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 2015.

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) 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.

At the time they were built, most of the transmission facilities that are currently in place were 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. Over time, the focus on interconnecting utilities has grown, even as the need to connect generation and distribution systems remains. This evolving 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

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

[3] Development continues of technologies to store un-needed electricity for later use (including batteries, pumped hydro, compressed air, flywheels, etc.). 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., some with assistance from the Department of Energy's Office of Electricity Delivery and Energy Reliability.

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 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 an increase in the cost of power delivered on the system. The entire electric system starts by using the least-cost available 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.

[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

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 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. 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. In addition, while the Minnesota Commission does not regulate the wholesale rates that Minnesota's investor-owned utilities

[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." See: http://www.nerc.com/Pages/default.aspx.

charge to wholesale customers,[9] 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. The 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, the portions of North Dakota with utilities belonging to MISO, 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 were unheard of, few customers had air conditioners, and there were few plug-in

[9] Rate regulation occurs as follows: FERC regulates wholesale rates, the Minnesota Public Utilities Commission regulates retail rates of both 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.

appliances. Most transmission facilities that exist today were sized to meet the then-current 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, 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 to be added to the system; it was certainly not known at that time that households would increase electricity use through home computers and the myriad other ways to use electricity in their homes and businesses which 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 negated some of the efficiency increases gained in refrigerators, dishwashers, and water heating. 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 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." In fact, the historic winter peak electric demand of 109,307 MW on MISO's system was set on January 6, 2014.[10] 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 the January 6, 2014 historic winter peak demand of 109,307 MW was 9 percent higher than the prior winter peak demand.[11] 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

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[10] MISO's highest peak occurs in the summer, with the historic peak to date set on July 20, 2011, at 127,125 MW.

[11] FERC's Energy Primer explains measurement of electricity as follows:

> Electricity is measured in terms of watts, typically in kilowatts (1,000 watts) or megawatts (1,000 kilowatts).
>
> A kilowatt (or watt or megawatt) is the amount of energy used, generated or transmitted at a point in time. The aggregation of kilowatts possible at a point in time for a power plant, for example, is its capacity. The aggregation of kilowatts used at a point of time is the demand at that point.
>
> The number of kilowatts used in an hour (kilowatt-hour or kWh and, in larger quantities, megawatt-hour or MWh) is the amount of electricity a customer uses or a power plant generates over a period of time.

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).[12]

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.[13]

While there is not a desire to have too much transmission, since excessive facilities lead to costs being higher than necessary, the overall goal is to have a system that is sized just large enough to be 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 the relatively low demand for power that occurs 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

[12] Utilities have demand-side management tools which can help reduce demand on the system at peak times.
[13] 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.

> not on current levels of demand – reflecting fluctuations in the economy and weather - but rather on long-term trends.[14]

The Minnesota Court of Appeals affirmed the Commission's decision on June 8, 2010.

Thus, even though Minnesota continues to recover from the Great Recession, as the economy recovers it will be necessary to ensure that the transmission system is ready to meet those needs. Prior to the Great 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.

Moreover, 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, 1990s and since 2000 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. For example, as more renewable energy has been added in and near Minnesota, there is a greater need to build more transmission to export the power during off-peak hours out of our area.

B. FEDERAL AND STATE ACTIONS RELATED TO MINNESOTA'S TRANSMISSION GRID IN 2015

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 reports listed developments that affected Minnesota in those years; the current report discusses several issues that developed in 2015 with potential effects on Minnesota. This report does not list all of these issues, but discusses a few issues briefly.

1. MISO South Integration, Update

As noted in prior reports, the Entergy Region [portions of Arkansas, Louisiana (including New Orleans), Mississippi, Texas, and Missouri] referred to as "MISO South" started their energy

[14] Minnesota Public Utilities Commission's May 22, 2009 Order in Docket No. E017, et. al./CN-06-1115, page 11.

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; the end of this period is under discussion at MISO. Integration issues continue to be sorted out, including the amount of electricity that can be transferred between the Southwest Power Pool (SPP), which is in the geographical area of Entergy, and MISO.

2. Constraints on Power Transfers within MISO

The amount of electricity that MISO can export to and import from the southern part of its system has been limited since 2014, when the SPP, another Independent System Operator like MISO, filed a complaint with FERC, claiming that MISO should pay for certain transfers that exceed 1,000 MW. SPP filed this complaint shortly after Entergy moved from SPP to MISO. Under a temporary settlement, MISO is currently paying SPP more to transfer power over 1,000 MW; this arrangement distorts the choices of least-cost options and increases costs for MISO customers.

In 2015, MISO and SPP reached a full settlement of the matter, including higher costs of power transfers with SPP than before the complaint but more price convergence between MISO North and MISO South. The settlement judge approved the settlement, which is awaiting consideration by FERC.

3. MISO's Competitive Bid Process for Regional Transmission (Transmission Developer Qualification and Selection)

One of FERC's goals is to promote competition for transmission projects; Minnesota and other states agree with this goal. In fact, Minnesota's existing certificate of need law requires the Commission to consider alternatives to proposed facilities. Minnesota Statutes also require Minnesota utilities to give notice as to whether or not they will build a transmission facility that has been identified in a MISO planning process as being necessary; if the utility does not intend to build the facility, the Commission may either require the incumbent utility or another entity to build the facility.

FERC requires MISO to have a Transmission Developer Qualification and Selection system and to eliminate the federal (but not state) right of first refusal on certain types of transmission projects. MISO's Transmission Developer Qualification and Selection system does not apply to transmission projects within the state of Minnesota, due to Minnesota's right of first refusal for incumbent utilities either to build transmission or to give up such a right. However, interfacing with MISO's system could be an issue for a transmission project that crosses multiple states that include Minnesota.

Minnesota has noted in FERC proceedings that reaching the overall goal of using competition to build new transmission resources -- obtaining the best projects at lowest costs -- depends critically on holding bidders accountable to their bids; if bidders are allowed to increase costs above bids or fail to meet the specifications in their bids with little or no accountability, then the process cannot be expected to result in low-cost, reliable resources. Specifically, the Department and the Commission filed comments on August 27, 2015 raising concerns about a utility's proposal as to rates charged for transmission projects.

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

As discussed in prior reports, 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 has sought to decrease the transmission owners' base ROE over 300 basis points below the current base ROE, to 9.15 percent.

In 2015, MISO's Public Consumer Group, of which the Department is a member, provided testimony identifying the basis for decreasing the ROE to a reasonable level. FERC's Trial Staff filed briefs that were supportive of consumer advocates' positions. Advocates argued that FERC's high ROEs have imposed undue costs on consumers and distorted 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 of society since there must be an appropriate balance of production and delivery of electricity. Further, such premiums may encourage inefficient decisions, especially if ratepayers are not appropriately credited with higher revenues from higher returns on equity.

Fortunately, with the Department's advocacy, the Minnesota Commission has required electric utilities subject to the Commission's jurisdiction to credit the excessive ROE revenues back to retail customers, thus limiting much of the harm of the high ROEs on Minnesota ratepayers who take service from utilities under the Commission's regulatory authority. While these ratemaking decisions have reduced the harm of high ROEs in Minnesota, not all ratepayers in Minnesota have had the benefit of revenue offsets to reduce the rates they pay for electric service.

On December 22, 2015, Administrative Law Judge David H. Coffman issued his Initial Decision, determining that the allowed base ROE should be reduced by 206 basis points, to 10.32 percent. MISO is required to refund the difference between the base ROEs of 12.38 percent and 10.32 percent. However, the proceeding is not over at this time: exceptions to the Initial Decision are due January 21, 2016, a final ALJ decision will be made, and this issue will be brought eventually before FERC in 2016.

Related to this proceeding is another complaint filed on February 12, 2015 regarding further reason to reduce the returns on equity for transmission assets in MISO. This complaint

relates to a change in analyzing returns on equity as reflected in an Order recently issued by FERC. The Initial Decision by the Administrative Law Judge is not expected to be issued in this separate proceeding before June 30, 2016.

5. Mercury and Air Toxics Standard

As mentioned in previous reports, the Environmental Protection Agency (EPA) issued rules regarding mercury emissions related to electricity. On June 29, 2015, the Supreme Court of the United States ruled against the EPA's MATS rule. However, on December 15, 2015, the U. S. Court of Appeals rejected a bid to throw out MATS entirely while the EPA considers costs. In any case, since many coal plants had already made the improvements to comply with the rules, or had decided to shutter their plants due to fierce competition from natural gas generation, many of the goals of MATS have largely been accomplished.

6. Clean Power Plan

The EPA also issued its final rule for regulation of carbon emissions from existing power plants, called the "Clean Power Plan." The Minnesota Pollution Control Agency (MPCA) has been hosting stakeholder meetings and working with MISO to understand how the rules may affect use of generation resources. MPCA also began a rulemaking process to address the matter. Moreover, discussions about regional trading of carbon emissions are occurring among various entities.

While these rule changes pertain to power plants rather than transmission facilities, the changes may have significant effects on the configuration of the existing integrated electrical system. For this reason, MISO is working with its own stakeholders to study expected effects of the Clean Power Plan on the transmission system under various assumptions as to how states within the MISO region will implement the Clean Power Plan. MISO has provided analyses indicating that regional approaches to compliance can reduce the overall costs compared to a state-by-state approach to compliance.

7. 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 has been conducting surveys, with help from the Organization of MISO States, to estimate changes in existing generation resources, due to many factors including regulatory requirements and the old age of many generation plants.

The most recent information (released in June, 2015) indicates the following:

- The MISO region as a whole has sufficient resources to meet its requirements in the near term;
- For 2016, the estimated surplus over the MISO region is 1,700 to 2,300 megawatt hours;

- Beginning in 2020, a shortfall of generation resources relative to demand for power is estimated;
- Thus, according to MISO and OMS, additional actions are "needed to ensure sufficient resources beyond 2019."

MISO and OMS expect to continue the survey of generation resources. The Minnesota Commission 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.

Decreases in resources generally increase energy prices for consumers. 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.

8. 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 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 in determining whether there are sufficient resources on its system. Further, rather that requiring each utility to have enough resources to meet the peak demand of the utility's system, MISO requires only that each utility have enough resources to meet its share of *MISO's* peak demand in the summer. This approach reduces the total amount of generation and demand resources needed, since utilities with systems that peak in the winter do not need as much resources in relative terms as a utility that peaks in the summer. 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.

9. 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 in both the short-term and the long-term 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.
- Needing to ensure that information about reliability of specific natural gas supplies for electricity is fully reflected in market signals.

These issues have not yet been resolved; MISO will continue to work with stakeholders on these matters. However, on April 16, 2015, FERC issued a final rule regarding coordination of scheduling processes for natural gas pipelines and electric utilities, to improve coordination between the two industries. There has also been better sharing of information and data between electric utilities and natural gas utilities regarding respective peak periods and outages on a real-time basis. The focus going forward is expected to be on expansions of capacity of natural gas pipelines to deliver more natural gas to generate electricity.

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 October 30, 2015 by the utilities listed below.

- 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

The utilities' 2015 Biennial Transmission Report states that over 100 transmission inadequacies, 40 of which have been newly identified, are needed to improve the transmission system. The 2015 Report identifies projects in the Northeast Zone for which Minnesota Power and Great River Energy[15] have already filed or will file certificate of need applications for new transmission lines in the near future.[16]

Name and Description of Proposed Transmission Project	Name of Utility
Great Northern Transmission Line 500 kV line between Winnipeg in Manitoba, Canada through numerous counties in Minnesota to the Blackberry Substation (225 to 300 miles), and a 345 kV double circuit line between Blackberry and the Arrowhead Substation near Hermantown in St. Louis County, Minnesota (approximately 50 to 70 miles). Impacted counties could include Kittson, Roseau, Marshall, Pennington, Red Lake, Polk, Clearwater, Lake of the Woods, Beltrami, Koochiching, Itasca, and St. Louis. Commission granted a certificate of need in May, 2015.	Minnesota Power
Cromwell/Floodwood: Construct new Savanna 115 kV Switching Station near Floodwood, Minnesota, and rebuild approximately 37 total miles of existing 69 kV line to 115 kV	Minnesota Power

[15] While the Minnesota Transmission Owners' 2013 Biennial Transmission Report indicated that Otter Tail Power and Minnkota Power would build a new 230 kV transmission line between Winger and Thief River Falls, the 2015 Biennial Transmission Report states that the expected completion date of 2016 was extended to 2023. In addition, Minnesota Power is delaying pursuit of the 230 kV upgrade near Duluth, due to slower load growth.

[16] In addition, the 2015 Report identified two possible projects, in Woodbury and in Chaska/Chanhassen, both of which would be built by Xcel that might require certificates of need. There is not enough information about the potential projects to indicate whether a certificate of need would be required.

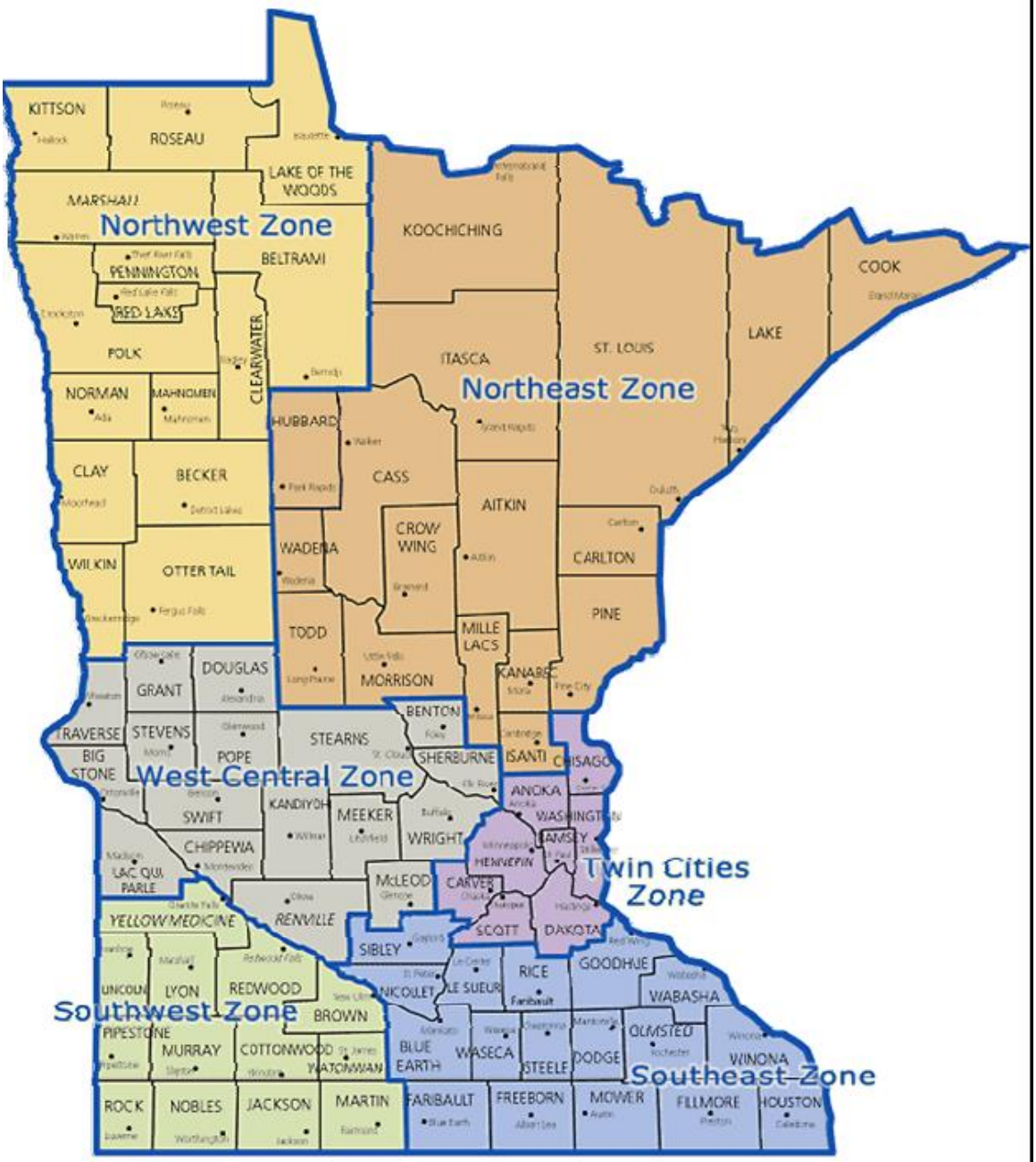
specifications between Lake Country Power's existing Cedar Valley Substation, the new Savanna Switching Station, Lake Country Power's existing Gowan Substation, and Great River Energy's existing Cromwell Substation. The project also includes a capacity upgrade of approximately 10 miles of existing 115 kV line Expected to be completed in early 2016.	
The Menahga Area 115 kV Project consists of approximately 22.5 miles of new 115 kV transmission line between Great River Energy's existing Hubbard Substation and a new Minnesota Pipeline pumping station, as well as the construction of three new substations (Minnesota Power "Straight River," Great River Energy "Blueberry," and Todd-Wadena Electric Cooperative "Red Eye"), relocation and voltage conversion of the existing Todd-Wadena Menahga Substation, and modifications to the existing Great River Energy Hubbard Substation.	Minnesota Power/ Great River Energy
Construct a new, 16.5 mile, 115 kV transmission line between the existing Itasca-Mantrap Cooperative Electric Association's (IMCEA) Potato Lake Substation and the existing Great River Energy (GRE) Hubbard Substation. The Project involves adding a new 115/34.5 kV substation to the Hubbard-Potato Lake 115 kV line to be named Elisha. The proposed project includes construction of a proposed new, 8.0 mile, 34.5 kV sub-transmission line from the Elisha 115/34.5 kV Substation to the existing IMCEA Osage substation.	Great River Energy
The Motley Area 115 kV Project consists of approximately 16 miles of new 115 kV transmission line between a point on Minnesota Power's existing 115 kV Line and a new Minnesota Pipeline pumping station, as well as construction of one new substation at the pumping station site (Crow Wing Power "Fish Trap Lake"), conversion of the existing Crow Wing Power Motley Substation from 34.5 kV to 115 kV service, and expansion of the existing Minnesota Power Dog Lake Substation to a more reliable design.	Great River Energy
Expand planned Iron Range 500 kV Substation to include two 1200 MVA 500/345 kV transformers and extend a double circuit 345 kV line from Iron Range to the existing Arrowhead 345 kV Substation. This project was formerly coupled together with the Great Northern Transmission Line (*2013-NE-N13*) but the two projects have since been decoupled due to the lack of sufficient transmission service requests to justify the 345 kV connection to Arrowhead.	Minnesota Power

Build a ~13 mile 115 kV transmission line from MP's 115 kV #13 line to the Enbridge Palisade Pumping Station.	Great River Energy

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
SWIFT
RAMSEY
CHIPPEWA
HENNEPIN
LAC QUI PARLE
McLEOD
CARVER
YELLOW MEDICINE
RENVILLE
SCOTT
DAKOTA
SIBLEY
GOODHUE
RICE
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

B. RENEWABLE ENERGY STANDARD TRANSMISSION STUDY

In addition to reporting on transmission in general, utilities are 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 2014 and expect to have enough renewable generation and transmission to meet increased future RES milestones through at least 2019. (Ongoing progress by utilities is monitored in several venues, including separate biennial reports to the Legislature on this issue. The last report was filed in January, 2015.[17])

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.

[17] At: http://archive.leg.state.mn.us/docs/2015/mandated/150096.pdf

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.[18] 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 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 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-

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

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 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.

On September 14, 2015, MISO issued a whitepaper called "Cost Allocation Issues Whitepaper" and took comments from stakeholders as to how costs of transmission should be allocated. MISO wanted to:

> …evaluate the current cost allocation metrics and criteria to determine: (1) if they are appropriate or are generally too conservative; (2) if and to what extent they may cause barriers to cost-effective and beneficial transmission investment; and (3) to evaluate if modifications are appropriate given the changing planning environment.

Both the Organization of MISO States and the Public Consumer Group Sector filed comments indicating that there was not a need for cost allocations changes at this time. If MISO intended to pursue cost changes, MISO should present a reasonable basis for doing so.

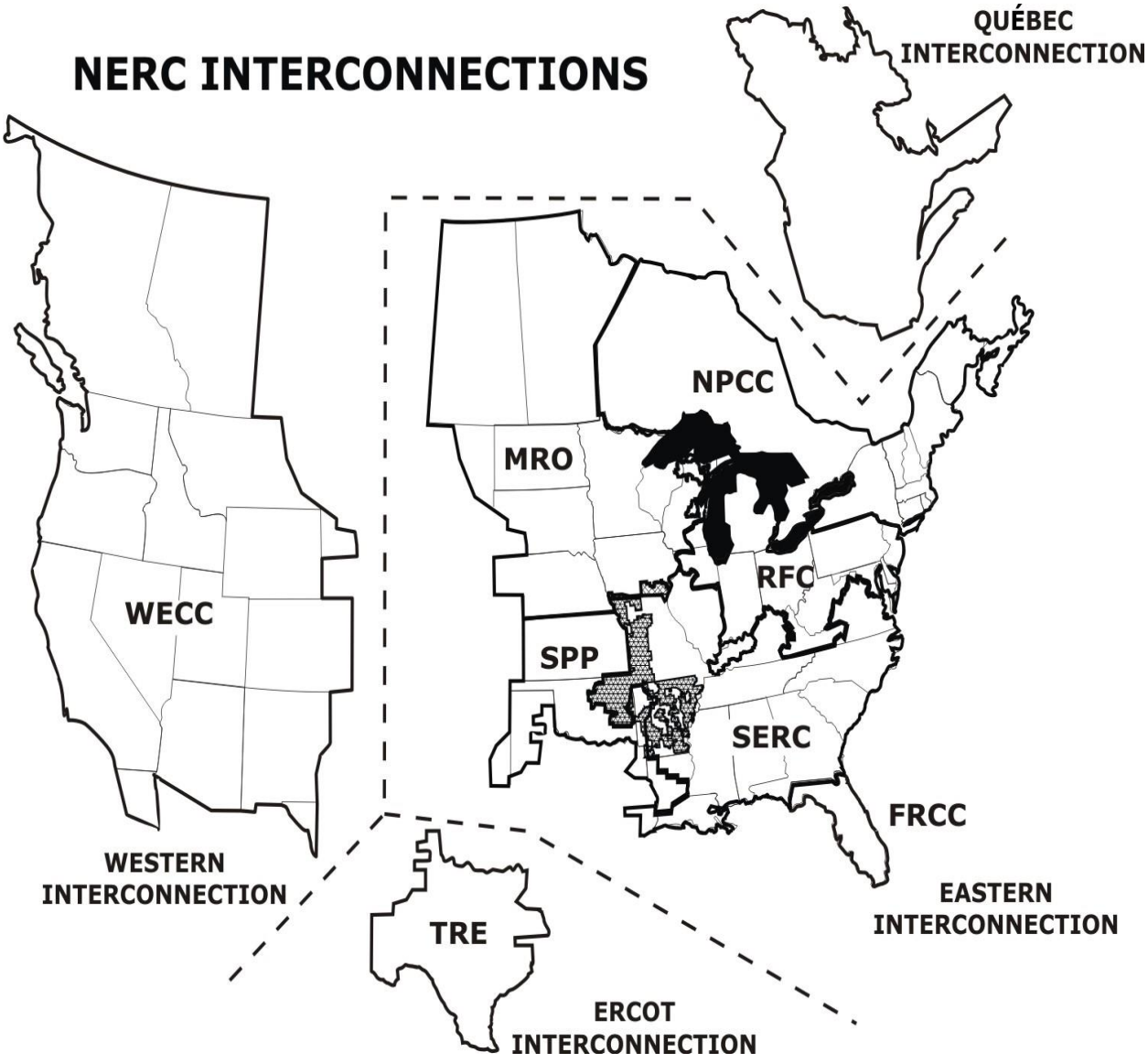
VIII. SUMMARY AND CONCLUSIONS

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.

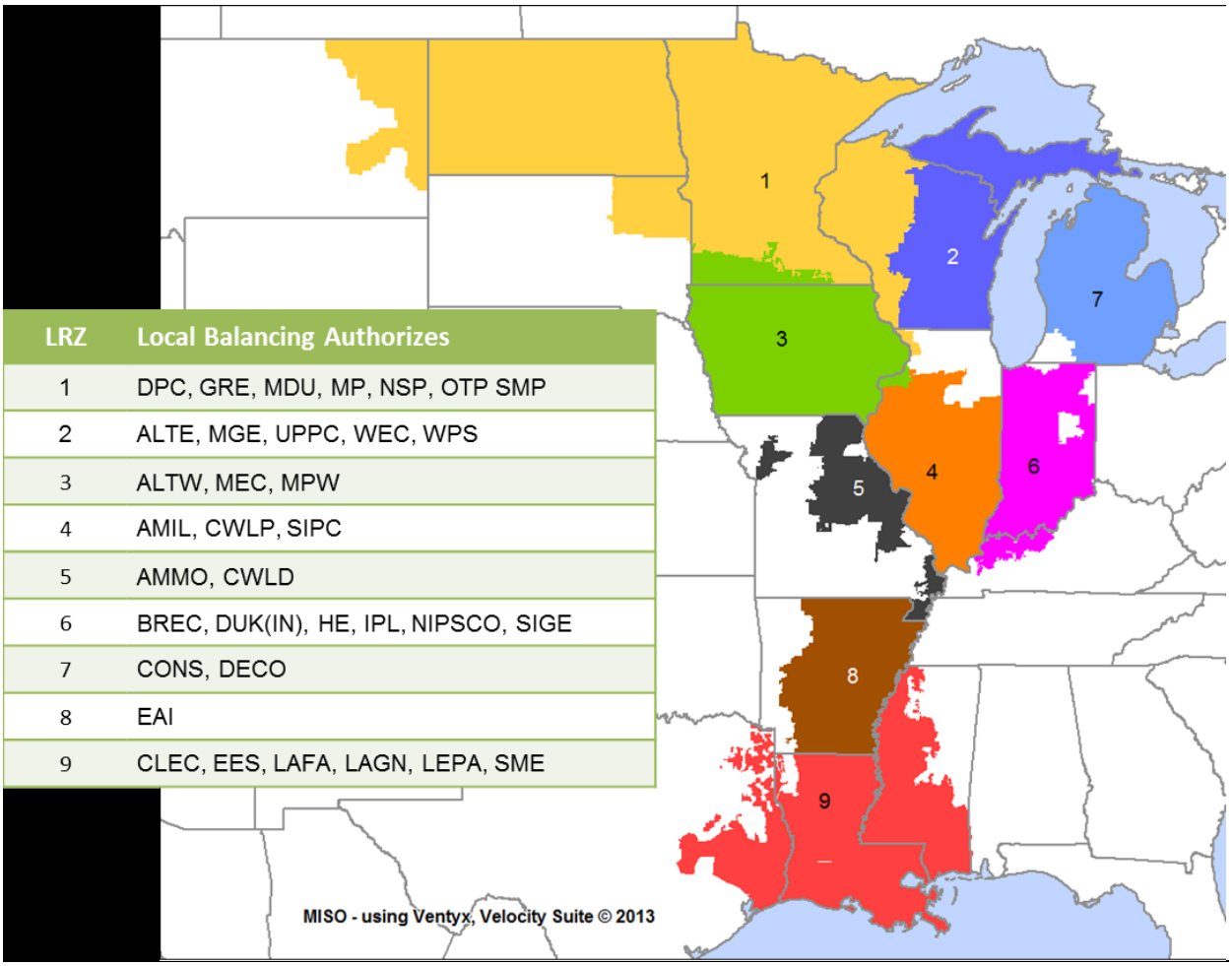
APPENDIX A: MAP OF REGIONAL RELIABILITY AREAS



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. Interstate also sold its distribution system to the Southern Minnesota Electric Cooperative.



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