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OPTIMIZING TRANSMISSION & DISTRIBUTION SYSTEM OPPORTUNITIES FOR C-BED PROJECTS

By
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February 6, 2006

THE FRAMEWORK

- The role of transmission is to connect generation with load.
- Where new load will appear on the system is the result of our societal activities. It is predictable from data like population growth forecasts and demand side activities.
- The transmission system configuration we need to build is the result of assumptions we have to make about where the new generation is to be located.
- There are many scenarios that can be "envisioned" about the future generation mix & location.
- Given any set of load and generation assumptions, only one transmission configuration is the most cost effective.
- We cannot build our way into a geographic "level playing field" energy market.
- Simply implementing one vision, the "CAPX" scenario, precludes doing what is best for Minnesota.

C-BED GENERATION RESOURCE CHARACTERISTICS

- Community owned generation resources add extra social value in local economic development.
- While not size limited, they will tend to be smaller scale than traditional fossil/nuclear technologies.
- New wind data shows at least ½ the state has economic wind energy development potential. This means there is likely to be many projects, generally located closer to load than traditional large power plants, and over time these sources could serve all future energy needs.
- They can connect to either the distribution system or the transmission grid.
- Lead times for C-BED projects are short, a lot shorter than for transmission elements.
- The vision of many smaller plants, with geographic diversity, is currently **not** in the utility industry generation or transmission planning paradigm.

RECOMMENDATIONS

- Facilitate new C-BED generation activities that utilize the existing bulk power system infrastructure. These projects can be implemented quicker and at lower total cost than building new transmission for remote generation.

- Existing substations are generation "on ramps" to the bulk power system. We need policies that utilize these as much as possible. Preliminary data from the West Central Transmission Planning Zone, roughly $1/7^{th}$ of the state, shows about 3000 MW of theoretical injection potential.

- New transmission elements that increase utilization of existing substations for power injection can likely be built quicker and cost less than larger lines that bring in power from remote sources. We need to establish policies that discover what these elements are and get them built.

- First, fix inadequacies in the transmission system for distributed generation utilization of the existing bulk power infrastructure. Only then can we know the need for larger regional bulk power system enhancements. Policies that examine and develop this C-BED resource opportunity first are prudent policy from a cost and energy security perspective.

ACTION ITEMS

- Establish a clear priority for CBED generation resources in generation planning.

- Integrate CBED resource planning into the state transmission planning process. Identify distributed resource potential capacity in the existing bulk power infrastructure and plan for new transmission that eliminates inadequacies and increases utilization of existing substation injection potential.

- Any "vision" today of future infrastructure needs shouldn't pre-empt the logical development of the optimal configuration for Minnesota's infrastructure through the state's established energy, environment, and economic policy planning processes.

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Winter 2006

Power System Constraints and Opportunities

Introduction

The Minnesota electrical power supply system, the Generation and Transmission grid, will require increased infrastructure development to serve Minnesota's future. We have a choice to make now about how this is done, like a fork in the road, which results in two radically different outcomes. One choice, a "business as usual" choice creates more of the same bulk power system that has evolved in the past. The other choice, that addresses broader societal needs and recognizes impacts from technological innovation, leads to a rather different outcome.

The most visible and recent expression of the need for power supply system enhancements has been developed by the transmission system owners, mostly Minnesota utilities, participating in a "future scenario" study project identified as CAPX 2020.

The CAPX 2020 scenario requires a multi-billion dollar high-voltage transmission investment beginning now, to connect new remote central-station generators to existing load centers. The alternative C-BED (Community-Based Energy Development) scenario will require a different set of high voltage transmission in the future, after distributed and dispersed generation capacity has been developed that optimizes the use of existing transmission infrastructure. Choosing the CAP X 2020 model now will dramatically inhibit society's ability to develop the C-BED alternative.

The CAPX 2020 scenario postulates that:

- Future electrical load growth to the year 2020 will be "business as usual," that is, the future growth in electrical consumption will look like it has in the past. This assumption results in a projected load growth of 6300 MW, and a need for at least 8000 MW of new generation resources.
- The CAPX 2020 Study also assumes that the majority of future new generation resources will be large-scale power plants, sited at locations quite distant from the load centers that will need to be served.

MINNESOTA Environmental Fund

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These CAPX2020 study assumptions produce results that show a need for 1620 miles of new high voltage 345 kV power lines by 2020, with a total cost that could be well in excess of $3 Billion dollars.[1] Large-scale power plants would be located as remote from load as in the coal fields in North Dakota and far northern Canada.

However, these CAPX study assumptions are not the only assumptions that could or should be used to anticipate what the future electrical grid infrastructure will need to look like in the year 2020. There are several factors at work that drive the need to consider other visions of the Minnesota energy future. These are:

- The recent and ongoing innovation of efficient new small scale generating technologies.
- The need to utilize additional renewable energy and conservation as a strategy to minimize environmental impacts and climate changes.
- The need to optimize local economic development by using local energy resources instead of imported resources.
- The need to enhance the reliability of energy supplies in the face of potential disruptions from natural disasters and possible terrorist attacks.

The question is whether the "business as usual" scenario postulated by CAPX 2020, of continued load growth and large generating plants remotely located from load, is an appropriate way to address these societal factors, or whether a more optimal solution to our future energy needs is an approach that depends increasingly on modern smaller scale community owned generating technologies that are distributed and dispersed throughout Minnesota, coupled with increased use of efficiency.

These two radically different scenarios result in different sets of new high voltage wires and generators that will be needed to serve Minnesota future energy needs.

Where are we today?

The North American Electric Reliability Council (NERC) provides annual assessments of the reliability of our bulk power supply system. Their most recent report outlines concerns about our region in the future availability of generation and transmission resources.

NERC projects that because of load growth, the amount of surplus generating capacity in our region is declining, from 18% in 2005 to just 6.7% in 2014. These figures include consideration of 2,122 MW of new planned generation for the period.[2] NERC indicates that the transmission system has constraints that prevent us from importing electricity during peak demand periods. A maximum of 1800 MW, or 5% of peak demand in 2004, can be imported into our area during the peak demand period.[3]

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[1] The CAPX Technical Update, May 2005, indicates a cost figure of $1.2 Billion dollars, but that figure does not include costs for lower voltage fixes necessary to support the high voltage facilities.

[2] See NERC report "2005 Long-Term Reliability Assessment", September 2005, p. 57.

[3] NERC report, p. 58.

Clearly electrical system infrastructure enhancements or significant conservation will be necessary in the 10-20 year horizon.

The DOE in their own vision study observes that use of Demand Side Management strategies can greatly improve the efficiency of the grid.

> "The national average load factor (the degree to which physical facilities are being utilized) is about 55%. This means that electric system assets, on average, are used about half the time. As a result, steps taken by customers to reduce their consumption of electricity during peak periods can measurably improve overall electric system efficiency and economics."[4]

This statement indicates that there are plenty of opportunities to improve the efficiency of utilization of the existing infrastructure if we can somehow shave the peaks off of system power demand. It makes sense to utilize the existing infrastructure to its maximum before we consider investing in more facilities that will also be used 55% of the time. Conservation and distributed Community Based Energy Development projects are two principle ways to increase power system utilization.

Utilizing existing system assets to their full potential to support CBED projects also maximizes opportunities for economic development without the need to invest in more transmission resources. We know where the new load growth is going to occur. Population projections give us a good marker for where new CBED projects could be installed. As the local grid demand grows, more local generation resources can be added to the local system as well. This approach allows more generation resource additions during the seven years or so it takes to build the next major set of high voltage transmission lines.

Where will we go from here?

The CAPX 2020 scenario provides one future vision that is possible. We have a choice to follow this course or capture additional societal benefits from a scenario that includes clean distributed CBED projects.

Each approach has its own unique set of new transmission assets required to support its development. The CAPX 2020 vision has not been shown to be the optimal scenario to minimize the need for additional infrastructure investment. New CBED resources on the system can reduce the total investment, will significantly delay the timing of the need for new transmission investments, and result in a very different set of new transmission lines than those required by the CAP X 2020 scenario.

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[4] See "GRID 2030", p.7.

Reliability benefits from CBED include reducing the potential for blackouts and the possibility of operating small load centers independently from the grid during times when storms have taken the grid out of service.

Local economic development accrues from local ownership of generation resources. These benefits have been demonstrated to be significant, and result from keeping the money from the generated energy in the local economy instead of shipping the money to some out of state entity.

Environmental benefits from utilizing renewable generation resources include a wide range of specific benefits from reduced acid rain, to less mercury in our fish, and less economic disruption from climate change impacts.

Which path would you choose?

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Winter 2006

LEGISLATIVE PROPOSAL TO OPTIMIZE C-BED AND RENEWABLE ENERGY DEVELOPMENT

Presently, Minn. Stat. 216B.2426 reads as follows:

216B.2426 Opportunities for distributed generation

The commission shall ensure that opportunities for the installation of distributed generation, as that term is defined in section 216B.169, subdivision 1, paragraph (c), are considered in any proceeding under section 216B.2422, 216B.2425, and 216B.243.

216B.169 specifies clean & efficient and less than 10 MW
216B.2422 requires ensuring opportunities in Resource Planning
216B.2425 requires ensuring opportunities in Transmission Planning
216B.243 requires ensuring opportunities in Certificates of Need for large energy facilities

Do not change this existing language, but add the following language, thereby making the existing language Subdivision 1:

Subdivision 2. **Identifying Distributed Generation Potential.**
(a) Consideration of distributed generation under subd 1 shall include an analyses by each electric utility (as defined in 216B.2425 Subd. 2a) that identifies a specific optimal potential of distributed generation export capacity that can be developed within the footprint of each of its substations that has transformer secondary voltage of 34.5 kV or higher:

1) utilizing existing substation transformer and high-voltage transmission infrastructure;
2) utilizing strategic transformer and high-voltage transmission system enhancements to optimize the efficient use of the interconnected transmission system; and,
3) utilizing the latest transmission system models developed by the regional transmission system operator or reliability authority to develop potential distributed generation export and load serving capability from each sub region of the state.

(b) Transmission and transformer enhancements identified pursuant to Minn. Stat. 216B.2426 Subd. 2(a)(2) shall be incorporated into the state transmission plan process under Minn. Stat. 216B.2425 and considered as inadequacies under Minn. Stat. 216B.2425 Subd. 2(c)(1).

(c) The 10 MW limit set in Minn. Stat. 216B.169 does not apply to the provisions of Minn. Stat. 216B.2426, subd. 2.

(d) The type of analysis developed under subd 2(a) shall be the basis for any distributed generation analysis in any proceeding under section 216B.2422, 216B.2425, and 216B.243.

(e) Each utility that must file a transmission plan pursuant to Minn. Stat. 216B.2425 shall include in its filing a transmission system map showing the location and the thermal limit megawatt loading rating of each of its transmission facilities over 34.5 kV nominal operating voltage.

Subdivision 3. **Priority.** (Optional)

The commission shall ensure opportunities for the installation of distributed generation by requiring the development of any capacity identified by analyses pursuant to Subdivision 2, if it is offered, prior to any proposed installation pursuant to the provisions of Minn. Stat. 216B.243 provided that:

a) the electric utility purchasing energy and/or capacity from the distributed generation option has identified a need in its most recent filing pursuant to Minn. Stat. 216B.2422 that can be met in whole or in part by the distributed generation option; or,
b) the purchasing utility has an existing renewable energy mandate or objective to fulfill; and,
c) the distributed generation option is competitive with other options considering:
    1. the relative price of energy and/or capacity;
    2. the value of the distributed generation option to the interconnected electrical transmission and distribution system in terms of enhanced reliability, voltage and dynamic stability, and the efficient use of transmission system assets;
    3. the value of environmental attributes; and,
    4. the value of local economic development activity.

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Of course the answer to the question, "Why build more power plants and accompanying power lines?" is to provide more electricity to a concentrated, growing urban population. A logical conclusion of nurturing economic growth in dense urban areas will be increased government subsidization of infrastructure (i.e. transportation). It becomes an ever-ratcheting cycle that fosters economic growth in some areas while depleting the resources in others. Two current on-going examples of the depletion / redirection of resources occurring in my region include: the transfer of planned highway dollars out of the region to another area in which the need was deemed more politically expedient and the possibly illegal piping of water out of a federally funded rural water project to support economic development outside the project.

In my school district we send away our resources, our water, our corn, our soybeans, our beef, our pork and our most important resource our well-educated children. Most astute businessmen and policy makers understand the need to maintain the balance between depleting resources and the re-investment of seed money to develop a harvest for the future. In my little corner of "greater Minnesota", the lack of investment in economic development leaves my community feeling less than great.

I come to ask for your advice and hopefully your consent. Within 10 miles of my schools we have: 1) SMI - a major manufacturer of wind towers, 2) EMS - a company that operates nation-wide erecting and servicing wind turbines, 3) a wind smith program at MN West Technical college, which prepares future wind energy technicians, and 4) The Canby School District is located in the windiest part of our state and has been identified by the Minnesota Department of Commerce to have excellent potential for the development of wind energy. And yet not one wind turbine is located in my school district. As a matter of fact I tried to apply for a grant sponsored by the State of Minnesota three years ago to erect a wind turbine for my school district. I was told Canby didn't qualify because we were in such a wind rich area we didn't need to worry about promoting wind energy. We are still waiting. One major factor limiting the growth of wind farming is the sharply escalating prices charged by our local utility company in connection fees for proposed local wind farms.

Why are there no wind turbines in my school district, while 15 miles south of Canby wind tower construction continues to expand all the way to the Iowa border along the Buffalo Ridge? Some writers call this wind energy rich region of our glorious but energy poor state "the Saudi Arabia of Minnesota". Of course the answer to the question is the area south of Canby is dominated by Excel energy. The Minnesota legislature directed Excel to develop sustaining energy resources in a compromise to store more low radiation dry cask storage at the Prairie Island nuclear plant.

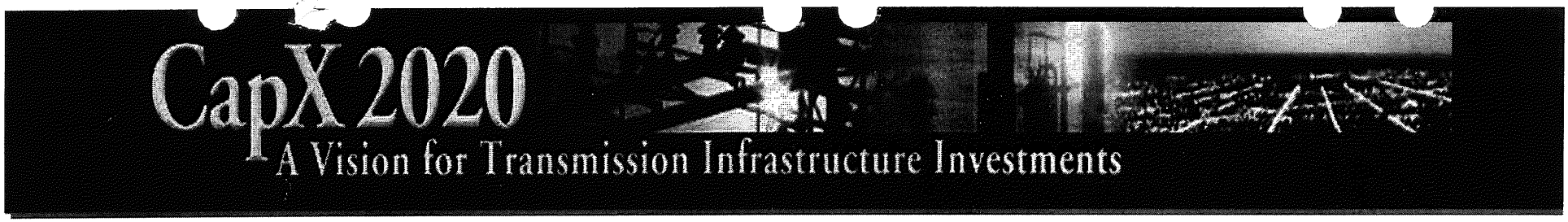
I am much more concerned that the Big Stone power plant expansion will dramatically increase mercury and other heavy metal pollution in the Minnesota River. This plant will hire South Dakota workers, paying South Dakota taxes, burning North Dakota and Wyoming coal, polluting the waters Minnesotan's fish, hunt and drink.

I beseech this legislature not to lose control of the power generated across our border and yet consumed by Minnesota citizens. Generation facilities that are built in states with little regard for the quality of Minnesota life.

I beseech the legislature to support the economic development of a clean, sustainable wind industry: energy generated in Minnesota, lowering the amount of energy dollars leaving our state.

I beseech my legislature to require Big Stone Transmissions to reserve 20% of transmission capacity of the new transmission lines for wind energy generated in **Minnesota.**

I beseech each of my legislators to support the development and sustainability of small, locally owned, CBED (Community Based Energy Development) wind farms. The profits and expenses of these farms will percolate around, through and up local economies to the regional and finally the state economy. This would be a win-win-win: A win for the Minnesota environment, a win for local economic development and a win for the economy of Minnesota.



Grid Expansion in the Upper Midwest:

A Briefing for the Energy Subcommittee of the Jobs, Energy and Community Development Committee

Will Kaul, VP, Transmission, Great River Energy

GREAT RIVER ENERGY

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AN ALLETE COMPANY

MISSOURI RIVER ENERGY SERVICES

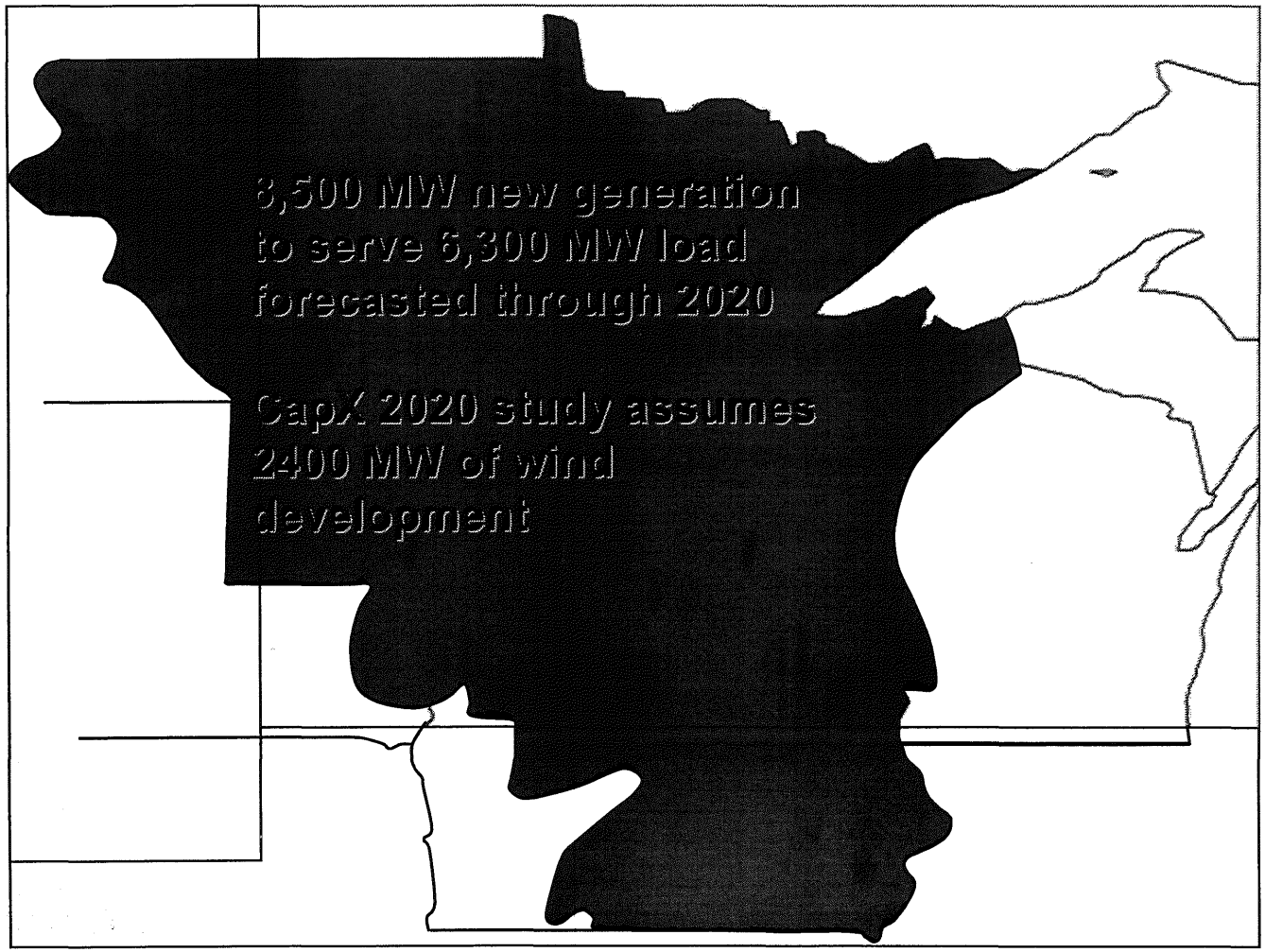
Midwest Municipal Transmission Group

OTTER TAIL POWER COMPANY

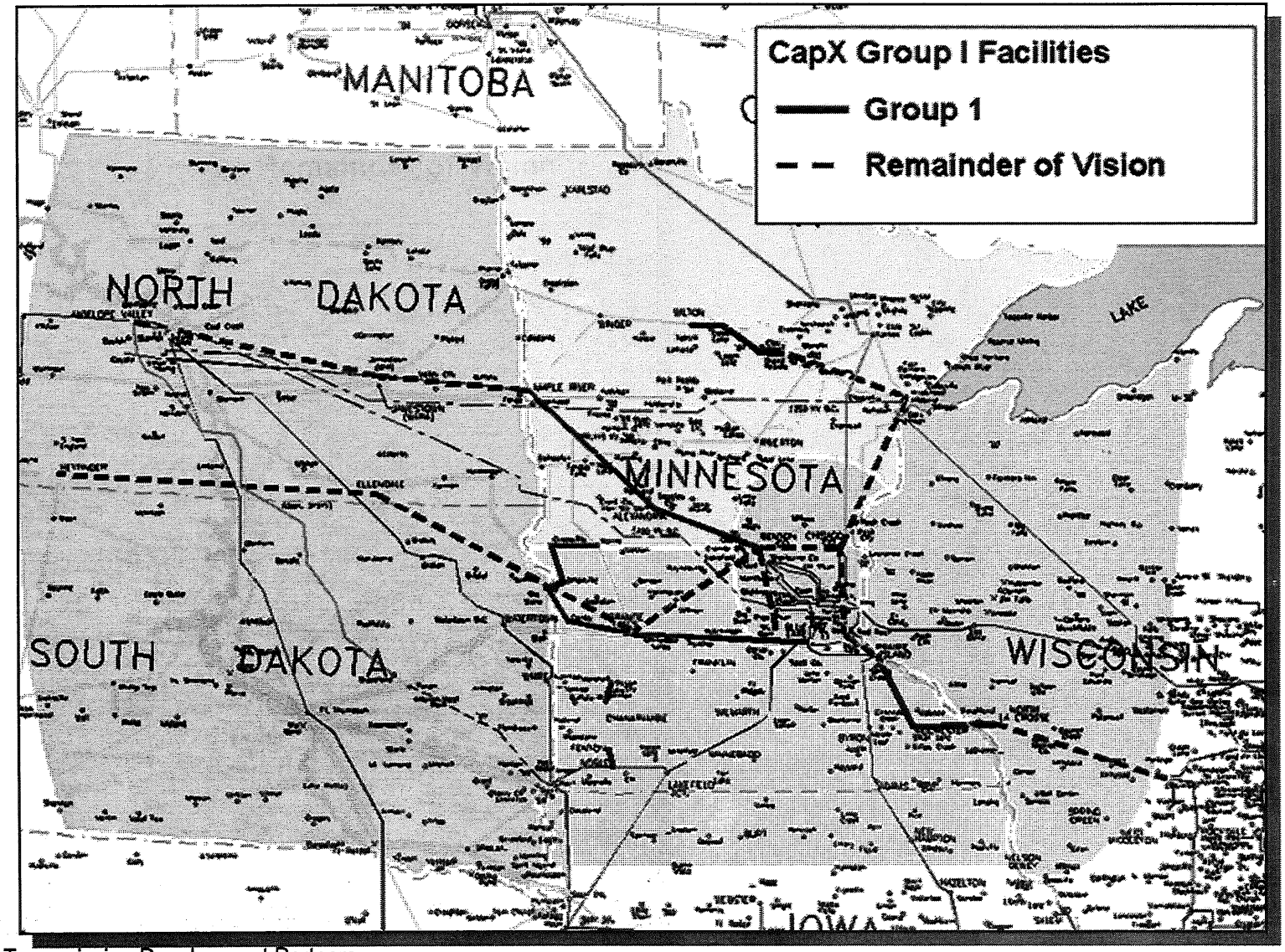
Southern Minnesota Municipal Power Agency

Xcel Energy

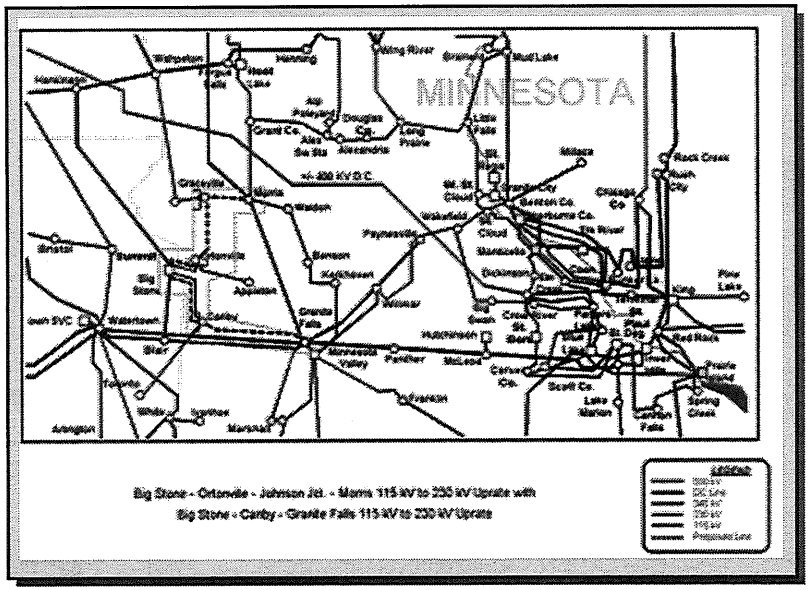
CapX utilities serve Minnesota and the immediate region

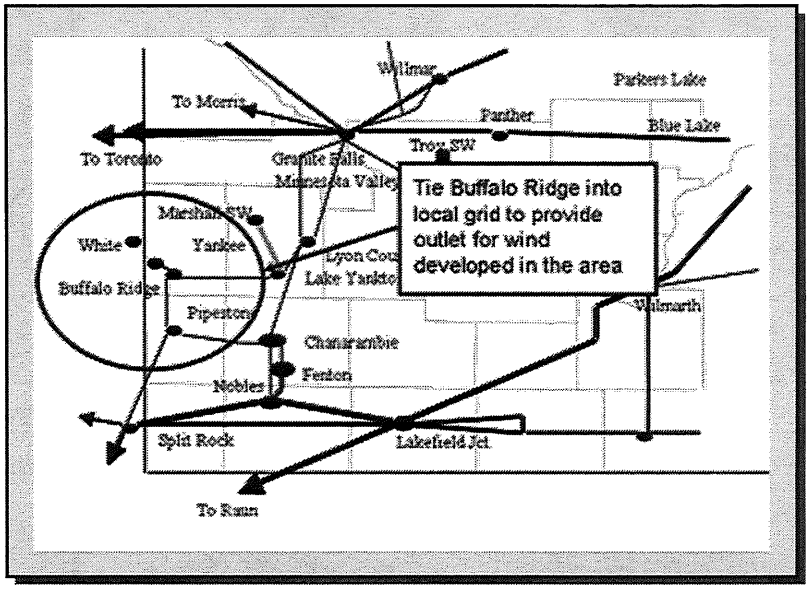


CapX Vision Study



Project Group 1 meets a variety of needs





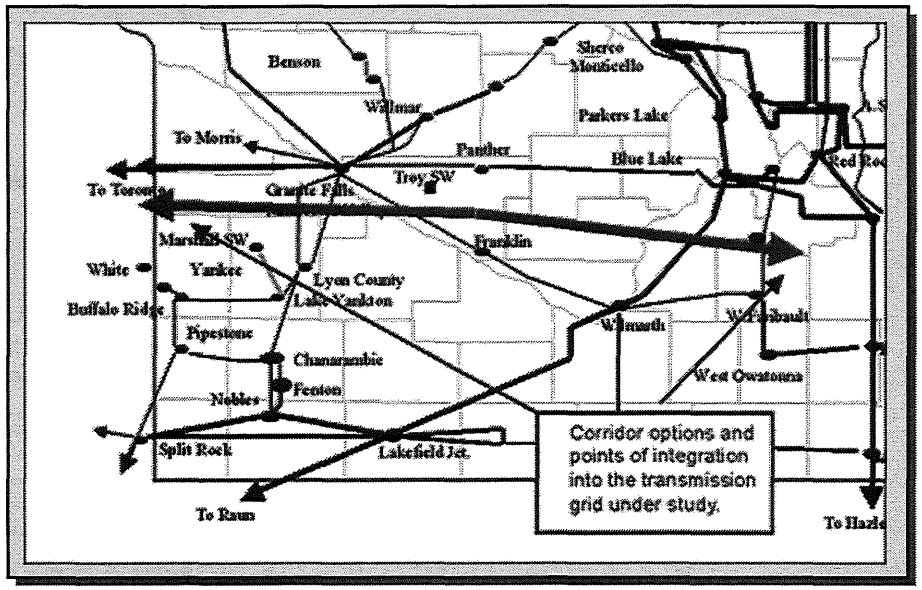
Big Stone II Transmission

- Driver – Big Stone II generation outlet
- Scope – 80 miles (est), 230 and 345 kV
- Expected In-Service – 2010

Buffalo Ridge Outlet

- Driver – Buffalo Ridge projects together provide outlet for 1000 MW of wind
- Scope – 50 miles (est), 115 kV
- Expected In-Service – 2009

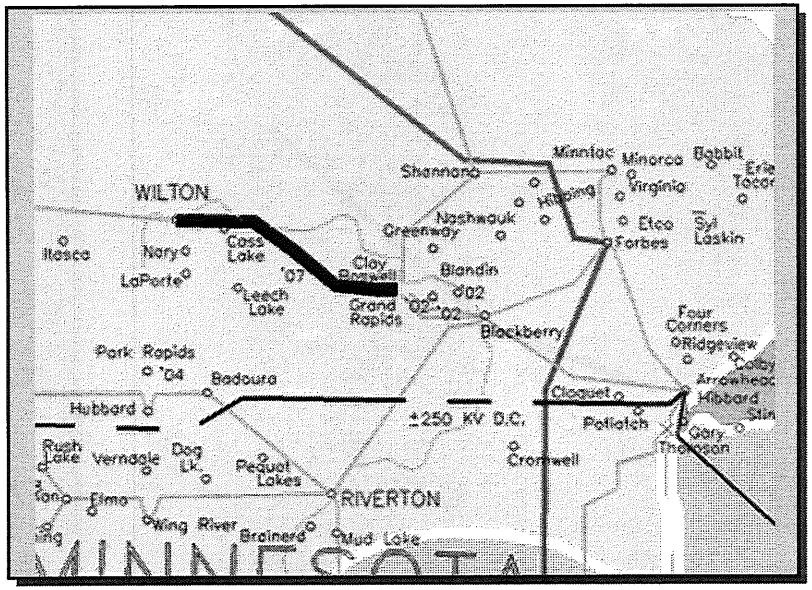
Project Group 1 meets a variety of needs (cont)

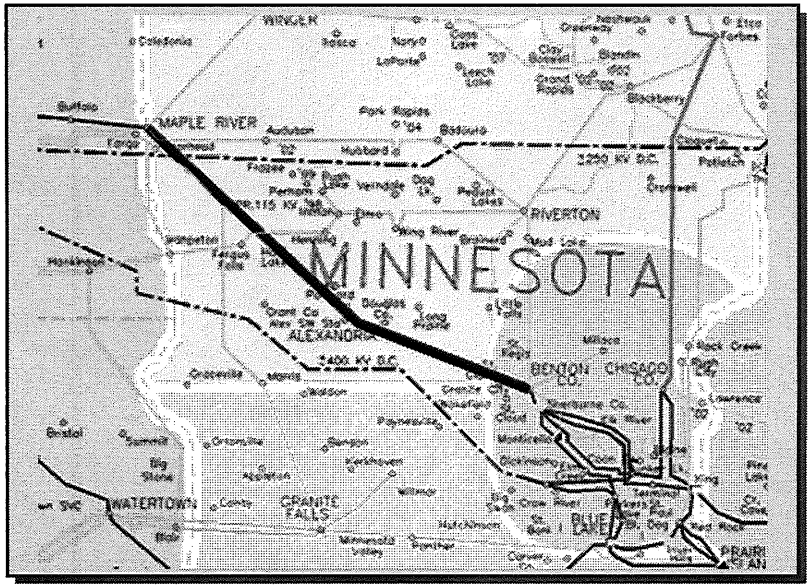


Buffalo Ridge – Metro Area

- Driver – Buffalo Ridge projects together provide outlet for 1000 MW of wind
- Scope – 180 miles (est), 345 kV
- Expected In-Service 2010

Project Group 1 meets a variety of needs (cont)





Boswell – Wilton

- Driver – Grand Forks and surrounding region reliability
- Scope – 60 miles (est), 230 kV
- Expected In-Service – 2010

Fargo – Alexandria – Benton

- Driver – Fargo to Central MN regional reliability
- Scope – 170 miles (est), 345 kV
- Expected In-Service – 2012

Project Groups
– established by timing and priority of needs

Group I– CON to be filed within one year		
Big Stone II Transmission	3rd qtr 05	2010
Buffalo Ridge Outlet	1st qtr 06	2009
Buffalo Ridge– Metro 345	3rd qtr 06	2010
Boswell– Wilton 230	3rd qtr 06	2010
Fargo– Alexandria– Benton County 345	3rd qtr 06	2012
Prairie Island– Rochester– LaCrosse345 *	3rd qtr 06	2011
Group II– Around the Twin Cities		
Forbes- Arrowhead		
Benton County– Chisago 345		
Benton County– Granite Fall 345		
Benton County– St Boni 345		
Arrowhead– Chisago 345		
Group III– Remote Generation Outlet		
Antelope Valley– Jamestown– Maple River 345		
Columbia– North LaCrosse345		
Chisago– Prairie Island 345		
Group IV– Remote Generation Outlet		
Hettinger– Ellendale– Granite Falls 345		

- Engineering modeling, regional planning, and need analysis established the Group 1 project list.
- Total Group 1 cost estimated $700M
- Groups 2, 3, and 4 have also been forecasted but the project list will evolve as more detailed analysis proceeds.

* The Prairie Island – Rochester – LaCrosse project involves RPU and other utility partners in coordination with CapX.