Southwest Minnesota-->Twin Cities EHV Development
Work Plan for Technical Studies

Scope & Goals

This is a generation outlet electric transmission study for southwestern Minnesota and eastern South Dakota Buffalo Ridge area generation additions, in conjunction with the Big Stone II generation addition. The primary goals are to:

- determine the amount of increase in Buffalo Ridge outlet capability achievable with a 345 kV-class development between southwest MN and the Twin Cities (as suggested by previous studies);
- gauge the 345 kV development's impact on regional power transfer capabilities;
- resolve details of the 345 kV line addition's integration into the existing transmission system: western (Buffalo Ridge/Big Stone area) connections, intermediate substations, and eastern (Twin Cities) connections.

The study will address delivery of power from the Buffalo Ridge primarily to the Minneapolis/St Paul ("Twin Cities") load center, while creating an optimized regional solution, including the transmission facilities and delivery of power associated with the Big Stone II project.

Background

During the past five years, several transmission studies have been performed relevant to the Buffalo Ridge outlet question.

A. Southwest Minnesota/Southeast South Dakota Electric Transmission Study (November, 2001)
B. Buffalo Ridge Incremental Generation Outlet Study (June, 2005)
C. MISO Iowa / Southern MN / Wisconsin Exploratory Study (2004-2005)
D. MISO Northwest Exploratory Study (2004-2005)
E. CapX 2020 (2005)

Study (A) developed the "825 MW" set of southwest Minnesota transmission improvements presently being implemented.

Study (B) developed the "Option 31A" set of improvements to achieve several hundred additional MW of Buffalo Ridge generation outlet.

Study (C), which is still under way, has provided useful information on the comparative performance of several EHV transmission concepts for southern/western Minnesota and northern Iowa to eastern Wisconsin.

Study (D) has developed two scenarios, with the potential for staged implementation, for the development of EHV transmission lines from the Dakotas to the Twin Cities.

Study (E) has indicated the desirability of an EHV connection between southwestern Minnesota and the Twin Cities, and the necessity for an outer EHV loop for the Twin Cities.

Studies have also been performed by MISO and others relating to Big Stone II outlet considerations. Drawing from the results of these five categories of studies, it is evident that an EHV transmission development from Western Minnesota to the Twin Cities is desirable.

Although many system alternatives can be devised, the study will focus on the following base transmission development, as shown in the attached diagram:

- Big Stone – Morris 230 kV Line (rebuild 115 kV → 230 kV)
- Big Stone – Canby – Granite Falls (Hazel) 230 kV Line (with option for 345 kV development)
- Brookings Co. – Lyon Co. – Franklin – Helena – Lake Marion – Hampton Corner/Black Dog 345 kV Line
- Lake Yankton – Lyon County – Hazel 345 kV (rebuild 115 kV → 345 kV)
- Toronto – Brookings County 115 kV

This base set of improvements will be the benchmark for the Buffalo Ridge outlet analysis. Additional improvements may be added if found advantageous. Some comparison to alternative transmission configurations will be performed.

The base 345 kV transmission plan will be evaluated with respect to Buffalo Ridge area generation outlet capacity achievable with the Big Stone II project in-service. Outlet capability will be determined by technical analyses performed under traditional transmission planning methods, criteria, and assumptions. Performance characteristics to be addressed will include:

- Steady-state performance (powerflow)
- Dynamic stability
- Voltage stability
- Constrained interface ("flowgate") impacts
- Losses

Enhancements/revisions to the Base Plan will also be evaluated. These will include

- Double circuit construction
- Series compensation
- Twin Cities (eastern terminus) optimization
- Improvements to underlying (lower-voltage) system facilities

Modeling

Steady state analysis will utilize the 2009 summer peak model from the Big Stone II System Impact studies. This model is based on the NERC 2003 series 2010 summer peak with the MAPP 2004 series 2009 summer peak representation merged into the case (replacing the original MAPP 2008 summer peak from the MAPP 2003 series representation). This case will be modified to reflect summer off-peak conditions for the 2011 timeframe. The incremental transmission facilities of option 31A from the BRIGO study will be inserted into the base model.

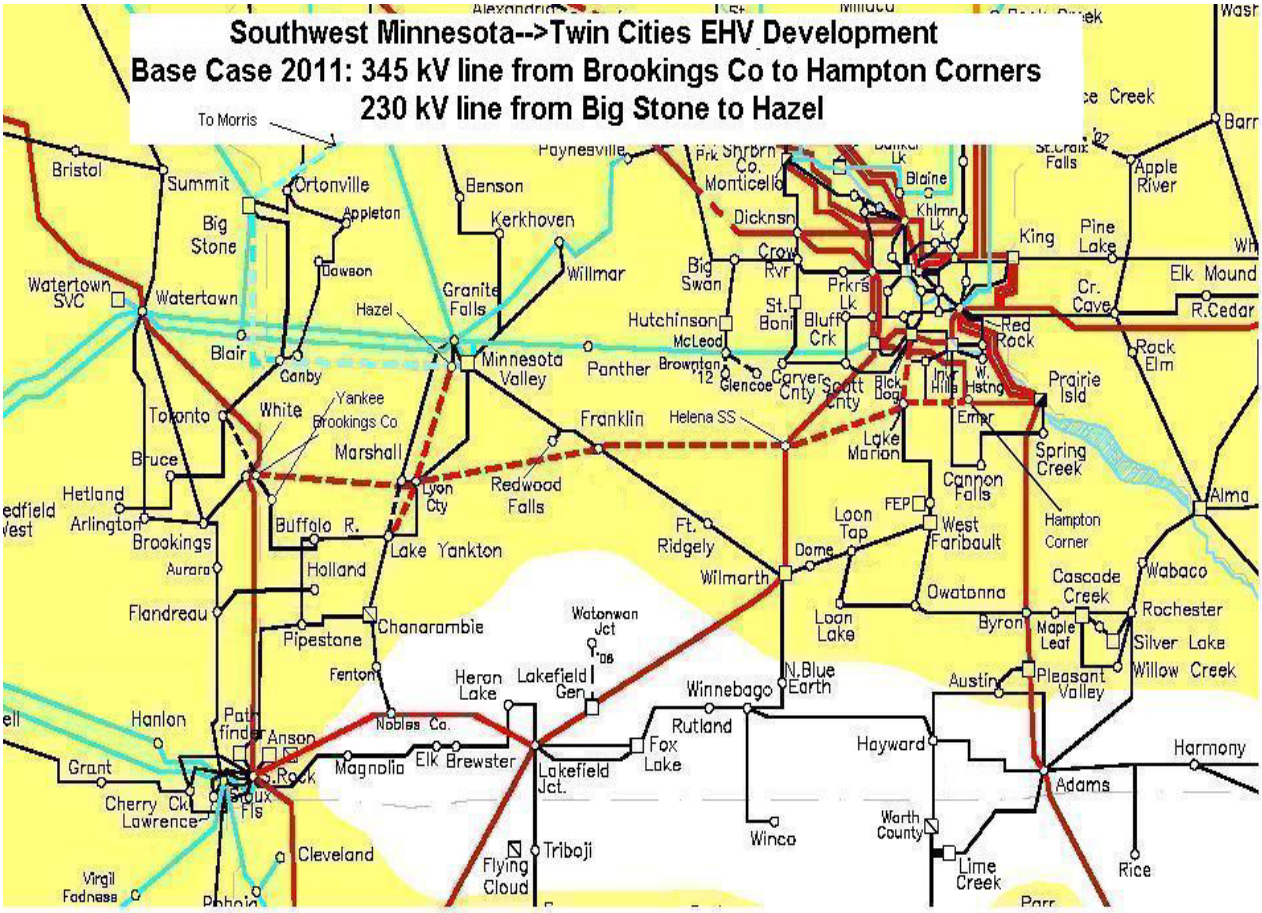
Stability analysis will include a high-level analysis of the regional disturbances within northern MAPP as well as disturbances on the new line sections. This analysis will not be redefining precise transfer limits or interfaces within the region, but will gauge the approximate level of transfer capability increases achieved with the EHV plan. Stability analysis will be performed using the NMORWG stability package with the MISO Coordinated Study (Group 2) stability models. Generation levels in the Buffalo Ridge area will be refined to more closely align with the pre- and post-EHV addition generation levels from the powerflow models.

Buffalo Ridge area generation will be assumed to start at a base generation level of 1200 MW. This 1200 MW of generation in the base models will be assumed at:

- 500 MW existing wind generation (primarily Chanarambie and Buffalo Ridge)
- 350 MW new generation, north side of Buffalo Ridge (Yankee, Brookings Co., Toronto)
- 350 MW of new generation, south side of Buffalo Ridge (Fenton and Nobles)

Schedule

Announcement to MAPP NM & MB SPGs	Thurs July 28, 2005
Presentation to MAPP NM SPG	Tues Aug 2, 2005
Presentation to MAPP MB SPG	Wed Aug 3, 2005
Base Case powerflow models revised	Thurs Aug 4, 2005
Study Group meeting #1 (Xcel Energy Offices)	Tues Aug 9, 2005
First run, incremental outlet contingency analysis (TLTG) to Group	Wed Aug 17, 2005
Constrained interface, losses tabulations to Group	Tues Aug 23, 2005
Study Group meeting #2 (GRE Offices)	Wed Aug 24, 2005
2nd round TLTG & Losses, Interface, & Installed Cost info to group	Tues Sept 13, 2005
Preliminary stability runs to group	Wed Sept 21, 2005
Study Group meeting #3 (MRES Offices)	Fri Sept 23, 2005
3rd round TLTG info & revised losses, cost info to group	Mon Oct 3, 2005
Stability "fixes" runs to group	Mon Oct 3, 2005
Study Group meeting #4 (optimize plan, begin report) (OTP Offices)	Thurs Oct 6, 2005
Study Group meeting #5 (draft report) (Country Inn - Watertown, SD)	Mon Oct 17, 2005
Report Issued	Wed Oct 26, 2005


Southwest Minnesota-->Twin Cities EHV Development
Base Case 2011: 345 kV line from Brookings Co to Hampton Corners
230 kV line from Big Stone to Hazel
To Morris
Bristol
Summit
Ortonville
Appleton
Big Stone
Dawson
Watertown SVC
Watertown
Blair
Canby
Yankee
Brookings Co
White
Toronto
Bruce
Hetland
Arlington
Brookings
Aurora
Holland
Flandreau
Buffalo R.
Lake Yankton
Pipestone
Chanarambie
Fenton
Hanlon
Pathfinder
Anson
Grant
S.Rock
Cherry Ck
Lawrence
Sioux Fls
Cleveland
Virgil
Fadness
Benson
Kerkhoven
Willmar
Granite Falls
Hazel
Minnesota Valley
Marshall
Lyon Cty
Redwood Falls
Franklin
Panther
Hutchinson
McLeod
Brownton
Glencoe
Carver Cnty
Scott Cnty
Blck Dog
Lake Marion
Helena SS
Ft. Ridgely
Dome
Wilmarth
Loon Tap
Loon Lake
N.Blue Earth
Winnebago
Watonwan Jct
Heron Lake
Lakefield Gen
Lakefield Jct.
Nobles Co.
Magnolia
Elk
Brewster
Fox Lake
Rutland
Flying Cloud
Triboji
Winco
Hayward
Austin
Worth County
Lime Creek
Adams
Harmony
Rice
Big Swan
Dicknsn
Monticello
Shrbrn Co.
Blaine
Khlmn Lk
Crow Rvr
Prkrs Lk
St. Boni
Bluff Crk
Red Rock
King
Pine Lake
Cr. Cave
Elk Mound
R.Cedar
Rock Elm
Prairie Isld
Spring Creek
Cannon Falls
FEP
West Faribault
Hampton Corner
Owatonna
Byron
Maple Leaf
Cascade Creek
Wabaco
Rochester
Silver Lake
Willow Creek
Pleasant Valley
Alma
Apple River
Falls
Barr
Creek