NERC
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to ensure the reliability of the bulk power system

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MRO

EXECUTIVE SUMMARY

The forecasted 2010–2019 Non-Coincident Peak Net Internal Demand for the MRO Region shows an increase at an average rate of 1.37 percent per year as compared to 1.60 percent predicted last year for the 2009–2018 period. The Total Internal Demand for 2019 is projected to be 54,392 MW. The Net Internal Demand is projected to be 51,113 MW. These projected demands are slightly lower than the 2018 demand projections due to the economic downturn. The Existing capacity resources for 2010 are 65,508 MW. The Existing-Certain resources for 2010 are 58,006 MW. This is 1,573 MW higher than the Existing-Certain resources reported for the 2009 (56,433 MW). The Future (Planned and Conceptual) capacity resources that are projected to be in service by end of 2019 is 19,164 MW. Approximately 1,600 MW of additional nameplate wind generation and 480 MW of hydro generation are projected to be placed in service in 2010 summer since 2009 summer. The projected Adjusted Potential Resources Reserve Margin for the MRO Region ranges from 29.0 percent to 22.7 percent for the 2010-2019 period, which is above the various target reserve margins established by the MRO Planning Authorities.

Table MRO-1: MRO Regional Profile

	2010	2019
Total Internal Demand	48,430	54,392
Total Capacity	65,508	67,629
Capacity Additions	0	2,121
Demand Response	3,199	3,279

A number of transmission reinforcements and various transformer and substation expansions and upgrades are projected to be completed during the 2010-2019 planning horizon. The MRO Transmission Owners estimate that 833 miles of 500 kV DC circuit, 31 miles of 500 kV AC circuit, 894 miles of 345 kV circuit and 570 miles of 230 kV circuit of planned facilities could be installed in the MRO Region over the next ten years.

The MRO Region is projected to have approximately 23,663 MW of nameplate wind generation by end of 2019, which includes Conceptual wind resources based on a 35 percent confidence factor. The simultaneous output of wind generation within the MRO Region has historically reached 75 percent or more of nameplate rating for extended periods of time, and this may occur during off-peak hours and minimum load periods. At the present time, ramp rates, output volatility, and the inverse nature of wind generation with respect to load levels have been manageable. However, the Reliability Coordinator and Operators in the MRO Region closely monitors the ramp-down rate of wind generation during the morning load pickup period. Extensive analysis is being performed on wind generation, in areas such as: regulation, load following, ramp rates, managing minimum load periods, forecasting, equitable participation during curtailments and redispatch. In addition, addressing future aspects of wind such as establishing appropriate capacity credits, day-ahead participation in market processes, and energy storage are being analyzed.

INTRODUCTION

The Midwest Reliability Organization (MRO) is a Cross-Border Regional Entity representing the upper Midwest of the United States and Canada. MRO is organized consistent with the Energy Policy Act of 2005 and the bilateral principles between the United States and Canada.

Sufficient generating capacity is forecasted within the MRO Region to maintain adequate reserve margins through 2019. With adjusted potential resources included from the generation interconnection queues in the MRO Region, a proxy Regional target reserve margin level of 15.0 percent for the six MRO Planning Authorities is projected to be met through 2019.

Through the 2019 planning horizon, the assessment shows that the transmission system in the MRO Region is projected to perform adequately assuming planned reinforcements are completed on schedule. The MRO Transmission Owners estimate that 833 miles of 500 kV DC circuit, 31 miles of 500 kV AC circuit, 894 miles of 345 kV circuit and 570 miles of 230 kV circuit of planned facilities could be installed in the MRO Region over the next ten years.

DEMAND

The compounded annual growth rate of the summer peak Net Internal Demand for the MRO-U.S. subregion is forecasted to be 1.24 percent during the 2010–2019 period as compared to 1.56 percent predicted last year for the 2009–2018 period. The decrease in projected demands is due to the economic downturn. The compounded annual growth rate for the MRO-Canada subregion is forecasted to be 2.08 percent during the 2010–2019 period as compared to 1.75 percent predicted last year for the 2009–2018 period.

While the MRO Region as a whole is summer-peaking, the MRO-Canada is a winter-peaking subregion. The compounded annual growth rate of the winter peak Net Internal Demand for MRO-Canada is forecasted to be 1.89 percent during the 2010–2019 period as compared to 1.68 percent predicted last year for the 2009–2018 period. This increase in load forecast is driven by higher residential load growth due to projected increases in population growth and increases in industrial load due to pipeline expansions, mining and smelting operations.

Peak demand uncertainty and variability due to extreme weather, economic conditions, and other variables are accounted for within the determination of adequate generation reserve margin levels. Most of MRO Planning Authorities use a Load Forecast Uncertainty (LFU) factor that considers uncertainties attributable to weather and economic conditions. Saskatchewan develops energy and peak demand forecasts based on a provincial econometric model and forecasted industrial load data. Forecasts take into consideration the Saskatchewan economic forecast, historic energy sales, customer forecasts, normalized weather and historical data, and system losses.[81]

[81] Saskatchewan 2009 Load Forecast Report.

Each individual Load Serving Entities (LSE's) member within the MRO Region maintains reserves based on its monthly peak load forecasts. The LSE's reported based solely on its own peak, which could occur at a different time than the system peak. The individual LSE's monthly peak load forecasts are then aggregated by summing these forecasts to develop the MRO Regional non-coincident demand forecast. The Regional non-coincident demand forecast does not include any diversity factors.

Interruptible Demand and Demand-Side Management (DSM) programs, presently amounting to 3,199 MW, are used by a number of MRO members. The Interruptible Demand and Demand-Side Management (DSM) programs are projected to increase to 3,279 MW by 2019. A wide variety of Energy Efficiency programs, including conservation, consumer education, direct load control (such as electric appliance cycling) and interruptible load are used to reduce peak demand. Reductions in demand due to Energy Efficiency are not known at this time.

Each MRO member uses its own forecasting method, meaning some may use a 50/50 forecast, some may use a 90/10 forecast or forecasts based on a provincial econometric model. In general, the peak demand forecast includes factors involving recent economic trends (industrial, commercial, agricultural, residential) and normal weather patterns.

GENERATION

The Existing (Certain, Other & Inoperable) capacity resources for 2010 summer are 65,508 MW. The Future (Planned and Other) capacity resources that are projected to be in service by end of 2019 are 3,992 MW. These values do not include import and export capacity transactions.

The nameplate capacity of the Existing variable generation for the MRO Region is approximately 7,540 MW for 2010 summer. The variable resources for the MRO-US subregion projected to be available at peak times are 570 MW, based on 8 percent of nameplate capacity for summer peak. The nameplate capacity of the Future variable generation for the MRO Region is estimated to increase to 1,770 MW by 2019. The variable resources for the MRO-US subregion projected to be available at peak times are estimated to increase to 131 MW by 2019 based on 8 percent of nameplate capacity for summer peak. The 8 percent for summer peak and 20 percent for winter peak of nameplate wind generation is used for the MRO-US subregion only. The 8 percent and 20 percent of nameplate capacity rule is used by MRO-US Planning Authorities when determining capacity credits of variable generation. 10 percent of nameplate wind generation is used for the MRO-Canada subregion for summer peak and 20 percent for winter peak. The existing biomass portion of resources for the MRO Region projected to be available at peak times is 156 MW. Future-Planned biomass is estimated to increase to 43 MW over the next ten-years.

The Conceptual capacity resources projected to come on-line for the MRO Region are estimated to increase to 15,172 MW by 2019 based on a 35 percent confidence factor. The Conceptual nameplate capacity of variable generation projected for the MRO Region is estimated to increase to 14,353 MW by 2019. The Conceptual variable resources for the MRO-US subregion projected to be available at peak times are 1,148 MW, based on 8 percent of nameplate capacity for summer peak. The 8 percent for summer peak and 20 percent for winter peak of nameplate wind generation is used for the MRO-US subregion only. The 8 percent and 20 percent of nameplate capacity rule is used by MRO Planning

Authorities when determining capacity credits of variable generation. 10 percent of nameplate wind generation is used for the MRO-Canada subregion for summer peak and 20 percent for winter peak. The Conceptual biomass portion of resources for the MRO Region is estimated to increase to 77 MW over the next ten-years.

Conceptual capacity resources were acquired from various generation interconnection queues within the Region that are active, or have initiated study work or agreements with the Transmission Provider. The majority of the Conceptual capacity resources in the MRO Region are wind generation. Much of this wind generation is being proposed within the next three years since federal Production Tax Credits for wind generation are presently effect through 2012.

A confidence factor was applied across each of the study years starting with 10 percent for 2011 through 35 percent for the 10th year to reduce the Conceptual capacity resources amount to a realistic projected value. This value is judged to be conservative and should not result in overstated Conceptual capacity resources.

There are uncertainties involved when using Conceptual capacity resources from applicable generation interconnection queues. In-service dates may be deferred or slip and some generation that is projected within the next several years may in fact qualify as "Planned" resources. Conceptual capacity resources from generation interconnection queue were coordinated with generation owners to verify and update in-service dates of key future generation (*i.e.*, large coal units) and to establish a reasonable confidence factor. MRO also considered when establishing the confidence factor that the LSE's within the MRO Region have an obligation to serve and meet their target reserve margins.

CAPACITY TRANSACTIONS ON PEAK

For the 2010, the projected total firm imports into the MRO Region are 1,993 MW. These imports are from sources external to the MRO Region. A total firm export of approximately 1,675 MW is projected for 2010 to serve loads outside of the MRO Region. The net import or export of the MRO Region may vary at peak load, depending on system conditions and market conditions. The total firm exports become progressively lower in future years while imports varied minimally through the study period.

Transfer capability from MRO-Canada (Saskatchewan and Manitoba) subregion into the MRO-US subregion is limited to 2,415 MW due to the operating security limits of the two interfaces between these two provinces and the U.S. The forecasted firm and expected on-peak transfers from MRO-Canada to the U.S. is 1,160 MW for 2010 and is estimated to decrease to 725 MW over the next ten-years.

Throughout the MRO Region, firm transmission service is required for all generation resources that are used to provide firm capacity. This means that these firm generation resources are fully deliverable to the load. The MRO Region is forecast to meet the various reserve margin targets without needing to include energy-only, uncertain, or transmission-limited resources.

TRANSMISSION

A number of transmission reinforcements and various transformer and substation expansions and upgrades are projected to be completed by 2010-2019 planning horizon. These planned reinforcements include several rebuilt or reconductored transmission lines.

The majority of the planned transmission for the MRO-Canada subregion is for hydro resource integration reinforcements.

There are no reliability concerns in meeting target in-service dates of the transmission projects. Operational procedures to maintain reliability will be implemented if unforeseen delays occur in these or other planned projects.

The Iowa system continues to see a large amount of new wind farm installations. The main driver in electric system improvements has been the large increase of installed wind generation. The Iowa system continues to experience the effects of several other forces including a surge of installed wind power in Minnesota and central Illinois. The eastern Iowa system has several flowgates impacted by high south to north flows that may occur for any load condition. The planned Salem to Hazleton 345 kV line will help alleviate these constraints.

The Nebraska transmission system is heavily impacted by north-to-south and west-to-east Regional transfers. System operating limits have been approached on north-to-south flowgates including the Western Nebraska – Western Kansas (WNE_WKS) and Cooper South (COOPER_S) Interfaces during these high transfers which predominately occur during off-peak time periods. For those time periods in which heavy flows to the south do occur, operating guides are in place to implement transmission loading relief and market redispatch to limit flows. Future transmission plans such as the Axtell – Post Rock - Spearville 345 kV line addition will help to alleviate these constraints as well as other transmission constraints.

The Wisconsin-Upper Michigan Systems (WUMS) southern interface includes tie lines in the southwest and southeast interfaces. The southwest interface comprises the Wempletown-Paddock 345 kV line and Wempletown-Rockdale 345 kV line. The southeast interface comprises Zion-Arcadian 345 kV line, Zion-Pleasant Prairie 345 kV line and Zion-Lakeview 138 kV line. The WUMS southern interface is thermally limited during periods of heavy transfer in either direction. The WUMS southern interface is also voltage stability limited during periods of heavy imports through the interface. Operating guides including coordinated reciprocal flowgates of the Midwest ISO and PJM RTO are used to monitor and manage these constraints. Completion of the second Paddock - Rockdale 345 kV line in March 2010 will help alleviate the southwestern interface constraints. The southeastern interface constraints are further being addressed by ATCLLC's analysis of transmission projects that potentially provide economic benefits, particularly, a Bain – Zion 345 kV line, and Midwest ISO's Cross Border Top Congested Flowgates Study.

The Minnesota-Wisconsin Export (MWEX) interface is comprised of the Arrowhead 230 kV phase shifting transformer and King-Eau Claire 345kV line. During high imports from Minnesota into WUMS across the MWEX interface, the system would be more susceptible to transient voltage instability issues than

thermal issues during light load conditions. An operating guide including coordinated reciprocal flowgates of the Midwest ISO and MAPP are in placed to monitor and manage these constraints to acceptable limits to ensure reliable operation of the transmission system. The proposed Twin Cities-North La Crosse 345 kV line (Hampton Corner – North Rochester – North La Crosse) and the ATCLLC La Crosse-Cardinal 345 kV line will address the export concerns across this interface resulting in redefinition of the interface or potential elimination of the interface. Further analysis will be performed as the proposed facilities advance forward.

The North Dakota Export (NDEX) interface is comprised of multiple tie lines that connect various parts of the transmission system together between Minnesota and the Dakotas. During high exports from the Dakotas into Minnesota, the NDEX interface sees increased loading during light load conditions, which may result in the transmission system being susceptible to transient voltage instability. Operating guides are in place to manage NDEX interface flow to acceptable limits to ensure reliable operation of the transmission system. The proposed Fargo-Monticello 345 kV and Bemidji-Grand Rapids 230 kV lines will both cross the existing NDEX interface and are projected to create additional interface capability between the Dakotas and Minnesota. Transmission studies underway for the planning horizon are evaluating the historical NDEX interface and considering a potential redefinition of the interface to include the proposed projects. Further analysis will be performed as the proposed facilities advance forward.

The eastern portion of the Upper Peninsula of Michigan (UP) experiences flows in both west to east and east to west directions. Heavy flows in either direction may cause Midwest ISO to initiate market redispatch or ATCLLC to open the 69 kV lines between the eastern UP and the rest of the WUMS system, using procedures defined in an operating guide. The transmission plans under development at ATCLLC through the UP Collaborative initiative will help alleviate these constraints. This includes the installation of AC-DC-AC power flow controller or phase shifting transformers at the Straits 138 kV substation.

Other significant substation equipment anticipated to be in service in MRO Region in the 2010 through 2019 planning horizon are as follows:

- Install AC-DC-AC power flow controller or phase shifting transformers at the Straits 138 kV substation
- Thompson Birchtree 95/-50 MVAr SVC
- Riel synchronous condensers (4 X 250 MVAr)
- 100 MVAr SVS in south-central Saskatchewan

OPERATIONAL ISSUES

There are no known operational issues for the next ten years other than existing system constraints identified above. Operating studies have been or will be performed for all scheduled transmission or generation outages. When necessary, temporary operating guides will be developed for managing the scheduled outages to ensure transmission reliability. Resource adequacy would be offset by planning reserves and external markets. If necessary, operational measures included in emergency operation plans include interruptible load, public appeals, and rotating outages.

The potential of CO_2 regulations as well as the requirement to reduce Critical Air Contaminants such as SO_2 and NO_x for MRO-US subregion could cause restrictions to high emitting technologies. The magnitude is unknown at this time. Environmental and regulatory requirements restrict the operation of the Manitoba Hydro Brandon #5 generating unit (100 MW) except during certain emergency conditions. This, however, will not impact the reliability of the interconnected system.

The MRO Region is projected to have approximately 23,663 MW of nameplate wind generation by end of 2019. There is a potential ambient temperature restriction (*e.g.*, some wind turbines may be restricted to operating in ambient temperatures between -20 degrees F and 104 degrees F) with wind turbines. However, accurate forecasting will help to identify any near-term concerns regarding ambient temperature limits.

Wind generation in Iowa will continue to cause implementation of congestion management procedures during high wind conditions. Some prior outage conditions will require establishing limits on wind farm outputs or fast reduction of wind generation. Operating guides are in place to address post-contingent and real-time loading on underlying 69 kV facilities. Midwest ISO Market LMP/binding procedures are used for congestion management when needed. Overall, the Iowa system is projected to operate in a reliable manner.

Sudden increases or decreases of levels of wind generation in Iowa and Minnesota have demonstrated significant impact on driving the flows through the WUMS western and southern interfaces, MWEX and SOUTH TIE interface, respectively. ATCLLC and the Midwest ISO are monitoring this operational issue closely. A real-time hourly operational study is performed by the Midwest ISO to anticipate the impacts of the sudden change in wind generation in Iowa and Minnesota on a number of selected Flowgates. Operators are alerted when the loading of any monitored Flowgate comes within 95 percent of its rating.

There are no known operational concerns resulting from generation connected to the distribution system. The MRO Region does not expect any reliability concerns resulting from high-levels of Demand Response resources.

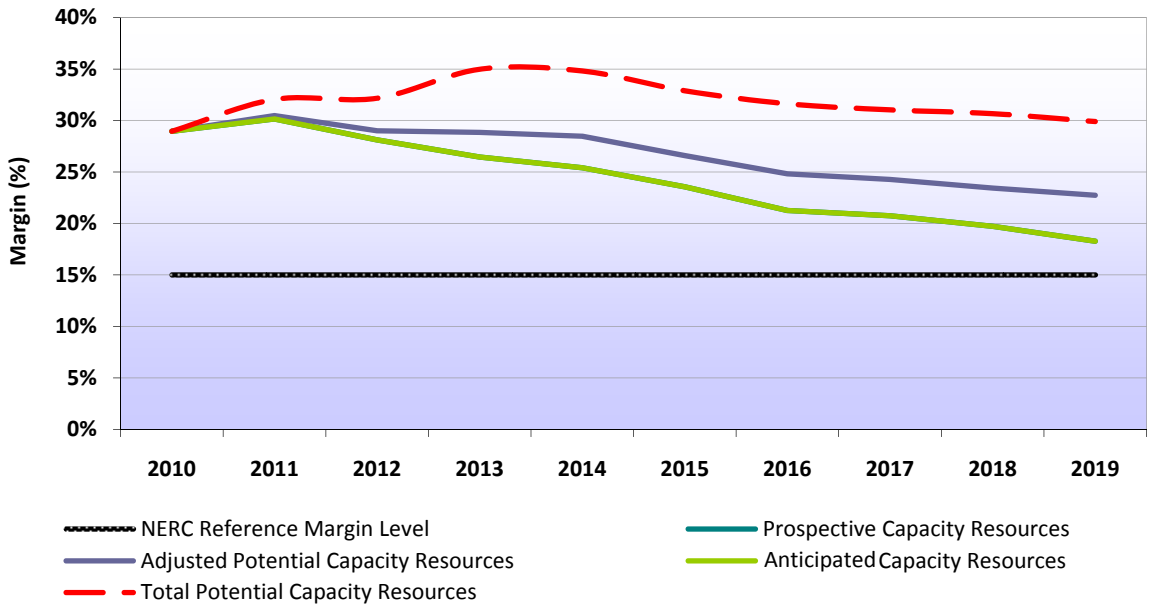
RELIABILITY ASSESSMENT ANALYSIS

The MRO's Regional projected Adjusted Potential Resources Reserve Margin ranges from 29.0 percent to 22.7 percent for the 2010-2019 period (see Figure MRO-1). Based on summer peak, the Reserve Margins for all the ten-years exceed the proxy Regional target Reserve Margins of 15 percent. Each MRO Planning Authority has a distinct Reserve Margin target. Basin Electric Power Cooperative and Western Area Power Administration use a planning reserve margin identified in the Loss of Load Expectation (LOLE) study performed and completed by MAPP on December 30, 2009. The MAPP Region applies a minimum of 15 percent reserve margin for predominantly thermal systems, and a minimum of 10 percent reserve margin for predominantly hydro systems.[82] The Midwest ISO has conducted a Loss of Load study establishing a minimum of 11.94 percent reserve margin requirement based on non-

[82] MAPP Loss-of-Load Expectation (LOLE) Study for the ten-year Planning Horizon 2010-2019, http://www.mapp.org/ReturnBinary.aspx?Params=584e5b5f405c567900000002cb.

coincident load for all Midwest ISO load-serving entities.[83] Both the Mid-Continent Area Power Pool (MAPP) and the Midwest ISO members within the MRO Region use a Load Forecast Uncertainty (LFU) factor within the calculation for the LOLE and the percentage reserve margin necessary to obtain a LOLE of 0.1 day per year or 1 day in 10 years. A minimum planning reserve margin of 13.6 percent applies to Nebraska's Balancing Areas as indentified in the LOLE study performed and completed by SPP on June 2009.[84] The study estimates the reserve margin required to obtain a LOLE of 0.1 day per year or 1 day in 10 years. Saskatchewan's reliability criterion is based on annual Expected Unserved Energy (EUE) analysis and equates to a minimum of 13 percent reserve margin.[85] The projected MRO's Regional reserve margin of 29.0 percent to 22.7 percent is in excess of these target reserve margins.

Figure MRO-1: Summer Peak Reserve Margin Projections



To meet the target margin levels, the MRO subregions rely on their internal resources only. No specific assessment is performed to ensure external resources are available and deliverable. However, to be counted as firm capacity, the various transmission providers require external purchases to have a firm contract and firm transmission service.

Reservoir water levels in the MRO-U.S subregion are adequate to meet reserve margin needs. However, from an energy perspective, reservoir water levels throughout the northern MRO-U.S. subregion (Montana, North Dakota, and South Dakota) have improved in recent years, but continue to remain below normal. For MRO-Canada subregion, generation on the Manitoba hydro units is projected to be about 82 percent of normal for 2010 summer. Hydro unit limitations due to requirements for

[83] Midwest ISO 2010 LOLE Report http://www.midwestmarket.org/publish/Document/13b9ea_1265d1d192a_-7b910a48324a.

[84] 2008 SPP LOLE Study – 2009 Update

[85] Saskatchewan 2009 Supply Development Plan.

endangered species will continue until such requirements are lifted. The Manitoba Hydro generation is planned to be adequate to supply Manitoba load and contracted firm export based on the lowest hydraulic flows on record (worst drought experienced in Manitoba). Saskatchewan does not anticipate any fuel delivery problems. Fuel-supply interruption in Saskatchewan is generally not considered an issue due to system design and operating practices. Saskatchewan reservoirs are expected to be at below normal conditions but near-normal operating regimes are expected. Reservoir levels are sufficient to meet peak demand. Low reservoir levels are expected to result in reduced energy output, but will not affect system reliability.

Resource unavailability within the MRO Region would be offset by planning reserves and external markets. If necessary, operational measures, which would include emergency plans, interruptible load, public appeals, and rotating outages, would be implemented. The MRO Region does not depend on energy-only or transmission-limited resources to achieve its resource adequacy target.

Renewable Portfolio Standards from the U.S. Department of Energy website, which does not include Canadian provinces, are shown in the table below.

Table MRO- 2: Renewable Portfolio Standards per US Department of Energy

State/Province	Amount (in percent Energy or MW)	Year
Minnesota	25 percent	2025
Iowa	105 MW	---
Montana	15 percent	2015
Wisconsin	10 percent	2015
South and North Dakota (Objective)	10 percent	2015
Nebraska	None	--
Manitoba	None	--
Saskatchewan	None	--

For resource adequacy assessment, 8 percent for summer peak and 20 percent for winter peak of nameplate wind generation are considered for the MRO-US subregion. 10 percent for summer peak and 20 percent for winter peak of nameplate wind generation are considered for the MRO-Canada subregion. Planning for wind resources involves appropriate siting for transmission infrastructure and wind regimes. Future wind installations will also be curtailed to meet operating needs.

Demand-side management, such as interruptible load and direct–control load management, was accounted for in the emergency operation procedures. Demand Response is currently not used for resource adequacy assessment. MRO members are reviewing the development of Demand Response programs.

The reliability impact due to retirement of generating units in the MRO Region is evaluated by MRO Planning Authorities and affected entities. Under the Midwest ISO procedure, if the potential retirement

of a unit causes reliability concerns that could not be addressed by feasible alternatives, such as generation re-dispatch, system re-configuration, transmission reinforcement acceleration, etc, then the unit will be required to operate under a System Supply Resource (SSR) agreement with the Midwest ISO until such alternatives become available.[86] The reliability impact due to retirement of generating units in the MAPP Planning Authority footprint is evaluated by the MAPP Design Review Subcommittee in coordination with generation and transmission owners. Saskatchewan has planned unit retirements over the next ten-years that have been included in the reliability assessment. Unit retirements are offset by unit additions in Saskatchewan's Supply Plan.

ATCLLC is planning to install a Special Protection System (SPS) as part of the Monroe County-Council Creek 161 kV line project in 2013 in lieu of rebuilding the 23 mile 138 kV line between Petenwell and Saratoga substations. This SPS will be retired if this 138 kV line is rebuilt in the future.

Emergency conditions within the MRO Region would be managed through the Reliability Coordinators and Operators. Resource or, transmission deficiencies are offset by planning reserves and external markets. If necessary, operational measures, which include emergency plans, interruptible load, public appeals, and rotating outages, would be implemented.

Planning studies are performed annually by the MRO Planning Authorities. MAPP performs a reliability assessment annually. The MAPP System Performance Assessment is an assessment to develop an understanding of the transmission system topology, behavior and operations.[87] In addition, the study is done to determine if existing and planned facility improvements identified in Appendix A of the MAPP Regional Plan meets the MAPP Members Reliability Criteria, NERC Transmission Planning Standards TPL-001 thru TPL-004 and, or, applicable MRO Regional standards. This is an assessment of the reliability of the MAPP Region for the present, near term (years one through five) and long-term (years six thru ten) transmission expansion planning.

The Midwest ISO performs annual Transmission Expansion Planning (MTEP) that focuses on reliability and efficient electricity expansion for the next ten years and complies with all relevant NERC Transmission Planning Standards.[88] Efforts are focused on identifying issues and opportunities related to the strengthening of the transmission grid, developing alternatives to be considered, and evaluating those options to determine if there is an effective solution among them. The objective is to identify projects that:

- Ensure reliability of the transmission system
- Provide economic benefit, such as through allowing increased efficiency in market operations (*i.e.* reducing cost of energy production and, or, the price paid by load)
- Enable public policy objectives, such as the integration of renewables, to be achieved
- Address other issues or goals identified through the stakeholder input process.

[86] http://oasis.midwestiso.org/OASIS/MISO

[87] 2009 MAPP System Performance Assessment

[88] Midwest ISO Transmission Expansion Plan, http://www.midwestiso.org/page/Expansion+Planning.

Nebraska's Balancing Areas participate in the annual SPP Transmission Expansion Plan (STEP) with Regional group of projects to address Regional reliability needs for the next ten-years. [89]

ATCLLC performs annual ten-year planning studies to ensure reliability in planning horizon.[90] ATCLLC also participates in the Midwest ISO Transmission Expansion Plan (MTEP) planning studies to coordinate Regional reliability issues.

Manitoba Hydro performs ongoing system planning studies ranging over the ten year planning horizon to assess and enhance reliability, integrate new generation, address forecast load growth connect new large industrial load and to facilitate transmission service requests. Manitoba Hydro publishes a ten-year Plan annually, which is posted on its website.[91] Manitoba Hydro also conducts a joint long-term reliability assessment with MAPP.

Saskatchewan performs ongoing transmission planning studies to integrate new generation and load and assess reliability, and there are ongoing infrastructure improvements being developed to address any issues identified.[92] Saskatchewan and Manitoba Hydro also perform joint operational planning studies for the MRO-Canada subregion to define transfer capability.[93] The studies define secure transfer capabilities and operational requirements for the season. Studies consider simultaneous transfers to and from Manitoba and North Dakota; and any known transmission and generation issues.

The Midwest ISO launched a three-year program to install more than 150 high-tech monitoring devices that will monitor the state of the electrical grid 30 times each second, increasing the efficiency and reliability of power delivery.[94] The SMART grid programs are part of Midwest ISO's agreement with the U.S. Department of Energy to implement synchrophasors, also known as phasor measurement units (PMUs), to more accurately measure voltage and current within the Eastern Interconnection. PMU measurements could increase available transmission and improve system-wide reliability and stability.

ATCLLC has several SMART Grid programs in process. The first is a relay betterment program which replaces electromechanical relaying with microprocessor based relays. This program is intended to increase system reliability and security via expanded use of carrier and fiber optic communication, decrease outage duration by providing fault location information, provide self monitoring alarm functions, and improve relay coordination. The other two SMART grid programs are part of ATCLLC's DOE funded project. ATCLLC is installing fiber optics in shield wires (OPGW) for improved relay, SCADA, and voice communications. These fiber optic paths provide communications capabilities to ATCLLC that will help us expand into other Smart Grid initiatives as they become available. Additionally, ATCLLC is installing phasor measurement units (PMUs) to measure the power angle across the network.

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[89] http://www.spp.org/publications/2009%20SPP%20Transmission%20Expansion%20Plan%20(Redacted%20Version).pdf

[90] 2009 – ATCLLC ten-Year Transmission System Assessment Update, http://www.atc10yearplan.com;

[91] http://oasis.midwestiso.org/OASIS/MHEB

[92] Saskatchewan 2009 and 2010 Planning Studies

[93] Manitoba Hydro - Saskatchewan Power Seasonal Operating Guideline on Manitoba-Saskatchewan Transfer Capability

[94] http://www.midwestiso.org/page/Recent+News+Details?newsID=253

OTHER REGION-SPECIFIC ISSUES

Because wind generation is a variable resource, the operational impacts of the large amount of proposed wind generation in the MRO Region will need to be closely monitored for any reliability impacts.

REGION DESCRIPTION

The MRO has 116 registered entities. There are seven Balancing Authorities: Lincoln Electric System (LES), Manitoba Hydro (MH), Nebraska Public Power District (NPPD), Omaha Public Power District (OPPD), Saskatchewan Power Corporation (SPC), Western Area Power Administrator (WAPA) and Midwest ISO, which assumes all tariff members under Midwest ISO operate as one Balancing Authority. The MRO Region as a whole is a summer peaking Region; however, both Canadian provinces are winter peaking. The MRO Region covers all or portions of Iowa, Illinois, Minnesota, Nebraska, North and South Dakota, Michigan, Montana, Wisconsin, and the provinces of Manitoba and Saskatchewan. The total geographic area is approximately 1,000,000 square miles with an approximate population of 20 million.

The MRO has six Planning Authorities registered within the footprint: the Midwest ISO, MAPP, American Transmission Company, Southwest Power Pool, Manitoba Hydro, and Saskatchewan Power Corporation. The Midwest ISO also spans into the RFC and SERC Regions. There are three Reliability Coordinators within the MRO footprint, the Midwest ISO, Southwest Power Pool, and Saskatchewan Power Corporation. The majority of Registered Entities within MRO are Midwest ISO tariff members and therefore participate in the Midwest ISO market operations. The Nebraska Balancing Areas are under the Southwest Power Pool tariff and Reliability Coordinator.