**BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION**

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| Gregory Scott | Chair |
| Edward Garvey | Commissioner |
| Marshall Johnson | Commissioner |
| LeRoy Koppendrayer | Commissioner |
| Phyllis Reha | Commissioner |

Docket No.

In the Matter of All Electric Transmission Projects, Reports and Development of Certified Transmission Line Projects

# MINNESOTA TRANSMISSION PROJECTS REPORT

Submitted by:

**Dairyland Power Cooperative**
**Great River Energy**
**Hutchinson Utilities Commission**
**Interstate Power Company**
**Minnesota Power**
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**Missouri River Energy Services**
**Otter Tail Power Company**
**Southern Minnesota Municipal Power Agency**
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**November 1, 2001**

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# I. INTRODUCTION AND EXECUTIVE SUMMARY

Minnesota's transmission system – the high voltage power lines that transmit electric energy from generation plants to local load and among utilities to ensure a high degree of reliability – is part of an overall regional transmission grid operated on a coordinated basis with other interconnected transmission systems throughout the Upper Midwest and the entire Eastern United States. Historically designed to reliably deliver power to the major electric load centers such as the Twin Cities metropolitan area, Duluth, Mankato, Rochester and St. Cloud, and to interconnect utilities for reliability reasons, the transmission grid is now relied on to do much more. It acts as a regional "highway" providing the physical link between sellers and buyers, facilitates an ever-increasing amount of transactions between an increasing number of market participants, and over increasing distances. At the same time, it continues to serve a critical reliability role.

While more is being expected of the system, transmission investment has remained flat and fallen far behind where it should be. One reason for the shortfall is the often contentious and protracted transmission need and siting proceedings. To help resolve these controversies, the 2001 Legislature passed the Minnesota Energy Security and Reliability Act (the "Act"). Minn. Laws 2001, Chap. 212.

The Act is comprehensive energy legislation that addresses a wide range of energy issues, including energy planning, conservation and infrastructure. Of particular relevance here, Section 30 of the new law, codified at Minn. Stat. § 216B.2425, amends the state's certificate of need ("CON") laws by requiring the state's electric utilities to file a state "transmission projects report," or State Transmission Plan with the Minnesota Public Utilities Commission by November 1 of each odd-numbered year. The filing shall:

- list specific present and foreseeable future transmission inadequacies;
- identify alternatives in addressing system inadequacies;
- identify general economic, environmental, and social issues associated with the alternatives; and
- summarize the input that transmission owners and operators have gathered from the public and local governments in assisting to develop and analyze alternatives.

The process is meant to allow the Commission the ability to review projects in a less confrontational manner than under traditional CON proceedings and in the overall context of other regional transmission projects being considered. If satisfied on a number of factors, including an evaluation of feasible and prudent alternatives, the Commission is required to place the project on its transmission "priority list." Placement on the list satisfies the sponsoring utility's CON obligation with respect to that facility.

It is significant to note that no utility is asking that any transmission project be placed on the priority list as part of this year's report. As it turned out, the November 1 filing deadline allowed insufficient time for utilities to prepare and assemble the data necessary for priority list approval. This means that any transmission project that requires a CON before June 1, 2004 will continue to be processed under the Commission's existing rules for certifying need for transmission lines, Minnesota Rules Chapter 7849.

Although it seeks no specific project list certification, this inaugural transmission plan nonetheless provides important information on issues affecting transmission planning in Minnesota. Specifically, Section II of the report provides an overview of the planning process undertaken by the region's electric utilities through their participation in the Mid-Continent Area Power Pool ("MAPP"). The overview includes a discussion of the role played by reliability standards of the North American Electric Reliability Council ("NERC") and the National Electric Safety Code ("NESC") and provides references where additional information may be obtained. It reviews the regional nature of MAPP's planning process whereby projects are coordinated not by their need or effect on one individual utility company but on what is the most prudent regional alternative. The report reviews the transmission modeling process used by MAPP and its member utilities, a critical piece in evaluating transmission need. Section II also discusses recent Federal Energy Regulatory Commission ("FERC") decisions affecting transmission and the proposed evolution of transmission planning to the Midwest Independent System Operator (the "MISO"). Last, because of its commonality to most all transmission projects wherever located, Section II addresses the most recent and important studies on electric and magnetic fields ("EMF").

Providing information on these issues here is meant to provide a foundation for further public discussion and the utilities invite comment and questions. Eventually, however, rules or guidelines should be established that removes these and other issues from having to be continually re-litigated in the context of individual project reviews.

Section III addresses the inadequacies facing the regional transmission system and the alternatives being considered to address them. It summarizes current transmission studies in Minnesota and the region that are an integral part of planning process undertaken in first part by the state's utilities. It also identifies the projects currently being discussed and planned to meet the inadequacies identified in the relevant studies. While the original intent was to categorize projects in this report by reference to the date in which a CON would be sought, i.e., Category I, Category II, etc., the fact that no projects are being proposed for priority listing this year made that format less appropriate. Instead, the projects, as are the studies, are organized by region of the state.

The purpose of the new planning process under the Act is simple, yet dignified. It seeks to create a process whereby transmission facilities with an

essential public purpose can be planned, and discussed collaboratively, thoughtfully, and expeditiously and in a manner that avoids unnecessary litigation and regulatory duplication. It can help focus debate on critical issues affecting certification of essential public facilities and provide guidance to utility planners before facility addition decisions are made. It is designed to facilitate meaningful interaction between utilities, the public, and government over how to best maintain a strong and environmentally sound electric infrastructure in Minnesota. At best, it can help avoid protracted litigation, and regulatory duplication. In the end, however, the new process will be what those with a stake in regional grid development and state energy policy make of it. Because transmission planing and siting has always been and will continue to be important to all Minnesotans, the state's electric utilities are committed to making this process work.

The report is being submitted by the following electric utilities: Dairyland Power Cooperative, Great River Energy, Hutchinson Municipal Utilities, Interstate Power Company, Minnesota Power, Minnkota Power Cooperative, Missouri River Energy Services, Otter Tail Power Company, Southern Minnesota Municipal Power Agency, Willmar Municipal Utilities, and Xcel Energy, Inc. Collectively these utilities own and operate more than six thousand five hundred miles of transmission lines in the state, representing an investment in the state of more than three-quarters of a billion dollars.

# II. ISSUES AFFECTING TRANSMISSION PLANNING

## Introduction

Minnesota's transmission system is highly reliable but also aging. Designed primarily to deliver power to major load centers such as the Twin Cities metropolitan area, Duluth, Mankato, Rochester and St. Cloud, Minnesota's last major transmission facility was constructed more than twenty years ago. With the exception of a few large baseload units located in North Dakota and the hydropower units located in Manitoba, Minnesota's generation supply was originally located in Minnesota and Wisconsin. As a result, the state has relatively few large, "interstate" interconnections critical in maintaining reliability. [1]

[1] Exceptions include three special use, direct current (DC) and 500 kV lines to North Dakota and Manitoba and three 345 kV interconnection lines south and east of the Twin Cities. The two DC lines and the 500 kV line are dedicated to deliver specific generation supplies to specific Minnesota loads. The 345 kV interconnections were constructed to allow for large generation plants developed in the early 70s. The lines provide the plants with regional backup in case of an outage. The remainder of the system throughout Minnesota was constructed to serve local area loads.

Given its age and increased use, it is widely recognized that Minnesota's transmission system is being stretched and there is wide recognition that upgrades are needed.[2] The Act's new planning process can help fill this need by providing the public and policy makers a better opportunity to provide meaningful input in the early stages of the transmission planning. Through increased public participation and elimination of redundant individual certificate of need proceedings, the state transmission plan process is designed to provide a more expeditious review and certification of transmission projects in the public interest.

In the sections that follow, this report reviews the national reliability standards established by NERC and the NESC. The report also explains the process of how these standards and other accepted industry guides are applied in the context of individual utilities' transmission plans and how these plans are coordinated on a regional planning basis under MAPP. The report will then discuss how changes taking place at the federal level are affecting regional transmission planning, including MAPP's expected assimilation into the MISO. The goal of this review is to provide additional context to the specific transmission studies and transmission projects provided in Sections III.

**Reliability Standards**

Reliability standards for electric transmission planning are established by the North America Electric Reliability Council ("NERC"). Since its formation in 1968, NERC has operated primarily as a voluntary organization based on reciprocity and mutual self-interest. Its primary purpose is to maintain electric system reliability in North America. As currently constituted, NERC is a not-for-profit corporation made up of ten Regional Councils throughout the country. Regional Council members come from all segments of the industry and account for virtually all the electricity supplied in the United States and Canada. MAPP serves as one of the NERC's Regional Councils.

Compliance with NERC's standards is mandatory, but as a private entity, NERC lacks any real authority to enforce these standards. The growth of competition and the structural changes taking place in the industry are causing participants to re-examine the current system of voluntary compliance. NERC is presently working to

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[2] *See, e.g.,* Minnesota Department of Commerce, *Keeping the Lights On – Securing Minnesota's energy Future,* 2001, at p. 3. Deputy Commissioner of Energy Linda Taylor recently warned that the grid needs new power lines. "The transmission system is being operated at capacity, it's old, and it is being asked to do things it was never built to do." *State Lowers Forecast for Energy Needs*, Tom Meersman, *Star Tribune - Metro Section*, October 25, 2001. The Department recently published its *2001 Draft Energy Planing Report*. The report provides an excellent review of Minnesota's transmission system and the issues affecting it. It can be found on the Department's Website at **http://www.commerce.state.mn.us.**

incorporate an enforcement mechanism by way of contracts between the ten Regional Councils. It is also in the process of transforming itself into "NAERO" – the North American Electric Reliability Organization. Like NERC, NAERO's principal mission will continue to be the development and implementation of reliability standards throughout North America. Federal legislation has been proposed that would provide NAERO with statutory, as opposed to contractual, authority to enforce reliability standards among all market participants.

The planning standards apply primarily to the "bulk" electric system – i.e., the electric generation resources, transmission lines, and interconnections generally operated above 100kV. These systems must be capable of performing under a wide-variety of expected system conditions and must be planned to withstand probable forced maintenance outages and other service interruptions known as "contingencies." The standards are designed to keep the interconnected system planned, designed, and operating to withstand a number of contingencies caused by the loss of a generation unit, transmission line, or other system failures. The standards require companies to continually keep the system in a secure state (able to withstand the next contingency) even after one or more contingencies have already occurred.

NERC's reliability standards can be found on its Website, **http://www.nerc.com/standards**.

**National Electric Safety Code**

A second national standard with application to transmission planning is found in the National Electric Safety Code ("NESC"). The NESC governs the design, construction and operation of electric utility transmission facilities to ensure public and employee safety.

The NESC was well defined by the 1920's and is currently revised every five years following extensive research and review. The NESC and related can be found at **http://standards.ieee.org/nesc/newssites.html**.

**Regional Planning Under MAPP**

At present, all planning and analysis for transmission facilities located in Minnesota is performed under the auspices of MAPP. Organized in 1972, MAPP is a voluntary association of electric utilities and other electric industry participants that operates under contract to facilitate the pooling of generation and transmission services. The goal of MAPP is to ensure that the regional interconnected electric system is operated securely and efficiently and that the economic benefits of power pooling are equitably shared through coordination, consistent standards and enforcement. MAPP has approximately 107 members, including investor-owned utilities, electric cooperatives, municipal utilities and public power districts, a federal power marketing agency, private power marketers, regulatory agencies, and

independent power producers. It currently performs three core functions: (1) serves as one of the ten regional councils within NERC, and as such is responsible for the safety and reliability of the bulk electric system; (2) is a regional transmission group, responsible for facilitating open access of the transmission system as required by FERC; and (3) provides a power and energy market where MAPP members and non-members engage in the buying and selling of electric energy, capacity, and ancillary services at wholesale.

The process by which regional transmission planning and analysis occurs begins with each MAPP member that owns and/or operates transmission facilities. Pursuant to MAPP's Restated Agreement, these members are required to prepare and maintain comprehensive plans for their transmission facilities that conform to reliability and transmission assessment standards established by NERC and implemented on a regional basis by MAPP. At a minimum, these plans assess the following: the member's current and expected transmission requirements to serve its retail and wholesale customers, its present and future network and firm transmission service (i.e., wheeling service) obligations, its coordination with neighboring utilities' plans, and any other contractual or regulatory obligations that in any way affect its transmission facilities. Once completed, these plans are submitted to Subregional Planning Groups ("SPGs").

MAPP has established five SPGs[3] to facilitate regional planning. The SPGs provide a forum to coordinate the individual member plans and to incorporate the planning expertise of the members' planning staff. The SPGs also facilitate the coordination of plans between SPGs and neighboring non-member utility systems.

Each SPG assesses the adequacy of proposed member plans to best meet the needs of the sub-region. It then develops a coordinated sub-regional transmission plan for the ensuing ten years, including alternatives, for all transmission facilities in the sub-region at a capacity of 115 kV or greater. Sub-regional plans are designed to:

- identify load serving problems;
- identify transfer capability limitations within the sub-region and with neighboring sub-regions and regions;
- identify transmission needs for new generation based on requests of generation owners;
- propose and study transmission expansion alternatives;
- recommend preferred alternatives;
- address sub-regional deficiencies identified by MAPP's Regional Plan (discussed below); and

[3] The five SPGs currently recognized by MAPP include the Iowa Transmission Working Group ("ITWG") SPG; the Nebraska ("NEB") SPG; and the three SPGs affecting Minnesota's transmission system – the Missouri Basin ("MB") SPG, the Red River Valley ("RRV") SPG and the Upper Mississippi Valley ("UMV") SPG.

- provide assessment of impacts of MAPP's Regional Plan on the sub-region.

The completed sub-regional plans are then submitted to MAPP's Transmission Planning Sub-committee ("TPSC"), a sub-committee of the Regional Transmission Council ("RTC"), biennially on or before June 1.

Using as a basis both the individual and sub-regional plans, TPSC develops a regional transmission plan for all transmission facilities 115 kV and higher in the MAPP region (the "MAPP Regional Plan" or "Regional Plan"). The Regional Plan is based on a ten-year rolling forecast and is intended to enable the transmission needs of MAPP members and the region generally to be met on a consistent, reliable, environmentally responsible, and economical basis. In addition, the TPSC ensures that projects proposed in one sub-region are consistent with and do not undermine or duplicate projects proposed in another sub-region. The TPSC also studies and quantifies transfer capability across the MAPP region, identifying "flow-gates[4] which act to limit the transfer of power for either exports or imports. These studies are then used as a basis to assess future regional projects.

The Regional Plan compares projects against alternative projects based on costs, reliability concerns and benefits, contractual and other obligations of the affected utilities, permitting concerns, and other factors. Once adopted by the RTC as a necessary and prudent plan, MAPP typically relies on the most affected utility(ies) to use their best efforts in supporting and implementing the projects.

The most current Regional Plan approved by MAPP is the *Regional Plan, 2000 through 2009* (as revised on March 21, 2001, available on MAPP's website at **http://www.mapp.org/Library/RegionPlan.htm**. It is currently being updated and will be available after November 15, 2001. This plan recommends the construction of certain transmission facilities over the planning period. The facilities located in Minnesota are included in Section III of this report and as part of *Form 1* and *Appendix A* to the Regional Plan, also available on the MAPP website.

**Regional Transmission Modeling and Analysis**

An important part of the MAPP transmission planning process is the use of modeling to assess regional grid reliability that (1) the system is operating as it was designed and (2) it will not be adversely affected by new generation, transmission

[4] The ability to transfer power from numerous source points to points of delivery depends on the relative impact that the resulting power flow has upon its components and key defined interfaces, known within MAPP as flowgates. A flow-gate is one or more elements that act as a proxy for an operating security limit. An operating security limit can be determined by transient or voltage stability, unacceptable voltage levels or thermal restrictions, whichever is most limiting. Flowgates have been identified for known system "bottlenecks" which limit transfer of power.

facilities or end-use load. Many sources of information are used in the modeling system reliability, including load reports and forecasts, real-time operating data on voltage and power flows, operating reliability standards, and physical system and hardware improvements.

Primary responsibility for building and maintaining these models in Minnesota and throughout the MAPP region falls with MAPP's Modeling Building Working Group (the "MBWG"). The MBWG maintains what is essentially a power flow, base case transmission model library. The library includes a series of power system models that simulate the behavior of the bulk electric system over a ten-year period. The models are designed to accurately represent all major generation, load, and transmission facilities in MAPP.

The MBWG maintains the following base case models. For each model, the generation, transfers, and load demand reflect expected operating conditions during the defined period.

- **Summer Peak Load**. This model replicates the expected summer peak demand in MAPP, including load reductions caused by demand-side management and other conservation programs.

- **Winter Peak Load**. This model replicates expected winter peak demand, including load reductions caused by demand-side management and other conservation programs.

- **Spring Light Load.** This model replicates the energy load on a typical early morning in April.

- **Summer Off-Peak Load.** This model replicates 85% of the summer peak load conditions in the operating model – the model that looks only at next year's conditions – and 70% of summer peak load conditions in the planning, summer off-peak models – those models that look at conditions in the two to ten year planning horizon.

- **Winter Off-Peak Load.** This model replicates 90% of the winter peak load conditions in the operating model. There are no winter off-peak models associated with the planning models.

The models are used by MAPP committees and individual members in their study of load serving adequacy, future transfer capability, generation interconnection and impact studies, and other system enhancement impacts. Information from these models may also be used to develop other regional and sub-regional models.

Computer software is used to simulate the response of the transmission network models under the various systems intact or outage conditions. Equipment current carrying capability, system voltages, transient stability, small signal stability,

and voltage stability all may be analyzed in these simulations. The output from the computer programs is compared against the appropriate criteria (NERC, MAPP, and local utility). Among other things, the analysis is designed to locate system inadequacies. Alternatives are then developed that attempt to address the inadequacies. The alternatives are then placed into the models and the computer analysis is rerun to determine the effectiveness of each of the alternatives. Review of these simulations and consideration of other factors will generally result in a "recommended" transmission alternative. The results are incorporated into a study report where they are then evaluated by MAPP and its various planning committees.

**FERC Developments**

Recent changes in energy policy have affected the transmission system. In 1992, Congress passed the Energy Policy Act that provided for the deregulation of wholesale power markets, i.e., utilities and other marketers purchasing and selling electricity from one another (as opposed to selling to the end-use customer). In response to claims that utilities were providing themselves with preferential access to their transmission lines and denying access to others and thus inhibiting the competition that the Act sought to promote, FERC enacted its landmark Order Nos. 888 and 889. Order No. 888 requires all transmission owners to (1) offer comparable open-access transmission service for wholesale transactions under a tariff of general applicability on file at FERC and (2) take transmission service for their own wholesale sales under the same tariff.

Order No. 889 required public utilities to functionally separate their transmission and reliability functions from their wholesale power marketing functions and to develop and maintain an Open Access Same-Time Information System ("OASIS") to give transmission users the same access to transmission information that the wholesale merchant function of a utility enjoys. Thus, a utility's wholesale merchant function is limited to receiving from a utility's transmission function only such transmission information that is posted on an OASIS, and is thereby publicly available on a simultaneous basis to third-party transmission customers.

In late 1999, the FERC issued Order 2000 to further encourage more competition in the wholesale power markets, this time by encouraging transmission-owning utilities to voluntarily join large regional transmission organizations.

These and other orders, policy statements and rulings are having significant impacts on the performance of the transmission system in Minnesota and throughout the region – including increased transactions and power flows. Plans for new generation in the region, including significant wind resources in southwest Minnesota, place added pressure on the grid's ability to keep up with demand.

**Transmission Planning Under the Midwest Independent System Operator**

One of the results from the changes in federal energy policy is the development of Regional Transmission Organizations ("RTO"). RTOs are voluntary organizations comprised mostly electric utilities that own, operate or control facilities for the transmission of electric energy in interstate commerce over large geographic regions. The goal of these organizations is to promote economic efficiency in the electric industry and to ensure that consumers are paying the lowest possible price for electricity. In the Midwest, the FERC has approved an RTO for this region known as the Midwest Independent System Operator, or MISO. Located outside of Indianapolis, Indiana, the MISO is expected to take over essentially all transmission planning functions currently conducted by MAPP. Currently, eight of the eleven members responsible for this report have either joined the MISO or filed conditional applications for membership.[5]

According to the Midwest Independent System Operator enabling agreement (the "MISO Agreement") that has been signed by its members, the MISO will be organized as a non-stock, not-for-profit corporation. Participating transmission owners are required to transfer to the MISO functional control over all "network" transmission facilities – generally those transmission facilities above 100 kV. The MISO will be authorized to provide non-discriminatory open access transmission service over the transmission system, to receive and distribute transmission revenues, and to be responsible for regional system reliability. The MISO's primary responsibilities will include ensuring reliability of the transmission system and administering a single, system-wide transmission tariff. The MISO will have *functional* control over the operation of the transmission system, which means that the utilities will continue to own and physically operate the facilities, subject to the MISO's direction. The MISO is scheduled to become operational as of December 15, 2001.

Of particular relevance is MISO's expected future role in regional transmission planning. The MISO planning process is expected to function very similar to the process currently undertaken by MAPP and its members. Like the MAPP Regional Plan, MISO is required to develop a long-range plan that will address both short-term and long-term regional transmission needs. The plan is intended to promote the efficient expansion of the transmission system under the control of the MISO and will be the result of a collaborative process with MISO members, transmission customers, regulatory agencies, and other interested parties. MISO terms its process as a "bottoms-up, top down" approach. In this regard, transmission owners will continue

[5] Alliant Energy, parent company of Interstate Power, and Xcel Energy are currently members of MISO and on September 28, 2001, in conjunction with several other companies, filed with the FERC to have the MISO provide unbundled regional transmission service for members of TRANSLINK, a proposed independent transmission company. Minnesota Power, Missouri River Energy Services, and Otter Tail Power Company are MISO members and Great River Energy, Dairyland Power Cooperative, and Southern Minnesota Municipal Power Agency have signed conditional membership applications.

to have primary responsibility for developing their system-specific plans, which will then be consolidated by MISO to develop the overall integrated MISO transmission plan. Much like MAPP's regional planning, the MISO planning process will allow for all projects with regional and inter-regional impact to be analyzed for their combined effects.

The MISO intends to develop the overall regional and inter-regional plan by incorporating, and modifying if appropriate, plans generated from multiple sources, including

- Transmission owners and regional planning groups, such as MAPP's SPGs;
- Plans developed through studies associated with requests by customers for firm transmission service;
- Plans developed through studies associated with requests for interconnection of generators;
- Plans developed by MISO to meet intra-regional needs; and
- Plans developed with other RTOs to meet inter-regional needs.

Once a plan is proposed, the MISO intends to seek technical input from member stakeholders through what it has termed its Planning Support Group. The Planning Support Group is an advisory group of MISO members that advise, guide, and provide recommendations to MISO. The proposed plan, modified as appropriate, will then be presented to the MISO Planning Advisory Committee ("PAC") for further input. The PAC will consist of one member from each of the following groups:

- transmission owners;
- transmission-dependent utilities;
- independent power producers and exempt wholesale generators;
- power marketers and brokers;
- end-use customers;
- state regulatory authorities;
- consumer groups; and
- environmental groups.

In summary, the proposed MISO process - like the MAPP planning process - is intended to ensure that the overall MISO transmission plan will receive the proper scrutiny and review from all interested parties and that the Midwest transmission system continues to be highly reliable.

**Electric and Magnetic Fields (EMF)**

Like every human action, transmission projects have some impact on the environment. Because no project priority listings are being sought in this filing, environmental issues associated with a particular facility or project are best

addressed on a case-by-case basis as they are brought before the Commission in separate dockets. Because it will be of concern to most all transmission projects wherever located, particularly in and around metropolitan areas, however, and because the issue has surfaced in preliminary discussions, it seemed appropriate to include some discussion here on the issue of power frequency electric and/or magnetic fields (EMF).

EMF exists wherever there is a flow of electric current. Common sources of EMF include electrical wiring in homes, offices and other buildings, electric equipment and appliances, and electric power distribution and transmission lines. As the Commission is aware, since the late 1970's, hundreds of scientific studies have been conducted in the U.S. and other countries to examine whether exposure to power frequency EMF adversely affects human health. This large body of research has been reviewed by many scientific panels and organizations. Most recently, the EMF research has been reviewed by the U.S. National Academy of Sciences, the U.S. National Institute of Environmental Health Sciences, the California EMF Program, the U.K. National Radiological Protection Board, and the International Agency for Research on Cancer.

***U.S. National Academy of Sciences – 1999***

In 1999, the National Research Council of the National Academy of Sciences (NAS) issued a report[6] summarizing the results of the 6-year national EMF research program, the Electric and Magnetic Fields Research and Public Information Dissemination Program (EMF-RAPID). The EMF-RAPID program was initiated by Congress in 1992 at a cost of over $40 million, a significant portion of which was provided by electric utilities. Overall, the NAS concluded that "[t]he results of the EMF-RAPID program do not support the contention that the use of electricity poses a major unrecognized public-health risk." Other essential conclusions from the NAS Report include:

- "The outcomes of the animal experiments completed under EMF-RAPID, like those conducted elsewhere, do not support the hypothesis that MF [magnetic field] exposure is involved in the carcinogenic process."
- "The *in vitro* results, for the most part, do not show effects that can be demonstrated as resulting from MF exposures at the field intensities that were explored. Few studies showed effects; the few reported effects were small and their connection to disease processes are speculative at best and irrelevant at worst."

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[6] *Research on Power Frequency Fields Completed Under the Energy Policy Act of 1992,* Committee to Review the Research Activities Completed Under the Energy Policy Act of 1992, Board on Radiation Effects Research, Commission on Life Sciences, National Research Council. National Academy Press, 1999.

- "The results of the *in vivo* studies do not support an MF effect on cancer initiation, promotion, or progression, and they should be recognized as important studies in the overall evaluation of potential carcinogenic effects of MFs."

- "In view of the negative outcomes of EMF-RAPID replication studies, it now appears even less likely that MFs in the normal domestic or occupational environment produce important health effects, including cancer."

***U.S. National Institute Of Environmental Health Sciences – 1999***

In 1999, the Director of the National Institute of Environmental Health Sciences (NIEHS) prepared a report on EMF health research, required by the U.S. Congress for completion of the EMF-RAPID program, which NIEHS administered.[7] This report reviewed the results of the EMF-RAPID program as well as the existing body of EMF research. While noting that reports of possible associations from epidemiology studies of childhood and adult leukemia could not be entirely dismissed, the NIEHS Director concluded overall that "[t]he scientific evidence suggesting that ELF-EMF exposures pose any health risk is weak." The NIEHS Director also concluded that "the level and strength of evidence supporting ELF-EMF exposure as a human health hazard are insufficient to warrant aggressive regulatory actions." Other key conclusions from the NIEHS Director's Report include:

- "The NIEHS believes that the probability that ELF-EMF exposure is truly a health hazard is currently small."

- "[B]ased on evidence to date, ELF-EMF exposure would not be listed in the [NIEHS] 'Report on Carcinogens' as an agent 'reasonably anticipated to be a human carcinogen.'"

- "The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal, scientific support that exposure to this agent [EMF] is causing any degree of harm."

- "None of the individual epidemiological studies provides convincing evidence linking magnetic field exposure with childhood leukemia."

- "Virtually all of the laboratory evidence in animals and humans and most of the mechanistic work done in cells fail to support a causal relationship between exposure to ELF-EMF at environmental levels and changes in biological function or disease status."

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[7] *NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields, Prepared in Response to the 1992 Energy Policy Act (PL 102-486, Section 2118).* National Institute of Environmental Health Sciences, National Institutes of Health, NIH Publication No. 99-4493, 1999.

### *California EMF Program – Draft Report 2001*

In 2001, the California EMF program released a draft report on power frequency EMF.[8] This draft report was prepared by three staff scientists with the California EMF program and provides their *individual* views as to whether EMF is related to 13 health endpoints, including leukemia, breast cancer, brain cancer, Alzheimer's disease and miscarriage, among others. The draft report bears a prominent warning "do not cite or quote." The three authors offer a range of opinions, some of which classify EMF as a "possible" cause of childhood and adult leukemia, adult brain cancer, miscarriage and amytrophic lateral sclerosis (ALS). The draft report also includes the subjective "degree of confidence" held by each of the three authors as to the possible relationship between EMF and the 13 health endpoints.

The draft report was released for public comment in July and approximately 80 sets of comments were submitted. A number of the comments submitted by scientists raise significant concerns about fundamental flaws in the methodology and analysis used in the draft report. The California EMF program has stated that revisions to the draft report will incorporate responses to the public comments. There is no set timetable for preparation and release of a final report.

### *U.K. National Radiological Protection Board – 2001*

In 2001, the U.K. National Radiological Protection Board's (NRPB) Advisory Group on Non-Ionizing Radiation (AGNIR) issued a comprehensive review of research conducted on power frequency EMF and cancer.[9] AGNIR is chaired by Sir Richard Doll, the prominent epidemiologist who first identified the association between cigarette smoking and lung cancer. The overall conclusion of the NRPB report is that while there is a "possibility" that "intense and prolonged" exposure to EMF could be associated with a small risk of childhood leukemia, neither the laboratory nor the epidemiological research support a firm conclusion that exposure to power frequency EMF causes childhood leukemia. Other key conclusions include:

- "In the absence of clear evidence of a carcinogenic effect in adults, or of a plausible explanation from experiments on animals or isolated cells, the epidemiological evidence is currently not strong enough to justify a firm conclusion that such fields cause leukemia in children."

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[8] *An Evaluation of the Possible Risks from Electric and Magnetic Fields (EMFs) from Power Lines, Internal Wiring, Electrical Occupations and Appliances*, Draft 3 for Public Comment, April 2001. California EMF Program, 2001.

[9] *ELF Electromagnetic Fields and the Risk of Cancer, Report of an Advisory Group on Non-ionizing Radiation*. National Radiological Protection Board, Vol. 12, No. 1, 2001.

- "There is no reason to believe that residential exposure to electromagnetic fields is involved in the development of leukemia or brain tumours in adults."

- "Overall, no convincing evidence was seen from a review of a large number of animal studies to support the hypothesis that exposure to power frequency electromagnetic fields increases the risk of cancer."

- "Laboratory experiments have provided no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer..."

***International Agency For Research On Cancer – 2001***

In June 2001, the International Agency for Research on Cancer (IARC) conducted a cancer evaluation of power frequency EMF. The evaluation was conducted by a Working Group of 21 scientists from the U.S., Europe and other countries. The final report of the IARC evaluation is expected to be available in 2002. However, IARC has released a summary of the Working Group's conclusions.[10] The Working Group concluded that based on "limited evidence" from epidemiology research on childhood leukemia, power frequency magnetic fields should be considered "possibly carcinogenic" and that there is "inadequate" evidence of any relationship between EMF and any other form of childhood cancer or any adult cancer. The Working Group also concluded that the animal research is "inadequate" to demonstrate a cancer role for EMF and that there is no established "scientific explanation" for any causal relationship between power frequency EMF and cancer.

***Summary Conclusions***

The prevailing view of these recent reviews of EMF is that while there remains a possible relationship between EMF and cancer, principally childhood leukemia, the evidence to date is insufficient to conclude a relationship between power frequency EMF and any disease or illness. Which is why the industry as a whole continues to be involved in research and study on the health and other effects of EMF. This includes all areas of public concern, including studies on leukemia, breast cancer, neurodegenerative and cardiovascular diseases and methodological modeling of biophysical processes, among others. Other research continues to investigate technologies that will help lower exposures even further. Minnesota's utilities are committed in their continued funding, monitoring and research review on EMF and will continue to incorporate EMF into the planning and operation of transmission facilities. Work will also continue on providing information to the public, interested customers and employees.

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[10] *Static and Extremely Low Frequency Electric and Magnetic Fields – IARC Monographs on the Evaluation of Carcinogenic Risks to Humans.* IARC, Vol. 80, in preparation, summary statement on IARC web-site.

## Need for Rulemaking

On October 23, 2001, the Commission formally considered a petition for rulemaking submitted by John and Laura Reinhardt. After hearing from the Reinhardts and others, the Commission denied the petition in so far as it requested that rulemaking be undertaken prior to November 1, 2001. Although concerned about the impact a rulemaking would have on Commission resources, the Commission agreed that at least some rulemaking was inevitable. It asked the Department of Commerce to convene an advisory group and to report back no later than January 15, 2002. While undoubtedly resource-intensive, rulemaking may present all interested parties with an opportunity to work through how the new planning process can best achieve its intended purpose to streamline the permitting process by engaging people early on and eliminating regulatory redundancy.

A rulemaking will also provide an opportunity to reexamine the Commission's existing certificate of need rules – rules written for a very different electric industry than the one that exists today. One issue raised is the type of notice to be provided local governments and potentially affected landowners. Obtaining public involvement is one of the central tenets of the new law and establishing a reasonable mechanism by which to do that is an important step. Another will be to reach locate and strip out regulatory redundancies that are either irrelevant or can be better addressed in other contexts such, as the resource planning process. The Department's advisory group is a sensible first step toward rulemaking and the state's transmission owners look forward to participation with other stakeholders.

## Additional Resources

Further information on issues affecting transmission may be found at the following Websites:

- American Public Power Association: **http://www.appanet.org**
- Edison Electric Institute: **http://www.eei.org**
- Electricity Consumers Resource Counsel: **http://www.elcon.org**
- Electric Power Research Institute: **http://www.epri.com**
- Electric Power Supply Association: **http://www.epsa.com**
- Federal Energy Regulatory Commission: **http://www.ferc.gov**
- Minn. Department of Commerce: **http://www.commerce.state.mn.us**
- Minn. Public Utilities Commission: **http://www.puc.state.mn.us**

- National Association of Regulatory Utility Commissioners: **http://www.naruc.org**
- National Rural Electric Cooperative Association: **http://www.nreca.org**
- North American Electric Reliability Council: **http://www.nerc.com**
- Wind on the Wires: **http://windonthewires.org**

# III. TRANSMISSION STUDIES AND PROJECTS

Summarized below are transmission studies that are either completed or ongoing in Minnesota as of November 1, 2001 and relevant to future transmission improvements. The studies identify system inadequacies and examine alternative methods of addressing each inadequacy. The studies are organized by region of the state in the following order: Twin Cities Metropolitan Area, Southwest Minnesota, Southern Minnesota, Northwest Minnesota, and Northeast Minnesota. Following each study are descriptions of proposed transmission projects and alternatives being considered to address the system inadequacies. A summary table of the studies and projects are listed on Appendix No. 1.

➢ **Designates a transmission study**
♦ **Designates a transmission project**

# A. TWIN CITIES METROPOLITAN AREA: CENTRAL METRO

- **Northern States Power Company Long-Range Delivery System Study, (2000): Central Twin Cities Area**

This study captures the electric delivery system deficiencies in the central portion of the Minneapolis/St. Paul Metro area based on then available load forecasts. The technical analysis indicates that various transmission and distribution system improvements will be necessary during the next fifteen year period (2000-2015) to serve load and maintain system reliability. The study's recommendations are based on technical, engineering, and economic considerations and are intended to be a starting point in considering all other aspects of examining the identified alternatives. These aspects may include further evaluation of alternatives, land use considerations, government relations, environmental issues, right-of-way considerations, regulatory issues, system operability, etc.

Substantial electric load addition (approximately 500 MVA) is anticipated in the Central Twin Cities metro area by 2005. This necessitates significant capital investments in the near future to provide adequate load serving capability. Powerflow analysis has indicated that various transmission system improvements will be necessary in this area to serve load during the study period.

- **Goose Lake – Lexington Reconductor**

The loss of both Terminal 345/115 kV transformers causes excessive loading on the Goose Lake-Vadnais Heights-Lexington 115 kV circuit beginning in the early 2000's. These overloads are more severe during off-peak conditions when Riverside generation will likely be off-line due to economic reasons. The proposed resolution is to reconductor Goose Lake-Vadnais Heights-Lexington 115 kV line to higher capacity during the early 2000's in order to mitigate contingent loading. An option to this project would be to double circuit the existing line to carry more through flow. This would be more expensive. The **Northern States Power Company Long Range Delivery System Study Central Twin Cities Area**, published in February 2000, describes this project in detail. The study was reviewed and updated in Spring 2001. No certification is required.

- **Long Lake – Baytown 115kV Upgrade**

Outage of the adjacent double-circuit 345 kV line (King-Chisago Co & King-Kohlman Lake circuits) may excessively load the existing Long Lake-Baytown 115 kV circuit beginning in the early 2000's. This project involves installing a second set of conductors on existing double-circuit 115 kV structures, thereby transforming the existing circuit into a bifurcated circuit with twice the capacity. Due to the low cost of conductoring an existing open circuit, no economically feasible alternatives have been identified. No certification is required.

- Designates a transmission study
- Designates a transmission project

### ♦ Tanner's Lake – Woodbury Reconductor

Loss of either end of the Long Lake to Red Rock 115 kV line causes the middle section from Tanner's Lake – Woodbury to overload due to increasing loads by the early 2000's. The proposed solution to this problem is to reconductor the 115 kV line from Tanner's Lake – Woodbury with 795 ACSS conductors, which have a summer rating of 310 MVA. Although construction of a new 115 kV line into Tanner's Lake substation would eliminate this need, this alternative was not pursued due to cost. The **NSP Long-Range Delivery System Study Central Twin Cities Area**, published in February 2000, describes this project in greater detail. The project was re-examined in Spring 2001 to verify need. Certification is not required or requested.

### ♦ Downtown St. Paul Area – Dayton's Bluff – Battle Creek Project

The core St. Paul area is served by three main transmission sources: the Terminal- Western, Terminal – Prior and Rogers Lake- High Bridge 115 kV lines. Outage of the Terminal – Western 115 kV line causes the 115kV line from Dayton's Bluff – High Bridge to load above acceptable limits beginning in the early 2000's. There are also numerous multiple outage, thermal loading problems in the downtown St. Paul Area involving the failure of the other sources. A special concern with this area is that downtown St. Paul network feeders are fed off the Dayton's Bluff Substation. With today's transmission substation design at Dayton's Bluff, the full reliability capabilities of the network cannot be provided. Reconductoring the 115 kV Minneapolis/St Paul system on a line by line basis as the loads continue to grow is one alternative solution. Over 20 miles of 115kV equipment would have to be reconductored or rebuilt to double circuit early in the decade.

The proposed resolution includes construction of a new 115 kV line from Dayton's Bluff to Battle Creek. This line will tie together these two 115 kV systems, and give another source to the area from Red Rock. The line is approximately 1.5 miles long and would be built to a 310 MVA summer rating. To handle the new post-contingent through flows, the existing 4 mile 115 kV line from Red Rock to Battle Creek would also be reconductored to a higher capacity and the two 345/115 kV 448 MVA transformers at Red Rock would be upgraded to 672 MVA units. These transformers will need to be replaced regardless of this new line. (See next project). Constructing this line relieves the overloads that the previously proposed Terminal to Fairview (new sub) to Western line would solve. This solution also defers or eliminates the need for a number of 115 kV line rebuilds and double circuits in the area. The new Dayton's Bluff – Battle Creek line was chosen as the least cost, most effective solution to the thermal overloads in the area.

One alternative that was reviewed included a new 115 kV line from Terminal to Fairview (new distribution substation) and on to Western. This plan included both transmission and distribution need, but was rejected because of substation location

did not meet distribution needs. Other alternatives included construction of a new 115 kV line from Dayton's Bluff to Tanner's Lake. Due to post-contingency through flows with this new circuit, the new Red Rock transformers are still needed, as well as reconductoring the Woodbury - Tanner's Lake – Oakdale - Long Lake. While this alternative achieves the same reliability results, it requires a longer new circuit - 7 miles versus 1.5 miles, and involves 12.4 miles of reconductoring versus 4 miles.

Support for the project can be found in the St. Paul Area Analysis, June, 2001. No certification is required.

- **Red Rock 345/115kV Transformers Upgrade**

Continued load growth cause the two 448 MVA 345/115kV transformers at Red Rock Substation in St Paul to load above acceptable limits during area transmission outages beginning in the early 2000's. Addition of the proposed Dayton's Bluff – Battle Creek 115kV circuit raises the loading on these transformers, causing needed transformer upgrades. The need for upgrades is a fundamental capacity issue in order to reliably deliver power from the 345 kV loop into the Twin Cities 115 kV network. The proposed upgrade includes the two 448 MVA units to 672 MVA units. This upgrade will not change the footprint of the Red Rock substation. The proposed schedule for this project is to install the transformers along with the construction of the Dayton's Bluff – Battle Creek line.

Any reasonable alternative would involve a new substation which would be significantly more expensive and require the development of new 115 kV corridors to interconnect with the existing 115 kV network. As a result, no alternatives where pursued. Support for the project can be found in the St. Paul Area analysis, June, 2001.

- **Aldrich – St Louis Park Reconductor**

For transmission outages in the Minneapolis area, the Aldrich – St. Louis Park 115kV circuit can load above acceptable limits. In addition, a review of the design assumptions of this old line has revealed a 40 MW reduction in its thermal capability. The proposed resolution is to reconductor the Aldrich – St. Louis park 115kV line to a summer rating of 310 MVA by the mid 2000's. This will be an increase of 176 MVA, rating the line at more than double the original 142 MVA.

Only construction of a new 115 kV line into St. Louis Park or Edina Substations from a northern or western source would eliminate the need for this project. As these would be substantially more expensive than a simple reconductor, they where not pursued. Support for this project can be found in **the NSP Long-Range Delivery System Study Central Twin Cities Area**, February 2000, and updated in Spring 2001. Certification for this project is not required.

- ➢ Designates a transmission study
- ♦ Designates a transmission project

- **Downtown Minneapolis Transmission Study- (Fifth Street-Main Street capacity upgrade) - XEL**

The study set out to examine alternatives to alleviate the Fifth Street-Main Street Loading issues that would not create new issues with the network of underground transmission lines out of Fifth Street. Also, there needs to be a new look at how the load growth may be handled in the downtown area as transmission. A project had been proposed for 2001 to add cooling to the Fifth Street – Main Street 115kV underground line to relieve thermal overloads caused by single contingencies. However, analysis determined the expected capacity increase was not feasible and the area needs to be restudied to find a new solution. This study has not been started and will is expected to be completed by Spring, 2002.

## B. TWIN CITIES METROPOLITAN AREA: SOUTHEAST METRO

- **Northern States Power Company Long-Range Delivery System Study, (2000): Southeast Twin Cities Area**

This study captures the electric delivery system deficiencies in the Southeast Region of the Minneapolis/St. Paul Metro area based on the most recent load forecast. The technical analysis indicates that various transmission and distribution system improvements will be necessary during the next fifteen year period (2000-2015) to serve load and maintain system reliability. The recommendations in this study are made based on technical, engineering, and economic considerations and is intended to be a starting point in considering all other aspects of the recommended alternatives. These aspects may include further evaluation of alternatives, land use considerations, government relations, environmental issues, right-of-way considerations, regulatory issues, system operability, etc.

This region is experiencing growth slightly higher than the Xcel Energy Metro Area with approximately 67.2 MVA of load growth anticipated over the next five year period. This necessitates capital investments in the near future for proper load serving capability.

- **Air Lake-Vermillion River-Empire 115 kV Development, 2nd Inver Hills- Koch Refinery**

Southeastern Dakota County is experiencing housing and commercial development. Much is occurring near Lakeville and Farmington. The primary source of electrical service to this region is from the north via the Twin Cities transmission grid. Both 115 kV and 69 kV transmission are used to deliver power south to this area from the Twin Cities system, with the primary transmission substations of Black Dog 115 kV, Pilot Knob 115-69 kV and the Inver Hills 345-115 kV.

- Designates a transmission study
- Designates a transmission project

Lakeville is served from the Xcel's Air Lake 115-13.8 kV distribution substation with the surrounding area served by Dakota Electric Association's Lake Marion 69-12.5 kV and Dodd Park 115-12.5 kV stations. The primary transmission source is the Black Dog- Riverwood- Burnsville- Dakota Heights- Lake Marion- Faribault and the Johnny Cake- Dodd Park- Air Lake- Lake Marion 115 kV lines. Further east the city of Farmington and its surrounding area is served by Xcel Energy's Farmington 69-13.8 kV substation and Dakota Electric Association's Farmington 69-12.5 kV substation. The Primary transmission sources are the Lake Marion- Farmington and Pilot Knob- Farmington 69 kV line.

There are a number of electrical issues associated with the 69 kV transmission and distribution systems in this area.

- The Xcel Energy Farmington Substation has physical restrictions.
- Reliable capacity of the Air Lake Substation is 42 MVA - a load level expected within the next few years.
- Dakota Electric's Farmington Substation transformer cannot reliably back up other area substations. Within two to three years, the substation will exceed its normal loading capability.
- Xcel's service territory between Rosemount and Farmington is sparsely developed but has significant growth potential, with no nearby distribution sources.
- The 69 kV transmission system serving the Farmington area is limited by the capacity of the Pilot Knob-Farmington 69 kV line. Outage of the Black Dog- Riverwood 115 kV line (primary source to the Lake Marion 115-69 kV station) in the early 200s results in excessive loading of the Pilot Knob-Farmington, due partially to loads served further south. Outage of the Lake Marion-Farmington 69 kV by late 200s also loads the Pilot Knob – Farmington 69 kV alternate source above acceptable limits.

This is a joint development plan with Dakota Electric Association and Great River Energy. A new distribution substation site will be developed near Farmington and used jointly by Xcel Energy and Dakota Electric, and developed for 115 kV transmission service, which will reduce the load and future load growth on the 69 kV system. The steps are as follows:

A new substation site (Vermillion River) will be developed for Dakota Electric's 115-12.5 kV distribution station. During construction, a new 115 kV line will be built from Vermillion River to Empire (a new Dakota Electric substation on the Rosemount-Cannon Falls 115 kV line approximately 5 miles east of Farmington). In 2004, the Air Lake-Farmington 69 kV line would be rebuilt double circuit 115 kV with one circuit going to Vermillion river and operated at 115 kV. Excel will add it's 115-34.5 kV Vermillion River distribution station during the mid-2000's.

➢ Designates a transmission study
♦ Designates a transmission project

In the late 2000's, the plan calls for the addition of a second Inver Hills- Koch Refinery 115 kV line. This addresses possible outages of the existing Inver hills-Koch Refinery 115 kV line or the Black Dog- Burnsville 115 kV line. There are a number of reasons that support the need for the proposed project: the immediate need of Dakota Electric to increase the capacity of its Farmington transformation (along with the need to rebuild the substation) allowing for conversion to 115 kV; Xcel's near term need to add a new substation; significant load growth; the 69 kV plan reaches the end of its capability near the end of the study period and does not provide for any future expansion capability.

The main alternative is to continue adding load to the 69 kV system. This would require a rebuild of the existing Pilot Knob- Farmington 69 kV line to high capacity 69 kV. A large capacitor bank would also be needed at Air Lake for voltage support to the area 115 kV. By 2009, the alternative would require either a second Black Dog-Burnsville or Inver Hills-Koch Refinery 115 kV line for outage of either the existing Inver Hills-Koch Refinery 115 kV line or the Black Dog-Burnsville 115 kV line. Dakota Electric would expand the existing Farmington substation and Xcel would create a new area 69-13.8 kV substation.

The Inver Hills-Koch Refinery 2nd 115 kV line is one alternative which will be further reviewed in the future along with other alternatives as the need gets closer.

Dakota Electric, Great River Energy and Xcel Energy are working together to develop the necessary permit applications for these facilities and anticipate filing a certificate of need application with the Commission in 2002.

Support for this project can be found in **the NSP Long-Range Delivery System Study Southeast Twin Cities Area**, March 2000.

### ♦ Red Rock-Stockyards-Rogers Lake Rebuild

The existing, 1920's-vintge, Red Rock-Stockyards-Rogers Lake 115 kV line is subject to overloading for several line and generation contingencies. The proposed resolution is double-circuit rebuild of the Red Rock-Rogers Lake 115 kV line. The replacement double-circuit line will eliminate the overload of the existing circuit and relieve numerous other first- and second-contingency transmission system overloads throughout the central and southern Twin Cities area during both peak and off-peak conditions. Detailed power-flow analysis of projected Summer 2004 conditions determined that the proposed project would eliminate 97 of the 106 identified possible overload conditions arising from single- and double-contingency conditions. Magnetic field strengths also would be reduced by the new double-circuit line.

Alternatives analyzed consisted of route alternatives and system alternatives. The route alternatives would establish a Red Rock-Rogers Lake 115 kV circuit, but using other routes. Since the proposed (existing) route is nearly straight-line, all the

alternatives routes are longer, thereby affecting more landowners. The route alternatives also make less use of existing transmission corridors. System alternatives studied involved establishing improved 115 kV transmission capacity into the Rogers Lake area from various other sources. These system alternatives were determined to be ineffective in addressing many of the identified overload conditions, despite higher installed costs.

Support for the project can be found in the **SE Metro Project CAI's Independent Review & Executive Summary Red Rock-Wilson 115 kV TX line**; Presentation to Transmission Line Steering committee (Red Rock- Wilson 115 kV Upgrade) March 22, 2001.

This project is presently in the permitting process with the local governments.

- ♦ **Wilson-Bloomington-Airport-Rogers Lake 115 kV**

The existing line, constructed in 1924 and reconductored in the late 1980's, is subject to overload under several single- and double-contingency conditions. The most severe contingencies are loss of both the Eden Prairie 345/115 kV transformers or outage of the Eden Prairie-Edina and Edina-St Louis Park 115 kV circuits. Failure of the Airport-Rogers Lake portion and the Edina-Nine Mile Creek line also causes overload of the Elliot Park-Southtown 115 kV line. Finally, a portion of the Wilson-Bloomington-Airport section of the line also needs to be rebuilt as an underground circuit due to the runway addition associated with the current expansion of the Minneapolis-St. Paul International Airport.

The proposed resolution is a rebuild of the Wilson-Rogers Lake line. The first section near Wilson Substation (double-circuited with one of the three Black Dog-Wilson 115 kV circuits) has already been rebuilt to accommodate road improvements. Proceeding eastward, the line will be rebuilt (a portion underground) as a single circuit line to the site of the new East Bloomington Substation. From East Bloomington eastward (past Airport Sub) to Rogers Lake, the line is proposed as double-circuit 115 kV to establish a new East Bloomington-Rogers Lake circuit.

Several 115 and 345 kV transmission alternatives were investigated. All would be more costly and involve significantly greater environmental impact, as they involve additional substation developments and/or new or expanded line rights-of-way.

Support for the project can be found in the **Bloomington Area Long Range Delivery System Planning Study, 1998**; and **SE Metro Project CAI's Independent Review & executive Summary Red Rock- Wilson 115 kV TX line**; Presentation to Transmission Line Steering committee (Red Rock- Wilson 115 kV Upgrade) March 22, 2001.

- ➢ Designates a transmission study
- ♦ Designates a transmission project

Portions of the project are presently under construction to accommodate airport expansion. Other portions are in local permitting processes. No certification is required.

- **Bloomington Area Long Range Delivery System Planning Study (1998)**

This study examined the required transmission developments necessary to accommodate the airport runway expansion plans and other projected load growth in the region of the Bloomington Substation and other first tier suburbs of southeast St. Paul. An independent consultant (CAI) also performed a review of the plans for the area, and the results of this review were summarized and interpreted in a subsequent presentation to the Steering Committee comprised of the mayors of Sunfish Lake, West St. Paul, and South St. Paul. Related studies include: **SE Metro Project CAI's Independent Review & Executive Summary Red Rock-Wilson 115 kV TX line (2001)**, Presentation to Transmission Line Steering Committee (Red Rock-Wilson 115 kV Upgrade (2001). Complete

## C. TWIN CITIES METROPOLITAN AREA: SOUTHWEST METRO

- **Northern States Power Company Long-Range Delivery System Study, (2000): Southwest Twin Cities Area**

This study captures the electric delivery system deficiencies in the Southwest Region of the Minneapolis/St. Paul Metro area based on the most recent load forecast. The technical analysis indicates that various transmission and distribution system improvements will be necessary during the next fifteen year period (2000-2015) to serve load and maintain system reliability. The recommendations in this study are made based on technical, engineering, and economic considerations and is intended to be a starting point in considering all other aspects of implementing the recommended alternatives. These aspects may include further evaluation of alternatives, land use considerations, government relations, environmental issues, right-of-way considerations, regulatory issues, system operability, etc.

This region is experiencing rapid growth (especially the Eden Prairie – Minnetonka – Hopkins area) with substantial electric growth (approximately 156 MVA) anticipated during the next five-year period. This necessitates substantial capital investments in the near future for proper load serving capability.

- **Westgate–Glen Lake–Gleason Lake 115 kV circuit**

The Minnetonka–Hopkins–Eden Prairie area is experiencing significant growth which has resulted in both transmission and distribution capacity and voltage contingency concerns. The primary source for this area is Eden Prairie Substation. By the early to mid 2000's, loss of the existing Eden Prairie transformer together with certain 115 kV line outages causes the remaining transformer at Eden Prairie to

- Designates a transmission study
- Designates a transmission project

overload. Outage of the double circuit line between Westgate and Eden Prairie results in low voltage on the 69 kV system served out of Westgate Substation.

The proposed plan is to convert the existing Westgate-Glen Lake-Gleason Lake line from 69 kV to 115 kV using 795 SSAC conductor to yield 310 MVA summer rating. All viable alternatives involve building new 115 kV lines, which would require conversion of a number of distribution substations. Support for the project can be found in the **Glen Lake Substation Expansion report, July 1998** and the **Northern States Power Company Long-Range Delivery System Study Southwest Area, February 2000**. Issues surrounding substation siting have delayed this project. A review will be instituted shortly to update information. The project will be submitted to the Commission separately for a certificate of need early in 2002.

- **Carver County 2nd 115-69 kV Transformer**

Outages of the 115-69 kV transformer at St. Bonifacius can result in excessive loading to the Carver County transformer. However, by the early 2000's, the main concern is outage of the existing Carver County 115-69 kV transformer. This can result in low voltage over much of the nearby 69 kV system, particularly around Glencoe, as alternate supplies are from distant back up sources.

This area was last studied in 1998. At that time, the recommendation was to create a new West Waconia 115-34.5 kV substation and add a second Carver Co. 115-69 kV 70 MVA transformer. The West Waconia substation has been added and the Carver County transformer is proposed for the early 2000's. The second transformer was chosen over the alternatives because of their relatively high cost compared with the transformer addition.

All alternatives involved building new 115 kV lines, which required the conversion of a number of distribution substations. Support can be found in the **Long-Range Delivery System Plan, Greater Minnesota Study Northwest Area Report, 1998**. No certification is required.

♦ **Eden Prairie-Edina/Eden Prairie-Wilson 115 kV**

By the late 2000's, the existing Eden Prairie-Edina 115 kV line is subject to unacceptable loading under several contingencies. The outage of the existing Eden Prairie-Edina line is also a cause of unacceptable loading on other 115 kV lines, in particular: (1) Elliot Park-Southtown during outage of Eden Prairie-Edina and either the Edina-St Louis Park or Terminal-Western 115 kV; and (2) High Bridge-Merriam Park during outage of Eden Prairie-Edina and Terminal-Western 115 kV. The proposal is to reconductor and de-bifurcate the existing Eden Prairie-Edina-Wilson line to create a new Eden Prairie-Wilson 115 kV circuit. This is Substantially less expensive than establishing a 345/115 kV substation at Black Dog site or equivalent alternative. Further review will be done as need becomes more imminent.

➢ **Waconia Area Load Serving Study (2002) - XEL**

Previous studies have identified voltage and capacity concerns with the 115 and 69 kV transmission system serving the area around Waconia. This analysis will determine the long-range transmission needs and proposed transmission reinforcements for this area. This is a subset of the **GRE/Xcel Energy Long-Range Plans Study** and will be initiated in 2002.

## D. TWIN CITIES METROPOLITAN AREA: NORTHWEST METRO

➢ **Northern States Power Company Long-Range Delivery System Study, (2000): Northwest Twin Cities Area**

This study captures the electric delivery system deficiencies in the Northwest Region of the Minneapolis/St. Paul Metro Area based on the most recent load forecast. The technical analysis indicates that transmission and distribution system improvements will be necessary during the next fifteen-year period (2001-2015) to serve load and maintain system reliability. The recommendations in this study are made based on technical, engineering, and economic considerations and are intended to be a starting point in considering all other aspects of evaluating the recommended alternatives. These aspects may include further evaluation of alternatives, land use considerations, government relations, environmental issues, right-of-way considerations, regulatory issues, system operability, etc.

The Northwest Region of the Twin cities has been growing steadily and significantly due to new residential and commercial business developments and is expected to grow by 142.1 MVA by 2005. System deficiencies are primarily driven by load growth, and any changes from the load forecast will affect the timing of these recommendations. Significant capital investments will be needed in the near future in order to provide adequate load serving capability. Major developments since the last delivery plan include increasing 345/115 kV transformer capability, increasing 115 kV outlets at Elm Creek Substation and enhancing the 34.5 kV distribution voltage at

Elm Creek and West Coon Rapids Substations. Substantial investments to eliminate 69 kV system deficiencies have been avoided in the Northwest Hennepin County Area by removing load from Hollydale and Orono Substations. Xcel Energy and GRE have coordinated their planning in this area to best identify long tern system requirements. GRE's proposed Elm Creek–Plymouth–Parkers Lake 115 kV line will relieve the Parkwood 115-69 kV overload. The study summarizes the investments to be made for the fifteen year planning period and estimates that 14 million dollars will be spent over the first five years. The investments will improve the transmission and distribution system.

- **Northwest Metro (2001) – Great River Energy**

The Wright-Hennepin Electric Cooperative (WHEC) Northwest Metro area has experienced tremendous growth, with annual growth rates over 5% projected to continue. The present 69 kV system is not adequate to support the future WHEC Northwest Metro distribution loads. Future loading will create overloaded transmission lines and low voltages during system intact and contingent events. In addition, the 69 kV transmission lines are long distances from sources, contributing to poor reliability. The affected WHEC distribution substations include the Arbor Lakes, Cedar Island 1 & 2, Corcoran, Bass Lake and Plymouth substations. Connexus Energy's Hennepin substation is also affected. Xcel Energy has also indicated a need for regional support to its Parkers Lake 115 kV system and an additional outlet line from its Elm Creek substation.

This study is looking at alternatives for serving this rapidly growing load. It was an extension the **NSP Long-Range Plan Metropolitan Study: Northwest Metro, 2000**. The study is ongoing.

- **Crooked Lake- Champlin Tap 115 kV**

Outages on the Coon Creek- Parkwood 115 kV line can excessively load the Crooked Lake-Champlin Tap 115 kV line during the mid 2000's. The proposed resolution is to reconductor the Crooked Lake-Champlin Tap 115 kV line to approximately 300 MVA Capacity. This is substantially less expensive than any feasible alternative. Support for the project can be found in the **NSP Long-Range Delivery System Study, Northwest Area, Vol. 1, February 2000**.

- **Elm Creek 345-115 kV 2nd Transformer**

By the mid 2000's, an additional 345-115 kV transformer is necessary for the area's 115 kV system load serving support. This will avoid contingency loading above acceptable limits of the underlying 115 kV transmission lines and existing345-115 kV transformers at Coon Creek and Elm Creek. A second 345-115 kV, 448 MVA transformer will be added in the mid 2000's at Elm Creek substation. This substantially less expensive than any feasible alternative, including the addition of a

- Designates a transmission study
- Designates a transmission project

third 345 kV transformer at Coon Creek and upgrading the 115 kV transmission to the north.

### ♦ Elm Creek-Osseo-Crystal-Indiana 115 kV

Presently there are three 115 kV lines from the Coon Creek 345/115 kV station southward to the Minneapolis area load center. By the late 2000's, loss of any two of the circuits will cause excessive loading on the remaining circuit. Loss of both Coon Creek 345/115 kV transformers can also cause excessive loading on the Terminal-Gopher-Main Street 115 kV circuit. Loss of one Coon Creek transformer and either a Terminal transformer or the largest generating unit at Riverside can cause excessive loading on the remaining Coon Creek transformer. There is an expected need by the late 2000's for a distribution substation in the Maple Grove/Brooklyn Center/Crystal/New Hope area near Interstate 694 and County Road 81. This "Crystal" substation would be a 115-13.8 kV distribution substation that would provide additional supply to the area and permit re-configuration of existing feeders. The Elm Creek Substation is designed for installation of a second 345/115 kV transformer to help supply growing loads in the northwest Twin Cities, but effective utilization of such capacity requires additional 115 kV outlet capacity from this site.

The proposed resolution is a rebuild of the Elm Creek-Osseo 115 kV to higher capacity (600 MVA) and construction of Osseo-Crystal-Indiana 115 kV line. This alternative engenders a yet-higher reliance on the Coon Creek 345/115 kV substation and the transmission corridor south of Coon Creek. It also does not address the Crystal area load-serving needs. Another shortcoming is the physical challenge of getting another transmission line into the existing Riverside Substation.

The alternative would require establishing a fourth Coon Creek-Minneapolis 115 kV circuit (Coon Creek-Riverside) and adding a third 345/115 kV 672 MVA transformer at Coon Creek. Support can be found in the **NSP Long-Range Delivery System Study, Northwest Area, Vol. 1, February 2000**. Timing of the project is not immediate.

### ♦ Parkers Lake-Gleason Lake 115 kV #1 & #2 Reconductor

Late in the decade excessive loading is expected on the above circuits following outage of the Parkers Lake-Eden Prairie double-circuit 345 kV line, or outage of either circuit and the Crow River-Medina 115 kV line. Reconductoring with ACSS conductor will increase the rating of each circuit to 310 MVA, approximately twice the present ratings of 167 MVA. This plan is substantially less expensive than any feasible alternative. Further review will be done as need becomes more imminent. Support can be found in the **NSP Long-Range Delivery System Study, Southwest Area, Vol. 1, February 2000**.

- ➢ Designates a transmission study
- ♦ Designates a transmission project

### ♦ Elm Creek—Plymouth—Parkers Lake 115kV line

Analysis of the existing transmission system, taking into account projected load growth patterns and physical system upgrade limitations, shows that short and long–term needs require construction of a 115 kV line from Xcel Energy's Elm Creek Substation to Xcel Energy's Parker Lake Substation. Distribution substations will be converted from 69kV to 115kV at Hennepin, Arbor Lakes, Cedar Island, Bass Lake, and Plymouth. New right of way will need to be acquired from Plymouth to Parkers Lake.

Alternatives include rebuilding the majority of the present 69 kV lines between Parkwood and Medina and several peripheral 69 kV lines. These lines and transformers would be uprated when required. Line capacity improvements, capacitor installations, new bulk substations, and substation capacity expansion would need to occur throughout the region, however, without significant reliability improvement.

Possible corridor evaluation and identification began in September 2001. Great River Energy and WHEC staff will meet with local jurisdictions during the last quarter 2001 and first quarter of 2002. Additional public involvement will include open house, public information meetings and ongoing meetings with appropriate governing and permitting bodies/agencies.

### ♦ Dickinson 115/69 kV Substation

The Mary Lake and Rockford distribution loads, consisting of expanding Twin Cities' suburban development, are on a long radial 69 kV line from the Corcoran Switching Station. The load on this line has grown such that no backup service is available. In addition, inadequate voltage occurs at Mary Lake during outages further east. Great River Energy is proposing to develop a Dickinson 115/69 kV, 48 MVA source at its existing 345/115 kV substation. This will provide a new 69 kV delivery point near the end of the long radial tap line. Minimal 69 kV line construction is needed. This source will provide improved reliability and voltage support.

Alternatives to the Dickinson source involve construction on new properties or longer 69 kV line construction. Alternatives would consist of new 69 kV lines from Buffalo or Lake Pulaski to Mary Lake. Any permitting will involve state, local and federal agencies and governing bodies.

## E. SOUTHWEST MINNESOTA

### ➢ GRE/XCEL Energy Long-Range Plan (Southwest Area) (1996)

This area covers the southwest corner of Minnesota roughly bordered by highway I-90 on the south, a north-south-line roughly between Blue Earth, Mankato,

➢ Designates a transmission study
♦ Designates a transmission project

and Glencoe on the east, and NSP's 230 kV line from Black Dog to Minnesota Valley on the north. The larger load center cities include Granite Falls, Mankato, Pipestone, and Madelia. SMMPA serves the city of Redwood Falls. Two other larger load centers are Marshall and New Ulm, both independent municipals. Most of the remaining smaller towns and rural areas are served by co-ops such as East River, Interstate Power Company, or independent municipals.

- **Southwest Minnesota/Southeast South Dakota Electric Transmission Study (2001)**

Subsequent to the GRE/Xcel Energy long-range study for southwestern Minnesota, Xcel Energy agreed with intervenors in its merger proceeding to examine the transmission requirements necessary to facilitate up to 825 MW of wind generation development on Buffalo Ridge. Xcel Energy led a study team of utilities serving the southwestern part of the state in that effort and regularly reported progress in MAPP Sub-regional Planning Group meetings. On August 17, 2001, Xcel Energy published a draft report that presented its findings ("**August 17 Draft Report"**).

Currently, there are 300 MW of nameplate wind powered generation on Buffalo Ridge. Previous work has determined that the electrical system is capable of accepting 260 MW of power in aggregate. Due to losses in the collection system and other factors, the 300 MW of production capacity has not exceeded the 260 MW system reliability limit to date. The study work performed and presented in the **August 17 Draft Report** found that any additional wind generation development on Buffalo Ridge will require substantial transmission improvements to ensure reliable system performance.

The study examined several different plans that could be implemented to accommodate additional wind development on the ridge along with other generation proposals in the area such as Fibrominn's 50 MW turkey litter fired facility in Benson. Each plan consists of a series of projects sequenced by the total number of megawatts of generation outlet capacity to be achieved.

The four system plans presented in the draft report represent a spectrum of approaches to the transmission expansion problem faced in the area. The first option would upgrade or reconductor existing lines and replace other components such as transformers as necessary to accommodate wind generation development as it occurs. The second plan looks at building a new 115 kV line from the Marshall area to Franklin Minnesota and further east. By doing so, the number of reconductoring projects can be reduced. However, because the plan would rely on the 69 kV and 115kV transmission system to move power from Buffalo Ridge, significant energy losses occur in the process. The third alternative looks at adding additional 115 kV and 161 kV lines to the second plan to improve efficiency. The fourth plan adds a new 345 kV line to the system between Sioux Falls and Lakefield Junction instead of

adding as many elements to the underlying 115 kV system. The 345 kV option significantly reduces the number of projects that have to be implemented to accommodate further wind development, transmits energy more efficiently than the other plans and addresses other potential load serving issues in the Sioux Falls area. Detailed listings of the components of the plans are presented in Appendix C of the **August 17 Draft Report**.

Xcel Energy believes the 345 kV plan is the best solution and intends to pursue permitting for the plan. The 345 kV line and some of the other elements of the plan require a certificate of need from the Public Utilities Commission. Xcel Energy plans to file its application for those facilities yet this year. In that filing, Xcel intends to present the results of the planning process, including all four of the alternatives that are presented in the above planning study. The August 17 draft will be finalized shortly.

- **Appleton – Dawson Load Serving Study**

This study evaluates existing transmission system capability and identifies future transmission expansion requirements for serving load increases in the Appleton and Dawson areas. Inadequacies addressed include the ability to serve load in the Appleton and Dawson area during single line outages. The study is just recently underway.

## F. SOUTHERN MINNESOTA

- **GRE / XCEL Energy Long-Range Plan (Southern Area) (1996)**

The southern Minnesota area is defined as a rectangular section of Minnesota generally bordered by the 345 kV line from Blue Lake to Wilmarth on the west, highway I-90 on the south, the Mississippi River on the east, and state highways 50 and 101 on the north. The larger Xcel (NSP) load centers include Northfield, Faribault, Red Wing, Waseca, and Winona/Goodview. Twenty-six single transformer, substations serve several small towns. Xcel service territory is approximately 35-40% of the land area. The other large load centers of Rochester, Lake City, and Owatonna are served by Southern Minnesota Municipal Power Agency ("SMMPA") with most of the remaining smaller towns and rural areas supplied by Great River Energy and Dairyland Power Cooperative. Re-examination of this study area is ongoing and will be revised in 2002.

- **Hastings – Alma Area Study (2001/2002)**

The above study has identified voltage and thermal limit problems in the Hastings to Alma area. A previous study from 1999, the Hastings/Alma Area Long-Range Draft, recommended upgrading the Spring Creek-Alma 69kV line to 161/69kV,

- ➢ Designates a transmission study
- ♦ Designates a transmission project

replacing existing Prairie Island 345/161kV 224 MVA transformer with a 448 MVA transformer, and installing two 14 MVAR capacitors in the Hastings 69kV system.

The 1999 study discussed a number of alternatives, including a Spring Creek-Alma 115kV, a Prairie Island-Alma 161kV, a Spring Creek-Alma 161 kV with double bundled conductor, a Prairie Island-Alma 161kV with double bundled conductor, and a Prairie Island-Columbus 345kV.

Another study of this area is scheduled to be completed in the winter of 2001/2002 to verify study results.

- **Preliminary Results of an Interconnection Study 250 MW of Combustion Turbine Generation near Faribault, Minnesota (2001)**

Xcel Energy received a request to add 250 MW of generation near Faribault by mid 2002. The addition of the generation on the 115kV at West Faribault caused several thermal overloads in the immediate area. The two West Faribault and the Loon Lake 115/69kV transformers are proposed to be upgraded, along with a two-mile 69kV line upgrade to a double circuit 115 kV (operated at 69 kV) from the West Faribault to Faribault substations. There will also be a 115 kV radial line from the generation plant site to the West Faribault substation

This project results of an Interconnection/System Impact Study performed by Xcel Energy to determine the feasibility of placing 250 MW of generation on the 115kV system in the Waterville, Minnesota area. Two alternatives were analyzed: interconnection directly on the 115kV line between Loon Lake and Porter Tap Substations, and interconnecting directly onto the West Faribault substation 115kV bus, with a 17 mile 115kV radial line from the Waterville site. The generation plant, however, is likely to be sited within one mile of the West Faribault substation.

Support for the project can be found in **Preliminary Results of an Interconnect Study for 250 MW of CT Generation Near Faribault, Minnesota, January 11, 2001**.

- **Adams 345/161 kV Transformer**

The existing 300 MVA unit is subject to near-nameplate loading during system intact conditions, and excessive loading during several 345 or 161 kV contingencies. Loading is dependent on bulk system power transfers and generation levels at Genoa, Pleasant Valley, and Rochester area. A formal study is planned in the coming year.

- ➢ Designates a transmission study
- ♦ Designates a transmission project

- **Mankato Loop and Mankato Twin Cities Corridor Study**

The Metro Mankato Corridor is defined between the southwest metro area, south to Mankato and extending east to encompass New Prague and Montgomery. There is a need to provide an additional transmission source into the Metro Mankato corridor in the early to mid 2000's. There are a number of concerns in this corridor. Outage of the Wilmarth-Traverse 69 kV line can result in low voltages in the Le Sueur area. Outages from Carver County can load the Wilmarth-Traverse 69 kV above acceptable limits. Outage of the Blue Lake-Wilmarth 345 kV line during heavy transfers can overload the Arlington–Traverse line above acceptable limits. The Metro-Mankato Corridor Transmission system upgrade is closely tied to the Mankato 115kV loop because of the limited potential to expand the Wilmarth substation. The most immediate concern is with the possibility of an on the 345 kV line. The proposal is to rebuild this line to higher capacity.

Previous studies have considered a number of improvements to the Metro-Mankato Corridor. The following is a list of options to be considered in upcoming study: addition of a new 345/115/69 kV substation near St. Thomas; rebuild Carver County-Mankato to 115 kV; rebuild Scott County-Mankato to 115 kV; and reconductor/rebuild various of 69 kV lines.

Support for this project can be found in the **Long-Range Delivery System Plan Greater Minnesota Study Southern Minnesota Area Report, June 1996.**

An updated Southern Minnesota Area Report, a subset of the Minnesota Outstate Long Range Plan is scheduled to be completed in the Winter of 2001/2002. This study proposes to reexamine and re-verify the need for the above projects. The study will address possible upgrades to the system to allow for additional wind generation.

- **St Peter Biomass Generation Outlet**

The 50 MW biomass fired generation facility is proposed to be located near St. Peter, Minnesota. The site is expected to be located adjacent to the existing 69 kV Traverse Switching Station, approximately 5 miles west of St. Peter.

Preliminary analysis indicates establishing adequate transmission outlet capacity for the proposed 50 MW facility would require rebuilding the existing north-south 69 kV transmission line from the Wilmarth substation to the Traverse Switching Station, to the Arlington Substation – a distance of approximately 32 miles. To coordinate with long-range transmission developments in this area, portions of the rebuilt line would likely be constructed to double-circuit 115/69 kV capability. Previous studies by Great River Energy and Xcel Energy had identified the desirability of establishing a 115 kV transmission system in this area – particularly

with respect to long-range load-serving needs in Le Sueur. Should this project go forward, a more detailed planning study would be required.

## G. NORTHWEST MINNESOTA

- **GRE/XCEL Energy Long-Range Plan (Northwest) (1998)**

The study area includes the north west portion of Xcel Energy's service territory in Greater Minnesota roughly encompassed by a line from the north west corner of the Minneapolis – St. Paul Metro area north west to St. Cloud and Alexandria, south to Glenwood and Granite Falls, east to Glencoe and then back to the west side of the Twin Cities Metro Area. The largest community in the study area is St. Cloud. Other cities in the study area include: Monticello, Sauk Centre, Glenwood, Paynesville, Cold Spring, Montevideo, Litchfield, Hutchinson, Willmar, Glencoe, Young America, Waconia and the sprawling outer western metro suburbs. The study is ongoing and will be updated again in 2002.

- **Douglas Co 115/69 kV transformers –2005**

The loss of the West St. Cloud, Paynesville or Wakefield 115/69 kV transformers causes load on the Douglas County 115/69 kV, 47 MVA transformer to exceed its reliable capacity. The proposed resolution consists of replacing the non-LTC 115/69 47 MVA Douglas County transformer with a 47 MVA Load Tap Changing ("LTC") transformer, and installing a second 115/69 kV transformer with LTC at Douglas County. A second transformer will alleviate this overload. In order to operate both transformers in parallel and achieve better voltage control on area 69 kV facilities, the existing non-LTC transformer should be replaced with an LTC transformer.

Because of the site's remoteness, any alternatives other than the transformer upgrades would be substantially more expensive. As a result, no other feasible alternatives were pursued. Support for the project can be found in the **Long Range Delivery System Plan Greater Minnesota Study Northwest Area Report, June 1998**, which is related to the Greater Minnesota Long Range Plan. Great River Energy is beginning a joint load serving of the area. The study will refine the plans and required in-service dates for this area validate the recommendation. Plans are to complete the joint study by Spring, 2002.

- **West Central Minnesota Transmission Study (1999) - GRE**

This study analyzed the capability of the network in West Central Minnesota (from Granite Falls to Minneapolis, and from New Ulm to Paynesville) to serve area loads through the winter season of 2003, and looked that the following areas: Willmar, Hutchinson, Litchfield, and Dassel-Montrose. The study has been completed.

Willmar. The study found high MW through-flow caused by the existing 230-69-115kV transmission path. The recommended alternative includes bypassing the 69kV system by extending Granite Falls—Willmar 230kV line from Willmar to Paynesville. Rebuilding the existing Willmar—Paynesville 115kV to 230kV system eliminates the 69kV through-flow problem by removing the 115kV path, while providing transmission path for transfers.

Hutchinson. This area represents a large load center that is not directly connected to 115kV-transmission system. The recommended alternative provides two new, independent 115kV sources. By transferring load to 115kV system, 69kV system capability is able to serve smaller, dispersed loads.

Litchfield. This area is served by a long radial 69kV line with marginally acceptable voltage during summer peak and normal conditions. Adding a two-breaker, 69kV switching station will improve voltage performance and service reliability.

Dassel-Montrose. Constructing a Victor 69kV breaker station takes advantage of several area 69kV lines, allowing mutual voltage support benefits. This will also reduce common breaker line exposure.

- **Willmar-Paynesville 115 to230 kV Rebuild**

The existing line was originally constructed as a 69 kV circuit, and was converted to 115 kV in the 1950's. Load growth in the Willmar area has rendered the line inadequate to provide back-up for loss of the Granite Falls-Willmar 230 kV line. The proposed solution is to replace the Willmar-Paynesville portion of the 1931-vintage Minnesota Valley-Paynesville line with a new 230 kV line. At Paynesville, this requires the addition of a 230/115 kV transformer. This alternative was chosen because the new Willmar-Paynesville 230 kV line will improve service to Willmar Municipal Utilities, distribution cooperatives taking service from Great River Energy, and the Xcel and GRE loads served from the Paynesville 115/69 kV substation. This project has already been approved by the MEQB for construction starting in 2002.

Alternatives studied included new or upgraded 115 or 230 kV circuits. Considering the anticipated need to replace the existing 115 kV line (due to age), its replacement with a new 230 kV circuit was identified as the recommended first step in improving electric transmission supply to this area. **Support for this project can be found in the West Central Minnesota Transmission Study, September 1999** – (a joint study of central Minnesota utilities).

♦ **Big Swan – Hutchinson 69 to 115kV Rebuild**

The 69kV transmission network to the Hutchinson load will be bolstered by the addition of two new 115kV sources to Hutchinson. GRE will be converting the existing, 13-mile, Big Swan to Hutchinson 69kV line to 115kV construction and operation. The projected in-service date is fall, 2003. Several other projects (Hutchinson – McLeod 115kV and the Victor 69kV breaker station) must be completed before the existing 69kV line can be taken out of service for reconstruction. Preliminary meetings with local and state government agencies have begun. GRE is evaluating its options with respect to this project.

➢ **Audubon – Rush Lake Timing Study (1995) - OTP**

The purpose of this study is to identify the timing for a line addition between Audubon and Rush Lake, and to determine a sequence for the addition. Past studies indicated a need for a 115 kV line between Audubon and Rush Lake. The study has been completed and many of the projects identified in the study have already been completed.

➢ **Red River Valley/Transmission Improvement Study (2002) - MP**

This study is looking at developing improvement plans to reinforce 115 kV and above transmission systems within the Red River Valley and west central Minnesota. It follows on the benchmark study, *West Central Minnesota Voltage Study* that examined the relationship of voltage problems on west central 115kV systems caused by native load versus "East Bias" interconnection flows. The ongoing study offers complete a technical analysis to identify transmission facility enhancements that would provide long-term adequacy for serving load in western Minnesota and eastern North Dakota. This study encompasses a broad area and the preliminary results of the study indicate the following transmission system inadequacies by area:

Bemidji Area – the Bemidji area is at significant risk for loss of the Winger – Wilton 230 kV line or the Wilton 230/115 kV transformer. Loss of either of these power system elements during winter peak loads will result in voltage levels below acceptable reliability limits.

Red River Valley Load (East Grand Forks/Grand Forks, Moorhead/Fargo) - voltage stability problems are a concern during winter peak conditions for loads in the Red River Valley. This includes loads spanning from the East Grand Forks/Grand Forks areas through Moorhead/Fargo into the Breckenridge/Wahpeton areas.

Alexandria Area - line loading on the 115 kV transmission system in the Elbow Lake-Alexandria-Douglas County area is exceeding line rating limits for outages on certain 230 kV transmission lines.

➢ Designates a transmission study
♦ Designates a transmission project

Fergus Falls Area - line loading on the 115 kV transmission system in the Fergus Falls area has been identified as a system inadequacy for loss of the 230/115 kV transformers at Audubon and Inman, the Fergus Falls-Henning 230 kV line, and other adjacent 115 kV lines in the area. In addition, voltage problems exist when local generation is off-line.

St Cloud Area - while this area is on the boundary of the study, problems of possible outages have been identified on the Benton-Granite City 115 kV line.

The study is underway and is expected to be completed in early 2003. The list of options to address the deficiencies has been narrowed down to eight options listed below. It is likely that multiple options will need to be phased in over a period of time to address the system deficiencies. Preliminary results of the study indicate that the Wilton (Bemidji) – Boswell 230 kV project will be able to address a significant number of problems that have been identified in the study.

- **St. Cloud Area Load Serving Study (2002) – Xcel Energy**

Previous studies have identified voltage and capacity concerns with the 115 kV transmission loop serving the City of St. Cloud. In addition, capacity of the Benton County 230/115 kV transformers is expected to become inadequate. This analysis will determine the long range transmission needs and proposed transmission reinforcements for this area. This is a subset of the GRE/Xcel Energy Long Range Plans study.

- **Benton Co 230/115 kV Transformers**

Each of the two existing 187 MVA units is subject to excessive overload upon loss of the partner unit. Previous studies have recommended replacing both Benton County 230/115 kV 187 MVA transformer with 230/115 kV 336 MVA transformers. Concerns now exist with the 115 kV loop that is served from the Benton County substation. Resolution could change the need for this project. Alternatives include adding a third 230/115 kV 187 MVA transformer and establishing a 230/115 kV transformation at a new site in the St Cloud area. These alternatives are substantially more expensive, however. Development of a new 230/115 kV transformation site will likely be appropriate at some later date when reinforcement of the St Cloud 115 kV loop is undertaken.

## H. NORTHEAST MINNESOTA

- **Sandstone Area Transmission Study**

This is an internal GRE study to address transmission issues in the Hinckley-Sandstone area. The load in the area is growing at a rapid pace. Existing support to this area involve two-69 kV lines and two-46 kV lines. These four sources are all

- ➢ Designates a transmission study
- ♦ Designates a transmission project

greater than 30 miles from the large loads in Hinckley and Sandstone. Low voltage situations occur during both system intact and contingent events. Due to the distance and the saturation of capacitors in the area, a new source is required for this area.

- **Sandstone (Bear Creek) 230/69kV Substation**

The recommended solution to inadequacies identified by the Sandstone Area Study is to develop a Sandstone 230/69 kV, 60 MVA source to provide voltage support to the 69 kV and 46 kV systems. GRE has teamed with Minnesota Power to determine a feasible location of a new 230 kV source to the east of the City of Sandstone. The source will directly tap the 230 kV line near an existing 69 kV crossing. Alternatives involve adding another source into this area. Existing 69kV sources would involve new line construction from a long distance and a breaker station installation in the Sandstone area to resolve relaying issues.

- **Baxter-Brainerd Area Transmission Study**

This is an internal GRE study of the transmission adequacy in the Brainerd area.

The existing 34.5 kV system cannot handle the existing and future load at Crow Wing Power's (CW) Baxter and Southdale substations. The voltages at Baxter and Southdale will be below the 92% per unit voltage reliability criteria in 2002 and 2004, respectively, under contingency conditions. To maintain these borderline voltages, line switching at three remote sites will need to occur before load is restored. Line switching events like this are not considered an unreliable backup source as outage time can be lengthy. In addition, future transmission facility deficiencies will continue to escalate as these loads continue to grow on the 34.5 kV system.

GRE looked at continuing to support the Baxter and Southdale substations from the 34.5 kV system. With load forecast from Crow Wing, however, it was determined that loads of this size would be very difficult to serve from the 34.5 kV system. To maintain proper voltage levels, construction activity would include a new Baxter to Southdale 34.5 kV line, existing lines upgrades, installation of capacitors, and substation capacity additions. Even with these additions, system reliability would not be significantly improved. Anything done on the 34.5 kV system would be a short-term resolution, would prevent line loss savings that the 115 kV plan offers, and would not provide any benefit to the City of Brainerd, which stated its desire for a new source to serve its load.

- Designates a transmission study
- Designates a transmission project

♦ **Baxter – Southdale-Brainerd 115kV line**

GRE is proposing to build a new 115 kV line from Minnesota Power's Baxter 115 kV substation to Minnesota Power's Brainerd 115 kV substation, including the conversion of 34.5 kV substations at Baxter, Southdale, and Nokay to 115 kV distribution substations. The 115 kV line will use existing 34.5 kV right of way from Minnesota Power's Baxter to Crow Wing Electric Cooperative's ("CW") Baxter, and from CW's Southdale to Minnesota Brainerd substations. A new line route will be established between CW's Baxter and Southdale substations. Total 115 kV construction is estimated at 14.8 miles.

GRE began preliminary corridor evaluation in October 2001. Roadways, distribution and transmission line corridors and other such lines of occupation will be evaluated. Routing criteria will consider land use compatibility, visual and cultural concerns and impacts, and future development. Potential avoidance areas will be identified such as protected wetlands, designated bodies of water, critical habitat, airports and designated cultural resources. Great River Energy intends to apply for a separate certificate of need under Minn. Stat. § 216B.243 and Minn. Rules Chapter 7849.

A meeting with local utilities, the cities of Baxter and Brainerd and Crow Wing County staff is expected for fall of 2001. Additional public involvement will include open house and public information meetings, potential advisory group meetings and meetings with staff of the appropriate governing and permitting agencies/bodies.

➢ **Hubbard-Park Rapids Area Study**

This study examined transmission needs the Hubbard County, Park Rapids area.

♦ **Hubbard-Park Rapids 115 kV Line**

The Park Rapids area is served at 34.5-kV with the bulk power sources at Minnesota Power's 115-kV substations at Hubbard and Badoura. At projected load levels, a stronger source is required in the area to provide adequate voltage levels under contingency conditions and eventually, normal system operating conditions.

GRE looked at continuing to support the Park Rapids area from the 34.5 kV system. With potential load projections, it was determined that loads of this size would be very difficult to serve from the 34.5 kV system with concern in delivering a proper voltage on the long 34.5 kV system. Capacitor installations and line capacity improvements would need to occur throughout the region without significant reliability improvement. Proposed alternatives include modifying the existing area 115 kV and 34.5 kV transmission system.

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**Miscellaneous Projects**

- **Chisago Co 345/115 kV Transformer #2 & 115 kV Shunt Capacitors**

Upon completion (2003) of the Harvey-Glenboro 230 kV line in central North Dakota and southwestern Manitoba, the Manitoba-U.S. transfer capability can be safely increased by approximately 200 MW in each direction, provided adequate reactive power supply is provided. A second 345/115 kV transformer will be added to the existing 500/345/115 kV Chisago County substation in 2003. This 448 MVA unit will provide improved security of supply to the local 115 kV loads and will facilitate the installation of 115 kV shunt capacitor banks at Chisago County substation. These shunt capacitors (5 x 80 MVAR) are primarily to compensate for increased reactive power consumption during high Manitoba to U.S. power transfer conditions. The Chisago County shunt capacitors provide the bulk of the compensation required for the southward capacity increase to be realized.

The Chisago 2nd 345/115 kV transformer will also provide 115 kV source capacity needed for the proposed Chisago-Apple River 115/161 kV transmission development. This replaces the required 345-161 kV transformer under the 161 kV option. Support for this project can be found in the Chisago Electric Reliability Project.

This proposal was selected because the addition of the transformer and capacitors at Chisago Co. is a modest investment to take advantage of bulk power transfer capability added to the transmission system incidental to the construction of the Harvey- Glenboro 230 kV line in North Dakota.

- **Chisago Electric Reliability Project: 115kV Chisago – Lawrence Creek, 161kV Lawrence Creek – Apple River**

Planning studies have identified numerous contingencies that result in low voltages and/or facility overloads in East Central Minnesota and Western Wisconsin. Xcel Energy and Dairyland Power Cooperative have attempted to address these transmission system needs with a proposal to connect Chisago County Substation near the North Branch and Apple River Substation near Amery, Wisconsin with a new transmission line. In 1996, the two utilities filed applications with the Minnesota Environmental Quality Board and the Wisconsin Public Utilities Commission for authority to route a 230/115 kV facility. Permits for the transmission proposal were granted by the Wisconsin Public Service Commission. Significant controversy, however, developed during both Minnesota and Wisconsin proceedings. The utilities entered into a mediation process with several of the parties most involved in the controversy. The mediation resulted in an agreement between Xcel Energy and Dairyland Power Cooperative and the Cities of Taylor's Falls, Minnesota and St. Croix Falls, Wisconsin. The utilities agreed to withdraw their EQB application for a

230 kV transmission line and instead pursue a 161 kV transmission alternative. The agreement also addresses several routing and design issues associated with routing the line through the federally designated Wild and Scenic St. Croix National Riverway.

After withdrawing the application to the EQB, Xcel Energy began working through the various design issues associated with the agreement and began consultations with local untis of government affected by the route contemplated in the agreement. The transmission line proposal has evolved further as a result of those consultations and design work.

The utilities now propose a combination 115 /161 kV transmission system improvement. The concept is to replace an existing 69 kV transmission line that connects the Chisago County Substation, Lindstorm Substation and St Criox Falls Substation. The existing line would be replaced with a 115 kV line between Chisago County Substation, Lindstrom Substaiton and a new substation just west of Taylors Falls, tentatively named Lawrence Creek. Voltage would be transformed at Lawrence Creek Substation and a 161 kV line would be built to Border Substation on the east side of St. Croix Falls. On the Minnesota side of the river, the new line would replace an existing 69 kV line. A double Circuit 69 kV/161 kv line would be built for the most part along the Wisconsin Public Service Commission approved route, from the Border Substation on to the Apple River Substation.

Numerous system alternatives have been discussed during previous proceedings in both Minnesota and Wisconsin. The **Chisago Electric Transmission Project Application, September 1996**; and **Chisago Electric Reliability Project Hybrid 115/161 kV Analysis, September 2001** describe the system needs analysis and examination of alternatives associated with the project.

With the amendments in the Certificate of Need and Routing processes associated with recent legislation (Minnesota Session Laws Chapter 212), the Chisago 115/161 kV proposal now requires a certificate of Need from the Minnesota Public Utilities Commisison and a Route Permit from the Minnesota Environmental Quality Board. Xcel Energy and Dairyland Plan to file a certificate of need application with the Commission yet this year.

### ♦ Arden Hills-Lawrence Creek 69 kV line conversion 115 kV

Without the Chisago Electric Reliability Project, the Arden Hills-St Croix Falls 69 kV line will overload for outage of the King-Eau Claire 345 kV line and Apple River-Garfield 69 kV line. The Apple River-Garfield 69 kV line outage will also result in low voltages at Shafer, Scandia, and May substations and substations between St. Croix Falls and Garfield in Wisconsin. Outage of the Chisago-Lindstrom 69 kV line will result in low voltage at Lindstrom in a few years. The Arden Hills-St Croix Falls

69 kV line is inadequate for near term load serving needs given the existing system configuration.

With the Chisago Electric Reliability Project, the Arden Hills-St Croix Falls 69 kV line would be terminated at a new Lawrence Creek Substation and the 69 kV tie to Wisconsin would be removed. The new configuration results in only the Birch, May, and Scandia substations being served by the Arden Hills-Lawrence Creek 69 kV line with 115-69 kV transformations at each end. This reconfigured line can serve approximately 30 MW of load and maintain adequate voltage for outage of the Scandia-Lawrence Creek 69 kV line for many years. Outage of the proposed Chisago-Lindstrom 115 kV line would cause the Arden Hills-Lawrence Creek 69 kV line to load above acceptable limits by approximately 2012.

No alternatives were considered for rebuilding the line to 115 kV, it being deferred for ten years. High system transfer levels may require operating the Arden Hills-Lawrence Creek 69 kV line normally open or installation of an auto-sectionalizing scheme at the Scandia substation. Support for the project can be found in the **Chisago Electric Reliability Project Hybrid 115/161 kV Analysis, September 2001**.

# I. OTHER REGIONAL TRANSMISSION STUDIES

In addition to the studies identified above, several other studies are underway that are likely to affect regional transmission decisions in the near future. A brief summary of these studies is provided below.

- **Western Area Power Administration – Montana Dakotas Regional Transmission Study Scope**

The Western Area Power Administration (Western), a federal power marketing agency of the Department of Energy recently held public workshops on October 19, 2001 in Billings, Montana to solicit input on a planning study of transmission expansion options and projected costs in Western's Upper Great Plains Region. Western is soliciting suggestions for sites in Montana and North Dakota that should be studied as potential locations for new generation resources and transmission alternatives needed to deliver the resources to western and eastern electric grids. Western is taking written comments until November 2, 2001 and will develop a final scope of study by November 1, 2001. A final report of study results will be published by June, 2002. A copy of the study scope and final study report will be posted on Western's Website at http://www.wapa.gov.

- **Lignite Energy Council – Vision 21 Program**

The Lignite Vision 21 Program is being sponsored a variety of government agencies, elected leadership and the lignite industry. The goal of the Lignite Vision

21 Program is to study the feasibility of an additional coal-fired electrical generating plant to be located in North Dakota. The North Dakota Industrial Commission has committed to invest substantial resources in research the project. Generation technologies under review include conventional pulverized coal technologies (subcritical, supercritical and ultra supercritical), fluidized bed and integrated coal gasification combined cycle operations. Vision 21 is also undertaking a comprehensive review of the power flow of the MAPP region for the purposes of identifying any additions and improvements necessary to absorb the increases in power generated by a new baseload plant. The first phase of this study has identified a proposed export route that will service the additional generation and enhance reliability. Site-specific analysis, system operation, line loss and stability study and recommendations are ongoing. More information on the Lignite Vision 21 Program can be found at its Website at http://www.lignitevision21.com/index.htm.

- **Big Stone Power Plant, Big Stone, South Dakota**

Otter Tail Power Company is in the early stages of identifying necessary transmission requirements for delivering up to 600 megawatts of new baseload generation at the existing Big Stone Power Plant located in Big Stone City, South Dakota. Technical studies are being organized and are expected to begin in the last two months of 2001. It is expected that transmission system additions will be required to deliver the output of this new generation.

- **Central North Dakota – Manitoba 230 kV Interconnection Study**

This study identified the transmission requirements for load serving capability in Central North Dakota and increasing transfer capability between the United States and Manitoba. The study was completed in 2000 and received MAPP Design Review Subcommittee Approval in December of 2000. The bulk of the facilities recommended are located in North Dakota and Manitoba, including approximately 100 miles of 230 kV facilities in North Dakota already permitted by the North Dakota PSC. However, the study also identified excess line loading problems on the Wilton–Bemidji 115 kV line that will need reconductoring.

- **Fibrominn, LLC**

Fibrominn LLC has proposed construction of a 50 MW power plant to be located in Benson, Minnesota. The plant is scheduled to be operational December 31, 2002 and will be a single unit, biomass installation using poultry litter as a fuel source. It is expected that the plant output will require construction of approximately one-third mile new 115 kV transmission line that will interconnect at the Great River Energy Benson 115kV substation. A proposed site for the plant was recently approved by the Minnesota Environmental Quality Board and is awaiting a Certificate of Need from the Public Utilities Commission.

- ➢ Designates a transmission study
- ♦ Designates a transmission project

- **Rochester Public Utilities**

Rochester Public Utilities (RPU) has proposed purchasing a 50 MW combustion turbine ("CT") electric generation unit to be installed at its Cascade Creek substation located in the City of Rochester, Minnesota. Output of the new generating unit will be used to serve the load growth in the RPU system.

- **MAPP Transmission Planning Sub-Committee Vision Plan**

MAPP's Transmission Planning Sub-Committee is presently undertaking an effort known as its Vision Plan. It is generally designed to allow MAPP members to identify additional transmission facilities needed to serve as an outlet for new generation, relieve a constrained interface, provide more transfer capability, or increase reliability and reduce losses for an area. Although the proposals will have some local benefit, the proposals are meant to have larger, regional benefit.

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- ➢ Designates a transmission study
- ♦ Designates a transmission project

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# IV. CONCLUSION

For the reasons described above, the utilities are not seeking priority list placement of any projects described in this report. This biennial report nonetheless is an excellent opportunity to present information on factors that affect regional transmission planning, relevant studies that identify system inadequacies and support the need for additional facilities, proposed transmission projects of various size and scope, and where additional information may be obtained. The utilities invite public comment on the contents of this report, guidance on what should be addressed in future reports, and how the planning process established under Minnesota Statutes Section 216B.2425 can foster a strong and environmentally responsible regional transmission infrastructure.

# APPENDIX NO. 1

| In Service Date (m/d/y) | From: | To: | Circut # | Voltage(s) (kV) | Reconductor or Thermal Increase | Rebuild or Conversion | New | Total Miles | A=Authorized P=Planned C=Completed W=Withdrawn | Study * | Reporting Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/1/02 | Wilson | Bloomington | 1 | 115 | | 2.2 | | 2.2 | A | 3 | XEL |
| 6/1/02 | Goose Lake | Lexington | | 115 | 9.2 | | | 9.2 | P | 1 | XEL |
| 6/1/02 | Long Lake | Baytown | | 115 | 6.9 | | | 6.9 | P | 1 | XEL |
| 6/1/02 | Vermillion River | Empire | | 115 | | | 6.0 | 6.0 | P | 3 | GRE |
| 6/1/02 | Sandstone Xfmr | | 1 | 230-69 | | | | | A | | GRE |
| 6/1/02 | Dickinson | | 1 | 115-69 | | | | | A | 9 | GRE |
| 12/31/02 | West Faribault | New generation site | 1 | 115 | | | 1.0 | 1.0 | A | 17 | XEL |
| 4/1/03 | Chisago Co Xfmr | | 2 | 345-115 | | | | | A | | XEL |
| 5/1/03 | Carver Co. Xfmr | | 2 | 115-69 | | | | | P | 5 | XEL |
| 5/1/03 | Westgate | Glen Lake | | 115 | | 3.6 | | 3.6 | A | 5 | XEL |
| 5/1/03 | Glen Lake | Gleason Lake | | 115 | | 6.6 | | 6.6 | A | 5 | XEL |
| 5/1/03 | Parkers Lake | Plymouth | 1 | 115 | | | | | A | 9 | GRE |
| 5/1/03 | Plymouth | ElmCreek | 1 | 115 | 3.5 | 6.0 | 2.5 | 12.0 | A | 9 | GRE |
| 5/1/03 | Willmar | Paynesville | 1 | 230 | | 27.0 | | 27.0 | A | 19 | XEL |
| 5/1/03 | Chisago | Lindstrom | 1 | 115 | | 7.0 | | 7.0 | A | | XEL |
| 5/1/03 | Lindstrom | Shafer | 1 | 115 | | 2.8 | | 2.8 | A | | XEL |
| 5/1/03 | Shafer | Lawrence Creek | 1 | 115 | | 6.2 | | 6.2 | A | | XEL |
| 5/1/03 | Lawrence Creek | St. Croix Falls | 1 | 161 | | | 2.1 | 2.1 | A | | XEL |
| 5/1/03 | St. Croix Falls | Apple River | | 161 | | 20.6 | 2.4 | 23 | A | | XEL/DPC |
| 5/1/03 | Lawrence Creek Xfmr | | 1-2 | 115-161 | | | | | P | | XEL |
| 6/1/03 | Tanners Lake | Woodbury | | 115 | 3.5 | | | 3.5 | P | 1 | XEL |
| 6/1/03 | Aldrich | St. Louis Park | | 115 | 5.4 | | | 5.4 | P | 1 | XEL |
| 6/1/03 | Baxter | Southdale | | 115 | | 1.3 | 6.5 | 7.8 | A | | GRE |
| 10/1/03 | Red Rock | (Stockyards) | 2 | 115 | 0.5 | | | 0.5 | A | 3 | XEL |
| 10/1/03 | (Stockyards) | Rogers Lake | 2 | 115 | | 5.8 | | 5.8 | A | 3 | XEL |
| 10/1/03 | Big Swan | Hutchinson | | 115 | | | 13.0 | 13.0 | P | 19 | GRE |
| 1/1/04 | Chanarambie | Lake Yankton | 1 | 115 | | 14.0 | 12.0 | 26.0 | A | 11 | XEL |
| 1/1/04 | Lake Yankton | Lyon County | 2 | 115 | | 27.0 | | 27.0 | A | 11 | XEL |
| 1/1/04 | Willmar Xfmr | | 1 | 115/69 | Upgrd | | | | P | 24 | XEL |
| 1/1/04 | Alexandria | Douglas County | 1 | 115 | 11.0 | | | 11.0 | P | 11 | OTP/XEL |
| 1/1/04 | Alexandria | Alex SS | 1 | 115 | 2.1 | | | 2.1 | P | 11 | MRES/XEL |
| 1/1/04 | Summit | Dome | 1 | 115 | 2.8 | | | 2.8 | P | 11 | XEL |
| 1/1/04 | Dome | Loon Tap | 1 | 115 | 22.1 | | | 22.1 | P | 11 | XEL |
| 1/1/04 | Loon Tap | W Faribault | 1 | 115 | 10.6 | | | 10.6 | P | 11 | XEL |
| 1/1/04 | Elbow Lake | Grant County | 1 | 115 | 3.6 | | | 3.6 | P | 11 | MRES/XEL |
| 1/1/04 | Brandon | Elbow Lake | 1 | 115 | 16.6 | | | 16.6 | P | 11 | MRES/XEL |
| 1/1/04 | Brandon | Alex SS | 1 | 115 | 13.2 | | | 13.2 | P | 11 | MRES/XEL |
| 1/1/04 | Willmar | Kerkhoven Tap | 1 | 115 | 14.7 | | | 14.7 | P | 11 | XEL |
| 1/1/04 | Paynesville | Wakefield | 1 | 115 | 15.0 | | | 15.0 | P | 11 | XEL |
| 5/1/04 | Bloomington | Airport | 1 | 115 | | 2.8 | | 2.8 | A | 3 | XEL |
| 5/1/04 | Bloomington | Rogers Lake | 1 | 115 | | 3.4 | | 3.4 | A | 3 | XEL |
| 5/1/04 | Airport | Rogers Lake | 1 | 115 | | 3.4 | | 3.4 | A | 3 | XEL |

| In Service Date (m/d/y) | From: | To: | Circut # | Voltage(s) (kV) | Reconductor or Thermal Increase | Rebuild or Conversion | New | Total Miles | A=Authorized P=Planned C=Completed W=Withdrawn | Study * | Reporting Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/1/04 | Air Lake | Vermillion River | | 115 | | | 4.2 | 4.2 | P | 3 | GRE |
| 5/1/04 | Benton Co Xfmr | | 1-2 | 230-115 | | | | | P | 22 | XEL |
| 6/1/04 | Red Rock Xfmr | | 1-2 | 345-115 | | | | | P | 1 | XEL |
| 6/1/04 | Daytons Bluff | Battle Creek | 1 | 115 | | | 2.0 | 2.0 | P | 1 | XEL |
| 6/1/04 | Elm Creek Xfmr | | 2 | 345-115 | | | | | P | 8 | XEL |
| 6/1/04 | Southdale | Brainerd | | 115 | | 7.0 | | 7.0 | A | | GRE |
| 6/1/04 | Traverse | Arlington | | 115/ op 69 | | 22.6 | | 22.6 | P | | XEL |
| 10/1/04 | Hubbard | Park Rapids | | 115 | | 7.2 | 1.0 | 8.2 | A | | GRE |
| 5/1/05 | Douglas Co Xfmr (+LTC) | (Add LTC) | 1 | 115-69 | | | | | P | 18 | XEL |
| 5/1/05 | Douglas Co Xfmr | | 2 | 115-69 | | | | | P | 18 | XEL |
| 6/1/05 | Prairie Island | Alma | | 161 | | | 54.0 | 54.0 | W | 14 | XEL |
| 5/1/06 | Crooked Lake | Champlin Tap | | 115 | 3.1 | | | 3.1 | P | 8 | XEL |
| 1/1/07 | Paynsville | Roscoe tap | 1 | 115/op 69 | | 7.6 | | 7.6 | P | | XEL |
| 1/1/07 | Roscoe tap | Munson tap | 1 | 115/op 69 | | 4.0 | | 4.0 | P | | XEL |
| 6/1/07 | Elm Ck | Osseo | 1 | 115 | 3.5 | | | 3.5 | P | 8 | XEL |
| 6/1/07 | Osseo | Crystal | | 115 | | | 3.5 | 3.5 | P | 8 | XEL |
| 6/1/07 | Crystal | Indiana | | 115 | | | 4.0 | 4.0 | P | 8 | XEL |
| 6/1/07 | Danube Xfmr | | | 230-69 | | | | | P | 11 | XEL |
| 6/1/08 | Inver Hills | Koch | 2 | 115 | | | 1.8 | 1.8 | P | 3 | XEL |
| 6/1/09 | Eden Prairie | Edina | | 115 | 3.4 | | | 3.4 | P | 5 | XEL |
| 6/1/09 | Eden Prairie | Wilson | | 115 | | 8.0 | | 8.0 | P | 5 | XEL |
| 6/1/10 | Parkers Lake | Gleason Lk | 1-2 | 115 | 2.5 | | | 2.5 | P | 8 | XEL |
| 5/1/12 | Arden Hills | Lawrence Creek | 1 | 115 | | 35.6 | | 35.6 | P | | XEL |

*** Key to Study Information:**

| | | |
|---|---|---|
| 1 | Northern States Power Company Long-Range Metropolitan Study (Central Metro) (2000) | XEL |
| 2 | Downtown Minneapolis Transmission Study (Fifth Street – Main Street capacity upgrade) | XEL |
| 3 | Northern States Power Company Long-Range Metropolitan Study (Southeast Metro) (2000) | XEL |
| 4 | Bloomington Area Long Range Delivery System Planning Study (1998) | XEL |
| 5 | Northern States Power Company Long-Range Metropolitan Study (Southwest Metro) (2000) | XEL |
| 6 | Waconia Area Load Serving Study (2002) | XEL |
| 7 | Glen Lake Expansion Project (1998) | XEL |
| 8 | Northern States Power Company Long-Range Metropolitan Study (Northwest Metro) (2000) | XEL |
| 9 | Northwest Metro (2001) | GRE |
| 10 | GRE / XCEL Energy Long-Range Plans – Southwest Minnesota Area (1996) (2002 update) | GRE/XEL |
| 11 | Southwest Minnesota / Southeast South Dakota Electric Transmission Study (2001) | XEL |
| 12 | MN Valley – Mankato Load Serving Study (Panther – Franklin 115 kV line) | XEL |
| 13 | GRE / XCEL Energy Long-Range Plans – Southern Minnesota Area (1996) (2002 update) | GRE/XEL |
| 14 | Hastings – Alma Area Study (2001/2002) | XEL |
| 15 | Mankato Loop and Mankato Twin Cities Corridor Study | XEL |
| 16 | Adams 345 / 161 kV Transformer | XEL |
| 17 | Preliminary Results of an Interconnection Study 250 MW of CT Generation near Faribault, Minnesota (2001-2006) | XEL |
| 18 | GRE / XCEL Energy Long-Range Plans – Northwest Minnesota Area (1998) (2002 update) | GRE/XEL |
| 19 | West Central Minnesota Transmission Study (1999) | GRE |
| 20 | Audubon – Rush Lake Timing Study (1995) | OTP |
| 21 | Red River Valley / Transmission Improvement Study (2002 | MP |
| 22 | St. Cloud Area Load Serving Study (2002) | XEL |
| 23 | Chisago Electric Transmission Line Project Application (1996) | XEL |
| 24 | Fibrominn, LLC | |