Western Wisconsin Reliability Study

Presented by:
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2011

Preliminary

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Agenda

- Study Participants
- Study Models and Assumptions
- Completed Analysis
  - Summary – All Alternatives
- Thermal Category B Overloads
- Cost Savings
- Transfer Capability
- Questions?

Study Participants

- The scope of the Western Wisconsin Reliability Study
  - Investigate the reliability needs in western Wisconsin under conservative wind assumptions
  - Identify transmission options that will address the identified needs.
- Participating TO's include:
  - Xcel
  - GRE
  - CapX2020
  - DPC
  - ITC Midwest
  - SMMPA
  - coordinated with MISO on modeling issues.

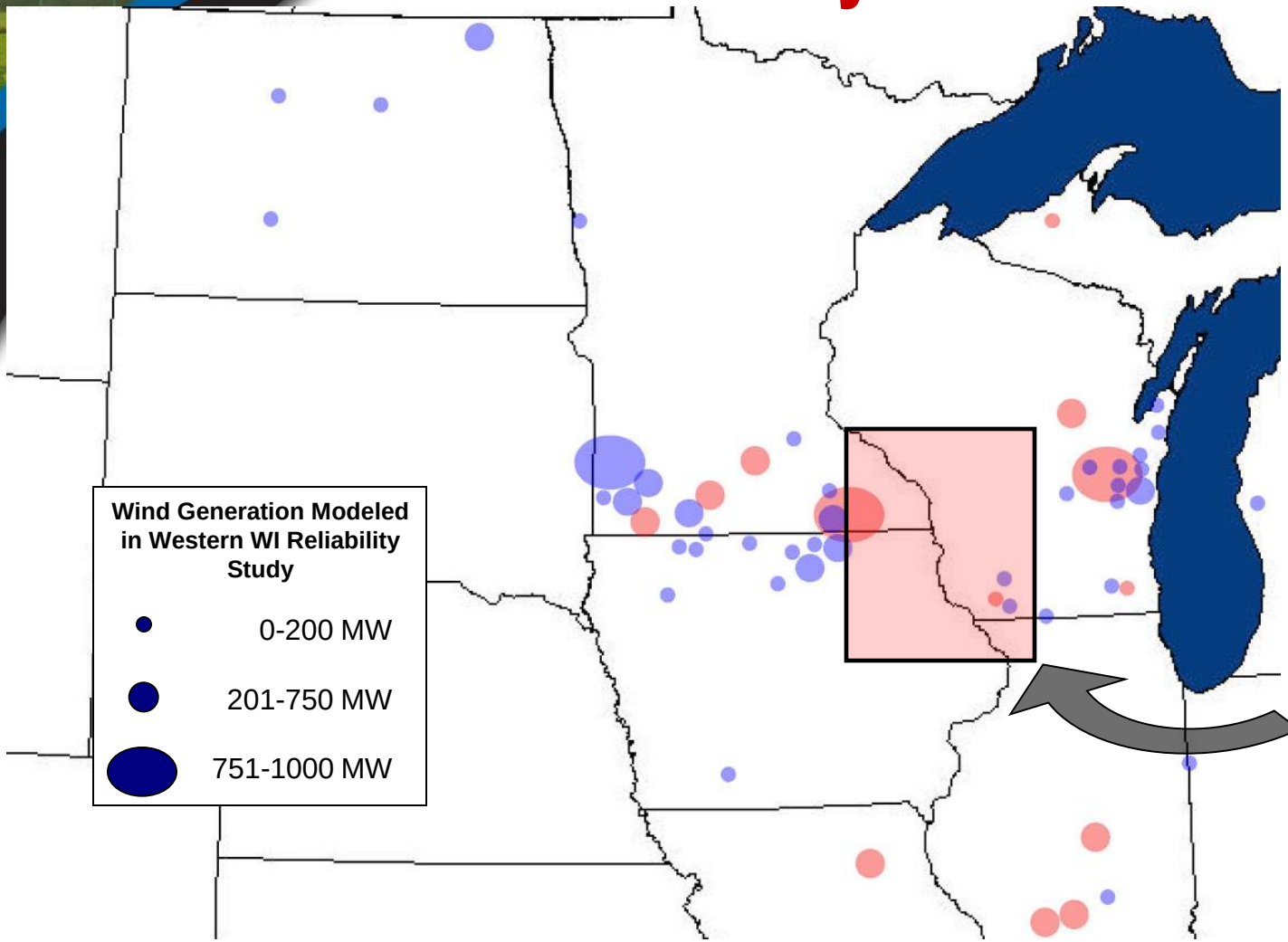
Study Models

	Wind Generation Output	MWEX	ATC West Interface	MRO Export	ATC Import
Summer Peak (SUPK)	20%	485 MW	540 MW Import	1175 MW	1218 MW
Summer Off Peak (SUOP)	35-45%	928 MW	1330 MW Import	1150 MW	1318 MW
Summer Off Peak 90% Wind (SUOP-90)	90%	1029 MW	1440 MW Import	1585 MW	1263 MW

The study models were built from the MISO MTEP08 2018 summer peak and off-peak cases. Study participants updated topology and load in the study footprint. The MISO-provided Security Constrained Economic Dispatch (SCED) dispatches were applied to the three cases.

Wind assumed in this case is conservative, totaling 13 GWs across entire MISO footprint in 2018. Current wind in MISO is 7.7 GWs.

Study Area/Wind locations



SD: 0 MW
ND: 583 MW
MN: 4782 MW
IA (MISO): 2401 MW
WI: 2823 MW

Total of above: 10,589 MW
Total in MISO: 13,277 MW

Blue = existing/proposed, Red = Conceptual

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Future Wind Units in Study Participants' Areas

Substation Location	Wind Generation (MW)
Burlington 138 kV	100
Hillman 138 kV	100
Rocky Run 345 kV	300
South Fond du Lac 345 kV	800
Adams 345 kV	1000
Wilmarth 345 kV	500
Lakefield 345 kV	400
Magnolia 161 kV	350
Total	**3550**

**Blue highlighting indicates wind farms in ATC's area

Completed Analysis

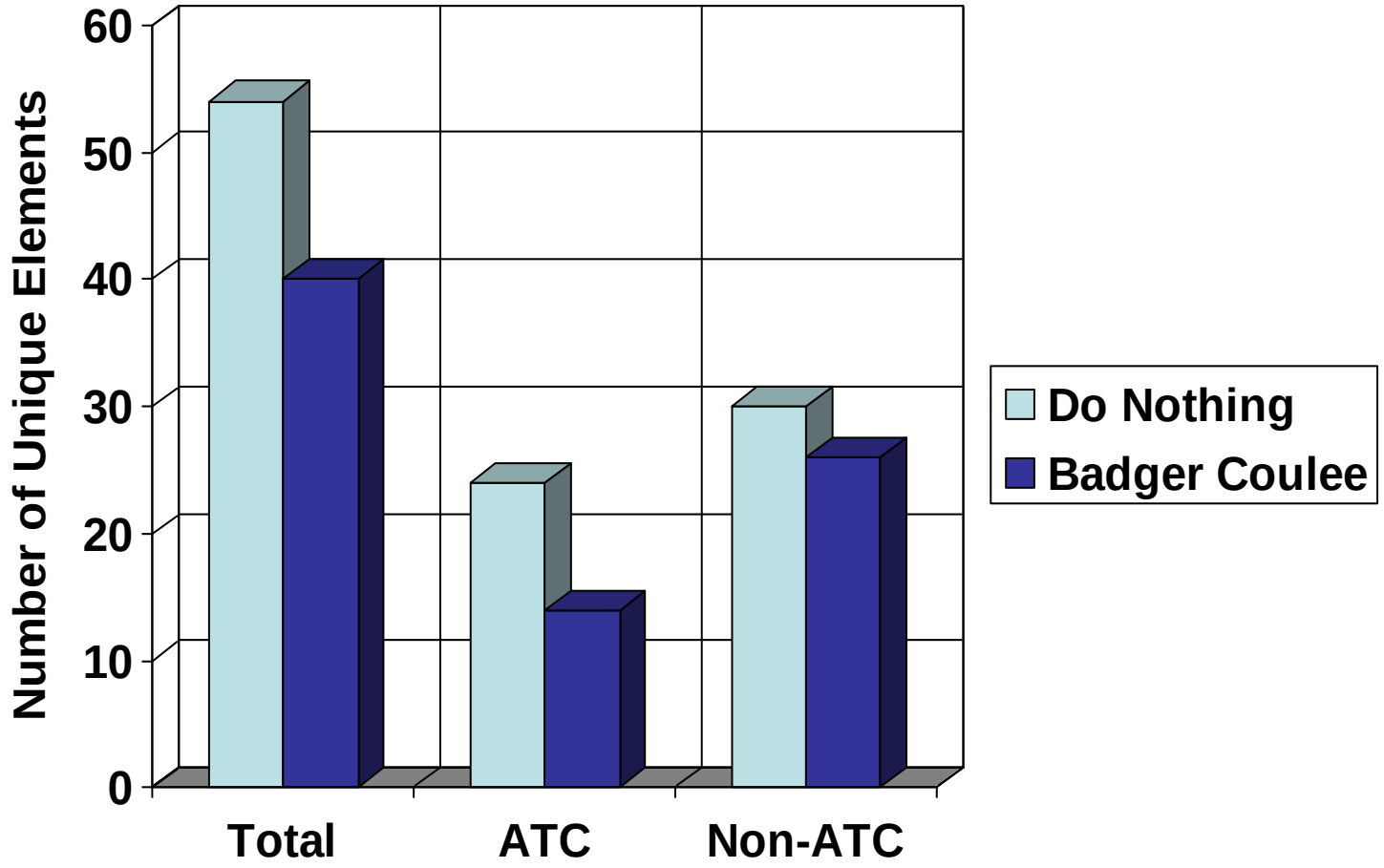
- Steady State
  - Category B & C Contingencies were tested
- Severity Index
- FCITC (SUOP & SUPK Only)
  - MN to WI, IA to WI, MN & IA to MISO Central & East
- Voltage Stability
- Transient Stability
  - Category B, C & D Contingencies were tested

These are preliminary results as of the date of this presentation. ATC's planning analysis is a continuing process, and ATC will provide updated results for this project as appropriate. ATC may also change its planning assumptions or methodology with respect to this project, and any such change may alter the results of its analysis. ATC's definitive planning analysis will be set forth in its CPCN Application for this project.

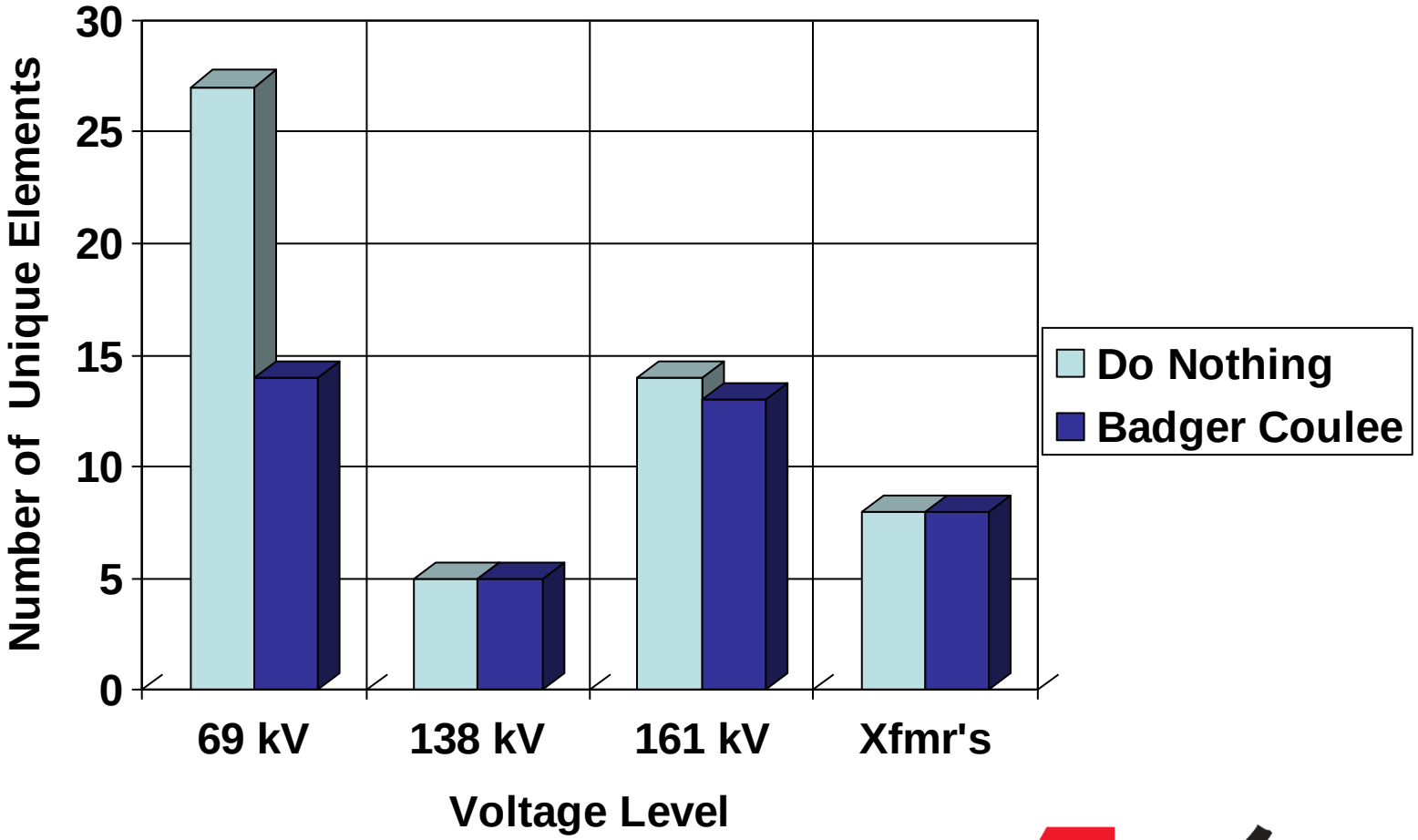
Completed Analysis Summary

		Low Voltage	NLAX-SPG-CRD (1a)	Badger Coulee (NLAX-NMA-CRD) (1b)	DBQ-SPG-CRD (8)	Badger Coulee + Dubuque (7c)	Genoa-NOM 765
NON-MONETIZED BENEFITS							
Regional wind outlet	qualitative		X	X	X	X	X
Looping LaCrosse 345 kV	qualitative		X	X		X	
MN RES/CVS supported	qualitative		X	X		X	
Competitive / HHI	HHI % improvement	5.52%	9.27%	8.71%	8.84%	11.59%	4.57%
Reliability Indices	RI (larger is better)	1.1	2.6	2.7	3.0	3.8	3.6
Transient Stability Benefit	Ranking (lower is better)	3	2	1	2	1	3

Thermal Overload Category B



Thermal Overload Breakdown



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Quantified Reliability Benefit
Avoided Low Voltage Facilities

$82.7M (Cat C Voltage Support not being built)

+ $54.7M (Cat B Thermal Support not being built)

= $137.4M in savings for ATC's area

Quantified Reliability Benefit
Voltage Support

MVAR	Type	Where	Voltage Class	Cost
75	SVC	Cardinal	138 kV	$23,503,486
75	SVC	Kegonsa	138 kV	$28,571,565
60	SVC	Town Line Road	138 kV	$27,406,762
32	Capacitor	Verona	138 kV	$1,638,500
32	Capacitor	Bass Creek	138 kV	$1,638,500

Without the addition of the Badger Coulee 345 kV line, the above Reactive Support would be needed to prevent voltage collapse. At a cost of $82.7M.

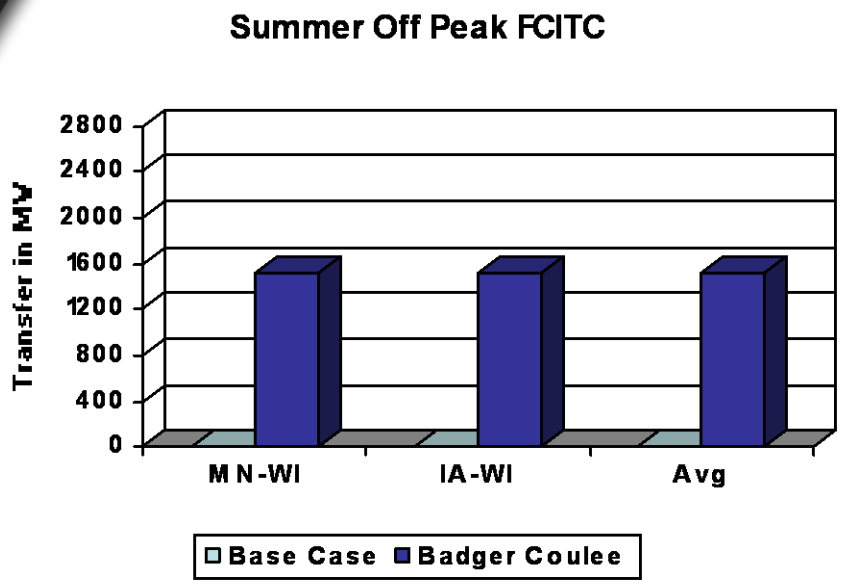
Quantified Reliability Benefit
Low Voltage Lines

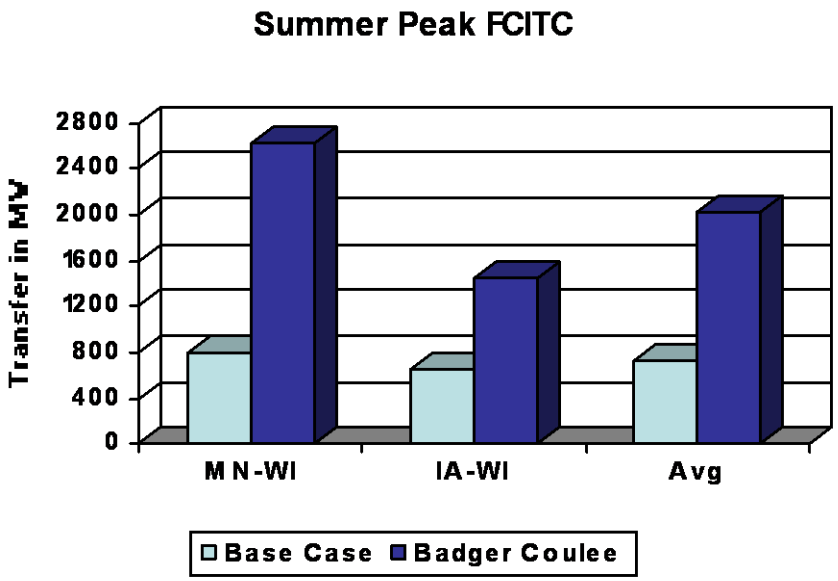
Elements	Mileage	Voltage Class (kV)
Eden to Mineral Point	5.26	69
South Monroe to Browntown	8.2	69
Browntown to Jennings Sw. Sta.	7.3	69
Wiota to DPC Gratiot Tap	3.8	69
Wiota to Jennings Sw. Sta.	1.5	69
Wauzeka to Boscobel	12	69
Gran Grae to Wauzeka	7.3	69
Lincoln Pump Sta. to ACEC Brooks	1.3	69
Mckenna to ACEC Brooks	5.3	69
Hilltop to West Mauston Tap	0.83	69
Total	**52.79**	

Without the addition of the Badger Coulee line the ten transmission lines above, in ATC's area, would need to be rebuilt for thermal overload support. Cost = $54.7M.

Transfer Capability

First Contingency Incremental Transfer Capability





Questions?

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