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ATC Market and PROMOD Congestion

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Agenda

- Overview of Congestion Severity Index (CSI)
- CSI Historical Data
- 2012 Day Ahead and Real Time Top Ten Tables
- 2012 Day Ahead and Real Time Top Ten Maps
- PROMOD Projected Congestion
- Conclusion

Congestion Severity Index

- Measures severity of constraints through the theoretical congestion cost (upper bound)
 - Theoretical maximum number of dollars (in millions) that could have been paid into the market due to the constraint
- The Congestion Severity Index takes into account:
 - 1) The amount of time a constraint is bound
 - Hours for Day Ahead and 5 minute intervals for Real Time
 - 2) The financial impacts of the constraint during those times
 - Severity of constraint impact captured in shadow price
- $$CSI = \sum_{\text{All binding hours}} \frac{[\text{Binding Line Rating} \times \text{Shadow Price}]}{1,000,000}$$

CSI History

Year	ATC DA Severity Index	ATC RT Severity Index
2008	179.31	179.89
2009	116.39	110.23
2010	109.19	111.68
2011	91.27	78.19
2012	71.02	54.80

Day Ahead Top Ten

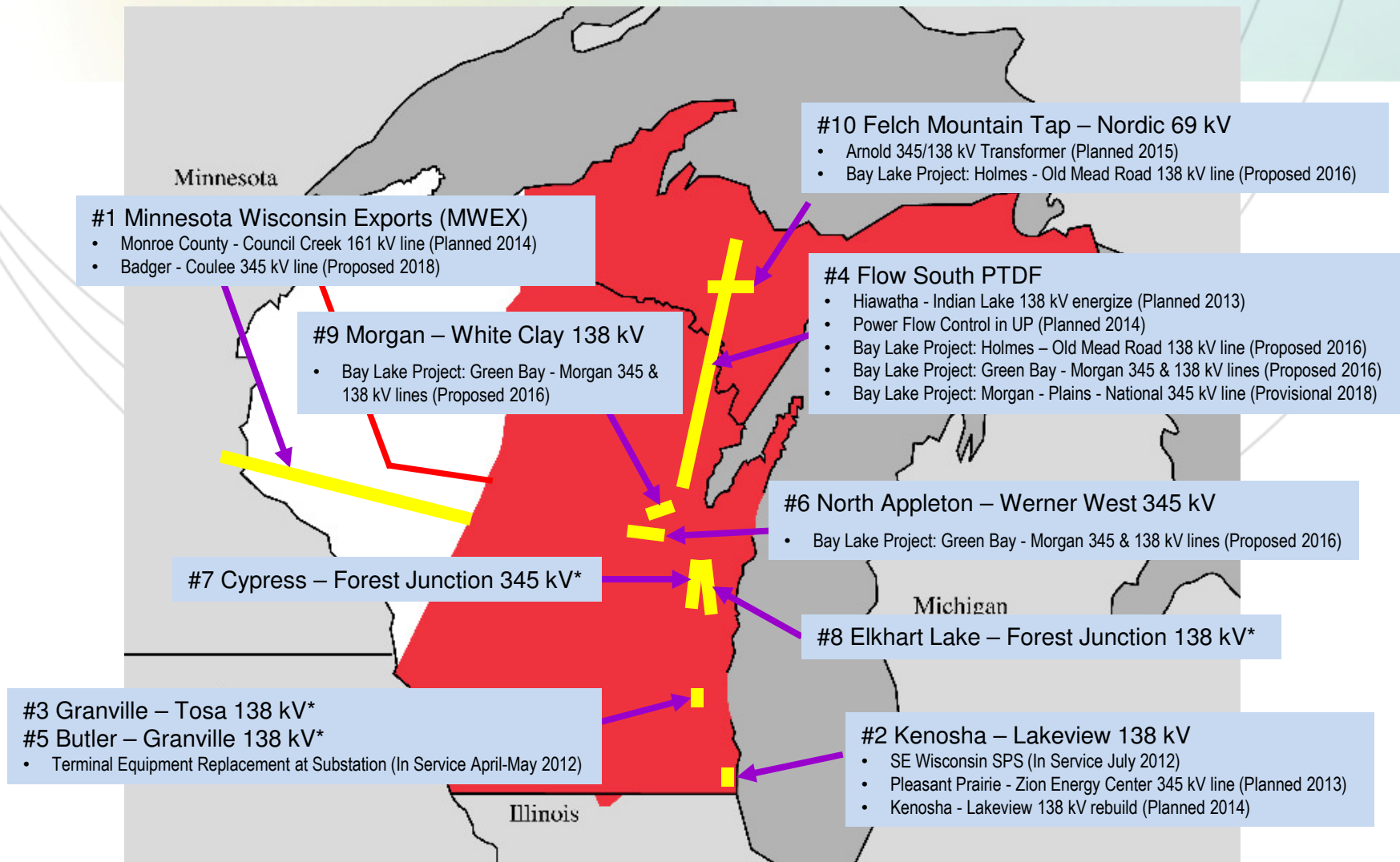
Severity Index	Hours	Day Ahead Element	
50.84	5,585	Most limiting ATC Day Ahead constrained elements in 2012	Potential Solutions
15.31	877	Minnesota to Wisconsin Exports Interface (MWEX)	Monroe County - Council Creek 161 kV line (Planned 2014) Badger - Coulee 345 kV line (Proposed 2018)
7.13	851	Kenosha - Lakeview 138 kV	SE Wisconsin SPS (In Service July 2012) Pleasant Prairie - Zion Energy Center 345 kV line (Planned 2013) Kenosha - Lakeview 138 kV rebuild (Planned 2014)
6.10	223	Granville - Tosa 138 kV	Terminal Equipment Replacement at Tosa Substation (In Service May 2012) ATC is currently investigating solutions
5.83	1,841	Flow South PTFD	Hiawatha - Indian Lake 138 kV energize (Planned 2013) Power Flow Control in UP (Planned 2014) Bay Lake Project: Holmes - Old Mead Road 138 kV line (Proposed 2016) Bay Lake Project: Green Bay - Morgan 345 & 138 kV lines (Proposed 2016) Bay Lake Project: Morgan - Plains - National 345 kV line (Provisional 2018)
3.90	453	Butler - Granville 138 kV	Terminal Equipment Replacement at Butler Substation (In Service April 2012) ATC is currently investigating solutions
3.74	147	North Appleton - Werner West 345 kV	Bay Lake Project: Green Bay - Morgan 345 & 138 kV lines (Proposed 2016)
2.79	181	Cypress - Forest Junction 345 kV	ATC is currently investigating solutions
2.78	291	Elkhart Lake - Forest Junction 138 kV	ATC is currently investigating solutions
1.65	294	Morgan - White Clay 138 kV	Bay Lake Project: Green Bay - Morgan 345 & 138 kV lines (Proposed 2016)
1.61	427	Felch Mountain Tap - Nordic 69 kV	Chandler 2 nd Transformer (In Service Spring 2012) Arnold 345/138 kV Transformer (Planned 2015) Bay Lake Project: Holmes - Old Mead Road 138 kV line (Proposed 2016)

Real Time Top Ten

Severity Index	Hours	Real Time Element	
35.25	527.17	Most limiting ATC Real Time constrained elements 2012	Potential Solutions
13.29	47.1	North Appleton - Werner West 345 kV	Bay Lake Project: Green Bay - Morgan 345 & 138 kV lines (Proposed 2016)
3.86	130.5	Kenosha - Lakeview 138 kV	SE Wisconsin SPS (In Service July 2012) Pleasant Prairie - Zion Energy Center 345 kV line (Planned 2013) Kenosha - Lakeview 138 kV rebuild (Planned 2014)
2.75	93.3	Cypress - Forest Junction 345 kV	Fitzgerald 2nd 345/138 kV Transformer (Provisional 2015) ATC is currently investigating solutions
2.36	12.8	Flow South PTDF	Hiawatha - Indian Lake 138 kV energize (Planned 2013) Power Flow Control in UP (Planned 2014) Bay Lake Project: Holmes - Old Mead Road 138 kV line (Proposed 2016) Bay Lake Project: Green Bay - Morgan 345 & 138 kV lines (Proposed 2016) Bay Lake Project: Morgan - Plains - National 345 kV line (Provisional 2018)
2.35	61.7	Arcadian - Zion 345 kV	Pleasant Prairie - Zion Energy Center 345 kV line (Planned 2013)
2.26	55.5	Goodman - Masonville 69 kV	Chandler - Old Mead Road 138 & 69 kV lines (Proposed 2014)
2.16	8.4	Lost Dauphin - North Appleton 138 kV	Area generation and transmission status may have contributed to this constraint
2.12	5.7	North Appleton 345/138 kV Transformer T1	Area transmission status may have contributed to this constraint
2.06	39.3	Morgan - White Clay 138 kV	Bay Lake Project: Green Bay - Morgan 345 & 138 kV lines (Proposed 2016)
2.03	73.0	Felch Mountain Tap - Nordic 69 kV	Chandler 2 nd Transformer (In Service Spring 2012) Arnold 345/138 kV Transformer (Planned 2015) Bay Lake Project: Holmes - Old Mead Road 138 kV line (Proposed 2016)

ATC Top Ten DA Constraints

Annual 2012

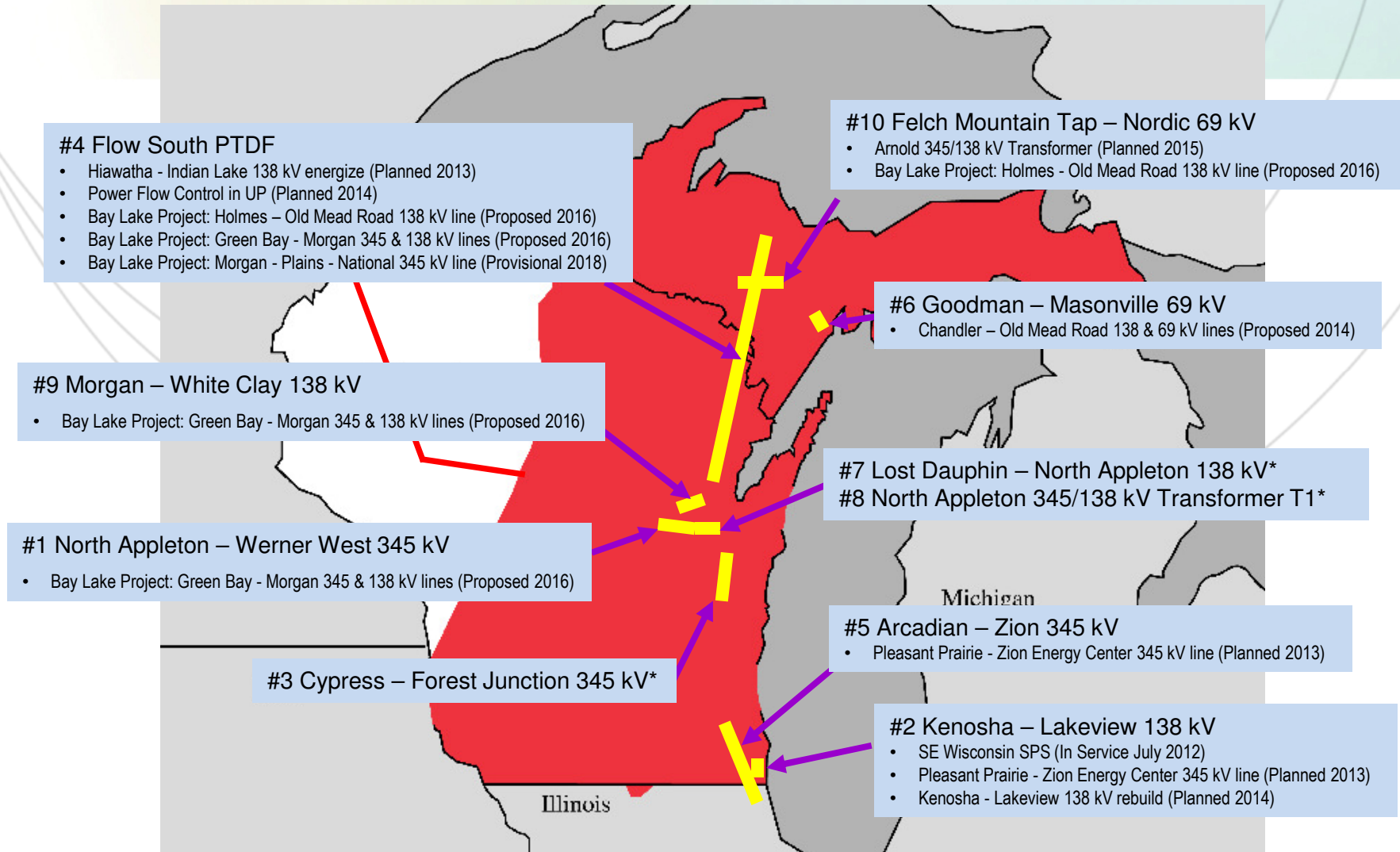


*Project solutions currently being studied



ATC Top Ten RT Constraints

Annual 2012



*Project solutions currently being studied

Projected Congestion

- **Top Projected ATC Limiting Elements**

- Assuming Appendix A projects in service
- Modeled in 2022 using BAU future using PROMOD
- Ranking using method similar to CSI (shadow prices x future rating)
- Many elements below continue to be studied for potential solutions

Ranking	Limiting Element
1	Pleasant Prairie - Zion 345 kV
2	Sugar Creek - North Lake Geneva Tap 138 kV
3	Badger West - Petenwell 138 kV
4	Butler - Granville 138 kV
5	Pleasant Prairie - Racine 345 kV
6	Petenwell 138/69 kV Transformer
7	Albers - Paris 138 kV
8	Arrowhead - Stone Lake 345 kV
9	Arcadian - Cypress 345 kV
10	Burlington - North Lake Geneva Tap 138 kV
11	Cypress - Forest Junction 345 kV
12	Blackhawk - Colley Road 138 kV
13	MWEX
14	Flow South
15	Custer - Manrap 69 kV

Conclusion

- Trend is Beneficial for Customers
- Continue to Study Future Impacts
 - Impacts include load changes, weather patterns, and generation and transmission outages (planned or unplanned)
 - Staying on top of potential retirements, upcoming projects, load or generation shifts
- Updated and posted monthly on MISO ATC Oasis
 - http://oasis.midwestiso.org/documents/ATC/market_constraints.html
- Questions or comments?

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