#### ATC Planning Stakeholder Meeting

#### **2008 Congestion Review**

Presented by Tom Dagenais ATC Economic Planning 3-6-09



## **Congestion Metrics**

- In the past, congestion measured on the ATC system by frequency of constraints.
- The "hours metric" counted the number of hours during which the constraint occurred.
- This measurement didn't provide a true assessment of the impacts our actions have on constraints in the MISO market.



#### **Hours Metric Shortcomings**

• Does not capture financial impacts of constraints Unit redispatch options vary by location and through time





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#### **Hours Metric Shortcomings**

- Eliminating constraints may *increase* hours
  - Multiple downstream constraints may occur
  - System is improved, but hours metric increases





#### Frequency ≠ Financial Impact

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Hours vs. Calculated Congestion Costs



### **Congestion Severity Index**

- ATC has developed a new measurement for tracking market constraints.
- The Congestion Severity Index takes into account both the amount of time a constraint is "bound" as well as the financial impacts of the constraint during those times.



# What is the Congestion Severity Index?

- Measures severity of constraints through the "theoretical congestion cost"
  - Theoretical maximum number of dollars (in millions) that could have been paid into the market due to the constraint in question
  - Approximation that puts a bound on the maximum amount of money that could be saved if the constraint did not exist



#### **Congestion Severity Index Background Assumptions**

How are "theoretical congestion costs" calculated? Background facts:

MW load at node \* MCC<sup>1</sup> at node = Congestion Dollars

□ MCC at sink node of path = Shadow Price on constrained path (public data)

Assumptions:

□ MW flow along path ≈ "MW load" at sink node of path

□ Flow while constrained  $\approx$  line rating (from ATC ratings database)

#### $\Sigma_{All Hours}$ [Rating \* Shadow Price] = Congestion Dollars



#### **Congestion Severity Index History**

	DA Severity Index	RT Severity Index
2005*	259.54	320.54
2006	190.50	223.08
2007	228.08	234.48
2008	177.13	179.87

\* No data before 4/1/05 (commencement of market operations)



#### Severity vs. Hours Real Time Market

Yearly Real Time Congestion



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#### Severity vs. Hours Day Ahead Market



# ATC's Top Ten List (RT)

2008 Real Time Market

Rank	Congestion Severity Index	Hours	Constraint		
-	179.87	3,101	Total for all ATC Real Time constraints in 2008		
1	45.13	376	Paddock 345/138 kV Transformer T21 flo Wempletown - Rockdale 345 kV		
2	12.67	104	Point Beach - Sheboygan Energy Center 345 kV flo Edgewater - Saukville 345 kV		
3	11.37	87	Eau Claire - Arpin 345 kV		
4	9.05	71	Ellington - Hintz 138 kV flo North Appleton - Werner West 345 kV		
5	7.60	284	Whitcomb - Caroline 115 kV flo Werner West - Rocky Run 345 kV		
6	7.30	19	Southeast Wisconsin Interface		
7	5.54	30	Stone Lake - Gardner Park 345 kV		
8	5.48	57	Pleasant Prairie - Zion 345 kV flo Zion - Arcadian 345 kV		
9	3.92	26	Pleasant Prairie - Zion 345 kV flo Cherry Valley - Silver Lake 345 kV (ComEd)		
10	3.87	36	Pleasant Prairie - Zion 345 kV		

128 Total constraints. Top Ten account for 62% of total severity but just 35% of total hours.

Highlighting indicates constraints for which ATC has not yet proposed a potential solution.



# ATC's Top Ten List (DA)

2008 Day Ahead Market

Rank	Congestion Severity Index	Hours	Constraint	
-	177.13	18,295	Total for all ATC Day Ahead constraints in 2008	
1	40.39	1,847	Paddock 345/138 kV Transformer T21 flo Wempletown - Rockdale 345 kV	
2	19.07	395	Pleasant Prairie - Zion 345 kV flo Cherry Valley - Silver Lake 345 kV (ComEd)	
3	16.22	469	Point Beach - Sheboygan Energy Center 345 kV flo Edgewater - Saukville 345 kV	
4	8.25	221	Minnesota to Wisconsin Exports Interface (MWEX)	
5	8.00	901	Whitcomb - Caroline 115 kV flo Werner West - Rocky Run 345 kV	
6	5.76	205	Ellington - Hintz 138 kV flo North Appleton - Werner West 345 kV	
7	5.18	166	Granville 345/138 kV Transformer T1 flo Saukville 345/138 kV Transformer T1	
8	4.51	78	Bluemound 230/138 kV Transformer T3 flo Bluemound 230/138 kV Transformer T1	
9	4.02	204	Hintz - Werner 138 kV flo North Appleton - Werner West 345 kV	
10	3.75	351	Dewey (CW8) - Weston 115 kV flo Eau Claire - Arpin 345 kV + Op. Guide	

142 Total constraints. Top Ten account for 65% of total severity but just 26% of total hours.

Highlighting indicates constraints for which ATC has not yet proposed a potential solution.



### ATC's Movers & Shakers (RT)

2008 Real Time Market - Largest change in congestion severity index from 2007

Real Time Market Constraint	Change from 2007 to 2008
Point Beach - Sheboygan Energy Center 345 kV	15.48
Whitcomb - Caroline 115 kV*	11.06
Pleasant Prairie - Zion 345 kV	10.45 g
Southeast Wisconsin Interface	6.85
Stone Lake - Gardner Park 345 kV*	5.54 2
Arpin - Sigel 138 kV	3.97
Rocky Run 345/115 kV Transformer T4*	3.36
Paddock - Town Line Road 138 KV*	3.36 🛱
Butler - Granville 138 kV*	3.33
Granville 345/138 kV Transformer T1*	3.20
Badger - Belle Plaine - Caroline - Whitcomb 115 kV	-2.88
Stiles - Pulliam 138 kV (64451)	-3.29
Minnesota / Wisconsin Stability Interface (MWSI)	-4.21 😫
Highway V - Preble 138 kV	-4.27 ਤੋਂ
North Appleton - Werner West 345 kV	-6.33
Pleasant Valley - Arthur Road 138 kV	-7.38 🗳
Pleasant Prairie - Racine 345 kV	-16.49
Gardner Park - Stone Lake 345 kV	-18.34
Eau Claire - Arpin 345 kV	-35.69
Ellington - Hintz 138 kV	-36.76

\* New constraint in 2008

Highlighting indicates constraints potentially addressed by 2008 economic analysis projects.



#### ATC's Movers & Shakers (DA)

2008 Day Ahead Market - Largest change in congestion severity index from 2007

Day Ahead Market Constraint	Change from 2007 to 2008
Pleasant Prairie - Zion 345 kV	19.43
Point Beach - Sheboygan Energy Center 345 kV	17.40
Minnesota to Wisconsin Exports Interface (MWEX)*	8.25 g
Whitcomb - Caroline 115 kV*	8.04 📽
Granville 345/138 kV Transformer T1*	5.18 2
Bluemound 230/138 kV Transformer T3*	4.51
Kelly - Whitcomb 115 kV*	4.11
Arpin - Sigel 138 kV*	3.80 <mark>–</mark>
Dewey (CW8) - Weston 115 kV	3.62
Rocky Run - Plover 115 kV*	3.43
Minnesota / Wisconsin Stability Interface (MWSI) PTDF	-4.89
Highway V - Preble 138 kV	-5.00
Gardner Park - Stone Lake 345 kV	-5.13
Pleasant Prairie - Racine 345 kV	-5.88 🗄
Paddock 345/138 kV Transformer T21	-8.36 p
Ellington - Hintz 138 kV	-12.67 🗳
Hintz - Werner 138 kV	-16.74
Pleasant Valley - Arthur Road 138 kV	-17.71 🖻
North Appleton - Werner West 345 kV	-23.65
Eau Claire - Arpin 345 kV	-40.58

\* New constraint in 2008

Highlighting indicates constraints potentially addressed by 2008 economic analysis projects



#### A Closer Look:

#### **Congestion Reduction - 2007 to 2008**

#### Arrowhead – Stone Lake – Gardner Park 345kV (late January 2008)

2007 vs. 2008	DA Hours	DA Severity Index	RT Hours	RT Severity Index
Congestion Reduction*	1,358	37.21	533	37.09
Percentage Reduction from 2007	79%	76%	85%	72%

\* Eau Claire – Arpin related constraints (Eau Claire – Arpin, MWSI, and MWEX)

#### Line and substation uprates on Ellington – Hintz – Werner 138 kV path (August 2007)

2007 vs. 2008	DA Hours	DA Severity Index	RT Hours	RT Severity Index
Congestion Reduction**	762	29.41	290	39.19
Percentage Reduction from 2007	65%	75%	76%	81%

\*\* Ellington – Hintz and Hintz - Werner

#### Saukville – St. Lawrence rebuild (April 2008)

2007 vs. 2008	DA Hours	DA Severity Index	RT Hours	RT Severity Index
Congestion Reduction***	254	18.16	88	7.44
Percentage Reduction from 2007	85%	85%	100%	100%

\*\*\* Pleasant Valley – Arthur Rd and Saukville – Pleasant Valley



### **Questions?**



Photo from: www.travelblog.org

