

### IMM Quarterly Report: Spring 2016

MISO Independent Market Monitor

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#### **Quarterly Summary**

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			-	Prior	Prior			-	Prior	Prior	
-			Value	Qtr.	Year			Value	Qtr.	Year	
	<b>RT Energy Prices (\$/MWh)</b>	9	\$21.84	0%	-19%	FTR Funding (%)		99%	102%	103%	
	Fuel Prices (\$/MMBtu)					Wind Output (MW/hr)	٩	5,595	-2%	4%	
	Natural Gas - Chicago	0	\$1.87	-11%	-33%	Guarantee Payments (\$M) <sup>4</sup>					
	Natural Gas - Henry Hub	0	\$1.82	-10%	-33%	Real-Time RSG		\$9.8	51%	-23%	
	Western Coal	٩	\$0.52	-5%	-11%	Day-Ahead RSG	٩	\$9.4	-6%	-64%	
	Eastern Coal	Coal S1.24 -9% -24% Day-Ahead Margin Assurance					٩	\$7.7	19%	-19%	
	Load (GW) <sup>2</sup>					Real-Time Offer Rev. Sufficiency	۲	\$1.9	12%	-44%	
A	Average Load		67.0	-9%	-5%	Price Convergence <sup>5</sup>					
F	Peak Load	٩	95.5	-3%	-2%	Market-wide DA Premium	٩	-1.0%	2.0%	-0.4%	
	% Scheduled DA (Peak Hour)	٩	99.0%	98.9%	99.6%	Virtual Trading					
A	Transmission Congestion (\$M)					Cleared Quantity (MW/hr)	٩	13,190	10%	33%	
30	Real-Time Congestion Value	0	\$302.2	51%	-17%	% Price Insensitive	٩	24%	28%	36%	
	Day-Ahead Congestion Revenue	0	\$159.9	15%	-26%	% Screened for Review		1%	1%	1%	
	Balancing Congestion Revenue <sup>3</sup>	٩	-\$6.4	-\$10.2	-\$4.7	Profitability (\$/MW)	٩	\$0.57	\$0.58	\$0.82	
	Ancillary Service Prices (\$/MWh)					Dispatch of Peaking Units (MW/hr)	۲	994	535	522	
	Regulation	0	\$8.54	55%	18%	Output Gap- Low Thresh. (MW/hr)		79	42	71	
	Spinning Reserves	٩	\$1.92	63%	50%	Other:					
	Supplemental Reserves	۲	\$0.58	23%	16%						
	Key: Sepected	ey: Sepected Notes: 1. Values not in italics are the value for the past period rather than the change.									

- <u>Notes:</u> 1. Values not in italics are the value for the past period rather than the change.
  - 2. Comparisons adjusted for any change in membership.
  - 3. Net real-time congestion collection, unadjusted for M2M settlements.
  - 4. Includes effects of market power mitigation.
  - 5. Values include allocation of RSG.

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### **Summary of Spring 2016**

- Overall, the market performed competitively and reliably this spring.
- Spring 2016 was characterized by low energy prices driven primarily by unprecedented low natural gas prices and moderate weather and load.
  - ✓ Gas prices were 33 percent lower this spring compared to last year, driving system-wide energy prices down almost 19 percent to \$21.84 per MWh.
  - Average and peak load were down 5 and 3 percent respectively from last year as spring conditions were generally milder this year in most MISO areas.
- Increases in planned and unplanned outages of transmission and generation contributed to significant increases in congestion this quarter.
- Regulating reserve clearing prices increased by 55 percent and spinning reserve clearing prices increased by 63 percent over last quarter.
  - ✓ A number of low-cost providers of regulating reserves were on outage during the quarter, which reduced the supply.
- On May 1, MISO implemented the ramp product.
  - The ramp-up product had only modest impact, binding in 3 percent of market intervals, with an average price of \$0.08.



#### **Highlights from Spring 2015**

#### **Decline in Fuel and Energy Prices (Slides 10, 14, 15, 29-31)**

- Mild spring conditions and high shale gas supply continued the downward trend in gas prices and affected many aspects of the market this quarter.
  - The Chicago and Henry Hub natural gas prices remained well below \$2 the lowest since the start of the market.
- Low gas and coal prices led to broad declines in prices and costs this quarter.
  - Energy prices fell 19 percent from last year and remained at record lows.
  - RSG and PVMWP fell 19 to 64 percent due to declines in energy prices and volatility. Uplift costs also fell because lower gas prices reduced the spread in costs between gas-fired peaking resources and other types of units.
  - ✓ Lower gas prices reduced the congestion levels that would otherwise have occurred this quarter, but outages led to increase in absolute congestion.

Low gas prices increased the use of gas resources, displacing coal-fired units.

- Capacity factors of combined-cycle units averaged 48 percent this quarter, compared to 25 and 39 percent over the past two springs, respectively.
- Capacity factors of peaking resources averaged 15 percent, up from 12 and 11 percent over the past two springs. Significant increases in generator outages in March and April also led to increased use of peaking units.



### **Highlights for Spring 2016**

#### Significant Increases in Transmission Congestion (Slides 23, 24)

- Despite falling fuel prices, day-ahead congestion increased by 15 percent and real-time congestion value increased more than 50 percent over last quarter.
  - ✓ Much of the increase in congestion was due to planned transmission outages.
  - Some of planned transmission outages were related to construction of Multi-Value Projects.
  - ✓ Overall congestion was still roughly 20 percent lower than last year.
- Half of the increase in real-time congestion values was attributable to two market-to-market constraints in the Central region.
  - ✓ Flows caused by MISO and PJM's wind resources in IL and some inflexible PJM resources contributed to the congestion on these constraints;
  - Unplanned unit outages also contributed to increased congestion on both of these constraints.
- Generator and transmission outages in the South led to a large amount of realtime congestion in Texas at the end of April.
  - This led to price convergence issues a real-time premium at the end of April and a day-ahead premium in May as the market late responded.



### **Highlights for Spring 2016**

#### Effects of Pseudo Tie Resources into PJM (Slide 27)

- On March 1, **5** MISO resources began pseudo-tying and following PJM commitment and dispatch as external capacity resources.
- On June 1, **17** MISO resources similarly started pseudo-tying to PJM.
- As we had projected, these the pseudo-tied resources resulted in a significant increase in need for market-to-market flowgates.
  - ✓ Approximately 100 new market-to-market flowgates have been created.
  - ✓ MISO has largely lost ability to commit/de-commit these resources.
  - ✓ The congestion on the new market-to-market constraints totaled \$22 million

     a six-fold increase in congestion over the prior quarter on these constraints.
  - PJM paid \$1.9 million to MISO for JOA coordination on newly-defined market-to-market constraints.
  - These results are expected because the market-to-market process is not as efficient as MISO's internal dispatch at managing constraints.



#### **Submittals to External Entities**

- We responded to FERC questions related to prior referrals regarding resources failing to update real-time offers and continued to meet with FERC staff on a weekly and monthly basis to discuss market outcomes.
- We presented our Winter Quarterly Report to stakeholders at the MSC.
- We are participating in the Reliability Subcommittee discussions on generator performance and improvements in the deviation thresholds.
- We continued working with MISO and customers to improve transmission ratings provided by transmission owners to more fully utilize the network.
  - Early results from ongoing pilot program has resulted in reduced congestion with no reliability concerns.
  - $\checkmark$  We will be further evaluating the pilot program impacts this summer.
- We have provided our documents regarding the Competitive Retail Proposals and have had a meeting to go over them.
- We presented our analyses of pseudo-ties and interface pricing to the MISO-PJM Joint and Common Market group.



#### **Other Issues**

- We continued working with MISO and PJM to develop procedures for firm capacity delivery as an alternative to pseudo-tying resources to PJM.
  - The procedures would guarantee the delivery of energy from external capacity resources and would address the economic and reliability issues raised by large quantities of pseudo-ties.
    - PJM has announced it will not consider this alternative, but will further limit participation of external resources to address some of issues with pseudo-ties.
- We continued to work with MISO, PJM and its customers to evaluate nearterm improvements that could be made to improve the RTO's interface prices.
  - We presented a comparative analysis of two near-term alternatives and provided comments on an analysis performed by the RTOs.
  - ✓ Our analysis shows that one of the two solutions produces more efficient and less volatile interface prices, but MISO has announced it will accept the other alternative proposed by PJM.



#### **Other Issues**

- At the direction of the Markets Committee, MISO and IMM have met several times to discuss the capacity market alternatives for competitive retail areas.
- We have discussed the issues associated with alternative proposals extensively and have been developing hybrid approaches that would address these issues and:
  - Produce efficient prices and revenues, which are needed to support good investment and retirement decisions in the CRAs;
  - Optimize the capacity procurement inside and outside of the competitive retail areas; and
  - Allow the existing PRA market to continue operating and setting prices outside of the CRAs;
- We are making progress.
  - The gap between the two hybrid approaches is much narrower than between our original proposals.
  - ✓ I hope we can agree on a common proposal.
  - ✓ Implementation for planning year 2017-2018 remains a priority.



#### Day-Ahead Average Monthly Hub Prices Winter 2014–2016



#### **All-In Price** 2014 - 2016



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#### Monthly Average Ancillary Service Prices December 2014 to February 2016



### **Ramp Up MCP** May 2016



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### **MISO Fuel Prices** 2014-2016



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#### Capacity Factors By Fuel Type Winter 2014–2016





#### Load and Weather Patterns Winter 2014–2016



<u>Note</u>: Midwest degree day calculations include four representative cities in the Midwest: Indianapolis, Detroit, Milwaukee and Minneapolis. The South region includes Little Rock and New Orleans.

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# Day-Ahead and Real-Time Price Convergence 2015–2016



#### Average DA-RT Price Difference Including RSG (% of Real-Time Price)

Indiana Hub	1	-3	1	1	0	1	2	3	1	2	0	3	2	-2	2	1	-1	-7	-2
Michigan Hub	0	-1	7	6	-1	2	0	0	0	0	-3	2	3	0	4	3	-1	-6	4
Minnesota Hub	1	2	-1	0	-1	2	3	-1	3	0	-2	14	5	3	4	5	-3	2	5
WUMS Area	2	0	1	0	2	4	1	3	3	0	1	1	-1	0	4	3	1	0	-1
Arkansas Hub	2	0	-3	3	-3	4	3	3	-3	0	0	0	6	4	2	2	-3	-3	6
Louisiana Hub	-4	-1	0	2	-10	-2	0	-10	1	-5	0	0	-1	4	2	3	-2	2	-2
Texas Hub	-4	-1	-1	1	-5	4	-10	4	0	-7	-2	-12	-15	3	1	6	3	-19	12



### Wind Output in Real-Time and Day-Ahead Markets Monthly and Daily Average



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#### Day-Ahead Peak Hour Load Scheduling 2015–2016



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#### Virtual Load and Supply 2015–2016



#### **Virtual Load and Supply by Participant Type** 2015-2016



#### Virtual Profitability 2015–2016





#### **Day-Ahead Congestion, Balancing Congestion** and FTR Underfunding, 2015–2016



#### Value of Real-Time Congestion 2015–2016



#### **Real-Time Hourly Interregional Flows** Nov. 2015 - Feb. 2016





## Congestion Costs on SPP Flowgates 2014–2016



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#### **MISO Congestion Value and JOA Settlement Constraints Impacted by March Pseudo-Ties**



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#### **Peaking Resource Dispatch** 2015-2016



#### Day-Ahead RSG Payments 2015–2016



## Real-Time RSG Payments 2015–2016



#### **Price Volatility Make Whole Payments** 2015-2016



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## Generation Outage Rates 2015–2016



#### **Monthly Output Gap** 2015-2016



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## Day-Ahead And Real-Time Energy Mitigation 2015–2016



### Day-Ahead and Real-Time RSG Mitigation 2015–2016



#### **List of Acronyms**

- AMP Automated Mitigation Procedures
- BCA Broad Constrained Area
- CDD Cooling Degree Days
- CMC Constraint Management Charge
- DAMAP Day-Ahead Margin Assurance Payment
- DDC Day-Ahead Deviation & Headroom Charge
- DIR Dispatchable Intermittent Resource
- HDD Heating Degree Days
- JCM Joint and Common Market Initiative
- JOA Joint Operating Agreement
- LAC Look-Ahead Commitment
- LSE Load-Serving Entities
- M2M Market-to-Market
- MSC MISO Market Subcommittee
- NCA Narrow Constrained Area
- ORCA Operations Reliability Coordination Agreement
- ORDC Operating Reserve Demand Curve
- PITT Pseudo-Tie Issues Task Team

- PRA Planning Resource Auction
- PVMWP Price Volatility Make Whole Payment
- RAC Resource Adequacy Construct
- RDT Regional Directional Transfer
- RSG Revenue Sufficiency Guarantee
- RTORSGP Real-Time Offer Revenue Sufficiency Guarantee Payment
  - SMP System Marginal Price
    - SOM State of the Market
    - SRPBC Sub-Regional Power Balance Constraint
  - TLR Transmission Line Loading
    - Relief
  - TCDC Transmission Constraint Demand Curve
  - VCA Voluntary Capacity Auction
  - VLR Voltage and Local Reliability
  - WPP Weekly Procurement Process
  - WUMS Wisconsin Upper Michigan System

