



MISO / PJM / SPP / TVA Inter-Regional Planning

Combined Stakeholder Meeting

November 1, 2007
Marriott, Pittsburgh Airport



Agenda

- **Introduction of Joint Planning Committee (JPC) and Discussion of Joint Operating Agreement (JOA) / Joint Regional Coordination Agreement (JRCA) Obligations**
- **Discussion of Preliminary Joint Coordinated System Plan Scope (JCSP) of Work**
 - Models required
 - Reliability Study for 2018
 - DOE Eastern Wind Integration & Transmission Study
 - Economic Study for 2024
- **Stakeholder Discussion Concerning Joint Coordinated System Plan Scope**



Introduction of Joint Planning Committee (JPC)

and

Discussion of JOA/JRCA Obligations



Joint Planning Committee (JPC)

- For this JCSP, combination of the Joint Regional Planning Committee and Joint Planning Committees under individual Joint Agreements
- Members are planning staff leadership from MISO, PJM, SPP and TVA:
 - John Lawhorn (Chair), Dale Osborn, Jeff Webb - MISO
 - Steve Herling, Paul McGlynn – PJM
 - Jay Caspary, Keith Tynes, Mak Nagle – SPP
 - David Till, Dennis Chastain - TVA



Joint Planning Committee (JPC)

General Responsibilities Under Joint Agreements:

- **Develop common power system analysis models to perform coordinated system planning**
- **Conduct, on a regular basis, a Coordinated Regional Transmission Planning Study, or Plan**
- **Coordinate planning activities, including the exchange of planning data and developing necessary report and study protocols**
- **Maintain an Internet site and e-mail or other electronic lists for the communication of information related to the coordinated planning process.**
- **Meet at least semi-annually to review and coordinate transmission planning activities**
- **Establish working groups as necessary to address specific issues**
- **Conduct the necessary stakeholder review and approval process associated with transmission system planning, as required by its OATT and/or applicable Federal or State regulatory requirements**



Stakeholder Input and Review

- Stakeholder group is formally a combination of entity planning stakeholder groups to the extent they exist plus other interested parties:
 - MISO PAC
 - PJM TEAC
 - SPP TWG
 - TVA stakeholders (CPPP being formed)
- In practice, will announce open forum stakeholder meetings on each web site
- Stakeholder meetings will be called, at a minimum:
 - Prior to the start of each cycle of the coordinated planning process
 - During the development of the Joint Coordinated System Plan
 - Upon completion of the Plan to review final results



JPC Recent and Scheduled Activities

- Completed first MISO / PJM coordinated system plan – end of year 2006
- Combined scope of study to include SPP and TVA for the 2007/2008 Joint Coordinated System Plan (JCSP)
- 2007/2008 JCSP will perform a long term planning study incorporating both economic and reliability analysis of system performance for the combined four JCSP areas
- Collaboration with the parallel DOE Eastern Wind Integration & Transmission Study will provide underlying input assumptions for generation scenarios
- Anticipate minimum of three stakeholder meetings with final reports due by the end of 2008





Discussion of Preliminary Joint Coordinated System Plan Scope of Work



JCSP Study – Major Objectives

- **Develop required models to perform nearly Eastern Interconnect wide studies**
- **Perform Reliability Study**
- **Perform Economic Study**
- **Incorporate DOE Eastern Wind Integration & Transmission Study objectives into the JCPS study and provide technical support for the DOE Study**



Schedule for JCSP Study

- Initial stakeholder meeting November 1, 2007
- Develop Models – Use ERAG 2018 model as starting point - All models developed/reviewed/documented by March 1, 2008
- Economic assumption workshops – December, 2007 and January 2008
- Reliability study begins – March 1, 2008
- Economic Study begins – March 1, 2008 } parallel
- Economic transmission development/analysis workshops – development in March, 2008 and May 2008 with analysis workshop in July
- Midterm stakeholder meeting – June, 2008
- DOE Eastern Wind Integration Study data available for study inclusion – August 2008 - Incorporate DOE wind results in study and test in Sept
- Final stakeholder meeting – November/December 2008



JCSP Model Development – Common Activities

Models required

**Power flow (2018,2024)
RRP (20 year capacity)
PROMOD (2018,2024)**

**Power flow (PSS/E)
Version 30**

**Reliability study – 2018
solved AC
Economic study - 2024**

**Regional Resource Planning
Model (EGEAS)**

**Twenty year capacity
forecasts for inclusion in
power flow and PROMOD**

PROMOD

**Reliability study – 2018
Economic study - 2024**



JCSP Reliability Study



Drivers

- **2006 CSP**
 - 2011 analysis of N-2 and generator deliverability
 - Examined independent and joint deliverability
 - Resulting continuing coordination improvements
- **2007 JCSP**
 - Order 890 – plan for aggregate resource integration + market efficiencies
 - 2006 ERAG reliability assessment called for longer term studies
 - Requires looking beyond 2011 time horizon
 - Extended reliability analysis – 2018

JCSP Reliability Study

Objective

- **2018 Coordinated reliability plan**
 - Merge most recent 2017/2018 plans.
- **Baseline for market efficiency study**
 - Test most critical bulk system contingencies from interregional perspective (230 kV and up)
 - NERC Category A, B and C
 - Assess reliability needs
 - Redispatch, or
 - Conceptual reinforcement, where possible



JCSP Reliability Study



Objective

- **Identify potential system reliability enhancements**
- **Quantify incremental 2018 transmission investment for reliability**
- **Quantify a system economy metric for reliability only system**
- **2018 reliability baseline power flow basis for 2024 model**
- **Analyze 2024 model plus integration / efficiency reinforcements for reliability issues / upgrades.**



Eastern Wind Integration and Transmission Study

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Eastern Wind Integration & Transmission Study

Objectives

- Evaluate the power system impacts (operating due to variability and uncertainty of wind; transmission; reliability) associated with increasing wind capacity to 20% and 30% of retail electric energy sales in the Joint Coordinated System Plan region (MISO/PJM/SPP/TVA) by 2024 ;
- Build upon prior wind integration studies and related technical work;
- Coordinate with JCSP and current regional power system study work;
- Produce meaningful, broadly supported results through a technically rigorous, inclusive study process.



Key Issues & Questions include:

- What are the benefits from long distance transmission that accesses multiple wind resources that are geographically diverse?
- What are the benefits from long distance transmission that moves large quantities of remote wind energy to urban markets?
- How do remote wind resources compare to local wind resources? Does geographical diversity help reduce system variability and uncertainty?
- What additional system operational impacts and costs are imposed by wind generation variability and uncertainty?
- What is the role and value of wind forecasting?
- What benefit does balancing area cooperation or consolidation bring to wind variability and uncertainty management?
- How does wind generation capacity value affect reliability?



Wind Integration Methods & Best Practices

- Capture system characteristics and response through operational simulations and modeling;
- Capture wind deployment scenario geographic diversity through synchronized weather simulation;
- Match with actual historic utility load and load forecasts;
- Use actual large wind plant power statistical data for short-term regulation and ramping;
- Examine wind variation in combination with load variations;

Wind Integration Methods & Best Practices – con't

- Utilize wind forecasting best practice and combine wind forecast errors with load forecast errors;
- Examine actual costs independent of tariff design structure.
- Examine impacts of BA consolidation and fast markets.



Eastern Wind Integration & Transmission Study

Key Tasks

- **Develop high quality wind generation data sets for the JCSP area (mesoscale modeling, 3 years)**
- **Identify wind generation sites for 20% & 30% wind energy scenarios**
- **Develop transmission plan (coordinated with JCSP)**
- **Evaluate operating impacts**
 - Regulation
 - Load Following
 - Unit Commitment
- **Evaluate reliability impacts (ELCC/LOLP)**



Eastern Wind Integration & Transmission Study

Preliminary Schedule

Nov 07 – Feb 08	Study Development
January 2008	Award Wind Mesoscale Modeling Contract
February 2008	Award Wind Integration Contract
Jan – Oct 2008	Develop Wind Data Sets
April – Dec 2008	Develop Transmission Plan in Coordination with JCSP
Sept 08 – May 2009	Evaluate Operating & Reliability Impacts
June 2009	Complete Study



JCPS Economic Transmission Study

Objective

- **Complete a preliminary joint transmission design of the combined MISO/PJM/SPP/TVA systems based off of the primary assumptions/premise of the DOE Eastern Wind Integration & Transmission Study**
 - **Develop high voltage overlay**
 - **Identify Areas of Highest LMP Spreads**
 - **Identify Facilities Producing Highest Projected Congestion**
 - **Identify Preliminary Solutions**
- **Value driven analysis on a regional to multi-regional level**
 - **Requires generation, transmission, demand response, environmental realities, fuel supply, reliability and economics to be analyzed together**



High Level Outline of Economic Study

- **Define Each Future**
- **Perform Regional Resource Planning (RRP)**
 - Develop input value drivers to develop generation forecasts inclusive of all resource types over twenty year horizon
- **Create multiple linked resource and transmission models**
- **Create transmission plans linked to the RRP's**
- **Test preliminary plans for flexibility across a wide variety of output value drivers**
 - Reliability to economics
 - Local to national implications
 - Cost allocation

Defined JCSP Futures

Future 1

- Based off of DOE Eastern Wind Integration & Transmission Study
- 20% Wind mandate, on an energy basis, for the defined Eastern region

Future 2

- Based off of DOE Eastern Wind Integration & Transmission Study
- 30% Wind mandate, on an energy basis, for the defined Eastern region

Uncertainties - Example

JCSP Participants input needed to update

	(All \$ = \$2008)	Low	Mid/Low	Reference	Mid/High	High
1	Overnight Capital Cost					
	Coal	(\$/KW)	1653		1835	2019
	CT	(\$/KW)	545		605	665
	CC	(\$/KW)	774		859	945
	IGCC	(\$/KW)	1901		2111	2323
	Nuclear	(\$/KW)	2245		2493	2743
	Wind	(\$/KW)	1720		1910	2101
	CC w/Sequestration	(\$/KW)	1003		1114	1226
	IGCC w/Sequestration	(\$/KW)	2475		2748	3023
2	Load Demand	%	Reference -25%		50/50 Projected Demand	Reference +25%
3	Fuel Prices					
	Gas	(\$/MMBtu)	Reference -10%		Year 2007 w/4% Growth	Reference +10%
	Oil	(\$/MMBtu)	Reference -10%		Year 2007 w/4% Growth	Reference +10%
	Coal	(\$/MMBtu)	Reference -10%		PowerBase/Consultant	Reference +10%
4	Environmental Allowance Cost					
	Clean Air Act Title IV SO ₂ /CAIR SO ₂	(\$/ton)	Reference -25%		PowerBase	Reference +25%
	NO _x /SIP NO _x /CAIR NO _x	(\$/ton)	Reference -25%		PowerBase	Reference +25%
	CO ₂	(\$/ton)	0		0	25
	Hg	(\$/ton)	Reference -25%		PowerBase	Reference +25%
5	Fuel Supply					
	Gas	(MMBTU)	Annual Reduction in Limit		Unlimited	Unlimited
6	Economic Variables					
	Wind Credit (Thru 2016)	(\$/MWh)	0		19	19
	Discount Rate	%	5		8	10
	Inflation Rate*	%	2		3	4.5
	Uneconomic Coal Retirement		As Scheduled		As Scheduled	Forced Retirement

Futures and Uncertainties Matrix

Uncertainties

		Capital Investments								Growth	Fuel Related Costs			Environmental Cost				Fuel Supply	Economic Conditions			
		CC	CT	Coal	IGCC	Wind	Nuclear	IGCC/Seq	CC/Seq	Demand	Gas	Coal	Oil	SO2	NOx	CO2	Hg	Gas	Wind Credit	Inflat.	Disc. Rate	Coal Ret.
		1	20% Wind Mandate	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	L	R	R
2	30% Wind Mandate	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	L	R	R	R	

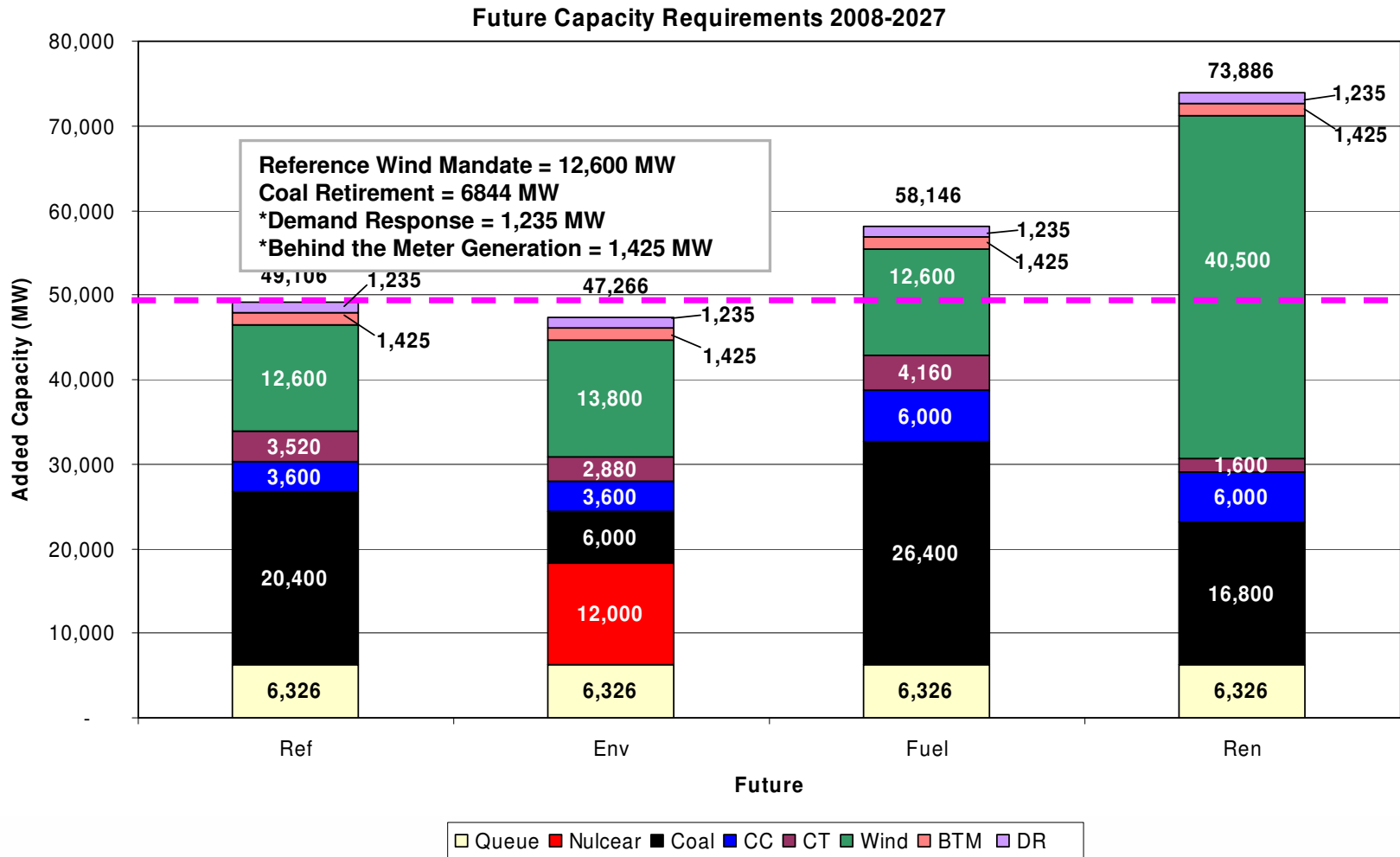
Futures

Variables Constant for all Futures

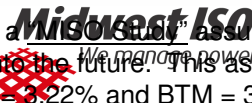
- **Planning Period**
- **Area Assumptions**
- **Resources**
- **Scheduled Interchange**
- **Financial Variables**
- **Reserve Margins**
- **Existing Wind Mandates**



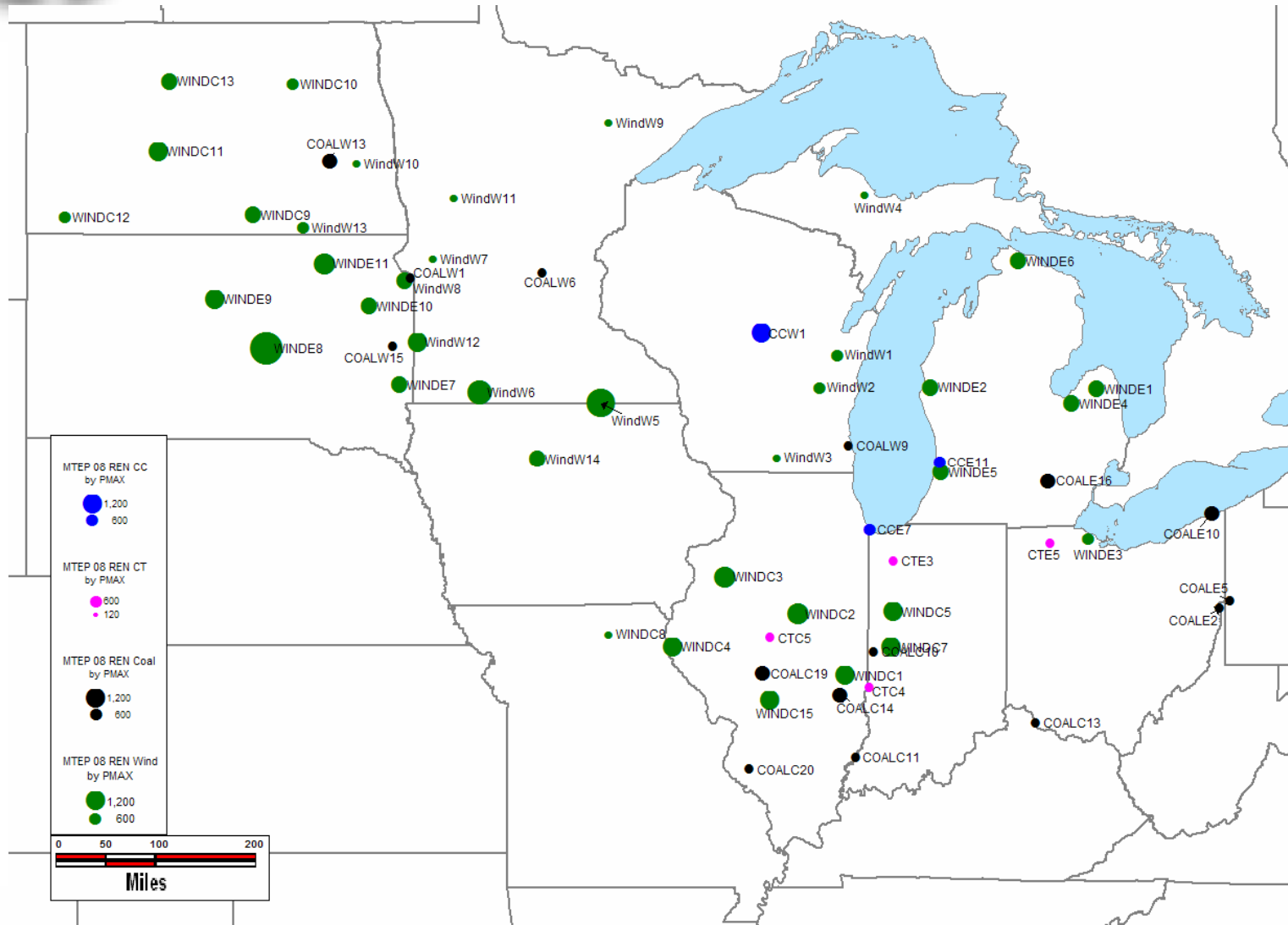
Example of RRP Output 2008-2027 Futures



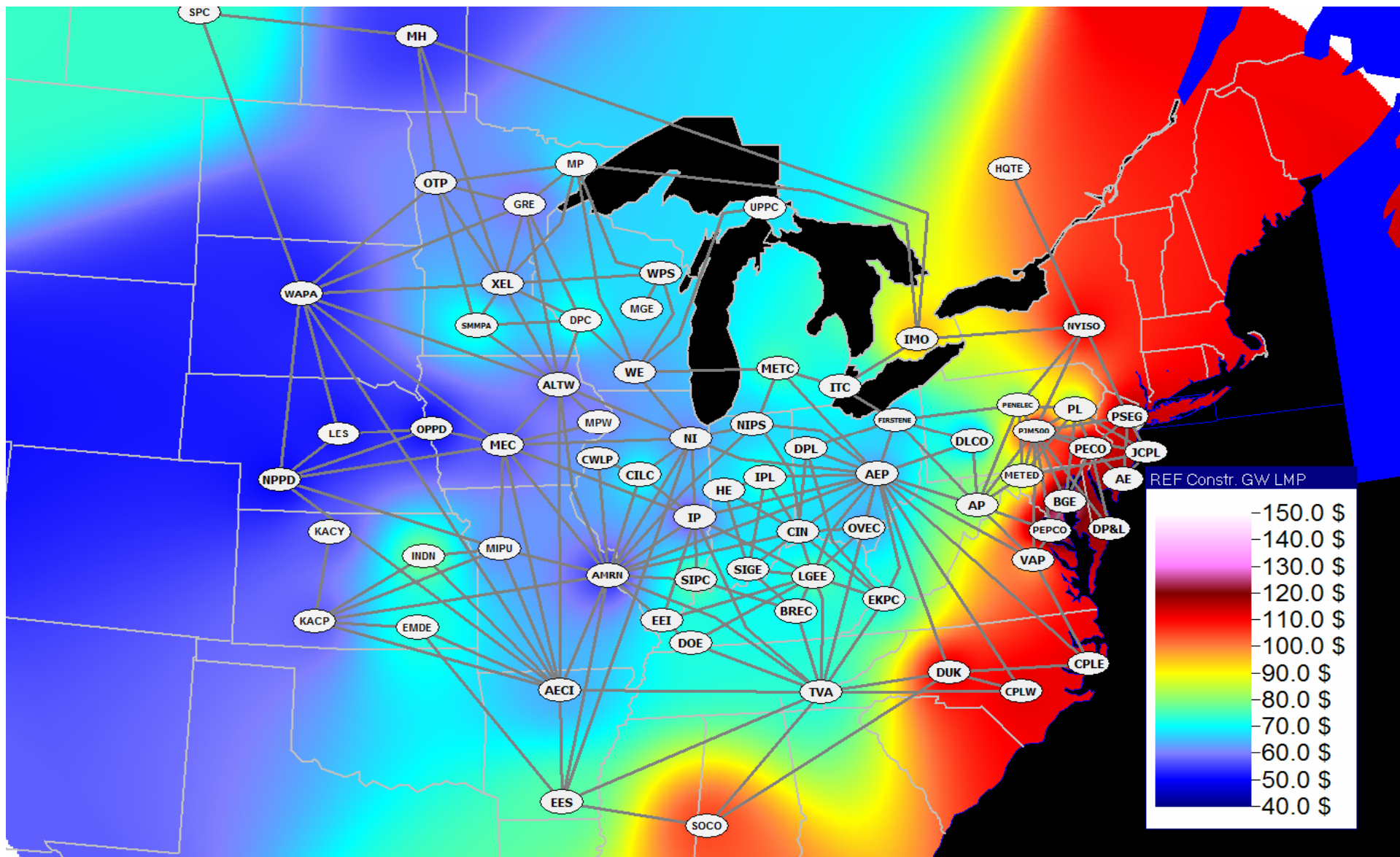
*Demand Response and Behind the Meter reflect a "business as usual" assumption that the current level of participation (as a percent of total demand) will continue into the future. This assumption was not discussed at a PAC meeting or stakeholder workshop. 2007 Demand Response = 3.22% and BTM = 3.58% of total load.



Example of Resource Placement

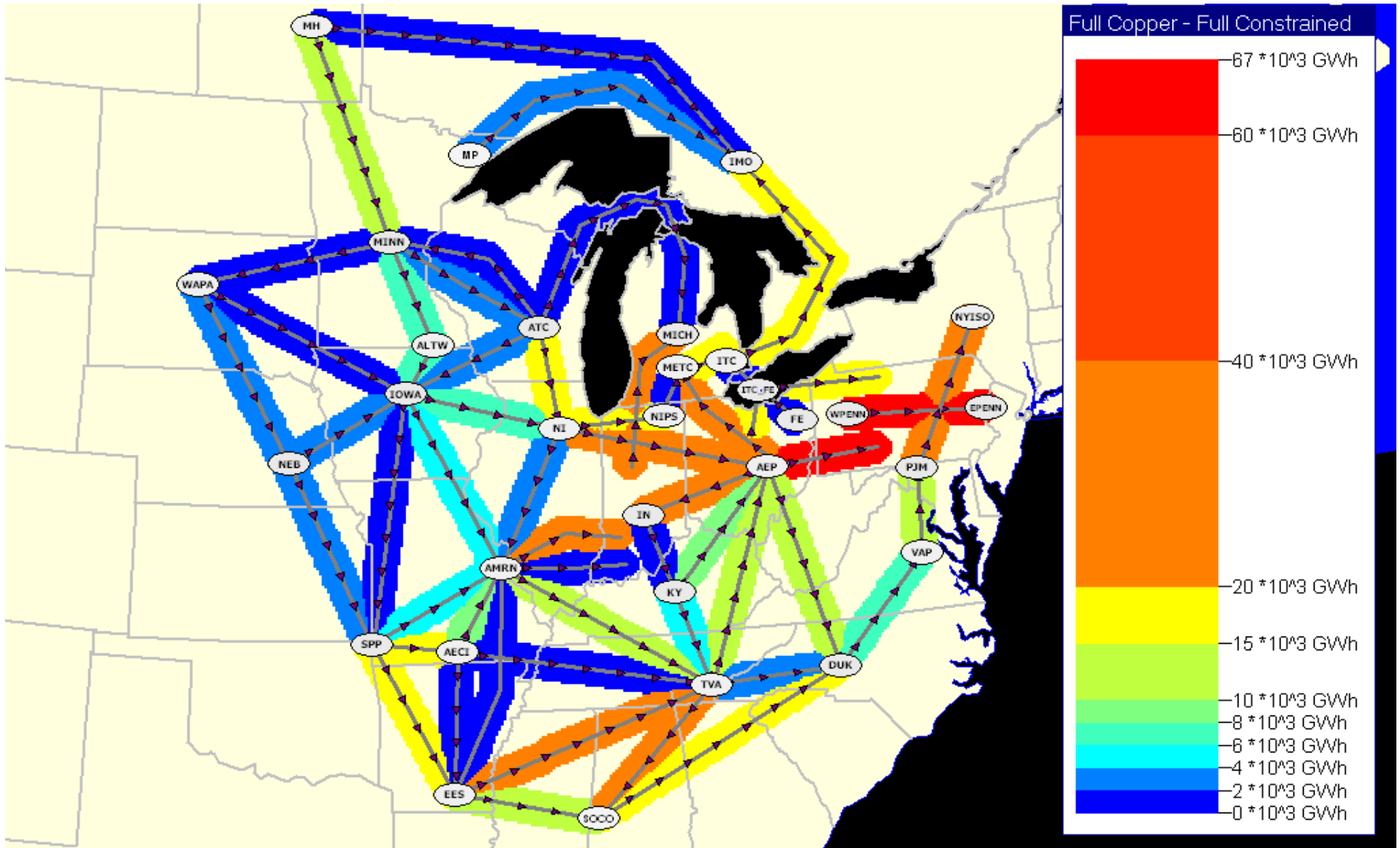


Reference with Existing System Generation Weighted LMP



August 8th and 9th
Meeting

Interface Contour: Annual Energy Difference Full Copper Sheet to Full Constrained Case





Stakeholder Comments on MISO-PJM- SPP-TVA Joint Coordinated System Plan

