

3.0 Transmission Studies

3.1 Introduction

The Public Utilities Commission requires that the utilities include in each Biennial Report a “list of studies that have been completed, are in progress, or are planned that are relevant to each of the inadequacies identified” in the Report. Minnesota Rules part 7848.1300, item F. In the 2005 Biennial Report, the utilities not only identified completed, ongoing, and planned studies but also described in general terms the transmission planning process. In the 2007 Report, the utilities again described the relevant studies and in addition, pursuant to legislative directive, described planning processes and studies related to compliance with Renewable Energy Standards.

In this 2009 Biennial Report, the utilities identify a number of studies that have been completed that either address expansion of the transmission network to generation expansion, in particular renewables, or address local inadequacy issues (noted with a Tracking Number). Section 3.3 describes ongoing regional studies that focus on expansion of the bulk electric system to address broad regional reliability issues and support expansion of renewables in the upper Midwest. Section 3.4 focuses on ongoing studies that are attempting to resolve local inadequacy issues.

3.2 Completed Studies

The following studies have been completed and where specific transmission projects have been identified, a Tracking Number is provided. The Tracking Number identifies the year the project was first considered for inclusion in a Biennial Report and the zone where the project is located.

Study Title	Completed	Utility Lead	Description
Dispersed Renewable Energy Study	2009	MTO	<p>State legislation in 2007 required a statewide study of dispersed renewable generation potential to identify locations in the transmission grid where a total of 1200 MW of relatively-small renewable energy projects could be operated with little or no change to the existing infrastructure. For the purposes of the study, dispersed renewable energy projects are wind, solar and biomass projects that will generate between 10 and 40 MW of power.</p> <p>The Phase I study goal was to identify locations in the transmission grid where a total of 600 MW of relatively-small sized renewable energy projects could be operated with little or no changes required to the existing infrastructure. The potential locations studied were based on public input, regional availability of renewable resources, current dispersed generation in the MISO queue, and access to existing transmission.</p> <p>Phase II of the study began in October of 2008. The goal of Phase II is to identify locations for an additional 600 MW of dispersed renewable energy.</p> <p>Study details can be found on the PUC website: http://www.puc.state.mn.us/PUC/electricity/documents/reports-studies/index.html</p>
Renewable Energy Standard (RES) Transmission Study	2009	MTO	<p>The objective of the Minnesota RES Update Study was to investigate and recommend future transmission alternatives to increase generation beyond that enabled by the proposed Southwest Twin Cities – Granite Falls upgrade. The study identified future limiting facilities on the transmission system with emphasis on several generation development zones. The study also addressed the operational impacts of increasing wind generation in the region on the transmission system. Study details can be found on the Minnelectrans website: www.minnelectrans.com</p>
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Southwest Twin Cities – Granite Falls Transmission Upgrade Study (Corridor Study)	2009	MTO	The objective of the Southwest Twin Cities – Granite Falls Transmission Upgrade Study was to confirm that upgrading the existing 230 kV corridor removes a key limiter to increasing generation delivery between western and southwestern Minnesota (as well as points further west) and the load centers in Minnesota. The study clarified the optimal transmission endpoint configuration for the recommended project. The study also determined that the upgrade created an additional 2000 MW of outlet capability. Study details can be found on the Minnelectran website: www.minnelectrans.com
Capacity Validation Study	2009	MTO	The study looked at several specific transmission projects, taken individually and in combination, to determine how much additional generation can be added to the system and where as a result of the transmission additions. The study results provide a range of additional generation that can be added by various combinations of transmission projects along with estimated locations of new generation. The study sought to verify and validate the transfer capabilities which have been estimated by other studies. Study details can be found on the Minnelectran website: www.minnelectrans.com
Green Power Express Study	2009	ITC	The proposed Green Power Express is a 3000 mile network of 765 kV transmission lines stretching from North and South Dakota, across Minnesota and Iowa, into Wisconsin, Illinois and Indiana. Four 765 kV substations and approximately 800 miles of the proposed project's transmission lines would be in Minnesota. When complete, the Green Power Express would facilitate movement of approximately 12,000 MW of power from wind-rich areas to major load centers in the Midwest ISO and PJM regions. Additional detail can be found on the ITC website: http://www.itctransco.com/projects/thegreenpowerexpress.html
Facility Study Report for Midwest ISO Project # F-075 (A411)	2009	Otter Tail Power	2009-NW-N5
Results of Interconnection Facilities Study Following Attachment X Process for MISO F-075 (Maple River Substation	2009	Xcel Energy	2009-NW-N6

Study Title	Completed	Utility Lead	Description
and Sheyenne Substation Line Upgrade to 336.5 MVA)			
Great River Energy Long Range Plan	2008	GRE	The study is a guide for future needs in the GRE service territory that assures its customers a reliable, cost-effective, and energy efficient power source to the year 2031. Although different plans may eventually be developed, this guide gives a good foundation for formulating ideas for future plans in specific areas.
North Mankato	2008	Xcel Energy GRE	2007-SE-N3
Mankato Area Study	2007	Xcel Energy GRE	2003-SE-N3
Outer Metro 115 kV	2007	Xcel Energy	2007-TC-N1
Regional Incremental Generation Outlet Study (RIGO)	2007	Xcel Energy	The RIGO Study was described in the 2007 RES Report. Currently, the Certificate of Need is moving forward on the 161 kV line from Pleasant Valley-Byron. It is expected to be filed by the end of 2009 or early in 2010. The other upgrades recommended in the RIGO Study will be pursued as generation interconnections necessitate their completion.
Bemidji, Minnesota Area Electric Transmission Study: Evaluation of Near-Term Transmission Needs in the Bemidji/Wilton Area	2007	CapX 2020	The objective of this study was to identify what transmission reinforcements were needed in the Bemidji / Wilton load center prior to the in-service date of the Bemidji – Grand Rapids 230 kV Line. As a result, additional capacitors are being added at Cass Lake, Under Voltage Load Shedding (UVLS) has been added in the Bemidji / Wilton load center, and the 115/69 kV transformer at Cass Lake has been replaced (all of these short-term upgrades are under described in more detail under tracking number 2007-NW-N2).
Adams-Rochester 161 kV Study	2008	Dairyland	2007-SE-N1
South Minneapolis Distribution Study	2008	Xcel Energy	2007-TC-N3
Dotson Area Load Serving Study	2007	ITC Midwest	Upgrades identified (2007-SW-N1, 2007-SW-N2, 2007-SW-N3) in the

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			study were based on the interconnection of a MISO wind generation project near Storden and based on future load serving needs in the southwest zone. The wind generation Developer has recently unsuspending the interconnection project driving 161 kV upgrades in southwest Minnesota, but while the project was in suspension, load serving needs changed, as proposed plans for area ethanol plants were either delayed or cancelled. The need for upgrades to accommodate ethanol plant loads has diminished, and a restudy is required.
Worthington Area Study	2007	ITC Midwest	2007-SW-N1
Red River Valley / Northwest Minnesota Load Serving Transmission Study (Transmission Improvement Planning Study – TIPS Update)	2006 (Update)	CapX 2020	The Fargo – Alexandria – Monticello 345 kV line (2005-CX-1) was one of the transmission projects identified in this study. The PUC Docket number is CN-06-1115. The Boswell – Wilton 230 kV Line (Bemidji – Grand Rapids) (2005-NW-N2) is another transmission project identified in this study. The PUC Docket number is CN-07-1222.
West Central Community based Energy Development (CBED) Study	2007	Several utilities	The focus of the study was to determine the impact dispersed generation might have on the transmission network. The high level study focused on identifying generation locations in the west-central planning zone.
Analysis of Transmission Alternatives to the Boswell – Wilton 230 kV Line Addition	2006	CapX 2020	This study evaluated different transmission alternatives to the Bemidji – Grand Rapids 230 kV Line. After evaluation of 3 different alternatives, the Bemidji – Grand Rapids 230 kV Line was determined to be the best alternative to meet the long-term needs of the transmission system (more information can be found under 2005-NW-N2 and within PUC Docket number CN-07-1222).
Mud Lake—Wilson Lake Study	2006	GRE	Project has been energized.
Buffalo Ridge Incremental Generation Outlet Transmission Study (BRIGO)	2005	Xcel Energy	The study identified three 115 kV lines and a new 345/115 kV transformer and capacitor additions at three substations. The PUC docket number is CN-06-1542
Southwest Minnesota-Twin Cities 345 EHV Development Study	2005	CapX 2020	The study identified the Brookings - Hampton Corners 345 kV project (2005-CX-2) as a transmission project that would create additional

Study Title	Completed	Utility Lead	Description
			generation outlet on the Buffalo Ridge. The PUC docket number is CN-06-1115
Southwest Minnesota Exploratory Study	2005	MISO	This study was discussed in the MTEP-06 Report. This study was also described in the 2005 Biennial Report.
Northwest Exploratory Study.	2004	MISO	This study was discussed in the MTEP-05 Report. This study was also described in the 2007 Biennial Report.

3.3 Regional Studies

While every study that is undertaken adds to the knowledge of the transmission engineers and helps to determine what transmission will be required to address long-term reliability and to transport renewable energy from various parts of the state to the customers, some studies are intentionally designed to take a broader look at overall transmission needs. Regional studies analyze the limitation of the regional transmission system and develop transmission alternatives that support multiple generation interconnect requests, regional load growth, and the elimination of transmission constraints that adversely affect utilities' ability to deliver energy to the market in a cost effective manner. Many of these studies are especially important for focusing on transmission needs for complying with upcoming Renewable Energy Standards.

3.3.1 Midwest ISO Transmission Expansion Plans

The Midwest ISO engages in annual regional transmission planning and documents the results of its planning activities in the MISO Transmission Expansion Plan (MTEP). The MTEP process coordinates the transmission plans of individual MISO member utilities to develop a coordinated regional transmission plan. The Minnesota Transmission Owners have reported on the latest MTEP Plans in each of the Biennial Reports.

MTEP-08 Report. The MTEP-08 Report was approved by the Midwest ISO Board of Directors on December 4, 2008. The subtitle of the report is "Growing the Grid Across the Heartland." The MTEP-08 Report identifies those projects required to maintain reliability for the ten year period through the year 2018, as well as a preliminary evaluation of projects that may be required for economic benefit up to twenty years in the future. There are 332 new projects recommended for approval by MISO in the 2008 plan, totaling \$2.4 billion, bringing the total of currently approved projects in MISO to 475 projects, totaling \$4.2 billion. Other planning projects are also listed in the report but are still in development or under study for possible inclusion in future approved plans.

MTEP-09 report. The 2009 Midwest ISO Transmission Expansion Plan is still being finalized. The following language from Section 1.2 of the Executive Summary of the draft MTEP-09 Report explains the purpose of this planning activity.

The MTEP Report is produced on an annual basis to provide interested parties with an overview of the Midwest ISO's planning processes, an update on the transmission planning studies underway, and an understanding of the analyses used in the execution of those processes. The report is also the vehicle to communicate the projects that, as a result of those analyses, are recommended to the Midwest ISO Board of Directors for approval and subsequent implementation.

MTEP 09, the 6th edition of this publication, is the culmination of eighteen-plus months of collaboration between the Midwest ISO's planning staff and its many stakeholders. For each report cycle, efforts are focused on identifying issues and opportunities related to the strengthening of the transmission grid, developing alternatives to be considered, and evaluating those options to determine if there is an effective solution among them. The objective is to identify projects that:

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

The draft MTEP 09 Report recommends 275 new projects totaling \$892 million of investment in transmission infrastructure.

The MTEP-09 Report should be finalized for approval by the Midwest ISO Board before the end of 2009.

MTEP-10 and Beyond. In the MTEP-09 Executive Summary, the following quote describes future planning activities by MISO.

A focus of MTEP 10 will be on the continued implementation of the value-based planning process that the Midwest ISO has been evolving to over the last couple of years. The Midwest ISO will be refining the robustness testing methodology with stakeholders and will seek to further the amalgamation of its planning functions. As these functions - short term reliability, long-term value based and targeted studies - become fully integrated, longer-term solutions that provide greater benefits will become alternative solutions to address issues that are today solved through a series of shorter-term, and many times less valuable, mitigation steps. That is not to say, however, that the discrete analyses will disappear. Studies over each of the timeframes are still required to meet the planning needs of the region in the most expedient and efficient standpoint. In fact, with continued experience the Midwest ISO has recognized the value of having the combination of plans. As the Midwest ISO seeks to implement nearer term reliability upgrades through the queue and the NERC reliability analyses, results from targeted studies provide insight into potentially more efficient alternative solutions based on the larger-scale transmission developed therein. Similarly, targeted studies such as the Regional Generation Outlet Study are informed by the long-term transmission roadmaps created through efforts such as the MTEP long-term value-based planning and the Joint Coordinated System Plan. By planning in the reverse order from which transmission is actually built, the nearer term transmission solutions can be developed in such a way to support future goals through more efficient plan development, including such considerations as preserving future right of way requirements.

The MISO Expansion Plans are available through the MISO webpage at:

<http://www.midwestiso.org/page/Expansion+Planning>

This link will lead directly to the reports.

http://www.midwestiso.org/publish/Folder/3e2d0_106c60936d4_-75240a48324a

3.3.2 Manitoba Hydro-Electric Board Transmission Service Request

MISO continues to process generation interconnection requests and transmission service requests. These studies will likely have an impact on the need for transmission in Minnesota. It is difficult to predict which projects, if any, will actually move forward, as the decision to move forward on a transmission project that is related to generation interconnection and transmission service is up to the generation developer. There is one particularly large transmission service request that involves the possible construction of a 500 kV transmission line in Minnesota. The transmission service request is asking to increase the ability to transfer power from Manitoba into the United States by 1100 MW. Two options have initially been identified, one involves a 500 kV line from Winnipeg to the Twin Cities via Northeast Minnesota, and the second option involves a 500 kV line between Winnipeg to the Twin Cities via the Red River Valley (Fargo). MISO continues to study these options as well as others.

3.3.3 Study of a LaCrosse to Madison 345 kV Transmission Line

ATC is continuing its efforts to study the potential benefits of a 345 kV transmission line that would extend from LaCrosse to the Madison area in Wisconsin. The line would be approximately 150 miles long, possibly include substation enhancements, and cost an estimated \$545 million to construct. ATC has submitted a North LaCrosse – Cardinal (located near Madison) 345 kV line with a possible in-service date of 2017 to Appendix C of the Midwest ISO Midwest Transmission Expansion Plan. The line is identified as project #2845 in the MTEP projects database.

ATC views that a LaCrosse to Madison 345 kV line would be driven by a combination of benefits – reliability, economic, and integration of renewable energy – and these benefits would potentially be provided to ATC’s service territory and the region, including Minnesota. For instance, the combined Southwest Twin Cities – Granite Falls Transmission Upgrade Study and Minnesota RES Update Study indicated that when wind generation increases beyond the level required for Minnesota’s 2016 RES milestone, a new 345 kV line that extends from LaCrosse to the Madison area would help avoid system stability issues in the Twin Cities. The Southwest Twin Cities – Granite Falls Transmission Upgrade Study and Minnesota RES Update Study also found that combining the Southwest Twin Cities – Granite Falls upgrade with a 345 kV line from LaCrosse to Madison would create a total of 3,600 MW of new generation delivery capability, 1,600 MW of which is attributed to the LaCrosse to Madison line.

In 2008, ATC began studying the potential economic benefits of a transmission line that would extend from LaCrosse to Madison and those efforts are continuing. Through ATC’s strategic flexibility approach, the company is analyzing various configurations of a 345 kV line from LaCrosse to Madison under several plausible futures. Results are expected in the first quarter of 2010. More information about ATC’s economic planning can be found on ATC’s 10-Year Assessment Website: www.atc10yearplan.com.

There also is an effort underway that will analyze the reliability benefits of a 345 kV transmission line from LaCrosse to the Madison area in Wisconsin. The Western Wisconsin Study is investigating the long-term reliability issues in the western Wisconsin area and transmission solutions to address those needs. The study is led by ATC and is a collaborative effort that includes Xcel Energy, Dairyland Power Cooperative, ITC Midwest, Great River Energy, Southern Minnesota Municipal Power Agency and the Midwest ISO. It is anticipated that the Western Wisconsin Study will be completed in the first quarter of 2010.

A LaCrosse to Madison 345 kV line also is being analyzed as part of phase I of the Midwest ISO's Regional Generation Study (RGOS I) as a possible transmission facility needed to satisfy renewable portfolio standards and goals in Upper Midwest states. It is anticipated that a LaCrosse to Madison 345 kV line will be included in the final 345 kV designs developed in RGOS I, results from which will be provided to the Upper Midwest Transmission Development Initiative (UMTDI) for its consideration in identifying transmission needed to satisfy renewable portfolio standards in five states.

3.3.4 Regional Outlet Generation Study (RGOS)

The Midwest ISO, in collaboration with stakeholders, has undertaken a Regional Generation Outlet Study in two phases.

The purpose of the RGOS Phase I is to develop transmission projects that will fulfill the renewable energy mandates in the four states of Illinois, Iowa, Minnesota and Wisconsin. The public policy is a major input component to RGOS and successful plan development. The Upper Midwest Transmission Development Initiative (UMTDI) is providing that public policy input. The (UMTDI) is a collaboration of the Governors and state Regulatory Commissions of Iowa, Minnesota, North Dakota, South Dakota and Wisconsin. The UMTDI has a two-fold purpose; encourage interstate transmission for renewable energy and develop an equitable cost-sharing methodology for transmission. The UMTDI and stakeholder helped the Midwest ISO define renewable energy zones within the five-state region of ND, SD, MN, WI, and IA for 15 & 25 GW wind outlet scenarios. The Midwest ISO along with the stakeholders performed the studies and 345 and 765 kV transmission expansion plans were developed for the two generation outlet scenarios. This RGOS Phase I work is expected to be completed and an Executive Report published in the December 2009 timeframe.

The objective of the RGOS Phase II study is to develop a mid-term (5-15 years, approx.) set of regionally coordinated transmission projects that meet the state renewable portfolio standard requirements for the states of Missouri, Illinois, Michigan, Ohio and the Midwest ISO load in Pennsylvania; as well as any increased requirements in the states studied in the RGOS Phase I at the least cost to the consumer. This study will leverage the renewable energy zones and transmission designs identified and established in RGOS Phase I. The RGOS Phase II study is intended to be completed in the January 2010 timeframe.

3.3.5 SMARTransmission Study

The Strategic Midwest Area Renewable Transmission Study (the “SMARTransmission Study”) is a comprehensive study of the transmission infrastructure that may be needed in the Upper Midwest to support renewable energy development and to transport that energy to consumers in the Upper Midwest, the Ohio River Valley, and farther East. The study is being sponsored by American Transmission Company, Electric Transmission America, LLC (a joint venture of American Electric Power & MidAmerican Energy Holdings), Exelon Corporation, MidAmerican Energy Company, Xcel Energy, and NorthWestern Energy.

Sponsors of the SMARTransmission Study have retained Quanta Technology to conduct the analysis, which will evaluate transmission alternatives 345 kV and higher and provide recommendations for new transmission development and how to appropriately stage that development. Results and recommendations will be folded into regional planning efforts such as the Midwest ISO Transmission Expansion Plan and PJM’s Regional Transmission Expansion Plan for additional study and validation. The study will include reliability and economic analyses and will focus on an area that covers the seams of three Regional Transmission Organizations – Midwest ISO, PJM and Southwest Power Pool. An open stakeholder process is being conducted to gather input and will be continued as results are published.

Completion of the SMARTransmission Study is anticipated in early 2010. More information about the study is located at: www.smartstudy.biz

3.4 Load Serving Studies

Load serving studies focus on addressing load serving needs in a particular area or community. Since many of the inadequacies in Chapter 6 are load serving situations, many of these studies relate to specific Tracking Numbers.

Study Title	Anticipated Completion	Utility Lead	Description
Cromwell-Wrenshall-Mahtowa-Floodwood Area	2010	Minn Power GRE	See Northeast Section for further study description (2003-NE-N2)
Duluth Area 230 kV	2010	Minn Power	See Northeast Section for further study description (2007-NE-N1)
Deer River area Reliability	2010	Minn Power	See Northeast Section for further study description (2009-NE-N2)
Enbridge Transmission Study	2010	Otter Tail Power Company	2003-NW-N2 2007-NW-N3

Study Title	Anticipated Completion	Utility Lead	Description
Ramsey Transformer Study	2010	Otter Tail Power Company	2003-NW-N2
Fergus Falls Area Transmission Study	2010	Otter Tail Power Company	2009-NW-N1

3.5 MAPP Load & Capability Report

The 2009 Mid-Continent Area Power Pool Load & Capability Report, dated May 1, 2009, can be found at:

<http://www.mapp.org/DesktopDefault.aspx?Params=454b040717565c79401a0c0b7b615d460000003cd>

The Introduction to the 2009 Load & Capability Report provides an overview of what the report is intended to do:

The MAPP Load and Capability Report is prepared in response to the requirement set forth in the MAPP Agreement and the MAPP Generation Reserve Sharing Pool Handbook for a two-year monthly and a ten-year seasonal load and capability forecast from each MAPP Participant. The report contains actual and forecast monthly load and capability data for the period of May 2008 through December 2011 and seasonal load and capability data for the ten-year period Summer 2009 through Winter 2018-19.