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414 Nicollet Mall
Minneapolis, MN 55401

November 21, 2017

—Via Electronic Filing—

Daniel P. Wolf
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101

RE: NERC 2016 LONG-TERM RELIABILITY ASSESSMENT
2017 BIENNIAL TRANSMISSION PROJECTS REPORT
DOCKET NO. E999/M-17-377

Dear Mr. Wolf:

On November 1, 2017, on behalf of the Minnesota Transmission Operators (MTO), we submitted the 2017 Biennial Transmission Projects Report for approval by the Minnesota Public Utilities Commission. On November 14, 2017, in accordance with Minn. R. 7848.1800, subp. 3, the Department of Commerce filed comments with the Commission on the completeness of the report. No other comments were filed.

The Department of Commerce reviewed the 2017 Biennial Report to determine whether it contained the information required by Minn. R. 7848.1300. The only piece of additional information the Department thought should be included in the Biennial Report was the load and capability report from the regional reliability council, required under part (B) of the Rule. Since the Mid-continent Area Power Pool (MAPP) no longer exists, the Department recommended that the MTO submit a copy of the Midwest Reliability Organization's (MRO) load and capability report found in the North American Electric Reliability Corporation's (NERC) 2016 Long-Term Reliability Assessment.

Accordingly, the MTO is submitting the pertinent pages for the MRO-MAPP load and capability report from the 2016 NERC Assessment. The entire NERC Assessment for 2016 can be found here, along with Assessments for other years: http://www.nerc.com/pa/RAPA/ra/Pages/default.aspx

If you have any other questions about this filing, please contact Jody Londo at jody.l.londo@xcelenergy.com or (612) 330-5601.

Sincerely,

/s/

BRIA E. SHEA
DIRECTOR, REGULATORY AND STRATEGIC ANALYSIS

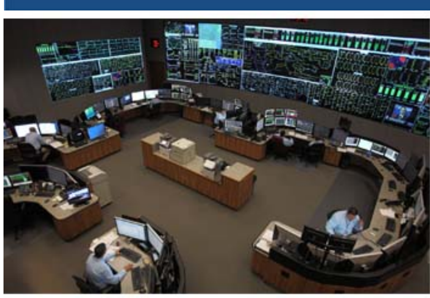
Enclosure
c: Service List

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

2016 Long-Term Reliability Assessment

December 2016

RELIABILITY | ACCOUNTABILITY




3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
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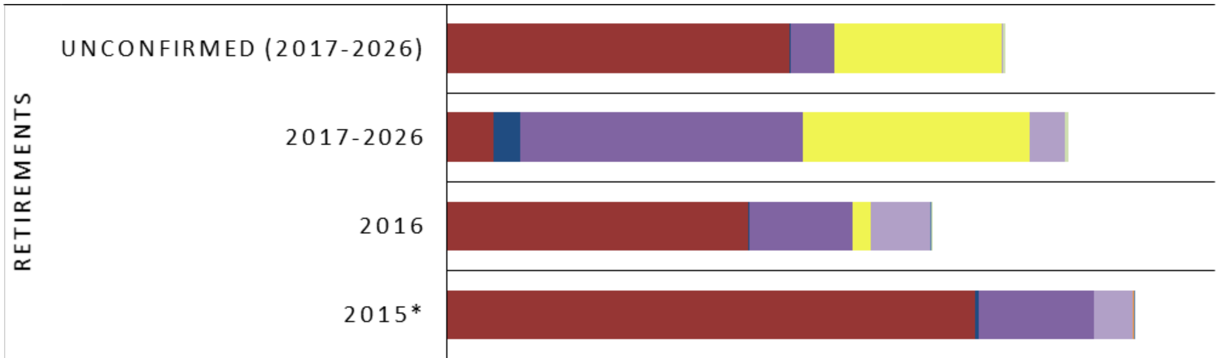


	Retirements			
	2015*	2016	2017-2026	Unconfirmed (2017-2026)
Coal	13,747	7,850	1,195	8,927
Hydro	104	21	692	20
Natural Gas	3,001	2,680	7,395	1,148
Nuclear	-	502	5,901	4,374
Petroleum	1,013	1,548	929	6
Solar	44	1	-	-
Wind	36	3	-	-
Other	-	10	87	67

Figure 1.6: NERC-Wide MW Nameplate Capacity Retirements from 2015 to 2026 by Fuel Type
***Actual Data[6]**

NERC also conducted a sensitivity analysis in which no Tier 2 capacity was built and all unconfirmed retirements were taken out of service. The aggregated unconfirmed retirements were provided from MISO through the Organization of MISO States (OMS) survey results for 2016.[7] This provides insight on the potential retirement of many resources in the MISO footprint. The survey results provide a greater confidence factor to apply the unconfirmed retirements into a reserve margin sensitivity analysis. Similarly, ERCOT released their 2016 CDR, providing additional detail on power plant retirement risks and generation fleet changes.[8] While both MISO and ERCOT have sufficient Tier 2 resources in the queue, depending on the timing of the retirements (Tier 2 resources may not be available to advance their in-service dates), which could increase the risk of an electricity supply shortage.

MISO

Similar to the *2014 LTRA* and *2015 LTRA* reference cases, the *2016 LTRA* reference case projects a shortfall in MISO's Anticipated Reserve Margins during the assessment period. The shortfall in projections is due to generation retirements outpacing the addition of Tier 1 resources; there is sufficient Tier 2 and Tier 3 generation that could be advanced to mitigate these capacity concerns. MISO is projecting an Anticipated Reserve Margin of 13.8 percent for the 2022 summer peak, which continues to trend downward to 9.0 percent by the end of 2026. MISO will require approximately 8 GW of additional resources by the end of the 10-year forecast in order to maintain the Reference Margin requirements of 15.2 percent. Considerations should be given to the assessment area's need for sufficient ERSs. These may include generation additions that are mostly asynchronous and may offer a reduced level of voltage, frequency, and/or ramping support, depending on equipment characteristics and facility design. Shown in **Figure 1.7**, the Reference Margin requirements are up by 0.9 percent compared to the *2015 LTRA* reference case due to resource adequacy study assumptions. These changes are mostly due to the

[6] Actual data for 2015 collected from EIA Electric Power Monthly
[7] Organization of MISO States Survey Results; 2016
[8] Report on the Capacity, Demand and Reserves (CDR) in the ERCOT Region, 2016-2025; May 2016

2014–2015 planning year being the first year of integrating the MISO South Zone with limited data being available.[9]

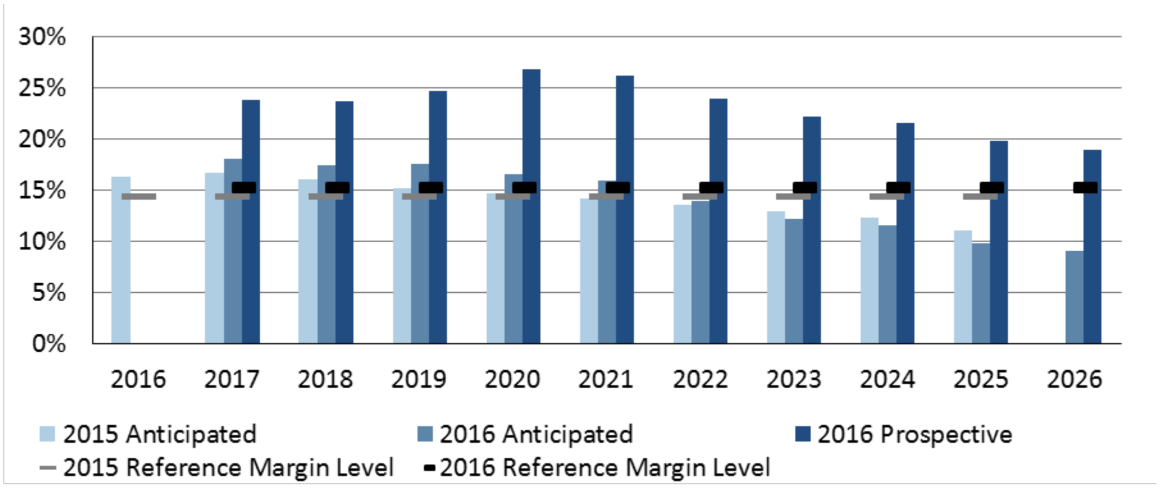


Figure 1.7: MISO 2015 LTRA and 2016 LTRA Reserve Margin Comparison

MISO gathered data for the past three years through the OMS Survey as part of their resource adequacy study. Survey results indicate that certain locations within the assessment area will have to rely on imports as early as 2017 from their neighboring zones, such as Missouri and Lower Michigan. The survey resulted in an estimation of 3.3 GW plant retirements by 2026. NERC considers these retirements as unconfirmed and are the major contributor in the advanced Reserve Margin shortfalls. ReliabilityFirst's *2016 Long-Term Resource Report* also identified these potential risks highlighted by the OMS survey results.[10]

Deliverability of New Resources

One of the major challenges in long-term system planning is the changing nature and location of available resources to load. The North American BPS does not provide infinite routes for all generation; therefore, the transition from a central-station model to a more dispersed BPS creates some challenges in power delivery and transmission. System planners use modeling software to simulate current and projected grid components and characteristics. From these models, transmission planners will identify potential future contingencies on lines and evaluate options, such as uprating or building new lines to mitigate contingencies before they occur. Having new resources built long distances from the load requires that new lines be built to effectively deliver this new generation to where it is needed. Transmission congested lines and operational challenges are likely to escalate within an area if the constraints are not alleviated.

Figure 1.8 includes the resulting unconfirmed retirement sensitivity analysis impacts on MISO's Anticipated Reserve Margins, which will fall below the Reference Margin Level by 2018. While the reference margin is not met in the five-year period given unconfirmed retirements, MISO appears to have sufficient Tier 2 resources to meet the Reference Margin Level. The long-term resource adequacy forecast is generally low risk, but as variable resources increase, Reference Margin Level requirements may increase beyond the current 15.2 percent in the future years.

[9] MISO Loss of Load Expectation Study Report: Planning year 2016-2017
[10] ReliabilityFirst 2016 Assessment-Long Term Resource; August 2016

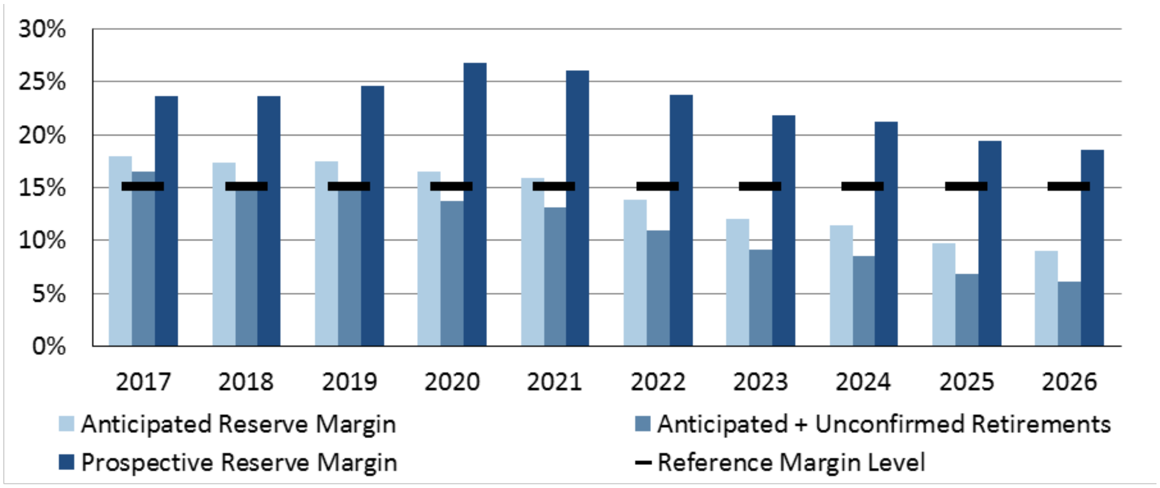


Figure 1.8: MISO Reserve Margins with Unconfirmed Retirements

MISO's long-term resource challenges are exacerbated by increasing transmission requirements. The MISO forecast includes a significant expansion of wind resources. Because of the geographic diversity of wind resources to load, more long-distance and networked transmission will be needed. Ensuring the deliverability of these resources is challenging when resources are located distant from the load. For example, forced curtailments of wind resources are sometimes required to prevent congestion on transmission lines. An August 2016 report by the U.S. Department of Energy[11] showed that the percentage of wind curtailment in MW to the total potential wind generation has increased in MISO from under 2 percent in 2007 to over 5.5 percent in 2015. An increase in wind curtailments could be a result of transmission inadequacy, minimum generation limits, other forms of grid inflexibility, and/or environmental restrictions. This could lead to an increased risk of real-time capacity deficiencies.[12]

NPCC-New England

The Anticipated Reserve Margins for NPCC-New England, shown below in **Figure 1.9**, exceed the Reference Margin Level for all years of the assessment period. Compared to the *2015 LTRA* reserve margin analysis, the Anticipated Reserve Margins have increased by 0.5 percent in 2017 and by 3.32 percent by year 2025. The majority of this change is due to a slight reduction in the ten-year peak load forecast.

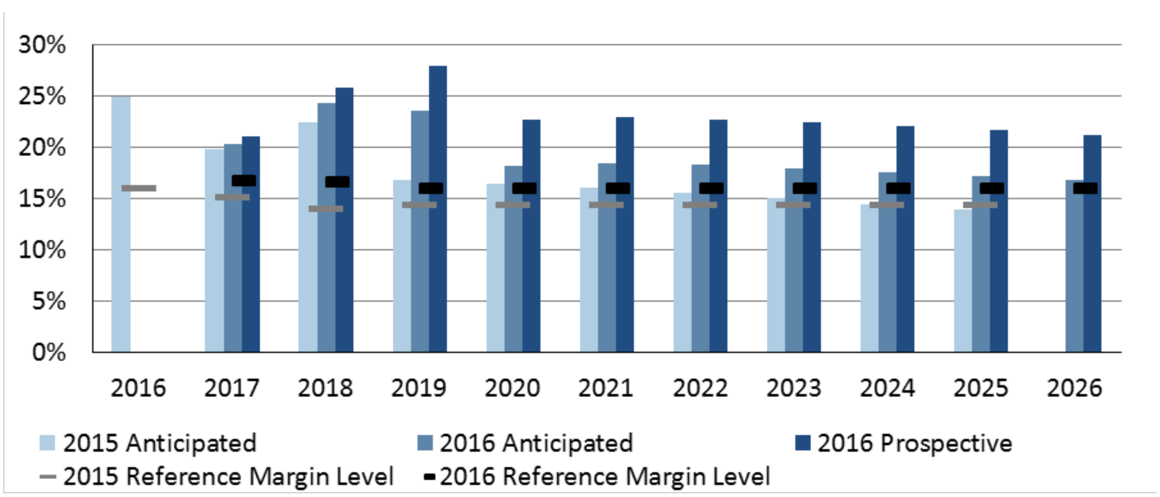


Figure 1.9: NPCC-New England 2015 LTRA and 2016 LTRA Reserve Margin Comparison

[11] Department of Energy: Wind Technologies Market Report - August 2016
[12] *Ibid*.

Transmission Adequacy

Maintaining sufficient transmission capacity is a key component of understanding and analyzing an assessment area's transmission adequacy. Load and resources are subject to a variety of factors that could lead to rapid changes to electric transmission infrastructure. This is generally restricted by slow planning, siting, and construction. While many generating units do require years to plan and build, unexpected retirements and the addition of generation with much shorter build times can stress the current transmission system. Through modeling and power flow studies, system planners provide the foundation for these essential transmission projects to be developed.

A FERC technical conference was held in August of 2016 that discussed competitive transmission development processes wherein Panel Four of this discussion involved Interregional Transmission Coordination Issues.[48] Amidst the discussion was an overview of several reports from The Brattle Group that highlighted studied transmission planning needs, trends, and recommendations.[49] As unprecedented shifts in the makeup of available generating resources and load occur, policy makers and regulators should advocate for developed processes that allow for transmission solutions that meet both reliability requirements and anticipated changes to due to environmental regulations. Tabulated below are the summarized major transmission project expansions provided in this report.

FRCC

The FRCC Region has not identified any major projects that are needed to maintain or enhance reliability during the planning horizon. Planned projects, shown in **Table 4.8**, are primarily related to expansion in order to serve forecasted growing demand, and they are related to maintaining the reliability of the BES in the longer-term planning horizon or for resource integration.

Table 4.8: FRCC Planned Transmission Projects

Name	Company	Driver	Line Length (Circuit Miles)	Operating Voltage/Type	Expected In-Service Year
Levee–Midway	Florida Power & Light Company	Reliability	150	500kV (ac)	2023

MISO

MISO's Transmission Expansion Plan[50] (MTEP15) includes proposals for over $2.75 billion[51] in transmission infrastructure investment through 2024, and these fall into the following categories:

- **90 Baseline Reliability Projects (BRP) totaling $1.2 billion:** BRPs are required to meet NERC reliability standards.
- **12 Generator Interconnection Projects (GIP) totaling $73.6 million:** GIPs are required to reliably connect new generation to the transmission grid.
- **1 Market Efficiency Project (MEP) totaling $67.4 million:** MEPs meet Attachment FF requirements for reduction in market congestion.
- **242 Other Projects totaling $1.38 billion:** Other projects include a wide range of projects, such as those that support lower-voltage transmission systems or provide local economic benefit but do not meet the threshold to qualify as Market Efficiency Projects.

[48] FERC Docket No. AD16-18-000; Notice Inviting Post-Technical Conference Comments; August 3, 2016
[49] The Brattle Group: Well-Planned Electric Transmission Saves Customer Costs: Improved Transmission Planning is Key to the Transition to a Carbon-Constrained Future; June 6, 2016
[50] MISO's Transmission Expansion Plan
[51] The MTEP15 report and project totals reflect all project approvals during the MTEP15 cycle, including those approved on an out-of-cycle basis prior to December 2015.

Several of MISO's major transmission projects are shown in **Table 4.9**.

Table 4.9: MISO Major Transmission Projects					
Name	**Company**	**Driver**	**Line Length (Circuit Miles)**	**Operating Voltage/Type**	**Expected In-Service Year**
Great Northern Transmission Line–partial segment	Minnesota Power (Allete, Inc.)	Hydro Integration	220	500kV (ac)	2020
MVP Portfolio 1–Ellendale to Big Stone South	Otter Tail Power Company	Reliability	165	345kV (ac)	2019
MVP Portfolio 1: N LaCrosse–N Madison-Cardinal-Eden-Hickory Creek	American Transmission Co. LLC	Reliability	161.8	345kV (ac)	2024
Great Northern Transmission Line–partial segment-	Minnesota Power (Allete, Inc.)	Hydro Integration	160	500kV (ac)	2020
MVP Portfolio 1: Lakefield Jct.–Winnebago–Winco–Kossuth County & Obrien County–Kossuth County–Webster	Ameren Services Company	Reliability	122	345kV (ac)	2018

Manitoba Hydro

Manitoba Hydro has plans for a significant number of system enhancement projects, including those listed in **Table 4.10.** Manitoba Hydro is planning for an addition of the third 2,000 MW Bipolar HVdc transmission system in 2018. Bipole III provides an alternative path to serve Manitoba load in the event of a major station loss or corridor loss associated with Bipole I and II. Manitoba Hydro is expecting a new 500 kV interconnection from Dorsey to Iron Range (Duluth, Minnesota) to come into service in 2020, as a result of an 883 MW transmission service request. Manitoba Hydro is also expecting a new 230 kV interconnection from Birtle South (Manitoba) to Tantallon (Saskatchewan) station with an in-service-date of 2020, as a result of a 140 MW transmission service request. The reliability impact of the 230 kV line is not evaluated in this assessment because a construction agreement has not been finalized with the customer yet.

Table 4.10: Manitoba Hydro Major Transmission Projects					
Name	**Company**	**Driver**	**Line Length (Circuit Miles)**	**Operating Voltage/Type**	**Expected In-Service Year**
Bipole 3–Riel	Manitoba Hydro	Reliability	1800	500kV (dc)	2018
Great Northern Transmission Line (Canadian Portion)	Manitoba Hydro	Reliability	146	500kV (ac)	2020

SaskPower

Saskatchewan has several major transmission projects for reliability during near-term of the assessment period. These projects, identified in **Table 4.11**, are heavily dependent on load growth, and involve the construction of approximately 570 miles (918 km) of transmission lines.

MISO

The Midcontinent Independent System Operator, Inc. (MISO) is a not-for-profit member-based organization. MISO administers wholesale electricity markets that provide customers with valued service, reliable, cost-effective systems and operations, dependable and transparent prices, open access to markets, and planning for long-term efficiency. MISO manages energy, reliability, and operating reserve markets that consist of 36 local Balancing Authorities and 394 market participants, serving approximately 42 million customers. Although parts of MISO fall in three NERC Regions, MRO is responsible for coordinating data and information submitted for NERC's reliability assessments.

Summary of Methods and Assumptions

Reference Margin Level
15.2 percent This increase is mainly driven by a process change within the LOLE study.

Load Forecast Method
Coincident

Peak Season
Summer

Planning Considerations for Wind Resources
Effective load-carrying capability (ELCC); varies by wind node

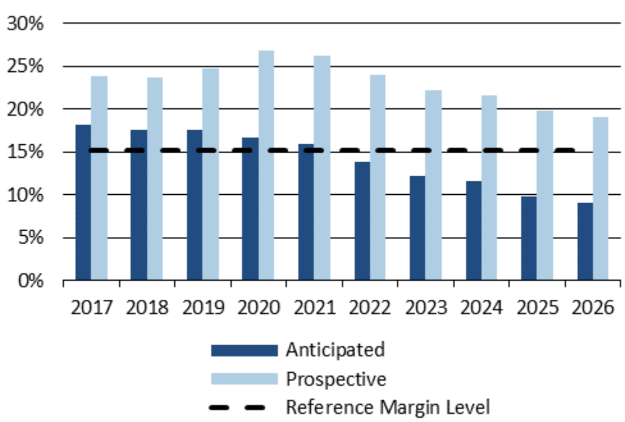
Planning Considerations for Solar Resources
No utility-scale solar resources in MISO

Footprint Changes
Minnesota is reporting under MISO this year

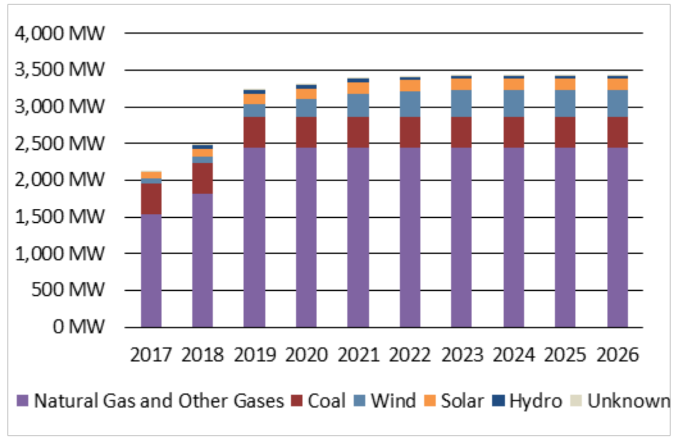
Peak Season Demand, Resources, Reserve Margins, and Shortfall

Demand (MW)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Total Internal Demand	127,641	128,270	129,367	130,076	130,728	131,517	132,261	132,959	133,581	134,462
Demand Response	5,827	5,827	5,827	5,827	5,827	5,827	5,827	5,827	5,827	5,827
Net Internal Demand	121,814	122,443	123,540	124,249	124,901	125,690	126,434	127,132	127,754	128,635
Resources (MW)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Anticipated	143,844	143,866	145,316	144,875	144,850	143,154	141,817	141,805	140,311	140,297
Prospective	150,779	151,474	154,063	157,614	157,590	155,722	154,517	154,506	153,062	153,047
Reserve Margins (%)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Anticipated	18.09%	17.50%	17.63%	16.60%	15.97%	13.89%	12.17%	11.54%	9.83%	9.07%
Prospective	23.78%	23.71%	24.71%	26.85%	26.17%	23.89%	22.21%	21.53%	19.81%	18.98%
Reference Margin Level	15.20%	15.20%	15.20%	15.20%	15.20%	15.20%	15.20%	15.20%	15.20%	15.20%
Shortfall (MW)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Anticipated	-	-	-	-	-	1,640	3,836	4,651	6,862	7,890
Prospective	-	-	-	-	-	-	-	-	-	-

Peak Season Reserve Margins



On-Peak Tier 1 Capacity Additions



Probabilistic Assessment Overview

- **General Overview:** MISO is a summer-peaking system that spans 15 states and consists of 36 local Balancing Authorities that are grouped into 10 local resource zones. For the ProbA, MISO utilized a multi-area modeling technique for the 10 local resource zones internal to MISO. Firm external imports and non-firm imports are also modeled. This multi-area modeling technique for resource zones and accompanying methodology has been thoroughly vetted through MISO's stakeholder process.

- **Modeling**: Each local resource zone was modeled with an import and export limit based on power flow transfer analysis. In addition to the zone-specific import and export limits, a regional directional limit was modeled that limits the Midwest (local resource zones 1–7) to south (local resource zones 8–10) flow to 3,000 MWs and the south to Midwest to 2,500 MWs. The modeling of this limit is the main driver for the difference between the probabilistic and deterministic reserve margins. MISO utilizes unit specific outage, planning, and maintenance outage rates within the analysis based on five years of Generation Availability Data System (GADS) data. Modeling unit specific outage rates increases precision in the probabilistic analysis when compared to the utilization of class average outage rates.

- **Results Trending:** Previous results in the *2014 Probabilistic Assessment* resulted in 182.2 MWh EUE and 0.09 Hours per year LOLH. The results from this year's analysis resulted in a slight decrease for 2018 when compared to the analysis completed in the *2014 Probabilistic Assessment*.

- **Probabilistic vs. Deterministic Reserve Margin Results:** The LTRA deterministic reserve margins decrease capacity that is constrained within MISO south due to the 2,500 MW limit which reflects a decrease in reserve margin. The constraint was explicitly modeled for the probabilistic analysis and determined if sufficient capacity was available to transfer from south to north and vice versa. The modeling of this limitation produces an increase for the ProbA forecast planning reserve margin.

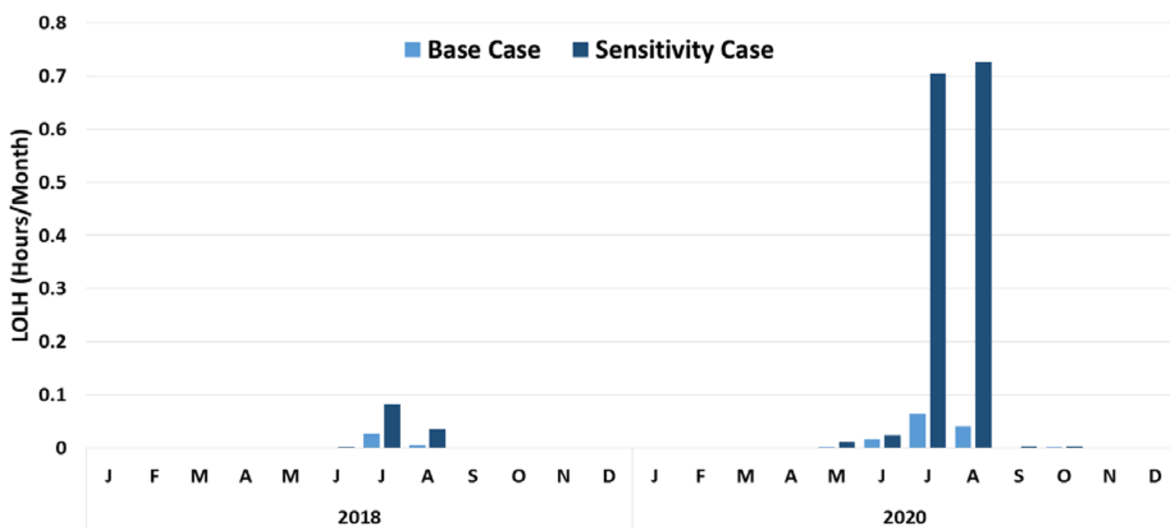
Base Case Study

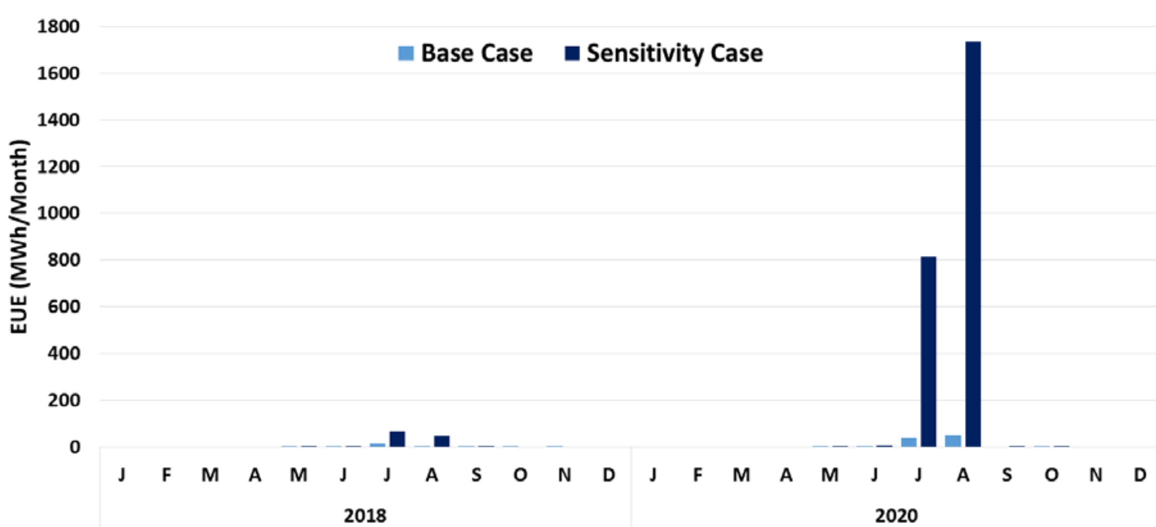
- The bulk of the EUE and LOLH are accumulated in the summer peaking months with some off-peak risk.
- Increases in loss of load statistics are expected with decreasing reserve margins.

Sensitivity Case Study

- The Sensitivity Case is a good proxy for increased retirement risk and/or increased load forecasts. The 2018 2 percent increase is equal to a 2,565 MW increase and the 2020 4 percent increase is equal to a 5,203 MW increase.

Summary of Results				
Reserve Margin (RM) %				
	Base Case		Sensitivity Case	
	2018	**2020**	**2018**	**2020**
Anticipated	17.5	16.6	-	-
Prospective	23.7	26.9	-	-
Reference	15.2	15.2	-	-
ProbA Forecast Planning	21.7	20.2	19.2	15.4
ProbA Forecast Operable	12.0	10.6	9.7	6.1
Annual Probabilistic Indices				
	Base Case		Sensitivity Case	
	2018	**2020**	**2018**	**2020**
EUE (MWh)	17.95	95.80	113.83	2565.70
EUE (ppm)	0.026	0.133	0.160	3.430
LOLH (hours/year)	0.033	0.125	0.119	1.474





Overview

MISO projects a regional surplus for the summer of 2017 with potential regional shortfall starting in 2018. These results show a potential regional short fall two years earlier than the *2015 MISO LTRA* results. These results are driven by a number of factors:

- A decrease in resources committed to serving MISO's load mainly by independent power producers (IPP).
- A decrease in load forecasts where the biggest drop was in Zone 6 (Indiana).
- The increase in committed resources (Tier 1) in Zone 7 (Michigan).
- MISO projects that each zone within the MISO footprint will have sufficient resources within their boundaries to meet their local clearing requirements or the amount of their local resource requirement (which must be contained within their boundaries).
- Several zones are short against their total zonal reserve requirement when only resources within their boundaries (or are contracted to serve their loads) are considered. However, those zones have sufficient import capability, and the MISO region has sufficient surplus capacity in others zones to support this transfer. Surplus generating capacity for zonal transfers within MISO could become scarce in later years if no action is taken in the interim by MISO load-serving entities.
- All zones within MISO are sufficient from a resource adequacy point of view in the near term when available capacity and transfer limitations are considered. Regional shortages in later years may be rectified by the utilities; MISO is engaged with stakeholders in a number of resource adequacy reforms to help rectify these later year's shortages.

Policy and changing generation trends continue to drive new potential risks to resource adequacy, requiring continued transparency and vigilance to ensure long-term needs.

- MISO projects that reserve margins will continue to tighten over the next five years and approach the reserve margin requirement.
- Operating at the reserve margin creates a new operating reality for MISO members where the use of all resources available on the system and emergency operating procedures are more likely. This reality will lead to a projected dependency in use of Load Modifying Resources, such as behind-the-meter generation and DR.

The SPP settlement agreement has put in place a Regional Directional Transfer Limit replacing the ORCA operating limit. Specifically the Midwest (LRZs 1-7) to south (LRZs 8-10) flow is limited to 3,000 MWs and south to Midwest is limited to 2,500 MWs.[80]

This year marks the third iteration of the Organization of MISO States (OMS) MISO survey, which helps provide forward visibility into the resource adequacy position of the MISO region. The survey also helped identify resources that had a low certainty of being available for each planning year.

The LTRA results represent a point in time forecast, and MISO expects these figures will change significantly as future capacity plans are solidified by load-serving entities and States. For example, there are enough resources in Tier 2 and 3 to mitigate any long-term resource shortfalls.

MISO forecasts the coincident Total Internal Demand to peak at 127,607 MW during the 2017 summer season. This is a decrease of roughly 2,700 MWs from last year's projection for 2017. This decrease is mainly driven by load reductions in Zones 5 (Missouri) and aluminum smelter closures in Zone 6 (Indiana). MISO projects the

[80] MISO Presentation: SPP Settlement Update; October 2015

summer coincident peak demand to grow at an average annual rate of 0.6 percent, which is less than the growth rate from the 2015 assessment.

As a result of the OMS-MISO survey, resources with a low certainty of being available for the given year are more visible. This number is small in Years 1–3 and then ramps up in the future. The reductions of these low certainty resources are more than offset with Tier 2 and 3 resources and should not cause any resource adequacy issues. However, MISO continues to see a number of large resources, generally IPPs, that are “at-risk” for retirement due to economics. Local reliability issues could result with some of the unannounced retirements.

The annual MISO Transmission Expansion Plan (MTEP)[81] proposes transmission projects to maintain a reliable electric grid and deliver the lowest-cost energy to customers in the MISO region. As part of MTEP15, MISO staff recommends $2.75 billion of new transmission expansion through 2024, as described in Appendix A of the MTEP report,[82] to the MISO Board of Directors for review, approval, and subsequent construction.

The 345 new projects in MTEP15 Appendix A represent $2.75 billion[83] in transmission infrastructure investment and fall into the following four categories:

90 Baseline Reliability Projects (BRP) totaling $1.2 billion: BRPs are required to meet NERC reliability standards.

12 Generator Interconnection Projects (GIP) totaling $73.6 million: GIPs are required to reliably connect new generation to the transmission grid.

1 Market Efficiency Project (MEP) totaling $67.4 million: MEPs meet requirements for reduction in market congestion.

242 Other Projects totaling $1.38 billion: Other projects include a wide range of projects, such as those that support lower-voltage transmission systems or provide local economic benefit, but do not meet the threshold to qualify as Market Efficiency Projects.

MISO is working with stakeholders to create resource adequacy reforms to move to a seasonal construct. The seasonal construct would create a summer and a winter planning reserve margin requirement and seasonal resource parameters (on peak capacity, EFORd, etc.). The seasonal construct will better reflect the seasonality of the wind, solar, etc. and increase the visibility of reliability in the winter season.

[81] MISO Transmission Expansion Planning (MTEP)
[82] MISO Transmission Expansion Plan 2015
[83] The MTEP15 report and project totals reflect all project approvals during the MTEP15 cycle, including those approved on an out-of-cycle basis prior to December 2015.

Certificate of Service

I, Jim Erickson, hereby certify that I have this day served copies of the foregoing document on the attached list of persons.

xx by depositing a true and correct copy thereof, properly enveloped with postage paid in the United States mail at Minneapolis, Minnesota

xx electronic filing

Docket No. E999/M-17-377

Dated this 21st day of November 2017

/s/

____

Jim Erickson
Regulatory Administrator

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Julia	Anderson	Julia.Anderson@ag.state.mn.us	Office of the Attorney General-DOC	1800 BRM Tower 445 Minnesota St St. Paul, MN 551012134	Electronic Service	No	OFF_SL_17-377_M-17-377
Christopher	Anderson	canderson@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022191	Electronic Service	No	OFF_SL_17-377_M-17-377
James J.	Bertrand	james.bertrand@stinson.com	Stinson Leonard Street LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
Derek	Bertsch	derek.bertsch@mrenergy.com	Missouri River Energy Services	3724 West Avera Drive PO Box 88920 Sioux Falls, SD 57109-8920	Electronic Service	No	OFF_SL_17-377_M-17-377
Carl	Cronin	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	No	OFF_SL_17-377_M-17-377
Stacy	Dahl	sdahl@minnkota.com	Minnkota Power Cooperative, Inc.	1822 Mill Road PO Box 13200 Grand Forks, ND 58208-3200	Electronic Service	No	OFF_SL_17-377_M-17-377
Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_17-377_M-17-377
Ian	Dobson	Residential.Utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012130	Electronic Service	No	OFF_SL_17-377_M-17-377
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_17-377_M-17-377
Michael	Greiveldinger	MichaelGreiveldinger@alliantenergy.com	Wisconsin Power and Light	4902 North Biltmore Lane Madison, WI 53718	Electronic Service	No	OFF_SL_17-377_M-17-377

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Kimberly	Hellwig	kimberly.hellwig@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
Michael	Hoppe	il23@mtn.org	Local Union 23, I.B.E.W.	932 Payne Avenue St. Paul, MN 55130	Electronic Service	No	OFF_SL_17-377_M-17-377
Alan	Jenkins	aj@jenkinsatlaw.com	Jenkins at Law	2265 Roswell Road Suite 100 Marietta, GA 30062	Electronic Service	No	OFF_SL_17-377_M-17-377
Richard	Johnson	Rick.Johnson@lawmoss.com	Moss & Barnett	150 S. 5th Street Suite 1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
Mark J.	Kaufman	mkaufman@ibewlocal949.org	IBEW Local Union 949	12908 Nicollet Avenue South Burnsville, MN 55337	Electronic Service	No	OFF_SL_17-377_M-17-377
Colleen	Knudtson	colleenk@cmpasgroup.org	Central MN MPA	459 South Grove Street Blue Earth, MN 56013	Electronic Service	No	OFF_SL_17-377_M-17-377
Thomas	Koehler	TGK@IBEW160.org	Local Union #160, IBEW	2909 Anthony Ln St Anthony Village, MN 55418-3238	Electronic Service	No	OFF_SL_17-377_M-17-377
Michael	Krikava	mkrikava@briggs.com	Briggs And Morgan, P.A.	2200 IDS Center 80 S 8th St Minneapolis, MN 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
Rick	Lancaster	rlancaster@grenergy.com	Great River Energy	12300 Elm Creek Blvd Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_17-377_M-17-377
Douglas	Larson	dlarson@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	No	OFF_SL_17-377_M-17-377

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Joel	Larson	jlarson@minnkota.com	Minnkota Power Cooperative, Inc.	1822 Mill Road Grand Forks, ND 58203	Electronic Service	No	OFF_SL_17-377_M-17-377
Mike	Malone	mmalone@hcpd.com	Heartland Consumer Power District	P.O. Box 248 Madison, SD 570420248	Electronic Service	No	OFF_SL_17-377_M-17-377
Pam	Marshall	pam@energycents.org	Energy CENTS Coalition	823 7th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_17-377_M-17-377
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
David	Niles	david.niles@avantenergy.com	Minnesota Municipal Power Agency	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
David	Raatz	draatz@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58501	Electronic Service	No	OFF_SL_17-377_M-17-377
Craig	Rustad	crustad@minnkota.com	Minnkota Power	1822 Mill Road PO Box 13200 Grand Forks, ND 582083200	Electronic Service	No	OFF_SL_17-377_M-17-377
Laura	Sandwick	lm.sandwick@smmpa.org	Southern MN Municipal Power Agency	500 1st Ave SW Rochester, MN 55902-3303	Electronic Service	No	OFF_SL_17-377_M-17-377
Richard	Savelkoul	rsavelkoul@martinsquires.com	Martin & Squires, P.A.	332 Minnesota Street Ste W2750 St. Paul, MN 55101	Electronic Service	No	OFF_SL_17-377_M-17-377

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William E.	Schwandt	bschwandt@mpsutility.com	Moorhead Public Service	500 Cedar Ave PO Box 779 Moorhead, MN 565610779	Electronic Service	No	OFF_SL_17-377_M-17-377
Bria	Shea	bria.e.shea@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, MN 55401	Electronic Service	No	OFF_SL_17-377_M-17-377
Mrg	Simon	mrgsimon@mrenergy.com	Missouri River Energy Services	3724 W. Avera Drive P.O. Box 88920 Sioux Falls, SD 571098920	Electronic Service	No	OFF_SL_17-377_M-17-377
Ken	Smith	ken.smith@districtenergy.com	District Energy St. Paul Inc.	76 W Kellogg Blvd St. Paul, MN 55102	Electronic Service	No	OFF_SL_17-377_M-17-377
Trevor	Smith	trevor.smith@avantenergy.com	Avant Energy, Inc.	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
Byron E.	Starns	byron.starns@stinson.com	Stinson Leonard Street LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
Fred	Stibor	fstibor@itctransco.com	ITC Midwest LLC	27175 Energy Way Novi, MI 48375	Electronic Service	No	OFF_SL_17-377_M-17-377
James M.	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	470 U.S. Bank Plaza 200 South Sixth Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_17-377_M-17-377
Keith	Stubbendick	kas@dairynet.com	Dairyland Power Cooperative	PO Box 817 La Crosse, WI 54602-0817	Electronic Service	No	OFF_SL_17-377_M-17-377
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_17-377_M-17-377

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Darryl	Tveitbakk	nmpadt@mncable.net	Northern Municipal Power Agency	123 2nd Street West Thief River Falls, MN 56701	Electronic Service	No	OFF_SL_17-377_M-17-377
Lisa	Veith	lisa.veith@ci.stpaul.mn.us	City of St. Paul	400 City Hall and Courthouse 15 West Kellogg Blvd. St. Paul, MN 55102	Electronic Service	No	OFF_SL_17-377_M-17-377
Michael	Voelker	mvoelker@eastriver.coop	East River Electric Power Coop., Inc.	211 S Harth Ave Madison, SD 57042	Electronic Service	No	OFF_SL_17-377_M-17-377
Daniel P	Wolf	dan.wolf@state.mn.us	Public Utilities Commission	121 7th Place East Suite 350 St. Paul, MN 551012147	Electronic Service	No	OFF_SL_17-377_M-17-377