MINNESOTA'S ELECTRIC TRANSMISSION SYSTEM: NOW AND INTO THE FUTURE

SUBMITTED BY

DIVISION OF ENERGY RESOURCES

In Consultation with

The Minnesota Public Utilities Commission

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I. INTRODUCTION

Minnesota Statute §216C.054, the Annual Transmission Adequacy Report to the Legislature,[1] requires the Commissioner of Commerce, in consultation with the Minnesota Public Utilities Commission, to prepare and submit this report annually to provide a nontechnical discussion of the "state" of Minnesota's current electric transmission system. This law also requires a report on transmission planning and other actions taken or in process to maintain electric service reliability as well as comply with the requirements of the State's Renewable Energy Standard.

Because transmission issues tend to involve numerous considerations and entities, this report provides a general discussion of transmission as a reference guide, similar to the discussion from previous reports. This report also provides an update of current transmission projects as identified in the most recent biennial transmission report required by Minnesota transmission owners, along with a list of certificates of need for transmission lines filed in 2014.

II. WHY TRANSMISSION MATTERS: OVERVIEW

Electricity is provided to consumers via three main steps: 1) electricity is generated at various power plants, 2) electricity is transmitted on an integrated system of large power lines and 3) the electricity is delivered to consumers through a distribution system of smaller power lines. As the link between the production (generation) of electricity and delivery (distribution) to consumers, transmission plays a vital role in helping to ensure that consumers have low-cost, reliable energy. While it is a critical component in providing electric service, transmission accounts for a much smaller percent of utility costs than either generation or distribution facilities. For example, transmission may account for 10 percent of the costs of providing electric service while generation and distribution make up the other 90 percent.

[1] The statute states:

> The commissioner of commerce, in consultation with the Public Utilities Commission, shall annually by January 15 submit a written report to the chairs and the ranking minority members of the legislative committees with primary jurisdiction over energy policy that contains a narrative describing what electric transmission infrastructure is needed within the state over the next 15 years and what specific progress is being made to meet that need. To the extent possible, the report must contain a description of specific transmission needs and the current status of proposals to address that need. The report must identify any barriers to meeting transmission infrastructure needs and make recommendations, including any legislation, that are necessary to overcome those barriers. The report must be based on the best available information and must describe what assumptions are made as the basis for the report. If the commissioner determines that there are difficulties in accurately assessing future transmission infrastructure needs, the commissioner shall explain those difficulties as part of the report. The commissioner is not required to conduct original research to support the report. The commissioner may utilize information the commissioner, the commission, and the Office of Energy Security [now known as the Division of Energy Resources] possess and utilize in carrying out their existing statutory duties related to the state's transmission infrastructure. The report must be in easily understood, nontechnical terms.

Transmission facilities currently in place have been designed primarily to interconnect a utility's generation and distribution facilities, and secondarily to interconnect neighboring utilities to each other to provide additional backup power. This design enables utilities to access other generation or transmission systems if something goes wrong on that utility's system. This interconnection with other electric systems provides a more reliable system overall than isolated systems and allows utilities to access lower cost power from other suppliers, or purchase power on a temporary basis rather than building a generation facility that may be used only intermittently. Transmission helps the entire system of interconnected utilities operate more efficiently and reliably than if each utility were operated on a stand-alone basis.

The interconnected transmission system is vast. Electrically, the transmission grid is split into three sections: the Eastern Interconnection, the Western Interconnection, and the Electric Reliability Council of Texas (ERCOT). These areas are shown in the map in Appendix A.[2]

Electricity follows the laws of physics: like water, it follows the path of least resistance. However, electricity has different properties that require different delivery systems than are used for water. For example, electricity placed onto the interconnected transmission grid could be withdrawn at any other place within the interconnection as long as there is no congestion on the transmission system. Moreover, the electrical system must be balanced, meaning that the amount of electricity being produced at any given time must essentially equal the amount of electricity being used by consumers. Because electricity cannot be stored in a reasonable manner with current technology, the transmission system helps maintain this balance by allowing electricity to flow around the electrical system where possible. [3]

III. TRANSMISSION, RELIABILITY AND POWER COSTS

Adequate transmission is one essential component to ensure that Minnesotans have reliable and reasonably priced electric service. When there are shortages in transmission capacity in certain areas, there are more frequent power outages and lower power quality (which can affect sensitive equipment such as computers). Since Minnesotans depend

[2] See Appendix A, with source and electronic link:
http://www.nerc.com/AboutNERC/keyplayers/Documents/NERC_Interconnections_BW_072512.jpg

[3] There are a number of technologies being developed to store un-needed electricity for later use. However, few of these technologies are commercially viable or operational at this time. One technology currently in use in limited circumstances is known as "Pumped Hydro Power" which in effect stores the electricity in the potential energy of water, by using electricity at times when little power is being used for other purposes to pump large amounts of water into a reservoir. Later, when electricity is needed, this reservoir water is allowed to flow through a hydro-power turbine, generating electricity. This technology's use is restricted due to the need for both a large amount of water to make it viable and large facilities to store the water and generate the hydro-power. Currently, the largest Pumped-Hydro facility in the Eastern U.S. is located on the eastern shore of Lake Michigan. In addition, Northern States Power d/b/a Xcel Energy is testing use of a large battery facility to store power from wind energy for later use. Such batteries are still in the testing stage in the U.S.

heavily on reliable power in their homes and businesses, it is critical to ensure that electric service is as reliable as reasonably possible to minimize the cost to Minnesota's economy in lost production time and disruption and potential harm to the myriad systems that depend on electricity. Electricity is also needed to deliver natural gas and other fuels to consumers as energy producers rely on electricity to produce and deliver their products.

Another negative effect of inadequate transmission capacity is increased cost of power delivered on the system. The entire electric system starts with the least-cost generators, adding power from generators that are increasingly expensive to operate. When there is not enough transmission capacity, certain paths on the system become congested, causing operators of the electric system to decrease the amount of electricity produced by generators in those areas and increase generation in other areas to make up for the generation that could not be delivered from the congested areas. As a result, when transmission congestion causes adjustments to the generation facilities used to produce power, the cost of power goes up as more expensive generation replaces less expensive generation.

Both of these factors hurt Minnesota's economy. Lapses in power quality and reliability, along with higher costs, could potentially disrupt businesses, industries, hospitals, schools, public services and citizens who depend on computers and other electronics in their day-to-day lives and expect that power costs will be reasonable.

IV. ROLES OF ENTITIES INVOLVED IN TRANSMISSION

Numerous entities are involved in various aspects of the design and cost of Minnesota's transmission system that serves Minnesota. While Minnesota's electric utilities are certainly involved in these matters, so are other entities. The following is a partial list of major players.

1. Because transmission lines located outside of Minnesota serve Minnesota customers, the utilities that own those facilities and states that regulate those utilities affect the cost and design of the transmission grid that serves Minnesotans.[4]
2. The Federal Energy Regulatory Commission (FERC)[5] regulates the wholesale rates that utilities charge for transmission service and the type of transmission services provided.
3. The Midcontinent Independent System Operator (MISO) does not own transmission, generation or electricity, but works with its voluntary transmission-owning members to operate the regional transmission system reliably and in the least-cost manner in MISO's robust energy market. MISO also helps its members develop long-term transmission plans for the region, which currently

[4] Similarly, the transmission grid physically located in Minnesota affects the electric service provided outside of Minnesota.

[5] http://www.ferc.gov/about/ferc-does.asp

covers 15 states and the Canadian provinces of Manitoba and Saskatchewan.[6] MISO cannot require any of its members to build new resources and is not responsible for developing long-term generation plans. To focus its review of the reliability of the transmission system, MISO has resource "zones." Minnesota is in Zone 1. FERC regulates MISO's rates and practices.

4. The North American Electric Reliability Corporation (NERC) works with electric reliability organizations or councils and others to develop and enforce certain electric reliability standards for what is known as the "Bulk Power System" or "the grid." There are eight NERC Reliability Regions covering the United States and Canada. Minnesota is in the "MRO" region as shown in Appendix A attached to this report and discussed in item 5 below. Because an outage in one part of the grid can affect other parts of the grid, NERC coordinates among these regions.
5. The Midwest Reliability Organization (MRO), with members in six states[7] and two Canadian Provinces (Manitoba and Saskatchewan), develops and ensures compliance with regional and interregional electric standards for the transmission system and performs assessments of the grid's ability to meet demands for electricity.[8]
6. The Organization of MISO States (OMS) is a self-governing organization of representatives from each of the state regulatory commissions with authority over utilities or other entities participating in MISO. The OMS analyzes and makes recommendations to MISO, FERC, and other relevant government agencies regarding matters that affect regional transmission issues.[9] The Minnesota Commission also represents Minnesota in the OMS. In addition, the Department represents Minnesota as an associate member in OMS and participates in efforts by OMS and MISO.
7. The Minnesota Public Utilities Commission (Commission) requires Minnesota utilities to develop sufficient transmission to serve load and regulates the rates that Minnesota's investor-owned utilities charge to their retail customers to recover transmission costs. While the Minnesota Commission does not regulate the wholesale rates that Minnesota's investor-owned utilities charge to

[6] Companies with transmission assets in Minnesota and membership in MISO include: ALLETE (Minnesota Power), Central Minnesota Municipal Power Agency, Dairyland Power Cooperative, Great River Energy, ITC Midwest, Missouri River Energy Services, Montana-Dakota Utilities, Northern States Power d/b/a Xcel Energy, Northwestern Wisconsin Electric Company, Otter Tail Power, and Southern Minnesota Municipal Power Agency.

[7] Minnesota, Wisconsin, Iowa, North Dakota, Nebraska, nearly all of South Dakota. MRO's service area includes the northeastern portion of Montana, and a small part of northwest Illinois, but those areas are served by MISO's members located in these six states.

[8] Neither NERC nor MRO have jurisdiction over generation facilities. NERC describes its function as follows: "The North American Electric Reliability Corporation is a not-for-profit entity whose mission is to ensure the **reliability of the Bulk-Power System** in North America." (Emphasis added). See: http://www.nerc.com/Pages/default.aspx.

[9] At the time of this report a MISO proposal is pending at FERC, as part of its compliance filing under FERC Order 1000, that would enhance the role of state regulatory commissions in the MISO transmission planning process beyond being purely advisory in nature. Action by FERC on the MISO proposal is discussed in Section V.B of this report.

wholesale customers,[10] the Commission does ensure that these utilities allocate transmission costs appropriately at the retail level, considering facts pertaining to retail customers.

8. The Division of Energy Resources of the Minnesota Department of Commerce (Commerce) investigates matters before the Commission and makes recommendations to address proposals by utilities and others.

Because it is so involved in the operations of Minnesota's electrical system, MISO warrants further discussion. As noted above, MISO is a Regional Transmission Organization created and regulated by FERC. It is involved in numerous matters that are critical to the reliable and low-cost operation of the bulk transmission system, including planning for contingencies if large generation plants or transmission components fail, conducting engineering analyses of the effects of changes in generation or transmission components on the system as a whole, planning for the transmission needs in the MISO region, coordinating with other areas of the Eastern Interconnection System, monitoring the day-to-day (and minute-to-minute) operations of the transmission system, operating the system to call on the lowest cost generation facilities to operate, operating the system to address the effects of congestion on the transmission system, analyzing where the greatest congestion exists and so forth. Commerce Department and Commission Staff participate in various MISO and OMS committees.

The geographical area of MISO's region spans numerous states. MISO uses "planning reserve zones" and focuses in each region on ensuring that there are adequate electric resources to meet the needs in each zone. Importing power across zones is more expensive than within a zone due to costs to transmit power.

As shown in Appendix B to this report, Minnesota is part of Planning Reserve Zone 1, along with the western half of Wisconsin, all of North Dakota, and portions of Montana, South Dakota, and Illinois. Utilities included in Zone 1 are Dairyland Power Cooperative, Great River Energy, Montana-Dakota Utilities, Minnesota Power, Northern States Power, Otter Tail Power and the Southern Minnesota Municipal Power Agency.

V. DETERMINING HOW MUCH TRANSMISSION IS ENOUGH

A. MINNESOTA'S TRANSMISSION SYSTEM

When the majority of Minnesota's current transmission system was designed and built, largely 30 to 70 years ago, items such as home computers, video games, cable TV, and cell phones did not exist, few customers had air conditioners, and there were few plug-in appliances. Most transmission facilities that exist today were sized to meet the then-current

[10] FERC regulates wholesale rates, the Minnesota Public Utilities Commission regulates retail rates of investor-owned utilities and cooperative utilities that elect such regulation, municipalities regulate retail rates of municipal distribution utilities and cooperative boards regulate the retail rates of cooperative distribution utilities.

electricity needs of the population and economy of the day plus some assumptions for growth based on what was known at that time. For example, facilities built in the 1940s were first sized to meet the demands of that era – electric lights to small houses, street or yard lights, plus power to radios, a few kitchen appliances and the new innovation at that time, the television, and secondarily sized to meet needs forecasted in the coming decade or so. Facilities built during the late 1970s and early 1980s were sized to provide (to a much larger population) electric lights to larger houses, street, traffic and (rural) yard lights, electric heating (during the "energy crisis" of the late 1970s), radios, stereos and televisions, clothes washers and dryers, major and small kitchen appliances including microwave ovens. Again, they were also sized so that the system could meet needs well into the future. However, the future-needs sizing at that time was primarily designed to make room for more consumers; it was certainly not known at that time that households would have home computers and the myriad other ways to use electricity in their homes and businesses that Minnesotans now enjoy.

While Minnesota's transmission system was previously built with more capacity than was immediately needed, Minnesota has been outgrowing its system, and the system has been aging. By the late 1990s, new houses continued to grow larger, households commonly had multiple televisions along with many other electric devices, and personal computers were readily available and in day-to-day use. Today, in addition to all of these items, Minnesotans now have a tremendous number of new appliances that are using electricity twenty-four hours a day – for example, cable television converter boxes, DVRs, clocks, and gaming systems left plugged in. In addition, the number of electrical uses in a household, including the demand for plug-in vehicles, has added more demand. Finally, the number of devices requiring charging – cell phones, laptop computers, and portable music devices – has grown significantly.

More transmission has been added and more is expected to be needed in the near future. Moreover, Minnesota customers and industry need not only electricity, but also acceptable power quality, meaning evenly delivered power without power surges and other fluctuations that can impact computers and other sensitive electronic devices. Lack of sufficient space or capacity on the grid also means that there could be some locations in the state where power quality may soon become unacceptable. Further, in some Minnesota locations too much electricity is trying to flow on the lines causing "grid lock," and reliability problems in making sure the power can be delivered where it is needed.

Determining the amount of transmission infrastructure needed to provide reliable electric service in Minnesota requires balancing the risks of building too much transmission or too little. However, these risks are not symmetrical. If more transmission capacity is built than needed to provide delivery service for available generation resources, the system will be relatively free of transmission constraints, but will cost more than is necessary to provide adequate service. However, if too little capacity is built for delivery service from existing generation resources, the transmission cost component of providing electricity service may be lower, but the overall costs to Minnesota's economy of the less reliable power that would result may be far greater than the cost of building transmission. As noted above, costs of a

less reliable electric system may include lost productivity, damage to security systems, damage to computer systems, and increased cost of producing electricity.

While use of the transmission system varies with the overall demand for electricity, transmission planning requires focus on the amount and timing of the highest demands for electricity. While peak electric use typically occurs in the summer, MISO must also plan for meeting high winter loads. For example, temperatures in January and February of 2014 were exceedingly cold during the two "polar vortexes." At the same time, there were shortages of propane and natural gas, two primary fuels used to heat homes and water in Minnesota and surrounding areas. Because this event was significant, MISO issued a report on September 23, 2014, "MISO and Stakeholder Polar Vortex Experiences with Natural Gas Availability and Enhanced RTO/Pipeline Communication," in which MISO stated that it experienced a new winter peak that was 9 percent higher than the prior peak, at 109,307 MW. MISO summarized its report as follows:

> The January 2014 polar vortex brought extreme weather conditions to the MISO Region that introduced significant challenges to the reliable operation of the power grid. The [e]ffects were far-reaching, spanning from the Canadian province of Manitoba to the Gulf Coast. While the severity of the conditions was forecasted well in advance, this was nevertheless a rare weather event for which the full impact could not be precisely anticipated. Overall, however, MISO was able to effectively manage system assets to maintain the reliability of the Bulk Power System within its region, while also supporting and assisting neighboring entities in their efforts to do the same. MISO's market functions performed as expected during the event.

In addition, well-designed transmission systems help facilitate more efficient use of generation resources. A transmission system or "grid" that covers a broader region and multiple utilities, with access to a larger portfolio of generation resources, permits strategic use of the most efficient resources available on the grid at any given moment. In its role as a regional transmission organization, MISO helps coordinate both regional transmission planning and operations of utility transmission operators. These functions help to mitigate potential inefficiencies that can result from a balkanized utility grid that is based on individual utilities planning and operating their systems solely to meet the needs of their service territories. Being aware of the various costs of resources in its region, MISO can provide direction to its members on how to dispatch those resources more efficiently overall.

As a result, it is important to plan to meet not only the expected demand for power but also the demand for relatively high amounts of power during extreme weather and other circumstances, along with growth in the demand for power over time. The minimum time period that should be considered in planning for new facilities is the number of years that it takes to build new transmission lines (including assessing a need, conducting engineering

analysis, working with local communities and landowners, obtaining needed permits and installing the lines).[11]

Strategically placed generation facilities also have a role in ensuring reliable power, particularly when such resources are relatively low cost, are located in areas where such resources can address congestion on the transmission system and can be counted on to produce power when needed.[12]

The goal is to have a system that is ready to handle the demand for power whenever it is needed and allow for growth in the economy. For example, if the transmission system were planned assuming that demand for power during a recessionary period would continue in the future, the transmission system would be unable to accommodate recovery and growth in the economy. Even if the transmission system were planned only to meet the demand for power during a reasonably healthy point in the business cycle, the transmission system could not accommodate a boom period in the economy. Moreover, if plans for transmission ignore growth in the economy and the demand for power over time, let alone for any expected new uses of electricity for applications that may not yet exist, then the transmission system may not be adequate in the future.

The Commission recognized these concepts in its May 22, 2009 Order in the certificate of need proceeding for the transmission capacity expansion project for 2020, or CAPX 2020:

> The fact that demand is less than forecast reflects a variety of factors, including both the current recession and abnormally cold weather. In evaluating the demand for facilities that are expected to last decades, however, the Commission must focus not on current levels of demand – reflecting fluctuations in the economy and weather - but rather on long-term trends.[13]

Thus, even as Minnesota emerges from the recent recession, as the economy continues to recover it will be necessary to ensure that the transmission system is ready to meet those needs. Prior to the recession, Minnesota's transmission grid was operating close to its limits with small amounts of unused space on the grid available in some locations to accept new power sources. Fortunately, significant transmission lines that the Minnesota Commission approved for use throughout Minnesota in the CAPX 2020 proceeding noted above have been added in Minnesota to accommodate growth in Minnesota's economy. These transmission lines and other facilities (substations, etc.) will help ensure that power is delivered reliably and allow new generation facilities of significant size to connect to these areas of the transmission grid in the future.

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[11] Utilities have demand-side management tools which can help reduce demand on the system at peak times.
[12] Generation interconnected to utilities' distributions systems, known as "distributed generation" may have limited effects on transmission systems; however, distributed generation is beyond the scope of this report.
[13] Minnesota Public Utilities Commission's May 22, 2009 Order in Docket No. E017, et. al./CN-06-1115, page 11. The Minnesota Court of Appeals affirmed the Commission's decision on June 8, 2010.

Minnesota largely avoided serious problems with its transmission system due to having one of the strongest energy conservation programs in the country. Minnesota's Conservation Improvement Program has, since its inception, conserved enough energy to push back by many years the need for building multiple major electric generation plants by offering industry, business and residents various programs to save energy in their day-to-day operations. As a consequence, while power usage continued to increase due to finding more ways to use electricity in our homes and businesses, the increases were smaller in the 1980s and 1990s than the increases experienced in the 1970s. However, these programs cannot put off additions to transmission indefinitely, particularly when more transmission is needed to accommodate new generation, as discussed below.

B. FEDERAL AND STATE ACTIONS RELATED TO MINNESOTA'S TRANSMISSION GRID IN 2014

Additions to transmission are needed not only due to factors in Minnesota, but also due to federal and regional governmental actions directly impacting the use of Minnesota's transmission grid (as well as other states' grids). The Department's prior transmission report listed historical developments that have affected Minnesota; the current report discusses several issues with potential effects on Minnesota.

During 2014, several state, regional or federal issues affected Minnesota or have the potential to affect Minnesota. This report does not list all of these issues, but discusses a few issues briefly.

1. MISO South Integration, Update

As noted in last year's report, the Entergy Region [portions of Arkansas, Louisiana (including New Orleans), Mississippi, Texas, and Missouri] referred to as "MISO South" started their energy market with MISO on December 19, 2013. As a result of this integration of MISO South, MISO's footprint added 16,000 miles of transmission lines (which is a 32 percent increase in transmission), 50,000 MW of generation (which is a 38 percent increase in generation), and 30,000 MW of load (which is a 31 percent increase in load). MISO South is expected to create benefits for existing MISO members by reducing MISO administrative fees since they will be shared across a larger footprint. FERC approved a five-year transition period for MISO transmission planning and MISO cost allocation for the MISO South Region. Integration issues continue to be sorted out, including the amount of electricity that can be transferred between the Southwest Power Pool, which is in the geographical area of Entergy, and MISO.

2. Resolution of FERC's Challenge to Minnesota's and other States' Rights of First Refusal

As described more fully in last year's report, in setting new rules on how MISO plans for new transmission resources with its members and related issues, FERC took away incumbent utilities' federal right of first refusal to build new transmission lines approved for construction in incumbent utility service areas. States did not object to FERC's decision

regarding the federal right of first refusal, but did object when FERC also tried to eliminate states' rights of first refusal.

Minnesota has a history of building transmission lines when such lines are needed and only if they are needed, and ensuring that such lines are built in a cost-effective manner; for example, in 2012 Minnesota passed Minnesota Statute §216B.246, Federally Approved Transmission Lines; Incumbent Transmission Lineowner Rights. This law established Minnesota's *state* right of first refusal to incumbent utilities to build transmission lines, but also required such utilities either to build the transmission lines approved in the MISO process or explain to the satisfaction of the Minnesota Commission why such lines should not be built. This statute works in conjunction with Minnesota's existing statutes, most notably Minnesota's certificate of need law (Minnesota Statute §216B.243), to ensure that Minnesota utilities provide reliable service at reasonable costs, in consideration of Minnesota's policy objectives.

Fortunately, FERC reversed its prior stance, acknowledging that FERC's Order "does not affect state or local laws or regulations with respect to siting, permitting or construction of transmission facilities, regardless of whether they are expressly stated in tariff provisions." Thus, it appears that this issue is resolved.

3. *Complaint by Large Power Customers to FERC regarding MISO Transmission Owners' Return on Equity*

As discussed in last year's report, a group of industrial end-users filed a complaint at FERC in late 2013 seeking to reduce the allowed return on equity (ROE) of MISO Transmission Owners and limit capital structure ratios and incentive equity adders. MISO transmission owners currently have a base ROE of 12.38 percent, with some stand-alone transmission owners at 12.88 percent. The complaint seeks to lower the transmission owners' base ROE over 300 basis points below the current base ROE, to 9.15 percent, which is more consistent with the returns on equity currently being granted to Minnesota's utilities for investments in generation.

Allowing utilities to charge a premium of over 300 basis points means that FERC's high ROEs impose undue costs on consumers and distorts decision-making by utilities toward transmission only and not generation resources. While transmission resources are needed, it would not be appropriate to build only transmission to meet the electric needs and; there must be production of electricity in order to transmit the power. Further, such premiums may encourage inefficient decisions such as utilities seeking to form transmission-only entities, which may have significant effects on Minnesota's electricity rates even for existing resources and services.

Fortunately, the Minnesota Commission has required electric utilities subject to the Commission's jurisdiction to credit the excessive ROE revenues back to retail customers.

As the proceeding before FERC continues, the OMS, the Public Consumer Group, and the Industrial End-Users have continued to advocate for lower costs of capital for transmission

facilities, with the overall goal that the cost of capital for transmission resources should reflect current market information regarding the cost of capital. It is expected that issues regarding the cost of capital for transmission resources will continue to be litigated at FERC and in state filings as appropriate.

4. Requirements of the Environmental Protection Agency

The Environmental Protection Agency's (EPA) Mercury Air Toxics Standard (MATS), while facing legal challenges, is poised to require significant changes in generation facilities in the Midwest to reduce mercury emissions. In addition, the EPA issued proposals for regulation of carbon emissions from new and existing power plants. Numerous comments were filed with the EPA regarding the carbon-regulation proposal, including comments by the Minnesota Commission, the Commerce Department, the Minnesota Pollution Control Agency, MISO, and many Minnesota utilities. While these rule changes pertain to power plants rather than transmission facilities, the changes are expected to have significant effects on the configuration of the existing integrated electrical system. As discussed further below, MISO has continued to conduct voluntary surveys to obtain from utilities in its region information on expected responses to these rules and in response to aging equipment.

5. Resource Adequacy Related to Generation Plant Retirements

While MISO is not responsible for ensuring that there are enough generation resources to meet consumer needs in its region, it is responsible for ensuring the reliability of the bulk transmission grid in its area. To help meet that responsibility, MISO conducted a survey, with help from the Organization of MISO States, to estimate changes in existing generation resources in the next 10 years due to the Mercury Air Toxics Standard of the Environmental Protection Agency, discussed above, and due to the old age of many generation plants.

As noted in last year's report, MISO has continued to work with its members to refine and update the information regarding generation facilities in the MISO region. The most recent information[14] indicates that, of the 245 coal-fired generation units in the northern MISO region that are affected by MATS, mercury controls are required at 100 larger units (summing to 34.3 gigawatts) while 98 small units (summing to 7.8 gigawatts) are uneconomic to continue in operation. Some of those units will be retired while others will be converted to other fuels (such as natural gas). For example, in Minnesota, the Taconite Harbor 3 coal facility will close at the end of 2015 while the Laskin facility will be converted to natural gas. Other coal facilities will install various means of reducing mercury emissions, including activated carbon injection, dry sorbent injection, flue gas desulfurization, selective catalytic reduction and electrostatic precipitators.

While the specific size of the decrease in generation resources is under careful review, the MISO region as a whole needs to replace the lost resources. The Minnesota Commission

[14] Found at:
https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/PAC/2014/20141112/20141112%20PAC%20Item%2016%20EPA%20Quarterly%20Survey%20(Q3%202014).pdf

generally ensures that utilities subject to its jurisdiction have sufficient generation resources to meet the needs of the utilities' ultimate consumers/members; however, states that have deregulated electric generation do not have the authority to do so.

Since MISO's energy market is based on generation resources throughout the MISO region, Minnesota utilities pay higher prices for replacement power when a Minnesota utility's generation resource has an unexpected outage and there are significant generation shortages. Since Minnesota utilities pass on these energy costs to their consumers/members, it is important to protect Minnesota industries, businesses and residential customers from paying higher energy rates merely because there are inadequate generation resources in the MISO region.

6. Planning for Resources to Meet MISO's Peak or a Utility's Peak

As noted above, MISO is responsible for ensuring the reliability of the bulk transmission system, which spans numerous states, while state commissions (such as the Minnesota Public Utilities Commission) are responsible for ensuring that utilities have sufficient generation and demand resources. In protecting the bulk transmission system, MISO monitors whether sufficient resources exist across its footprint so the amount of resources equals the demand for power at all times on the electrical system.

MISO's measurements of the amount of resources and demand for power on its system change annually and consider only the near term. Further, rather than requiring each utility to have enough resources to meet the peak demand of the utility's system, MISO requires only that each utility has enough resources to meet *MISO's* peak demand in the summer. This approach reduces the total amount of generation resources need, since utilities with systems that peak in the winter do not need to have as many resources. However, in light of the polar vortexes in 2014 and other factors, this method is being reexamined, at a minimum to ensure the presence of sufficient resources in summer and winter seasons.

While MISO's annual methods for assessing whether there are sufficient resources over its footprint are likely to continue to vary, the Minnesota Commission must determine in integrated resource planning whether utilities under its jurisdiction have sufficient resources over the 15-year planning period and especially the near-term 5-year planning period, taking into consideration all relevant information and the importance of ensuring reliable service at reasonable rates. For example, the Commission considers a utility's sales forecast, age of resources, and Minnesota laws and federal requirements.

7. Electric and Natural Gas Coordination

Since electric utilities need natural gas to produce electricity and natural gas utilities need electricity to produce and deliver natural gas, there has been more effort to coordinate between the gas and electric industries. If more natural gas is going to be used to produce electricity, greater coordination is needed not only with day-to-day operations but also with long-term plans as to where the electric and natural gas resources will be located.

MISO and the Electricity and Natural Gas Coordination Task Force provided an overview of the issues that are expected to arise in the near future, including:

- Needing to ensure that both the electric and natural gas utilities have enough resources to provide reliable service.
- Needing to synchronize the timing of natural gas scheduling and the MISO markets.
- Needing to coordinate operations between MISO and natural gas pipelines.
- Needing to ensure that information about costs of using natural gas for electricity and vice versa is fully reflected in market signals.

These issues have not yet been resolved; MISO will continue to work with stakeholders on these matters.

8. Minnesota Study of Renewable Power and Transmission: Report

The Commission's July 22, 2013 Order described the background for this study as follows:

> Minnesota Laws 2013, Chapter 85, Article 12, Section 4(a) directs the Commission to order all electric utilities as defined in Minn. Stat. § 216B.1691, subd. 1(b), and all transmission companies as defined in Minn. Stat. § 216B.02, to conduct an engineering study of the impacts on reliability and costs, including necessary transmission network upgrades, of increasing the renewable energy standard established in Minn. Stat. § 216B.1691, subd. 2a, to 40 percent by 2030, and to higher proportions thereafter, while maintaining system reliability. The Act requires the study to be completed and submitted to the Commission by November 1, 2014.
>
> Section 4(b) of the Act requires Minnesota electric utilities and transmission companies to complete the study under the direction of the commissioner of the Department of Commerce (the commissioner). Prior to the start of the study, the commissioner, in consultation with the electric utility and transmission companies, is also to appoint a technical review committee of up to 15 individuals with experience and expertise in electric transmission system engineering, electric power systems operations, and renewable energy generation technology. It will be the responsibility of the technical review committee to review the study's proposed methods and assumptions, ongoing work, and preliminary results.
>
> Section 4(c) of the Act requires electric utilities and transmission companies to incorporate and build upon current and previous studies conducted in Minnesota of relevance to the Renewable Energy Standard. As part of the planning process, the electric utilities and transmission companies are

> also required to collaborate with the Midcontinent Independent System Operator (MISO), to encourage the integration of Minnesota's planning work and other regional considerations into MISO's future transmission expansion planning work.
>
> Finally, the study is required to include a conceptual plan for the transmission necessary for generation interconnection and delivery. The report must include a description of the analyses conducted and the results obtained, and must identify any critical issues and potential solutions to identified issues as they pertain to increasing the renewable energy standard to 40 percent by 2030.

On November 5, 2014, the Department filed its report with the Minnesota Commission, with the following overall conclusions:

- With upgrades to existing transmission, the power system can be successfully operated for all hours of the year (no unserved load, no reserve violations, and minimal curtailment of renewable energy) with wind and solar resources increased to achieve 40 percent renewable energy in Minnesota and with current renewable energy standards fully implemented in neighboring MISO North/Central states.
- Further analysis would be needed to ensure system reliability at 50 percent of Minnesota's annual electric retail sales from variable renewables.

The Department presented the report to the Commission on January 13, 2015.

VI. MINNESOTA'S TRANSMISSION SYSTEM – PLANNING FOR THE FUTURE

A. BIENNIAL TRANSMISSION REPORT

Minnesota Statute § 216B.2425 requires utilities that own or operate electric transmission facilities in the state to report by November 1 of each odd-numbered year on the status of the transmission system, including present and foreseeable inadequacies and proposed solutions.

The last Biennial Transmission Report was filed on November 1, 2013 by the utilities listed below. The January, 2014 "Minnesota's Electric Transmission System – Now and Into the Future" reported on the 2013 Biennial Transmission Report.

- American Transmission Company, LLC
- Dairyland Power Cooperative
- East River Electric Power Cooperative
- Great River Energy

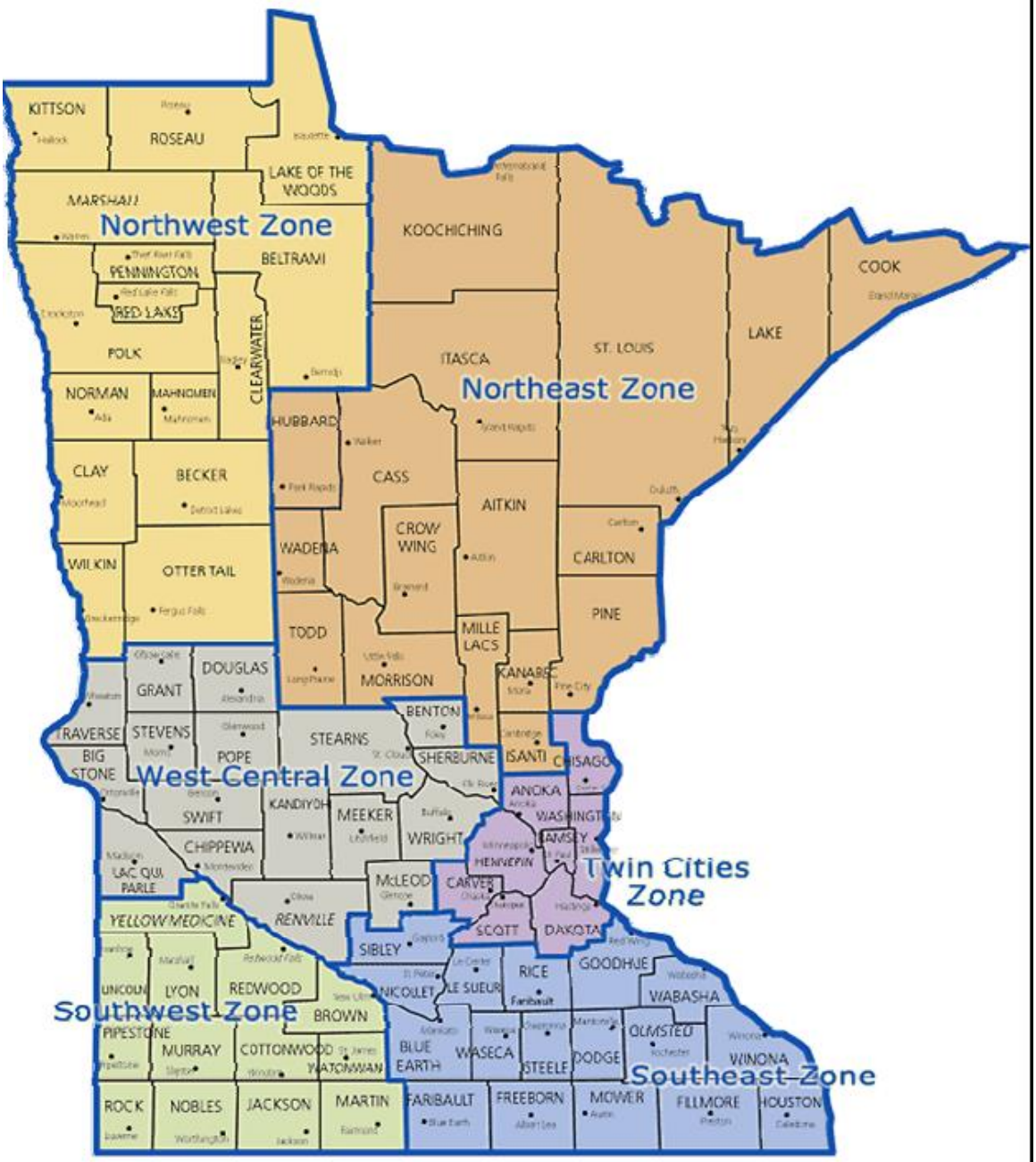
- Hutchinson Utilities Commission
- ITC Midwest LLC
- L&O Power Cooperative
- Marshall Municipal Utilities
- Minnesota Power
- Minnkota Power Cooperative
- Missouri River Energy Services
- Northern States Power Company d/b/a Xcel Energy
- Otter Tail Power Company
- Rochester Public Utilities
- Southern Minnesota Municipal Power Agency
- Willmar Municipal Utilities

These utilities also jointly maintain the following helpful website that provides information about transmission planning and projects: http://www.minnelectrans.com

Detailed information (including maps) on all transmission actions is broken down into six geographic zones of the state: Northeast, Northwest, West Central, Twin Cities, Southwest and Southeast. The transmission-owning utilities operating in six geographical zones put that zone's report together. The six zones in the state are shown in the map below.

The transmission-owning utilities in each Minnesota region are:

1. Northwest Zone – Great River Energy, Minnkota Power Cooperative, Missouri River Energy Services, Otter Tail Power company and Xcel Energy
2. Northeast Zone – American Transmission Company, LLC, Great River Energy, Minnesota Power and Xcel Energy
3. West Central Zone – Great River Energy, Hutchinson Utilities Commission, Missouri River Energy Services, Otter Tail Power Company, Willmar Municipal Utilities and Xcel Energy
4. Twin Cities Zone – Great River Energy and Xcel Energy
5. Southwest Zone – ITC Midwest LLC, East River Electric Power Cooperative, Great River Energy, L&O Power Cooperative (headquartered in Iowa), Marshall Municipal Utilities, Missouri River Energy Services, Otter Tail Power Company and Xcel Energy
6. Southeast Zone – Dairyland Power Cooperative, Great River Energy, ITC Midwest LLC, Rochester Public Utilities, Southern Minnesota Municipal Power Agency and Xcel Energy


Northwest Zone
Northeast Zone
West Central Zone
Twin Cities Zone
Southwest Zone
Southeast Zone
KITTSON
ROSEAU
LAKE OF THE WOODS
MARSHALL
BELTRAMI
KOOCHICHING
COOK
LAKE
ST. LOUIS
ITASCA
PENNINGTON
RED LAKE
POLK
CLEARWATER
NORMAN
MAHNOMEN
HUBBARD
CASS
AITKIN
CARLTON
PINE
CLAY
BECKER
WADENA
CROW WING
WILKIN
OTTER TAIL
TODD
MILLE LACS
KANABEC
DOUGLAS
GRANT
MORRISON
BENTON
TRAVERSE
STEVENS
STEARNS
SHERBURNE
ISANTI
CHISAGO
BIG STONE
POPE
ANOKA
KANDIYOHI
MEEKER
WRIGHT
RAMSEY
SWIFT
CHIPPEWA
HENNEPIN
LAC QUI PARLE
McLEOD
CARVER
YELLOW MEDICINE
RENVILLE
SCOTT
DAKOTA
SIBLEY
GOODHUE
RICE
LINCOLN
LYON
REDWOOD
NICOLLET
LE SUEUR
WABASHA
BROWN
PIPESTONE
MURRAY
COTTONWOOD
WATONWAN
BLUE EARTH
WASECA
STEELE
DODGE
OLMSTED
WINONA
ROCK
NOBLES
JACKSON
MARTIN
FARIBAULT
FREEBORN
MOWER
FILLMORE
HOUSTON

Although most of the smaller transmission fixes are planned for the years 2011-2016, some information on transmission upgrades planned for 2020-2026 is included along with pertinent assumptions and other data on the needs and timing of these longer-range projects. In addition, the Minnesota transmission owners are actively participating in the longer-range regional transmission planning efforts currently underway, which should inform their own Minnesota longer-range planning efforts in the future.

B. RENEWABLE ENERGY STANDARD TRANSMISSION STUDY

In addition to reporting on transmission in general, utilities are also required to determine any transmission upgrades needed to meet an upcoming milestone of the Minnesota Renewable Energy Standard (RES), which pertains to the percentages of each electric utility's total retail electric sales to retail customers in Minnesota to be generated by eligible energy technologies. Part of that analysis requires assessing how many megawatts of renewable generating resources utilities will require beyond what is presently available of the RES. As indicated in a separate legislative report on the RES, utilities are in compliance with present RES standards through 2013 and expect to have enough renewable generation and transmission to meet increased future RES milestones through at least 2019.

VII. CHALLENGES TO TRANSMISSION PLANNING – POTENTIAL IMPACTS TO MINNESOTA

A. NEW TRANSMISSION PROJECTS RAISE CONCERNS ABOUT LAND USE AND LAND RIGHTS

In recent years, a number of energy entities, including natural gas pipelines, electric utilities, and crude oil pipelines, have sought approval to construct new energy projects in Minnesota. Since the siting process in Minnesota mandates a number of public meetings and hearings and other outreach efforts to potentially impacted residents and landowners, the laws and issues regarding land rights and land use are also receiving close scrutiny. In addition to wanting to know what benefit their area of the State would derive from the project, landowners and other impacted citizens naturally want to know what their rights are regarding such projects impacting their land so they may be assured that their rights are not infringed upon during the process.

To date, answers to impacted citizens and landowners have been identified during the regulatory processes. The answer to "what benefit does this project have for my area or my State" is a key question that is addressed in the State's Certificate of Need process (Minn. Stat. § 216B.243) and land rights questions are addressed in various parts of Minnesota's statutes.

To help stakeholders understand facility permitting proceedings before the Minnesota Public Utilities Commission that affect them and to help them have more productive input into those proceedings, the Commission created the specially designated position of Public Advisor. This position is responsible for designing and implementing a program to better

inform stakeholders and to advise them on how to have a meaningful voice in the permitting process.

B. COST RESPONSIBILITY FOR MITIGATION

As utilities build more energy infrastructure, state regulators need to ensure that utilities use cost discipline as they construct new resources. To encourage cost discipline and prevent ratepayers from paying more than is reasonable for new utility infrastructure, at a minimum, a utility must justify any cost recovery above the amount the utility originally indicated that the project would cost. This focus on cost discipline is important since decisions to approve or deny a project are based in part on cost effectiveness of the proposed facility. Consequently, it is important to minimize errors in estimation to avoid ill-informed decisions from being made that would result in higher system costs than necessary.

When utilities install infrastructure in an area, there are always mitigation measures employed to address local concerns. Thus, it is important to ensure that decisions made by a utility on behalf of local governments reasonably consider the cost implications noted above. Further, it is important that costs of any significant upgrades are equitably allocated to ratepayers, based on ratemaking principles such as cost-causation, cost minimization and administrative feasibility. Discussions about such issues have occurred and are likely to continue in the future.

C. FEDERAL VS. STATE JURISDICTION OVER TRANSMISSION SITING AND CONSTRUCTION

The federal government "opened up" the interstate electric transmission grid in the 1990s. Certain eastern States challenged the federal government's jurisdiction over interstate electric transmission lines.[15] The challenge went to the U.S. Supreme Court which upheld that FERC has legal and regulatory jurisdiction over electric lines used for interstate commerce (States retain jurisdiction over small power lines that distribute power directly to retail electric customers.) After the Supreme Court reached its verdict, FERC issued a policy statement saying that it would not "preempt" state regulation of transmission lines as long as transmission service is not detrimentally impacted by state actions. When the federal approach of one-size-fits-all has not worked for Minnesota, the Commerce Department and Commission have advocated for the interests of Minnesota (with examples discussed above).

D. ALLOCATING THE COSTS OF NEW TRANSMISSION PROJECTS POSES MAJOR CHALLENGES

In every business transaction, some of the bottom-line questions are, naturally, "Who will use it or benefit from it, how much will it cost and who will pay for it?" What seems like a fairly straight-forward concept is anything but straight forward when the business transaction in question is a package of large interstate, interconnected transmission lines

[15] See New York, et al. v. FERC, et al. and Enron Power Marketing, Inc. v. FERC for further details.

costing billions of dollars. The "how much will it cost" question may eventually be answered, but the "who will use it or benefit from it" question becomes elusive, albeit important, because of the myriad uses and benefits to different parties that any new transmission line can provide, given the integrated nature of the grid and the need to balance on a moment-to-moment basis between the amount of electricity delivered to the system and the amount used.

Deciding who pays for transmission is one of the largest energy challenges facing the states, utilities and the grid operator, which in turn affects all those who use electricity. Not only are the answers difficult to find, but even more so, whatever answers are found are not agreed to by all parties. The controversy in these questions is probably the core challenge facing all of the regional and national planning processes discussed below. It is one of the factors prompting the expanded role of state commissions in MISO transmission planning process, mentioned above. It also is a core challenge for project proposers because transmission proposers and investors are reluctant to move forward with transmission construction until they have answers on how they will be able to recoup their investment from those who use or benefit from the new project.

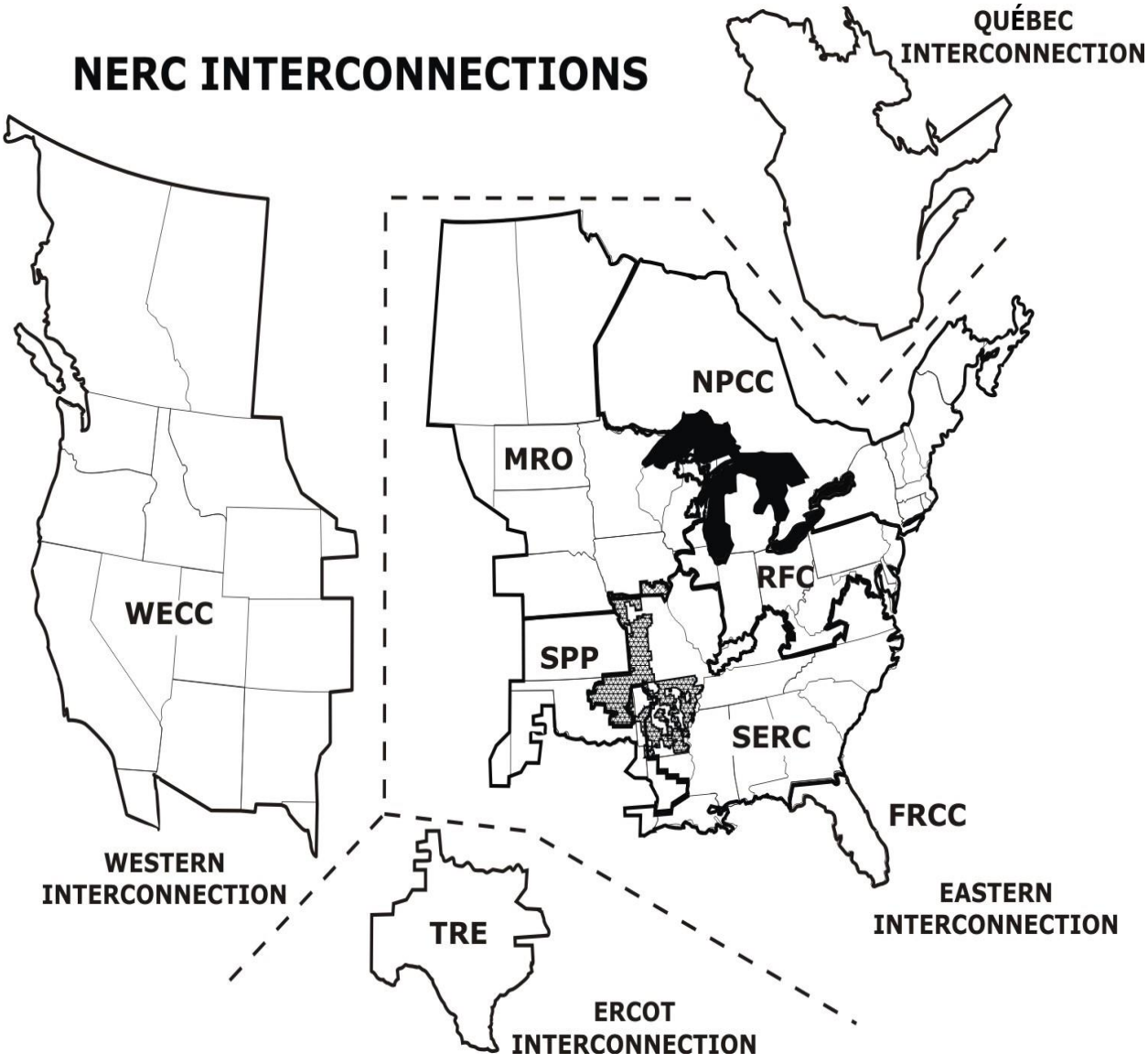
VIII. SUMMARY AND CONCLUSIONS

In summary:

- Electricity continues to be an essential component in providing needed energy to Minnesota's homes and businesses.
- Minnesotans and the economy depend on reliable power every day.
- A Regional Transmission Organization (e.g., MISO) operates the electric transmission system in Minnesota and surrounding states to achieve regional coordination and efficiency.
- Even though we are using the transmission system in a highly efficient manner, our increased use of electricity has strained the transmission grid, which was not designed for the purposes for which it is currently being used and expected to be used in the future, not only as we use more electricity but also as we rely on the broader regional energy markets to meet energy needs.
- Because we have outgrown our aging transmission system and we need highly dependable electricity for computers and other sensitive equipment in our homes and businesses, it is necessary to upgrade and enhance our transmission infrastructure to match current needs and provide room for expansion in the future.
- The way that we build transmission is affected by state and federal policies, rules and laws facilitating the construction of certain types of generation and transmission and restricting other types of electricity and transmission in the state, region and across the United States.
- Minnesota has been and will continue to be involved in numerous regional and national efforts to ensure that electric transmission lines are planned and

constructed in a reliable, cost-effective and environmentally responsible manner for the State's economic future and the needs of its businesses and citizens.

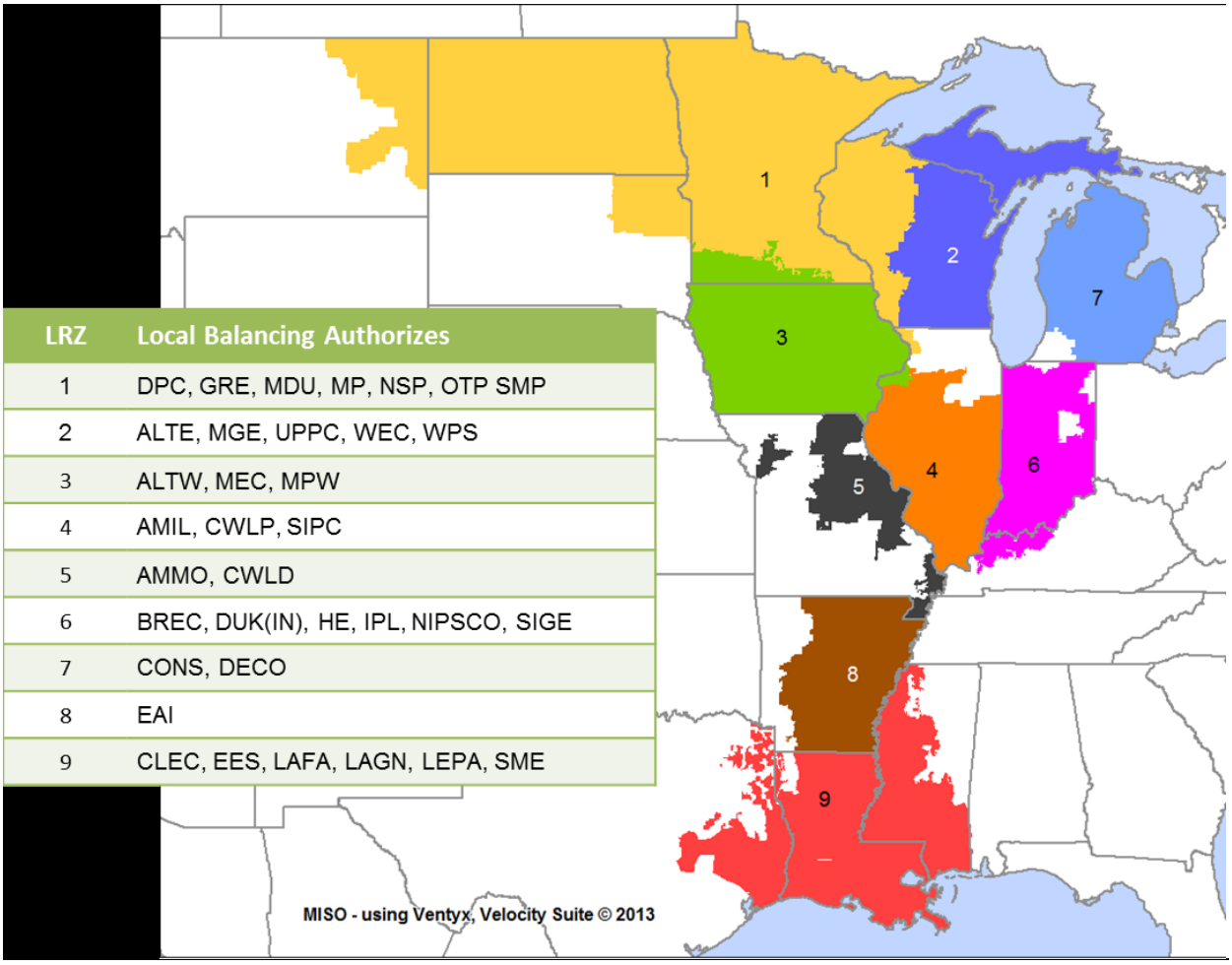
APPENDIX A: MAP OF REGIONAL RELIABILITY AREAS



Source: North American Electric Reliability Corporation

APPENDIX B: MISO'S RESOURCE PLANNING ZONES

The geographical area of MISO's region spans numerous states. MISO has "planning reserve zones" to focus each region on the need to ensure that there are adequate electric resources to meet the needs in each zone. Minnesota is part of Planning Reserve Zone 1, along with the western half of Wisconsin, all of North Dakota, and portions of Montana, South Dakota, and Illinois. Utilities included in Zone 1 are Dairyland Power Cooperative, Great River Energy, Montana-Dakota Utilities, Minnesota Power, Northern States Power, Otter Tail Power and the Southern Minnesota Municipal Power Agency. The utility that serves Minnesota in Zone 3, in the southernmost part of Minnesota, is Interstate Power and Light, which sold its transmission resources to ITC Midwest, a transmission-only utility.



LRZ	Local Balancing Authorizes
1	DPC, GRE, MDU, MP, NSP, OTP SMP
2	ALTE, MGE, UPPC, WEC, WPS
3	ALTW, MEC, MPW
4	AMIL, CWLP, SIPC
5	AMMO, CWLD
6	BREC, DUK(IN), HE, IPL, NIPSCO, SIGE
7	CONS, DECO
8	EAI
9	CLEC, EES, LAFA, LAGN, LEPA, SME

Source: The Midcontinent Independent System Operator