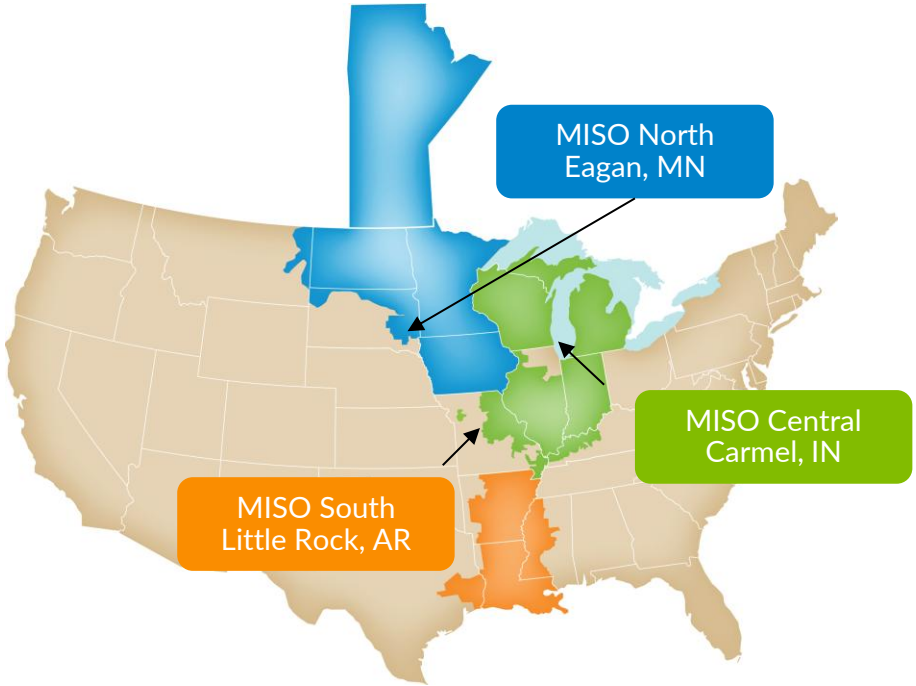
Probabilistic Methods Applied to MISO's LRTP Business Case

ESIG Spring Technical Workshop
March 19th in Austin, Texas
Session 6A: Transmission Planning

MISO key facts



Area Served	15 U.S. States and Manitoba, Canada
Population Served	45 Million
Generating Units	> 1,447
Record Demand	127 GW on 7/20/2011
Market Participants	> 500

MISO's reliability footprint and regional control center locations

MISO applies probabilistic methods to several processes

System Planning	Markets & Operations	Markets & Digital Strategy
✓ LOLE/PRM Study	✓ Operations Risk Management	✓ Strategic Assessments
✓ LRTP Business Case		

LOLE: Loss of load expectation | PRM: Planning reserve margin | LRTP: Long-range transmission planning

Probabilistic methods applied to LRTP T2.1 Business Case methodology

- **Leverages** information from ESIG's Multi-Value Transmission Planning for a Clean Energy Future
- **Integrates** transmission planning and RA into a single study framework

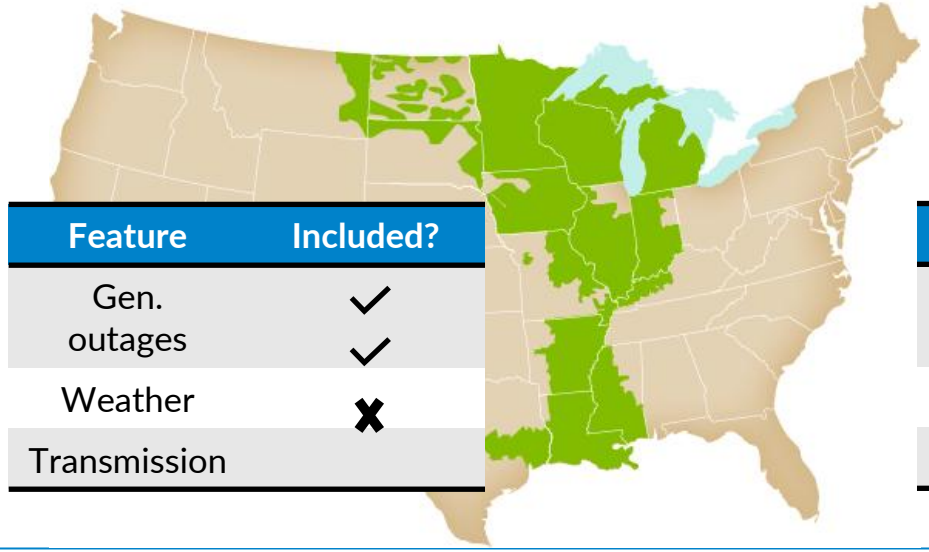
LRTP T2.1 Benefit Metrics		
1 Energy savings from reduced losses	2 Capacity savings from reduced losses	3 Decarbonization
4 Mitigation of reliability issues	5 Congestion & fuel savings	6 Avoided transmission investment
7 Avoided Capacity Cost	8 Reduced risks from extreme weather impacts	9 Reduced transmission outage cost

RA: Resource adequacy | LRTP T2.1: Long-range transmission planning tranche 2.1

Integrated transmission & RA method adopted in LRTP T2.1

Typical RA model

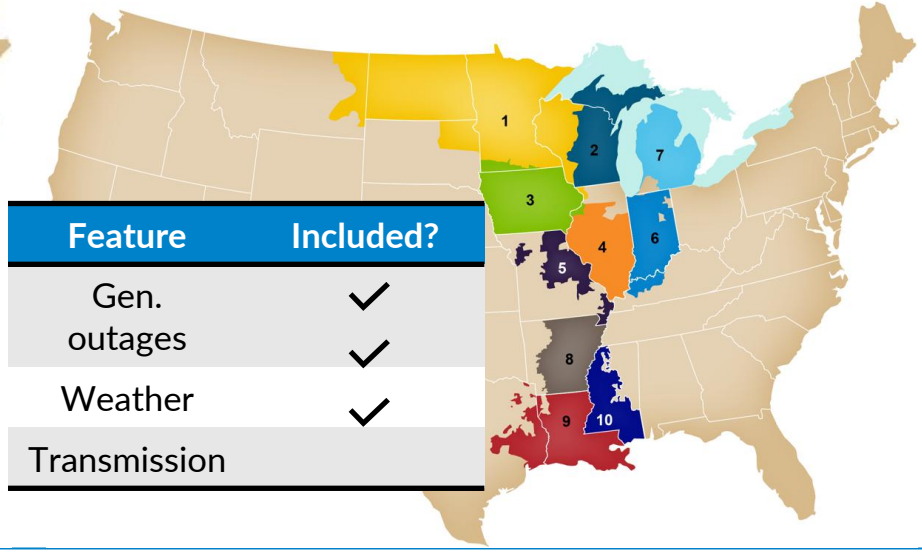
Unconstrained transmission



Feature	Included?
Gen. outages	✓
	✓
Weather	✗
Transmission	

LRTP T2.1 RA model

Constrained transmission

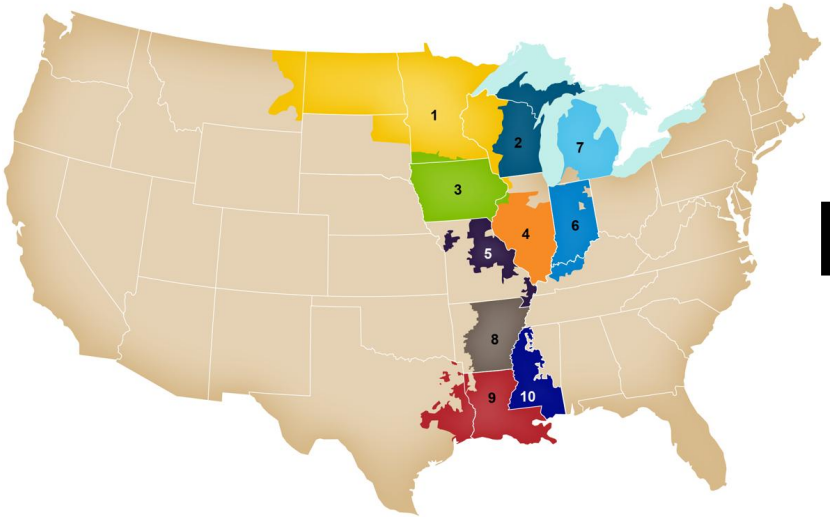


Feature	Included?
Gen. outages	✓
	✓
Weather	✓
Transmission	

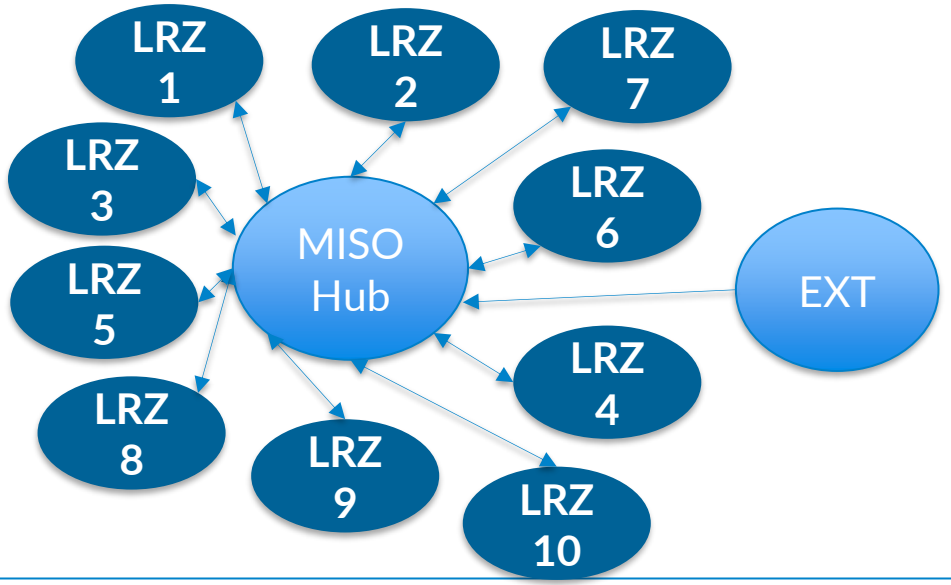
RA: Resource adequacy | LRTP T2.1: Long-range transmission planning tranche 2.1

Integrated transmission & RA method adopted in LRTP T2.1

LRTP T2.1 RA model



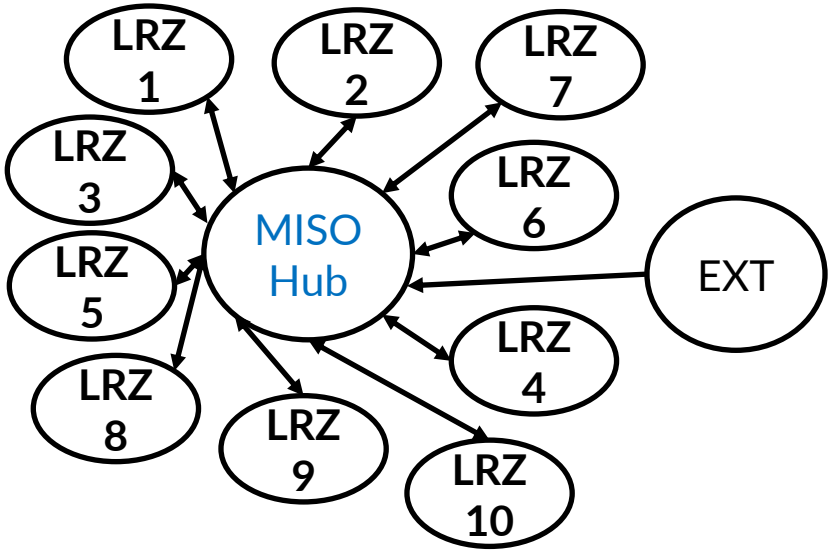
Constrained transmission



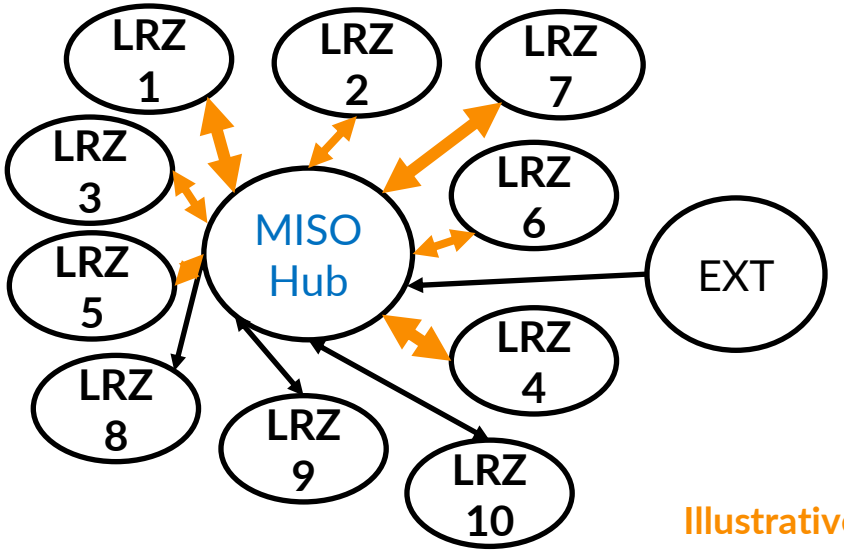
RA: Resource adequacy | LRTP T2.1: Long-range transmission planning tranche 2.1 | EXT: External

Benefits reflect increases in transfer capabilities across the footprint

LRTP T2.1 "base" RA model



LRTP T2.1 "change" RA model



Illustrative

RA: Resource adequacy | LRTP T2.1: Long-range transmission planning tranche 2.1 | EXT: External

Avoided capacity cost benefit (ACC)

7

How much capacity can LRTP T2.1 avoid?

LRTP T2.1 "base" RA model

"Base" case reserve margin

LRTP T2.1 "change" RA model

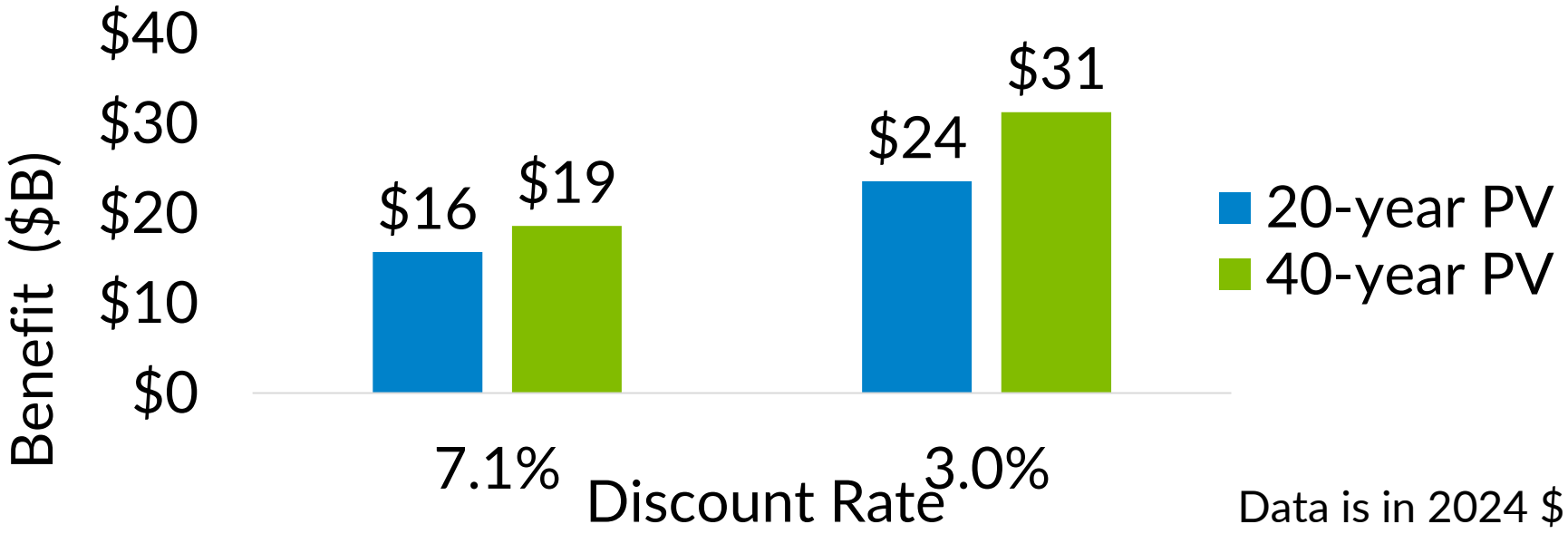
"Change" case reserve margin

LRTP T2.1 ACC benefit = 1 - 2

RA: Resource adequacy | LRTP T2.1: Long-range transmission planning tranche 2.1 | EXT: External

Avoided capacity cost benefit (ACC)

Benefit is monetized by calculating the present value of the incremental capacity need using a resource expansion model

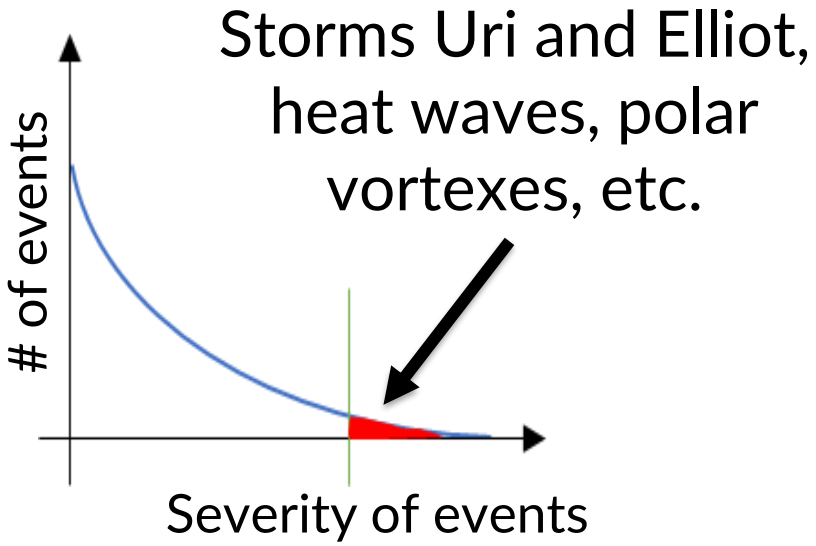


Data is in 2024 $B

RA: Resource adequacy | LRTP T2.1: Long-range transmission planning tranche 2.1 | EXT: External

Reduced risks from extreme weather impacts benefit

- Focuses on the “worst” events
- Same assumptions & method as the ACC benefit metric
- Combines RA metrics and scarcity pricing
- Probability of occurrence must be defined



Illustrative distribution of risk

Reduced risks from extreme weather impacts benefit

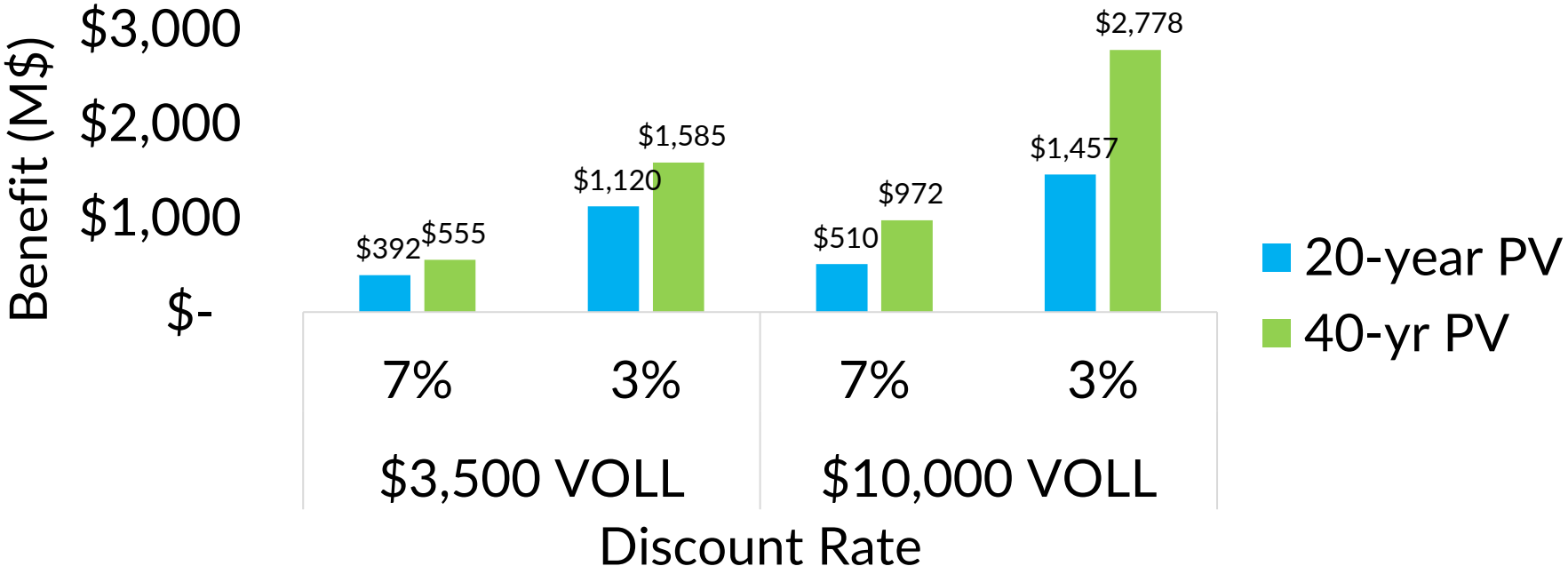
	Expected Unserved Energy during top 20% worst events													
Cases	2007	2008	2009	2010	2011	2012	2014	2015	2016	2017	2018	2019	2020	2021
Without T2.1		▲			▲	▲	❄					❄		❄
With T2.1														

Lower severity

High severity Medium severity Low severity

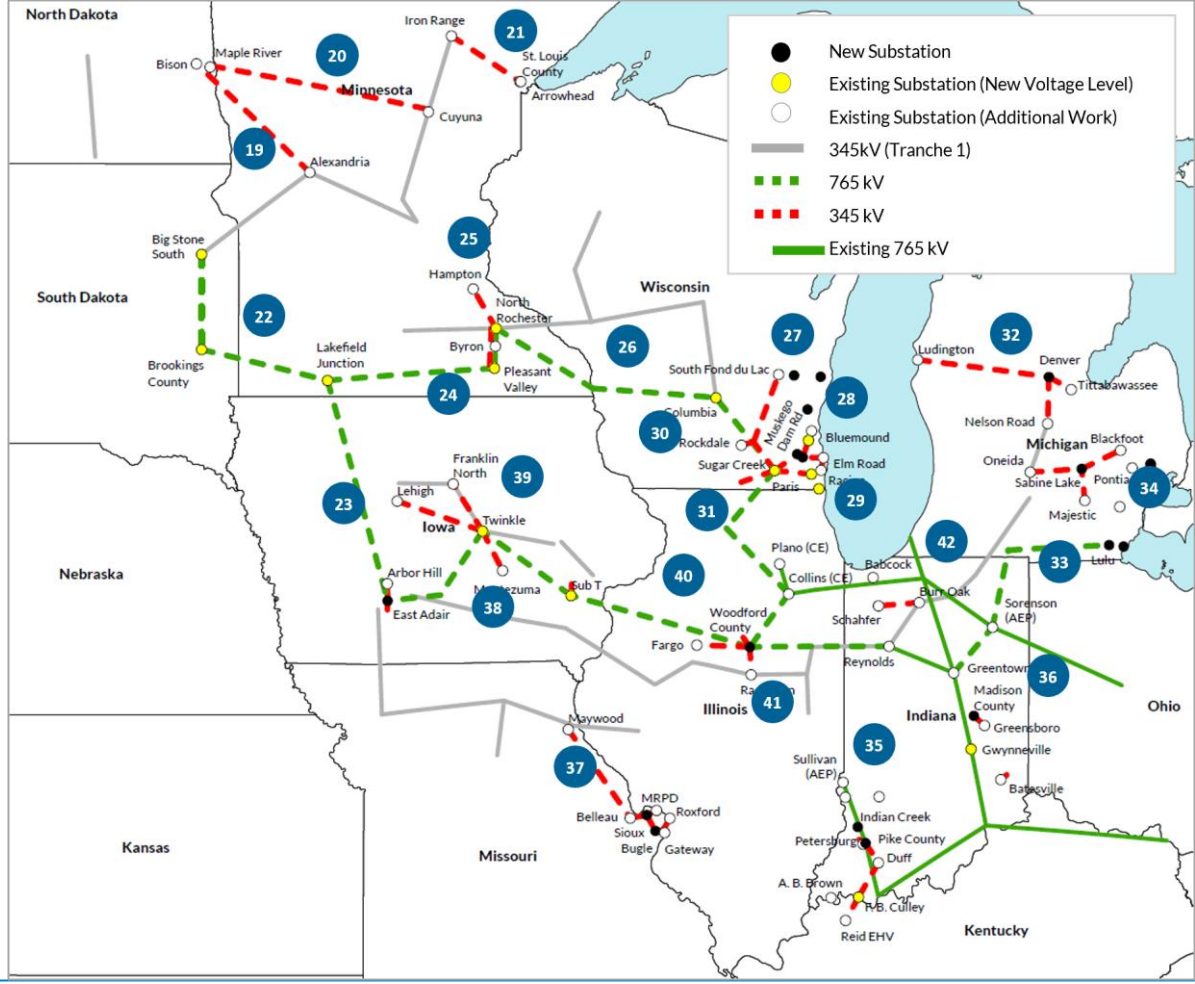
▲ Heat wave ❄ Polar Vortex

Reduced risks from extreme weather impacts benefit



RA: Resource adequacy | LRTP T2.1: Long-range transmission planning tranche 2.1 | EXT: External

When all 9 benefits are included, the LRTP T2.1 benefit to cost ratios result in **1.9-3.8**



How can the Probabilistic Methods developed in MISO's LRTP T2.1 business case be extended to other processes?

LRTP T2.1 Benefit Metrics		
Energy savings from reduced losses	Capacity savings from reduced losses	Decarbonization
Mitigation of reliability issues	Congestion & fuel savings	Avoided transmission investment
Avoided Capacity Cost	Reduced risks from extreme weather impacts	Reduced transmission outage cost

RA: Resource adequacy | LRTP T2.1: Long-range transmission planning tranche 2.1

Thank you!

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