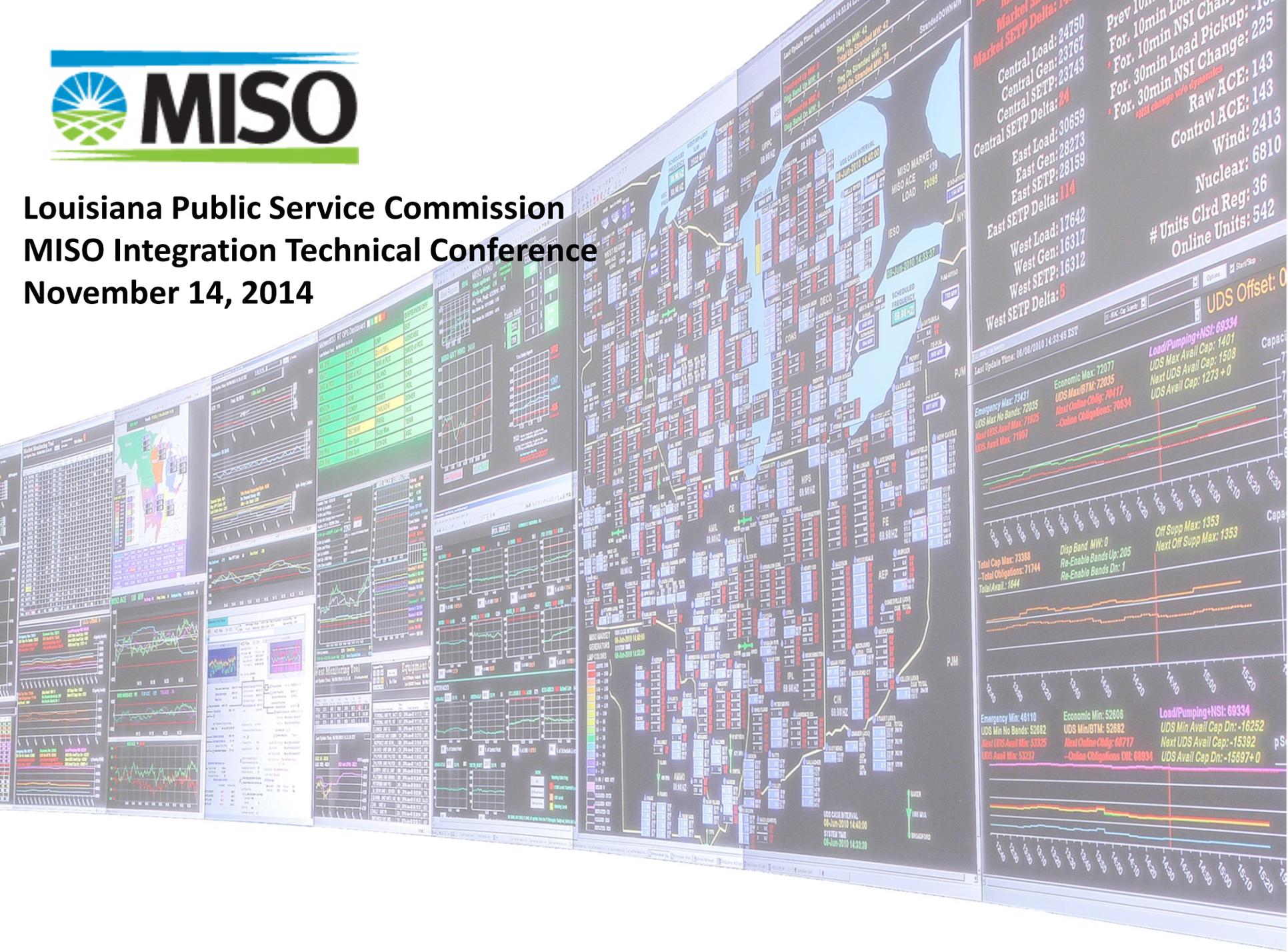




Louisiana Public Service Commission MISO Integration Technical Conference November 14, 2014



Market SETP Delta: 24
Central Load: 24760
Central Gen: 23767
Central SETP: 23743
East Load: 30659
East Gen: 28273
East SETP: 28159
West Load: 17642
West Gen: 16317
West SETP: 16312
West SETP Delta: 5

Prev 10min Load: -10
For. 10min Load Pickup: 225
For. 30min Load Change: 143
For. 30min Load Change: 143
Raw ACE: 143
Control ACE: 143
Wind: 2413
Nuclear: 6810
Units Cld Reg: 36
Online Units: 542

Emergency Max: 72491
UDS Max No Bands: 72035
Next UDS Avail Mar: 71825
UDS Avail Mar: 71907

Economic Max: 72077
UDS Max BTM: 72095
Next Online Oblig: 70417
-Online Obligations: 70634

Load/Pumping+NSI: 69334
UDS Max Avail Cap: 1401
Next UDS Avail Cap: 1508
UDS Avail Cap: 1273 + 0

Total Cap Max: 73388
-Total Obligations: 71744
Total Avail: 1844

Disp Band MW: 0
Re-Enable Bands Up: 205
Re-Enable Bands Dn: 1

Off Supp Max: 1353
Next Off Supp Max: 1353

Emergency Max: 49110
UDS Min No Bands: 52892
Next UDS Avail Mar: 53325
UDS Avail Mar: 53237

Economic Min: 52806
UDS Min BTM: 52882
Next Online Oblig: 68717
-Online Obligations Dn: 68934

Load/Pumping+NSI: 69334
UDS Min Avail Cap Dn: -16252
Next UDS Avail Cap: -15392
UDS Avail Cap Dn: -15697 + 0

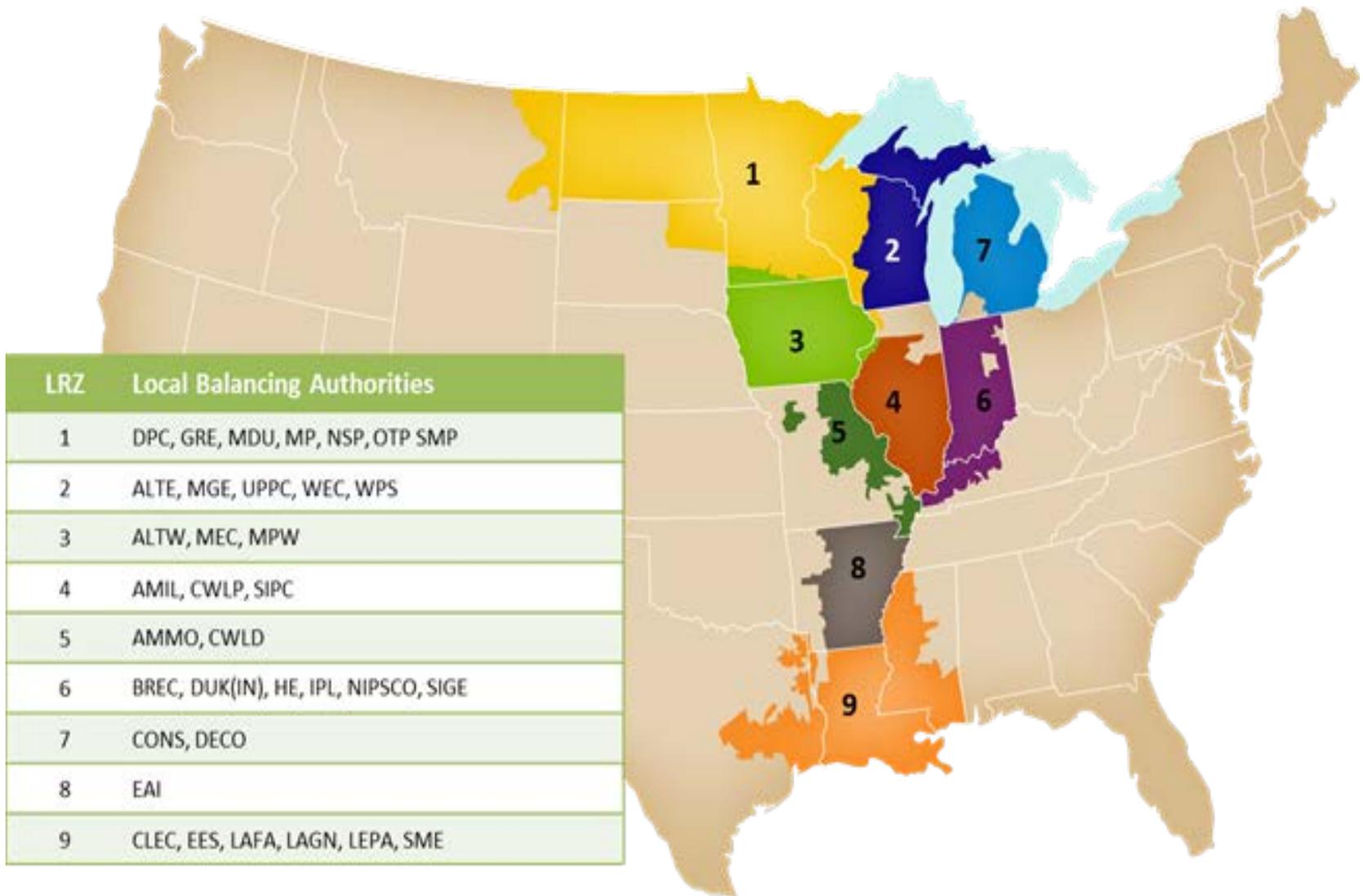
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Planning Reserve Margin Summary

- MISO determines the Planning Reserve Margin (PRM) for all MISO zones via a Loss of Load Expectation Study
- Installed Capacity (ICAP) PRM for 2015-2016 Planning Year of 14.3% (unforced capacity PRM of 7.1%) which is a decrease of 0.2% from previous year
 - Planning year runs June 1, 2015 – May 31, 2016
 - PRM applied to Load Serving Entities coincident peaks
 - Each and every generation unit is analyzed and MISO determines the amount of UCAP credit it receives based on performance
- While Unforced Capacity (UCAP) is the calculation used by MISO, the ICAP is a more traditionally recognized measure of resource adequacy requirement

MISO Local Resource Zones



MISO System-Wide PRM Results

MISO Planning Reserve Margin (PRM)	2015/2016 PY (June 2015 - May 2016)	Formula Key
MISO System Peak Demand (MW)	127,586	[A]
Time of System Peak (EST)	8/5/2015 16:00	
Installed Capacity (ICAP) (MW)	152,616	[B]
Unforced Capacity (UCAP) (MW)	142,006	[C]
Firm External Support (MW)	3,155	[D]
Adjustment to ICAP (MW)	-9,995	[E]
Adjustment to UCAP (MW)	-8,532	[F]
ICAP PRM Requirement (PRMR) (MW)	145,775	[G]=[B]+[D]+[E]
UCAP PRM Requirement (PRMR) (MW)	136,628	[H]=[C]+[D]+[F]
MISO PRM ICAP	14.3%	[I]=([G]-[A])/[A]
MISO PRM UCAP	7.1%	[J]=([H]-[A])/[A]

MISO Generation

- **Thermal units**

- Starting point using results from 2014-2015 Planning Resource Auction to determine eligible units
- Forced outage rates and planned maintenance factors over a 5-year period
- Behind-the-Meter Generation modeled like any other generation class
- Sales incorporated for all firm sales in and out of MISO to other seams (e.g. PJM – 2,044 MW)
- Generation units that have approved suspensions or retirements due to EPA MATS
- Future generation and upgrades incorporated
- Intermittent resources such as run-of-river hydro, biomass, wind
- Demand Response

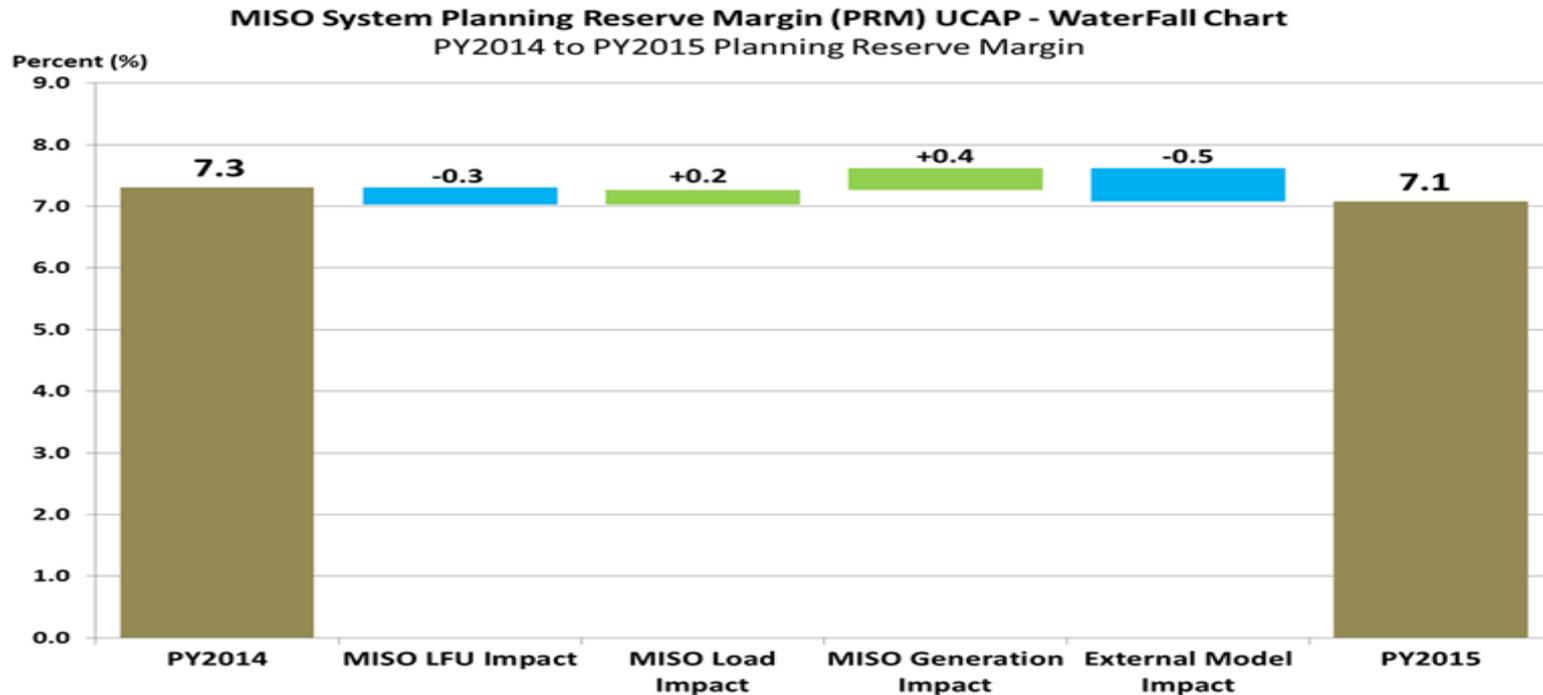
Load Information

- **Utilized historical load shape developed on a base historical year**
 - MISO South base is 2006 due to extreme weather in 2005 with Hurricane Katrina
 - Then modified to reflect current conditions and forecasts
- **Load Forecast Uncertainty (LFU)**
 - Determines the local reliability requirement as well as the overall system requirement
- **External System**
 - Seven (7) external zones modeled to determine an appropriate level of support MISO could expect from external systems
 - Calculated using 2013 import/export data for Central and North and directly via all MISO South LBA's for South
 - Includes SPP, SWPA, AEP, OG&E, Empire, Southern, TVA and Associated Electric

Local Resource Zone Analysis

PY 2015-2016	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/MS/TX	Formula Key
UCAP (MW)	18,345	14,868	9,195	11,255	7,935	19,158	21,921	10,166	29,195	[A]
Adj. to UCAP (MW) {1d in 10yr}	1,625	-550	1,638	944	2,448	867	2,789	-601	-821	[B]
LRR (UCAP)	19,970	14,318	10,833	12,199	10,383	20,025	24,710	9,565	28,374	[C]=[A]+[B]
Peak Demand (MW)	17,974	12,441	9,527	10,048	8,576	18,067	21,632	7,532	25,512	[D]
Time of Peak Demand	7/14/2015 16:00	7/6/2015 16:00	7/22/2015 19:00	8/11/2015 17:00	8/5/2015 16:00	7/27/2015 16:00	7/27/2015 17:00	7/19/2015 16:00	8/17/2015 16:00	
LRR UCAP P.U. of LRZ Peak Demand	111.1%	115.1%	113.7%	121.4%	121.1%	110.8%	114.2%	127.0%	111.2%	[E]=[C]/[D]

Comparison of Planning Year 2014 to 2015



Managing tightening reserve margins

- **Enhance forward visibility of supply and demand**
 - Independent 10 year regional load forecast
 - On-going 10 year resource survey
 - Establish more specificity for load modifying resources
 - Monitor fuel issues - including transportation
- **Improve utilization of existing resources**
 - Evaluate solutions to stranded capacity resources
 - Improve seams barriers
 - Evaluate seasonal nature of resource and reserve requirements
- **Evaluate/implement market improvements**
 - Appropriate capacity qualification for all resources – supply and demand
 - Seasonal procurement of resources
 - Gas/electric harmonization

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Emergency Operations

- **Protecting Reliability**
 - Conservative Operations
 - Reliability issue possible
 - Emergency Operations
 - Alerts
 - Hot, cold, or severe weather
 - Minimum Generation
 - Maximum Generation
 - Warning
 - Max Generation
 - Events
 - Maximum Generation



Operating Conditions

Operating Conditions				
Threat Level	Level 0 - Low	Level 1 - Elevated	Level 2 - High	Level 3 - Severe
System Status	Normal	Short, minor impact	Longer term, major impact	Major impact on ability to operate reliably
		Temporary infrastructure issue	Loss of monitoring data or member infrastructure	Hardware failure, bomb threat, sabotage, evacuation of control center

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Overview

- In December, MISO staff will present recommended MTEP 2014 Appendix A projects, as well as the report, for approval by the Board of Directors.

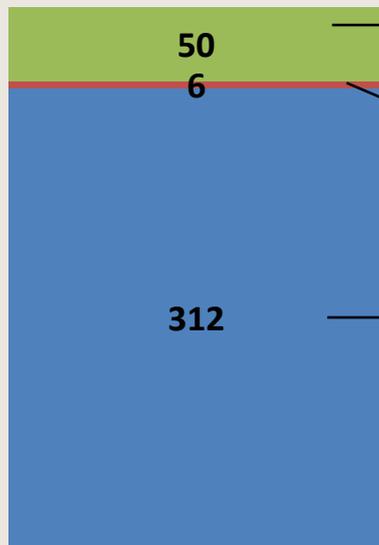


In MTEP 2014 – 368 new projects, at a cost of \$1.8 billion, will be recommended for approval

Modest cost sharing in MTEP 2014 - Six Generator Interconnection Projects

MTEP 2014
New Investment

Project Count - 368



MTEP 2014
New Investment

Project Cost - \$1,842 million



Baseline Reliability
Generator Interconnection
Other Driven by Local Needs

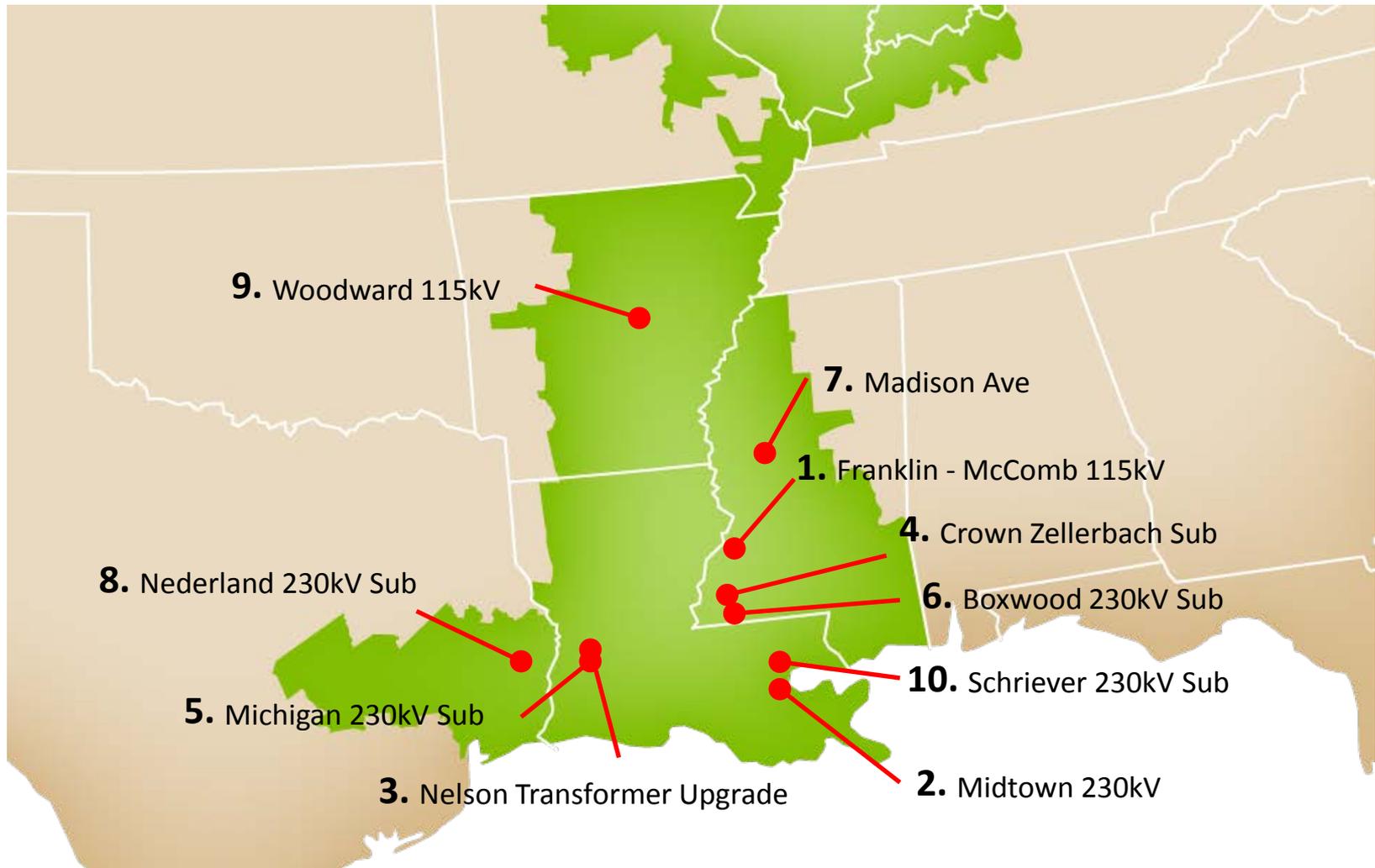
South Region fully integrated into MTEP14

- Subregional Planning Meetings (SPM) in Little Rock, Arkansas and Metairie, Louisiana
- \$113 million of Baseline Reliability Projects and \$246 million of Other local area projects

Region	Baseline Reliability Project (BaseRel)	Generator Interconnection Project (GIP)	Other	Total
Central	\$36,068,000	\$0	\$434,695,000	\$470,763,000
East	\$95,610,000	\$35,378,000	\$284,483,000	\$415,471,000
West	\$24,984,000	\$3,444,000	\$568,370,000	\$596,798,000
South	\$112,844,000	\$0	\$246,386,000	\$359,230,000
Grand Total	\$269,506,000	\$38,822,000	\$1,533,934,000	\$1,842,262,000

South Region MTEP 2014 Project Highlights

Cost Ranking



Louisiana In MTEP14 – 29 new projects, at a cost of \$182 million are being recommended for approval

MTEP 2014
New Investment

Project Count - 29

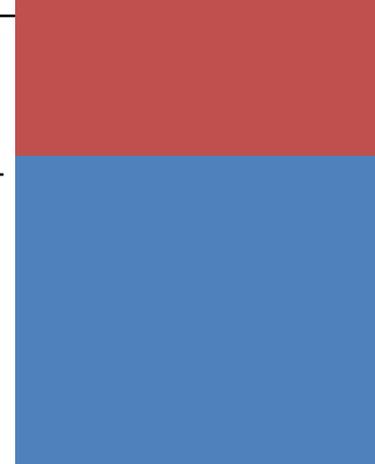


Baseline
Reliability

Other
Driven by Local Needs

MTEP 2014
New Investment

Project Cost - \$182 million



South Region Market Congestion Planning Study

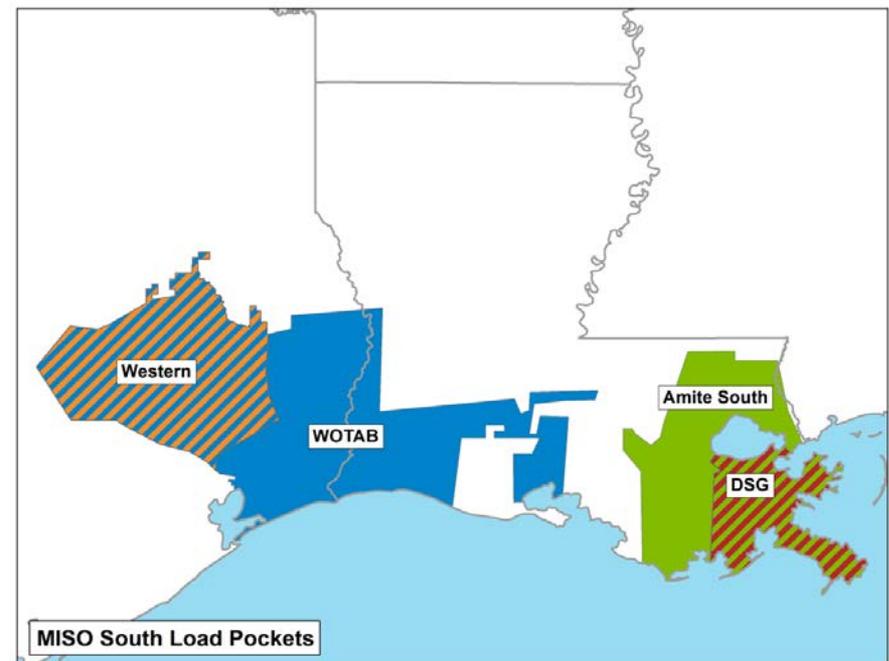
- Two projects being recommended for congestion relief in MTEP 2014
- Congestion benefit and reliability analyses completed with stakeholders
- Project costs recovered from local pricing zones
- Additional congestion relief projects from study completing evaluation June 2015 for MTEP 2015 recommendations

ID	Description	Project Cost (\$ millions)	Benefit to Cost Ratio	Funding Entity
PC_P	Upgrade ANO - Pleasant Hill 500kV & ANO - Mabelvale 500kV Terminal Equipment	4.1	9.9	Entergy AR
PC_W	Richardson - Iberville 230kV & Bagatelle – Sorrento 230kV cut-in to Panama 230kV & Coly 500/230kV Transformer & Upgrade Wilton – Romeville 230kV	56.3	6.4	Entergy LA / Entergy GS

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Voltage and Local Reliability Solutions

- Analyses continue to address the “Voltage and Local Reliability” (VLR) issues in South Region
- Transmission could eliminate the need for reliability starts of uneconomic generation in several “pockets” in MISO South
- Estimated annual uplift cost of these start-ups: \$70 million
- Expect project recommendations by June 2015



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QF Registration

- ~15 QF's (4,250 MW of QF generation) registered to participate directly in MISO
 - This could be via a designated Agent or directly as a MISO Market Participant
- ~40 QF's (1,800 MW of QF generation) remain behind the meter
 - Average size of these QF is 45 MW
 - On a quarterly basis, any QF has the ability to provide registration information and participate directly in MISO

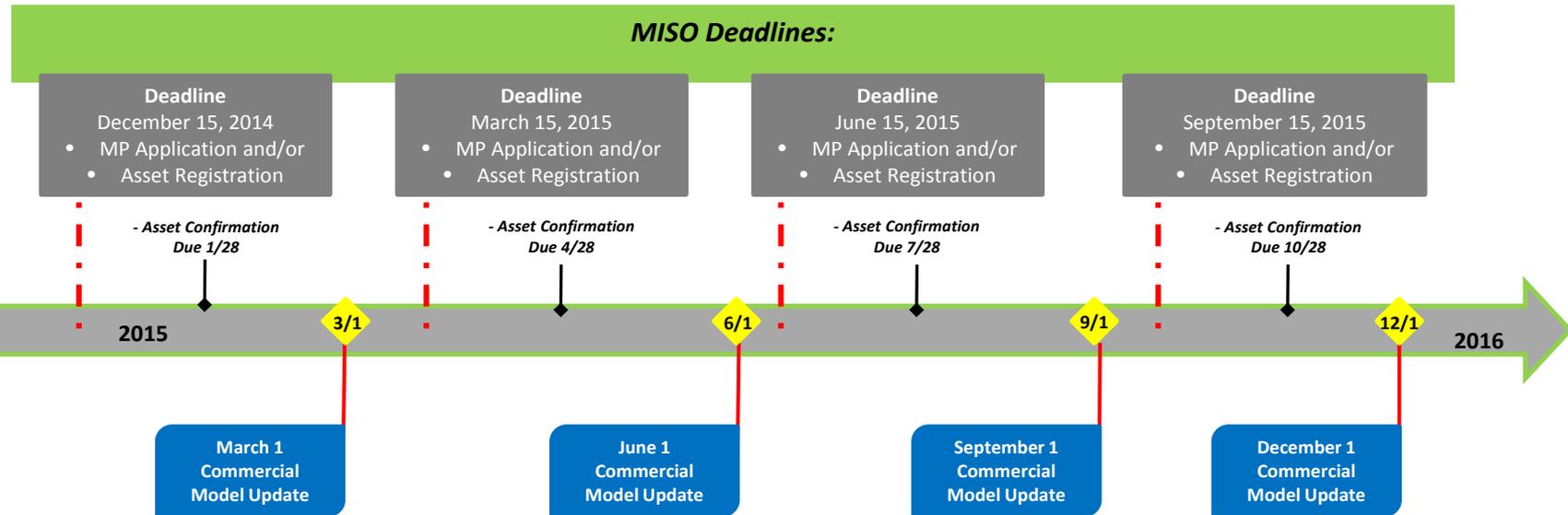
MISO Participation Options

1 **Option 1:**
Register as MISO MP

- Hybrid Modeling
- SCADA Required
- Follow Dispatch
- Credit Application & Approval

2 **Option 2:**
Contract with Agent MP

- Hybrid Modeling
- SCADA Required
- Follow Dispatch
- Credit Approval of Agent MP



MISO Market Participant “QF’s”

(As of November 1, 2014)

- CALPINE ENERGY SERVICES L.P.
- CONOCO PHILLIPS
- DOW CHEMICAL COMPANY
- EXXON MOBIL CORPORATION
- EXXONMOBIL OIL CORPORATION
- OCCIDENTAL POWER SERVICES, INC.
- SABINE COGEN, L.P.
- TENASKA POWER SERVICES

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Key Findings – Why is MISO Commenting to EPA?

- Proposed rule will have a direct impact on MISO members
- MISO offers information to ensure reliability and resource adequacy are maintained during implementation of compliance requirements
- Compliance is not trivial
 - ~\$90B net present value for Building Blocks
 - ~\$55B net present value for regional optimization
- Regional compliance is 40% less expensive
 - \$38/ton (regional) vs \$57/ton (sub-regional) CO₂ emissions reduction
- Compliance timeline significantly challenges resource adequacy

The generation fleet in MISO is being affected by timing, fuel prices and multiple phases of environmental regulations.

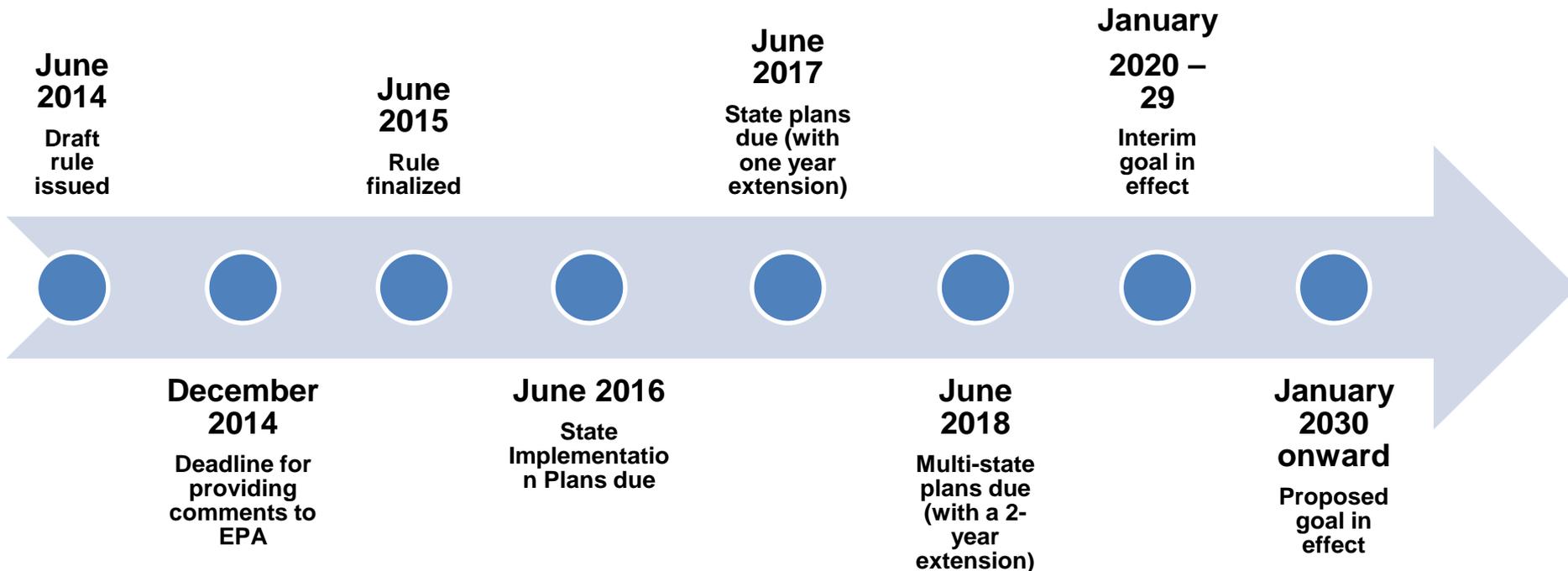


Nature of Regulation	Mercury and Air Toxics Standards	Cross State Air Pollution Rule and Water Regulations (316(b))	Carbon regulations (Clean Power Plan/NSPS)	National Ambient Air Quality Standards/ Coal Ash?/Other?
Compliance Dates	2015 / 2016	As early as 2015	2020-2030	???
Impacts	<ul style="list-style-type: none"> • Significant coal retirements • Outage coordination challenges • Shrinking reserve margins around MISO • Growing dependence on natural gas 	<ul style="list-style-type: none"> • NO_x requirements tighten • Final water intake rule released May 2014. • Higher plant costs that influence retirement decisions 	<ul style="list-style-type: none"> • Draft Rule released June 2014 • Continued pressures on reserve margins • Increased dependence on natural gas 	<ul style="list-style-type: none"> • Potential ozone NAAQS changes • Haze rules • Etc.

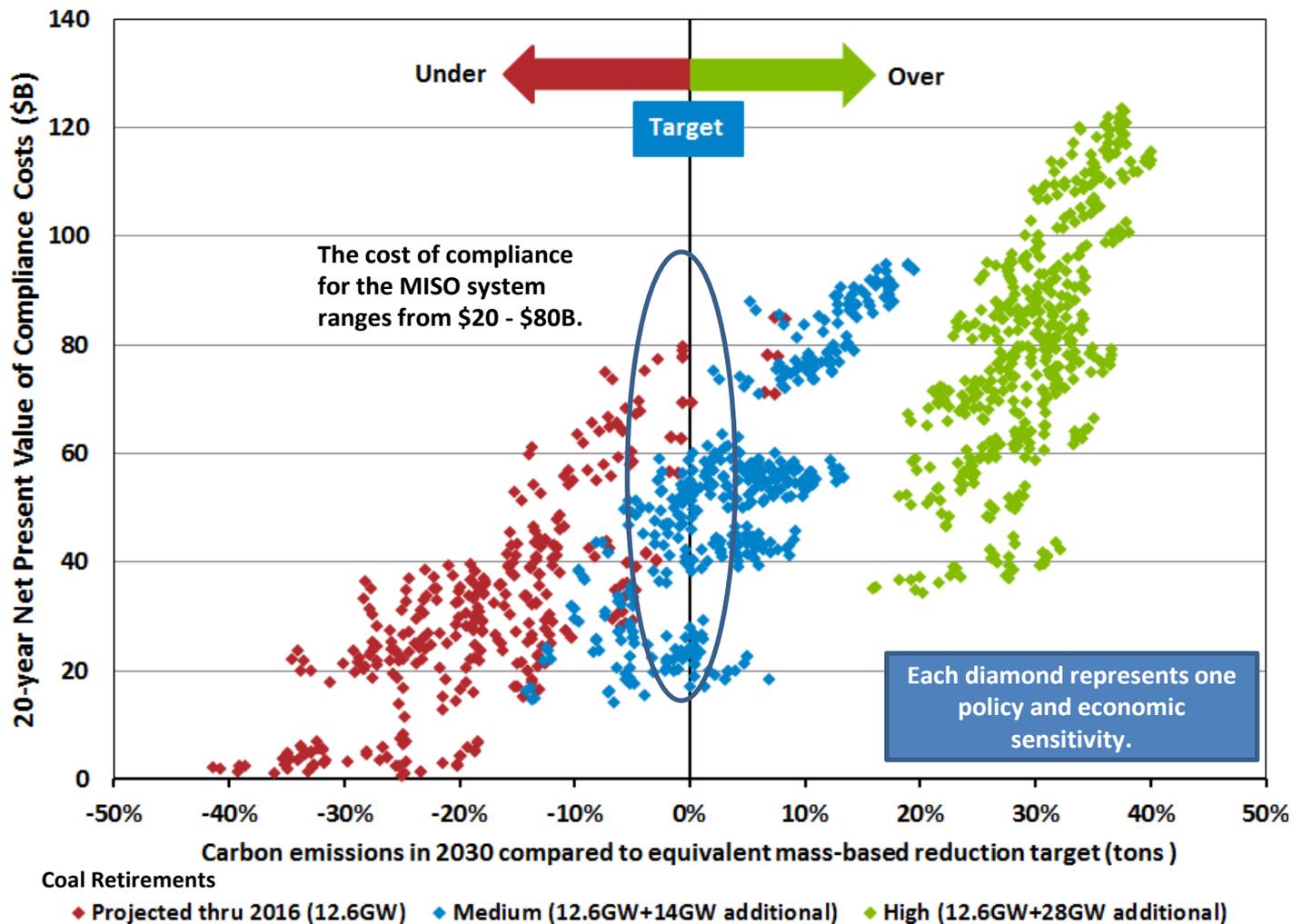
These factors will culminate in the erosion of reserve margins and an increase in reliability risk.

The purpose of MISO's analysis

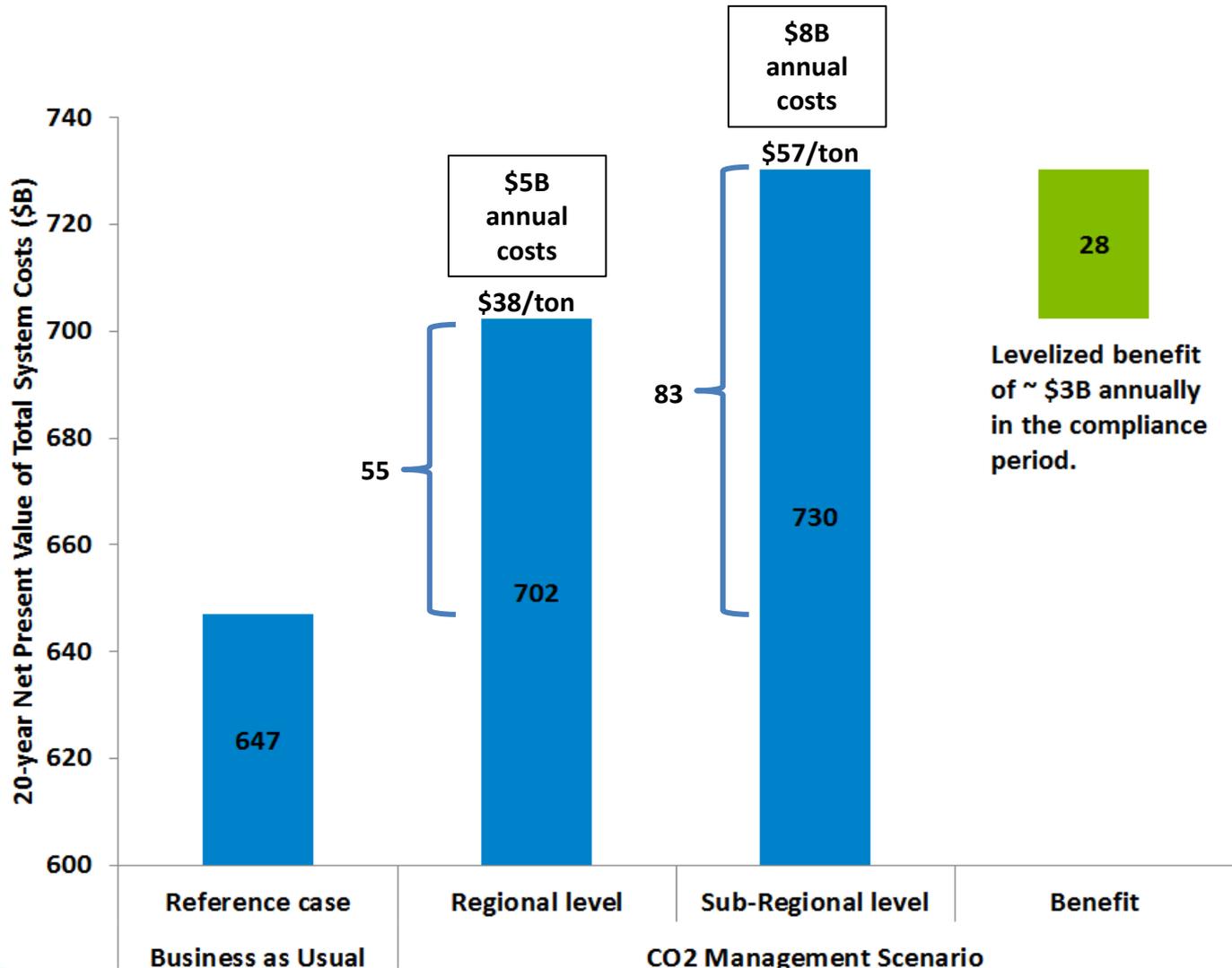
Inform stakeholders of potential impacts on the generation fleet and load resulting from the EPA's proposal to reduce CO₂ emissions from existing electric generating units



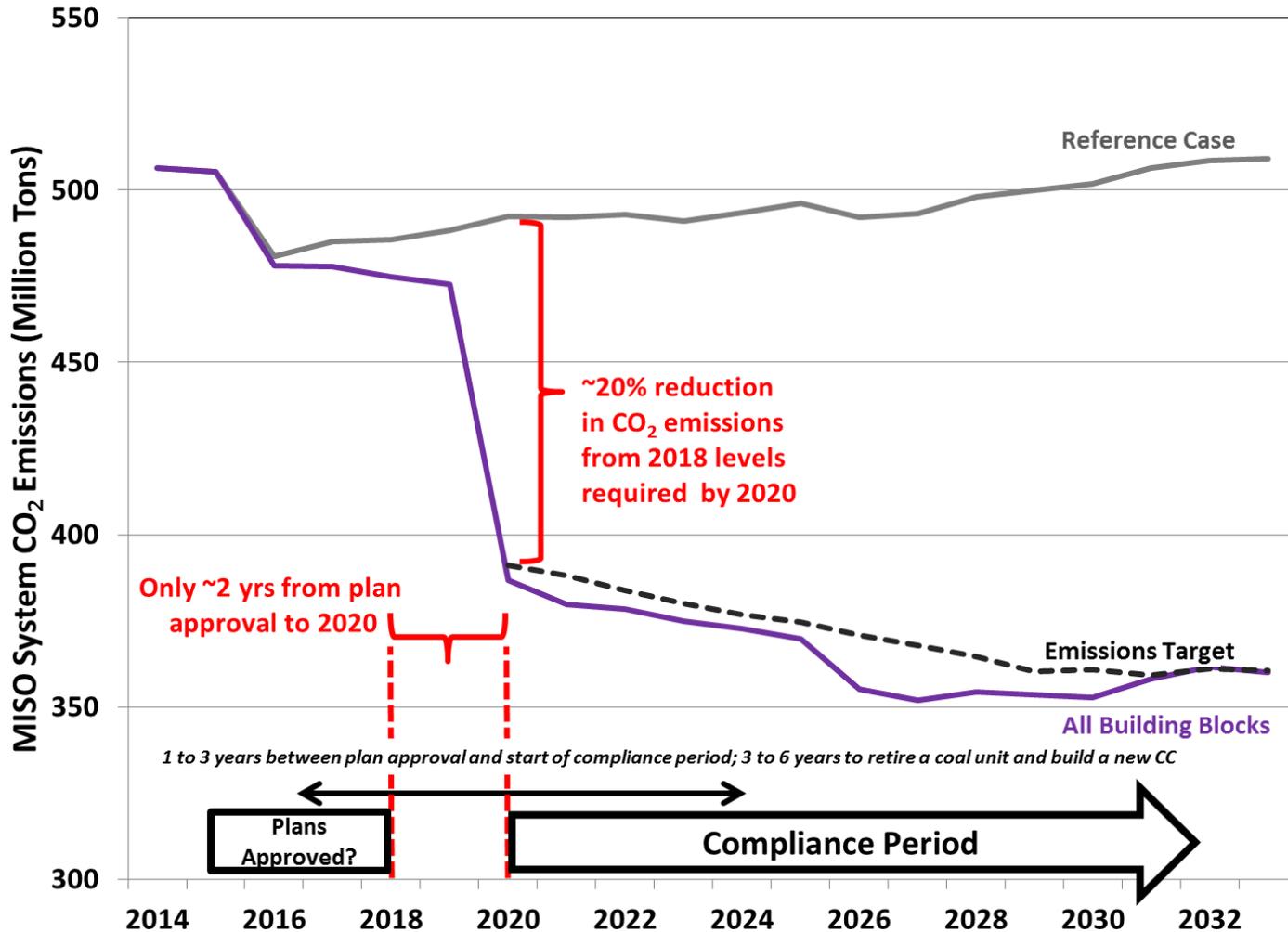
Lower cost compliance strategies would retire up to an additional 14GW of coal capacity



Regional compliance options avoid approximately \$3B annually compared to sub-regional compliance



Time required to implement lower cost compliance strategies



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Background – Sub Regional Power Balance Constraint

- During South integration, MISO filed request for declaratory order with FERC on interpretation of Section 5.2 of the MISO-SPP Joint Operating Agreement and FERC granted the request
- SPP appealed FERC decision to DC Circuit Court and DC Circuit vacated and remanded FERC decision in January 2014
- SPP began billing MISO for usage over 1,000 MW firm path on December 19, 2013 (integration) and MISO proposed to voluntarily restrict dispatch flow to 1,000 MW target
- Because MISO is a non-profit entity, MISO had to put in place cost recovery mechanism for changes paid (still under negotiation)
- Sub Regional Power Balance Constraint put in place to manage dispatch flows above the 1,000 MW including the addition of a hurdle rate in the economic dispatch to offset
- Settlement proceedings underway, with conferences held in April, June, August and October 2014

SRPBC Summary *(July 17 – October 20 2014)*

- **Real-Time calculated Intra-Regional flows are North to South direction 79.8% of the time and South to North direction 20.2% of the time**
- **Day-Ahead Market production cost savings exceeded the hurdle rate 7.2% of the time¹**

July 17th - October 20th, 2014	July++: 360 Hours		August: 744 Hours		September: 720 Hours		October: 480 Hours		Total: 2304 Hours	
CONSTRAINT_NAME	Production Cost Savings Exceeded Hurdle Rate	Hours Bound	Production Cost Savings Exceeded Hurdle Rate	Hours Bound	Production Cost Savings Exceeded Hurdle Rate	Hours Bound	Production Cost Savings Exceeded Hurdle Rate	Hours Bound	Production Cost Savings Exceeded Hurdle Rate	Hours Bound
SO_MW_Rev_Transfer (North to South)	5.30%	264 (73.3%)	7.06%	538 (72.3%)	1.72%	349 (48.5%)	18.97%	232 (48.3%)	7.38%	1383 (60.0%)
SO_MW_Transfer (South to North)	23.81%	21 (5.8%)	0.00%	23 (3.1%)	0.00%	47 (6.5%)	6.52%	46 (9.6%)	5.84%	137 (5.9%)
Grand Total	6.67%	285 (79.2%)	6.77%	561 (75.4%)	1.52%	396 (55.0%)	16.91%	278 (57.9%)	7.24%	1520 (66.0%)

*Percents based on total hours in the month
 ++Hurdle Rate implemented on July 17, 2014

- **Real-Time Market production cost savings exceeded the hurdle rate 17.9% of the time¹**

July 17th - October 20th	July++: 4320 Intervals		August: 8928 Intervals		September: 8640 Intervals		October: 5760 Intervals		Total: 27648 Intervals	
CONSTRAINT_NAME	Production Cost Savings Exceeded Hurdle Rate	Intervals Bound	Production Cost Savings Exceeded Hurdle Rate	Intervals Bound	Production Cost Savings Exceeded Hurdle Rate	Intervals Bound	Production Cost Savings Exceeded Hurdle Rate	Intervals Bound	Production Cost Savings Exceeded Hurdle Rate	Intervals Bound
SO_MW_Rev_Transfer (North to South)	7.99%	2077 (48.1%)	7.58%	4315 (48.3%)	19.94%	4323 (50.0%)	27.03%	2453 (42.6%)	15.33%	13168 (47.6%)
SO_MW_Transfer (South to North)	38.82%	170 (3.9%)	51.82%	247 (2.8%)	66.23%	308 (3.6%)	38.90%	347 (6.0%)	49.72%	1072 (3.9%)
Grand Total	10.32%	2247 (52.0%)	9.97%	4562 (51.1%)	23.02%	4631 (53.6%)	28.50%	2800 (48.6%)	17.91%	14240 (51.5%)

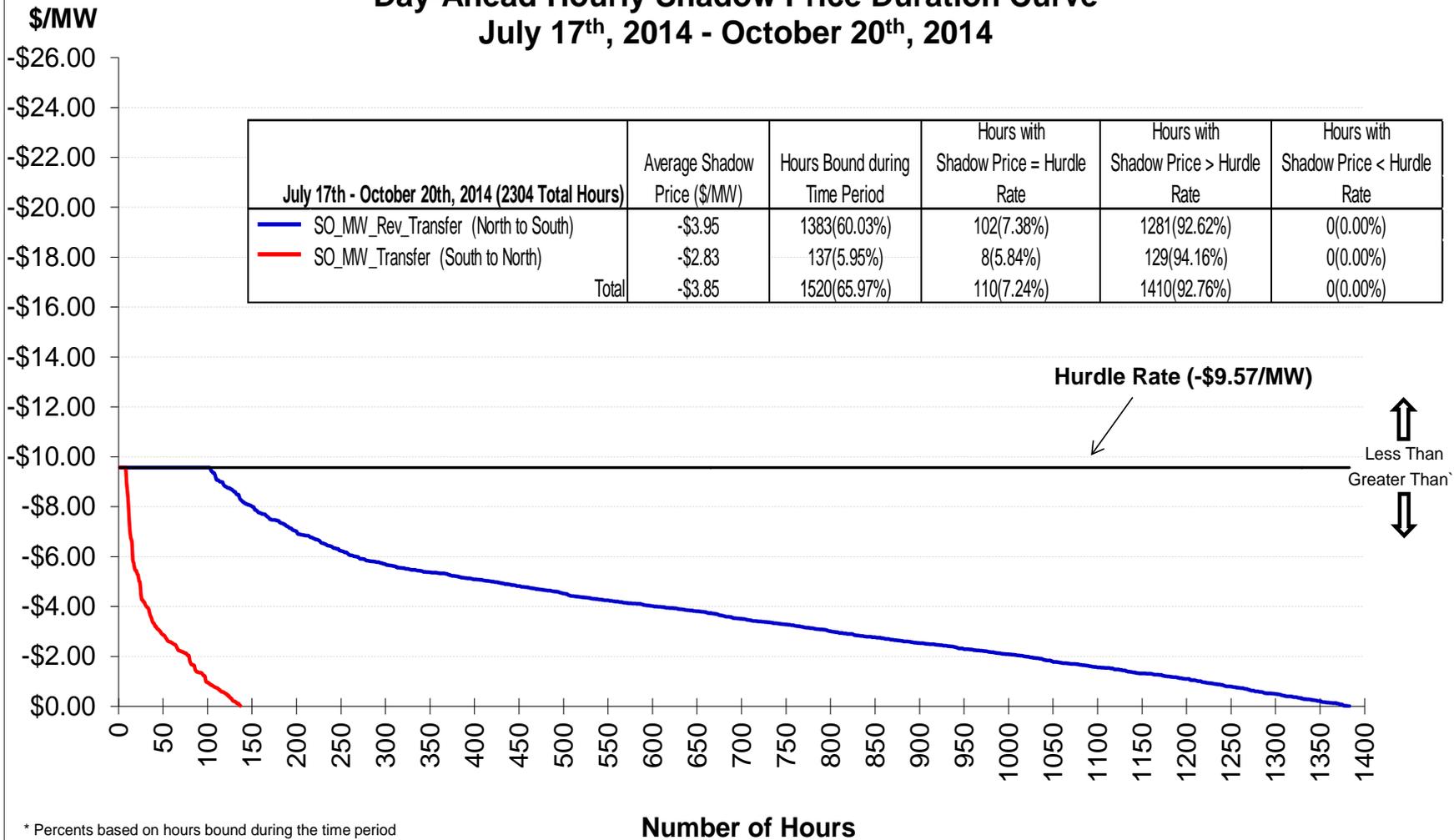
*Percents based on total intervals in the month
 ++Hurdle Rate implemented on July 17, 2014



¹ Defined as the total number of hour equal to the hurdle rate divided by the total number of hours bound

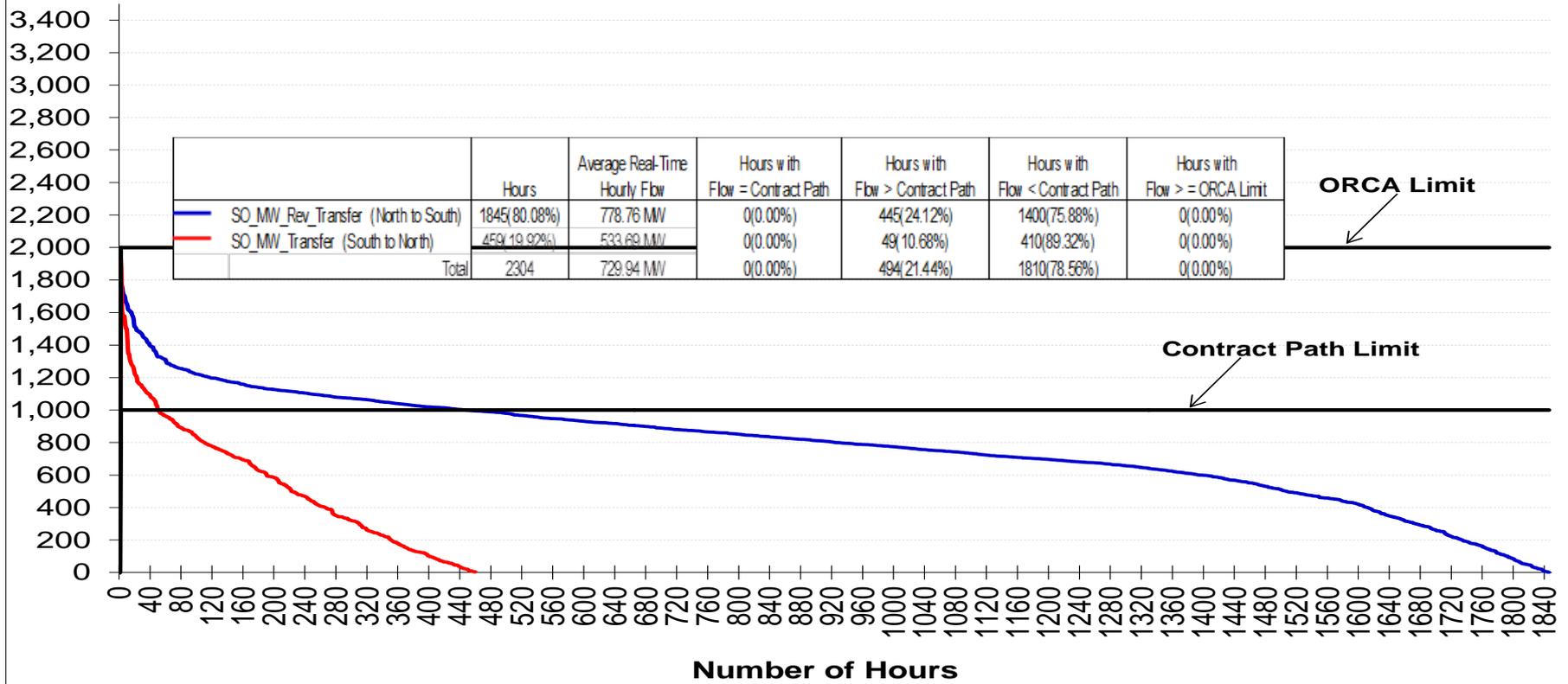
Day-Ahead Market Performance

Day-Ahead Hourly Shadow Price Duration Curve
July 17th, 2014 - October 20th, 2014



Hourly Real-Time Constraint Performance

Real-Time Hourly Average Actual Intra-Regional Flow Duration Curve
July 17th - October 20th, 2014



July 17th - October 20th, 2014	July ++: 360 Hours		August: 744 Hours		September: 720 Hours		October: 480 Hours		Total: 2304 Hours	
CONSTRAINT_NAME	Average Flow (MW)	Number of Hours	Average Flow (MW)	Number of Hours	Average Flow (MW)	Number of Hours	Average Flow (MW)	Number of Hours	Average Flow (MW)	Number of Hours
SO_MW_Rev_Transfer (North to South)	904.29	293 (81.3%)	877.66	635 (85.3%)	665.72	577 (80.1%)	677.73	340 (70.8%)	778.76	1845 (80.1%)
SO_MW_Transfer (South to North)	454.95	67 (18.6%)	494.82	109 (14.7%)	569.60	143 (19.9%)	564.97	140 (29.2%)	533.69	459 (19.9%)
Grand Total	820.66	360 (100.0%)	821.57	744 (100.0%)	646.63	720 (100.0%)	644.84	480 (100.0%)	729.94	2304 (100.0%)

*Percents based on total hours in the month

++Hurdle Rate implemented on July 17, 2014