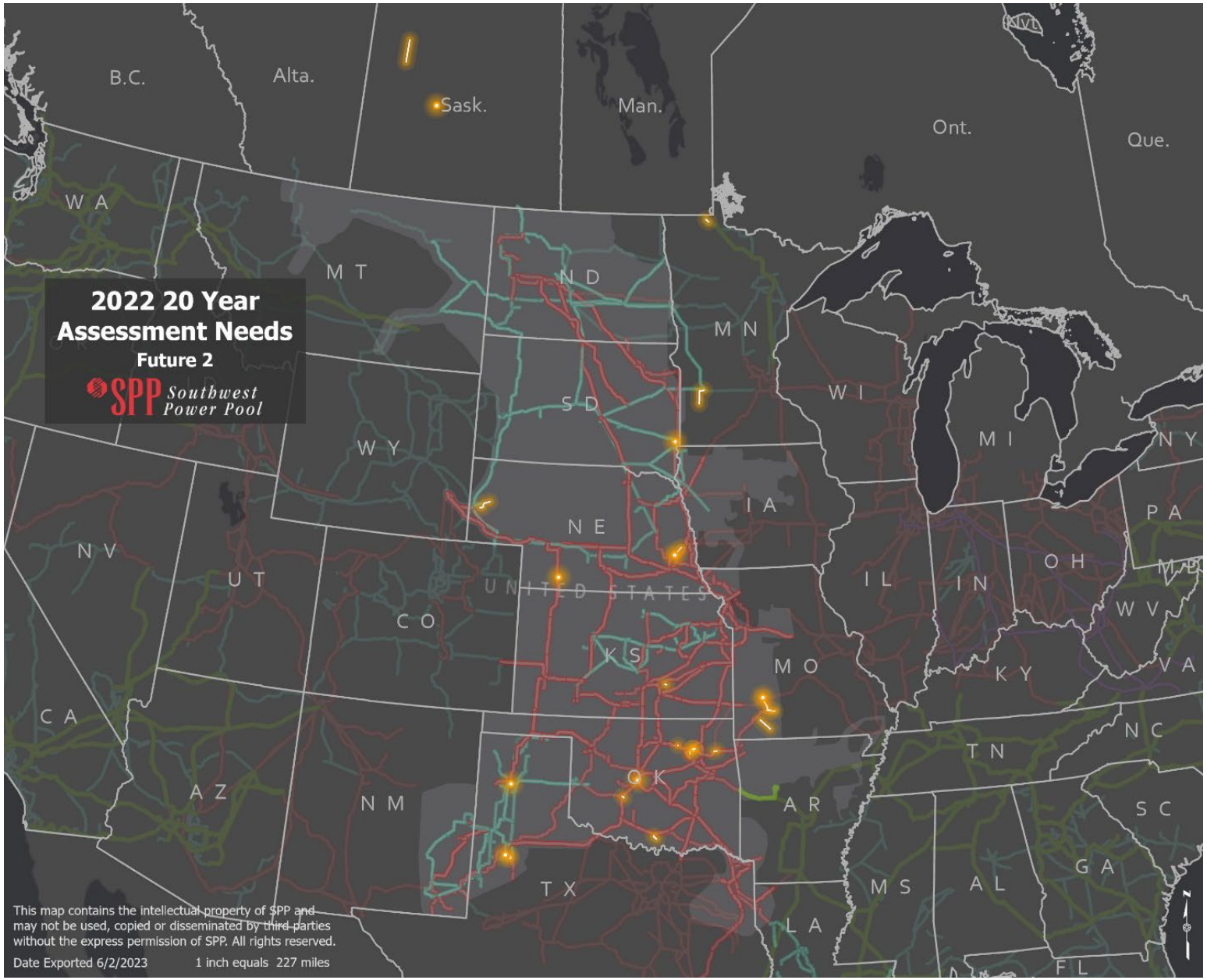
- Butler - Midian 138 kV for the loss of (FTLO) Weaver 138 kV-Tallgrass 115 kV
- Tulsa North-46th Street Tap 138 kV FTLO Tulsa North-Cherokee Data Center West Tap 138 kV
- Springfield-Clay 161 kV FTLO Huben-Morgan 345 kV
- Morrill -Gering Tap 115 kV FTLO Wayside-Stegall-Wayside Line Reactor 230 kV
- Tulsa North-Pine & Peoria West Tap 138 kV FTLO Tulsa North 345-/138 kV transformer



FUTURE 2 NEEDS

Top 5 congested constraints:

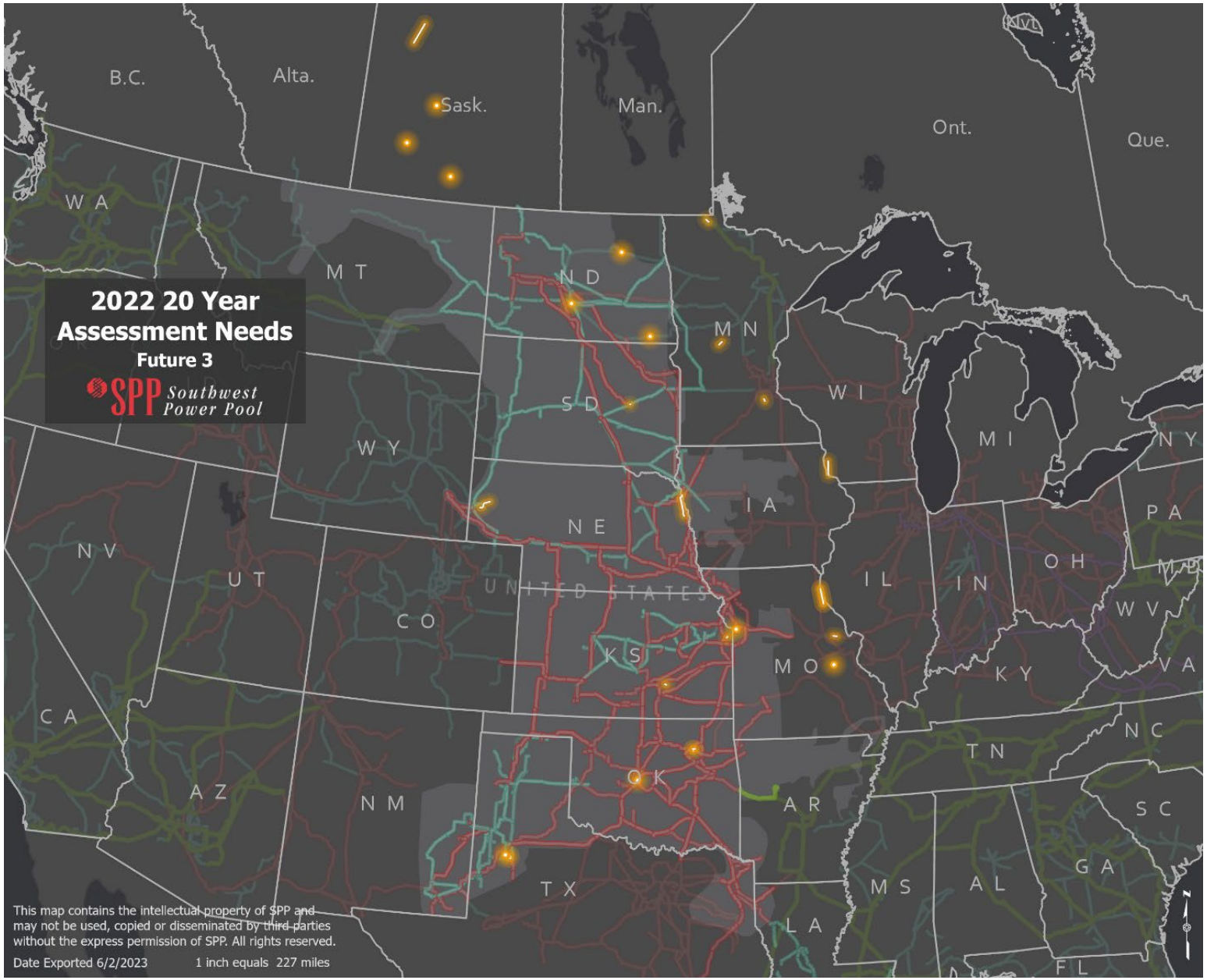
- Tulsa North-Pine & Peoria West Tap 138 kV FTLO Tulsa North 345 kV/138 kV Transformer
- Butler-Midian 138 kV FTLO Weaver-Tallgrass 115 kV
- Granite Falls-Marshall Tap 115 kV FTLO Lyon County 345/115 kV Transformer
- Springfield-Clay 161 kV FTLO Huben-Morgan 345 kV
- Lubbock South Interchange-Lubbock East Interchange 115 kV FTLO Lubbock East Interchange-Jones Station 230 kV



FUTURE 3 NEEDS

Top 5 congested constraints:

- Swift Current 230/138 kV Transformer circuit 2 FTLO Swift Current 230/138 kV Transformer circuit 1
- 5Big Ckb2 -Warren 161 kV FTLO Enon Tap-Montgomery 345 kV
- Assiniboia 230/138 kV Transformer FTLO Poplar River-Assiniboia 230 kV
- Butler-Midian 138 kV FTLO Weaver-Tallgrass 115 kV
- Tulsa North-46th Street Tap 138 kV FTLO Tulsa North-Cherokee Data Center West Tap 138 kV



FUTURE 4 NEEDS

Top 5 congested constraints:

- Assiniboia 230/138 kV Transformer FTLO Poplar River-Assiniboia 230 kV
- Butler-Midian 138 kV FTLO Weaver-Tallgrass 115 kV
- Tulsa North-46th Street Tap 138 kV FTLO Tulsa North-Cherokee Data Center West Tap 138 kV
- Bismark 115 kV-East Bismark 115 kV FTLO Base Case
- Coteau 230/138 kV FTLO Herbert 230 kV-Pasqua 230 kV