NSP System: 10-Year Transmission Plan / 20-Year Scenario Assessment

December 2010

This report contains transmission planning data that may be conceptual in nature and is subject to change. The transmission projects listed may change scope or not be constructed.
Purpose and Scope

The purpose of this document is to present the transmission plans and needs on the NSPM/NSPW integrated transmission system (NSP System) looking forward 10-20 years.

Scope of work:
- Perform an annual assessment and update of the NSP System transmission assets
  - NERC reliability standards compliance requirements
  - Load forecast (2010) (including wholesale)
  - Resource plan (2010)
  - MN Renewable Energy Standard
  - Regional Delivery of Wind Generation

Stakeholder input
- Input on needs and responsive plans are encouraged from stakeholders
- Plan Subject to Midwest ISO stakeholder process
Executive Summary

- 10-Year Transmission Plan
  - Core Reliability projects assessed (2011-15)
  - States Renewable Energy Standards
    - MN RES 30% renewables by 2020
    - Wisc RES 10% renewables by 2015
    - ND RES 10% renewables by 2015
    - SD RES 10% renewables by 2015
    - Western MN, eastern ND & SD wind generation major driver
  - Significant sub-regional transmission involvement
    - CAPX 2020 group 1 completion by 2015
    - Corridor and La Crosse- Eastern Wisconsin 345 kV projects 2015-2025 in-service
    - Second Manitoba Hydro 500 kV in MISO TSR for 2017 in-service
Executive Summary, cont.

- 20-Year Transmission Scenario Assessment
  - 20-year scenario assessment is a conceptual vision
  - NSP evaluated 4 Sub-Regional scenarios based on possible upper Midwest (IA,MN,ND,SD,WI) renewable energy policies
    1. High Manitoba Hydro development
    2. Sub-Regional renewable development
    3. Carbon reduction future
    4. Regional 500 kV overlay/high renewable scenario
  - Conclusion
    - 345 kV overlay likely sufficient to meet likely upper Midwest only needs
    - Significant national level renewable exports may drive a different approach
    - CAPX 2020 group 1 good fit with the future scenario developments.
Regional studies and proposals

- Potential with national RES policy development
- Wind generation primary driver
- Regional 765 kV proposals
- Projects under study proposed by regional entities
  - MISO Regional Generation Outlet Study (RGOS 1 and 2)
  - Green Power Express 765 kV project
  - SMARTTransmission Study

Note: NSP is participating in these studies to ensure the NSP System and local area are properly represented and to ensure customer focus, cost effectiveness, operational reliability and regional policymaker alignment.
Key Messages

- **10-Year Plan**
  - New load peak in August 2010 shows growth
  - Wind generation continues to be a driver of transmission although development slower than in recent past
  - CAPX 2020 and Corridor project support Minnesota Renewable Goals

- **20-Year Transmission Scenario Assessment**
  - 20-year scenario assessment is a conceptual vision for the NSP area
  - NSP evaluated 4 unique transmission scenarios
  - Scenarios include various levels of renewable energy, and varying potential upper midwest environmental policies
Key Messages

- Regional Studies and Proposals
  - Wind potential in Dakotas, Iowa and Minnesota is one driver for interest in Regional 765 kV transmission development
  - NSP engaged in regional and national efforts to broaden policy considerations
    - Support for renewable energy
    - Incorporate potential climate change policy impacts
    - Evaluation of various export strategies
    - Assure coordination with NSP transmission system

Note: NSP is participating in these studies to ensure the NSP system and local area are properly represented and to ensure customer focus, cost effectiveness, operational reliability and regional policymaker alignment.
NSP System Statistics: 2010

- 7,153 miles of transmission (34.5 kV and above)
- 477 substations served
- 7,570 MW Xcel Energy-owned generation
- 1,292 MW Wind generation
- NSP System Previous Peak Load: 9,027 MW (Actual) (July 2006)
- NSP System Peak Load 9,125 MW (Actual) (August 2010)
NSP Transmission System

- NSP’s transmission assets are located in MN, WI, ND, SD, and MI
  - Under operational control of the Midwest Independent Transmission System Operator, Inc. (MISO)

- Major Utility Interconnections
  - Dairyland Power Cooperative, Great River Energy, Minnesota Power, Manitoba Hydro Electric Board, Otter Tail Power, ITC Midwest, Western Area Power Administration, American Transmission Company LLC and others

- Under Functional control of MISO. NSP System planning subject to MISO Transmission Expansion Plan (MTEP) process
MISO Service Territory
Planning Principles

- Principles
  - Focus on customers and affordability
  - Ensure alignment with policy makers
  - Ensure cost recovery support from regulators
  - Coordinate with local regional utilities
  - Actively participate in regional plan development
NSP System Planning process

- Reliability planning and other studies
- Annual NERC assessments
- Make extensive use of regional planning groups and the MISO MTEP process
  - Participate in the Northern MAPP Sub-Regional Planning Group meetings
  - Issues and proposals submitted to MTEP process
  - Issues and Proposals also aired at the MTO & submittal in the Minnesota Biennial Transmission Planning Report
Planning Process

- Planning for Generation Additions Performed by MISO
  - All requests to interconnect with the NSP transmission system must be made with MISO
  - For further information go to:
    - www.midwestiso.org
Regional Planning Process

- **NSP internal reliability annual reviews**
- **MN Transmission Assessment and Compliance Team (MNTACT)**
  - Minnesota joint utility annual NERC assessment
- **MAPP Sub-Regional Planning Group’s (SPG)**
  - Coordination of studies and plans
- **MISO Transmission Expansion Plan (MTEP)**
  - MISO annual plan and FERC order 890 compliance
- **MISO Initiated studies**
- **Interconnection-wide planning such as the Eastern Interconnection Planning Collaborative (EIPC)**
- **Special purpose studies**
- **State ordered studies**
  - Renewable Energy Standard (RES)
    - Corridor
    - 2016 RES
  - Distributed Renewable Generation (DRG)
  - MN Biennial Plan
Economic Planning

- Economic planning involves
  - Various resource scenario evaluations
  - Economic impact of market congestion on transmission elements
  - Energy and demand loss evaluation on transmission elements

- Benefits frequently not large enough to justify stand alone transmission investment

- Economic Benefits coupled with other benefits (reliability, local or regional policy, etc) together enter into transmission alternative evaluation
Economic Planning

- NSP reviews studies by others and is actively involved in regional and Sub-Regional economic planning efforts such as:
  - The Department Energy (DOE) national transmission congestion studies
  - MTEP process
  - MAPP SPGs
  - MTO TACT Study Group
Most MISO transmission congestion is east of Minnesota
Stakeholder input

- MAPP SPG meetings
  - MAPP sends it out on the public exploder email list
  - http://www.mapp.org/

- MISO MTEP process sub-regional meetings
  - MISO posts these SPM meetings on their public website
  - MISO sends out an email to the Transmission Customers list

- MN Biennial Plan Annual public meetings
  - Local and regional newspaper ad
  - http://www.minnelectrans.com
### 2010 Planning Process Calendar

#### Months:
- **Jan**: 5 year capital budget studies
- **Feb**: NSP Load Interconnection Studies
- **Mar**: MTO Public Hearings & Biennial Plan
- **Apr**: 5 year budget approved
- **May**: Generation Interconnection and Transmission Service Studies (MISO Process)
- **Jun**: NSP 10 year plan and 5 year Budget Studies
- **Jul**: Minnesota Transmission Assessment Compliance
- **Aug**: MTO Public Hearings & Biennial Plan
- **Sep**: Northern Map Subregional Planning Group
- **Oct**: MTEP11 Submittals and FERC 890
- **Nov**: MTEP11 Public meetings
- **Dec**: Final Plan Developed

#### Special Notes:
- **MTEP10 Study and Planning Group Meeting**
- **MTEP10 MISO Board Approval**
### Planning Criteria

#### Steady State Planning Criteria

<table>
<thead>
<tr>
<th>Limits</th>
<th>System Intact Condition</th>
<th>Post-Contingency Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Line Loading</td>
<td>100% of Rating</td>
<td>110% of rating for single contingency, unless limited by terminal equipment or line clearance</td>
</tr>
<tr>
<td>Transformer Loading</td>
<td>100% of Rating</td>
<td>Summer 115% post-contingency if pre-contingency loading is below 90%</td>
</tr>
<tr>
<td>Generator Bus Voltage</td>
<td>0.95 to 1.05 per unit</td>
<td>0.95 to 1.05 per unit</td>
</tr>
<tr>
<td>Load Bus Voltage</td>
<td>Twin Cities metro 0.92 to 1.05 per unit. Outside TC Metro 0.90 to 1.10 per unit</td>
<td>Twin Cities Metro 0.92 to 1.05 per unit. Outside TC Metro 0.90 to 1.10 per unit.</td>
</tr>
</tbody>
</table>
## Planning Criteria

### Dynamic Stability Criteria

<table>
<thead>
<tr>
<th>NERC Categories</th>
<th>Transient Voltage Deviation Limits</th>
<th>Rotor Angle Oscillation Damping Ratio Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Nothing in addition to NERC Requirements</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Minimum 0.70 p.u. at any bus</td>
<td>Not to be less than 0.0081633 for disturbances with faults or less than 0.0167660 for line trips.</td>
</tr>
<tr>
<td>C</td>
<td>Minimum 0.70 p.u. at any bus</td>
<td>Not to be less than 0.0081633 for disturbances with faults or less than 0.0167660 for line trips.</td>
</tr>
<tr>
<td>D</td>
<td>Nothing in addition to NERC Requirements</td>
<td></td>
</tr>
</tbody>
</table>
## Drivers

### Transmission Development

<table>
<thead>
<tr>
<th>Load growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Load forecast (9,125 MW in 2010)</td>
</tr>
<tr>
<td>▪ Wholesale/retail load serving interconnections</td>
</tr>
<tr>
<td>▪ NERC Reliability compliance and planning criteria</td>
</tr>
<tr>
<td>State renewable portfolio standards</td>
</tr>
<tr>
<td>▪ MN RES 30 % renewables by 2020</td>
</tr>
<tr>
<td>▪ Wisc RES 10% renewables by 2015</td>
</tr>
<tr>
<td>▪ ND RES 10% renewables by 2015</td>
</tr>
<tr>
<td>▪ SD RES 10% renewables by 2015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regional and National Renewable Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Western MN, Eastern ND &amp; SD major wind resources</td>
</tr>
<tr>
<td>▪ National Energy policy</td>
</tr>
<tr>
<td>▪ Potential national Renewable Energy Standard</td>
</tr>
<tr>
<td>▪ Carbon Emissions Reduction (Cap and Trade?)</td>
</tr>
<tr>
<td>▪ Intermittent renewable resource reliability and operations criteria</td>
</tr>
</tbody>
</table>
Historic Load Growth (NSP Native)
Drivers
Low but continuing load growth (NSP Native)

20-Year Growth Rate = 0.71%

*Forecast October 2010
Driver
State Renewable Generation Policy

Combined Minnesota Utilities

Collectively, RES Utilities have a Surplus of Renewables in 2010-2016
(represented by negative #s on graph)

Driver
Generation Additions

(MISO Queue Map Oct. 2010)
Driver
National Renewable Policy

Midwest wind for national RES?

NSP System Sub-regional Plan
CAPX2020

Group 1 Projects

- Nearly 700 miles and $1.7 billion
  - Upsizing adds about $200 million

<table>
<thead>
<tr>
<th>Project</th>
<th>Distance</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fargo-St. Cloud-Monticello</td>
<td>250-miles, 345-kV</td>
<td></td>
</tr>
<tr>
<td>Brookings County-Hampton</td>
<td>240-miles, 345-kV</td>
<td></td>
</tr>
<tr>
<td>Hampton-Rochester-La Crosse</td>
<td>150-miles, 345-kV</td>
<td></td>
</tr>
<tr>
<td>Bemidji-Grand Rapids</td>
<td>70-miles, 230-kV</td>
<td></td>
</tr>
</tbody>
</table>

- Alleviates emerging community service reliability concerns around the state
- Critical foundation for future transmission and generation
- Provide needed transmission capacity to support new generation outlet
- In-service dates from 2011-2015

- CAPX 2020 Group 1 projects resulted from Vision plan
Post CapX 2020
Potential Projects

1. Corridor (Granite Falls-Twin Cities 345 kV) Project
   - Next likely development
   - Increase Western MN- MISO market transfer 1000MW
   - Support wind generation development

2. Manitoba- Minnesota 500 kV
   - Increase MH to US transfer 1100 MW
   - MISO Manitoba Hydro Group TSR Study

3. La Crosse-Madison 345 kV
   - Multiple purpose line
   - Increase Western MN- MISO market transfer 2000MW

4. Other potential projects further support wind generation development
5-Year Expansion Plan (2010-2014)
Planning Zones

<table>
<thead>
<tr>
<th>Zone 1</th>
<th>Twin Cities Metro Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 2</td>
<td>Southeast Minnesota</td>
</tr>
<tr>
<td>Zone 3</td>
<td>St Cloud and West Central Minnesota</td>
</tr>
<tr>
<td>Zone 4</td>
<td>South Dakota / Sioux Falls</td>
</tr>
<tr>
<td>Zone 5</td>
<td>Northern Wisconsin</td>
</tr>
<tr>
<td>Zone 6</td>
<td>Southern Wisconsin</td>
</tr>
<tr>
<td>Zone 7</td>
<td>North Dakota</td>
</tr>
<tr>
<td>Zone 8</td>
<td>Minnesota Valley / SW Minnesota</td>
</tr>
</tbody>
</table>
Proposed Transmission Projects

Zone 1: Twin Cites Metro Area

- Twin Cities metro made up of Minneapolis/St. Paul and surrounding suburbs
- Max Generation: 3518 MW
- Peak Load: 5388 MW (60% of NSP System load)
- CAPX 2020 Brookings 345 kV line begins development of an outer 345 kV transmission ring of the metro area.

Issues
- 345 kV transformer capacity maxed out
- Impact of reduced 115 kV generation due to high wind generation conditions
- Inner city/suburbs require new distribution substations with associated transmission
- Expansion of metro growth outside the US 694/494 freeway loop
# Proposed Transmission Projects

## Zone 1: Twin Cities Metro Area (2010-2014)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eden Prairie 345/115 kV transformer</td>
<td>Replace existing 448 MVA transformers with two new 672 MVA transformers</td>
<td>TBD</td>
<td>Reliability</td>
</tr>
<tr>
<td>2</td>
<td>Upgrade Red Rock transformers</td>
<td>Upgrade Red Rock 115/345 kV transformers to 672 MVA</td>
<td>TBD</td>
<td>Reliability</td>
</tr>
<tr>
<td>3</td>
<td>New 115kV substations</td>
<td>Hiawatha and Midtown new 115kV Substations</td>
<td>2011</td>
<td>Distribution</td>
</tr>
<tr>
<td>4</td>
<td>Hiawatha – Midtown 115kV</td>
<td>New double circuit 115kV line from Hiawatha to Midtown</td>
<td>2011</td>
<td>Distribution</td>
</tr>
<tr>
<td>5</td>
<td>Hollydale Distribution Interconnection</td>
<td>Upgrade distribution substation to 115 kV and increase loading</td>
<td>2013</td>
<td>Distribution</td>
</tr>
<tr>
<td>6</td>
<td>Scott Co.-Augusta–West Waconia conversion</td>
<td>Convert the existing 69 kV line along with the distribution substations to 115 kV</td>
<td>2013</td>
<td>Reliability</td>
</tr>
<tr>
<td>7</td>
<td>Glencoe–West Waconia conversion</td>
<td>Convert the 69 kV line between Glencoe and West Waconia to 115 kV</td>
<td>2013</td>
<td>Reliability</td>
</tr>
<tr>
<td>8</td>
<td>Scott County-Westgate conversion</td>
<td>Convert the 69 kV line between Westgate – Scott County to 115 kV along with Excelsior and Deephaven substations</td>
<td>2014</td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change
Potential Transmission Projects

Zone 1: Twin Cities Metro Area (2015-2019)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red Rock – Afton 115 kV</td>
<td>Rebuild existing Red Rock – Afton 115 kV line to 795 ACSS</td>
<td></td>
<td>Reliability</td>
</tr>
<tr>
<td>2</td>
<td>Parkers Lake 345/115 kV transformer</td>
<td>Replace existing 448 MVA transformers with two new 672 MVA transformers</td>
<td></td>
<td>Reliability</td>
</tr>
<tr>
<td>3</td>
<td>Meadow Lake Distribution Interconnection</td>
<td>New 115 kV distribution substation and line</td>
<td>2015</td>
<td>Distribution</td>
</tr>
</tbody>
</table>
Proposed Transmission Projects

Zone 2: South East Minnesota

- Rochester is the major load center. RPU owned.
- Increased interest in renewable generation in this area.
- Max Generation: 2422 MW
- Except in the vicinity of Rochester this area is primarily rural with minimal load growth
- CAPX 2020 La Crosse 345 kV line will add substantial capability to serve Rochester
- Issues
  - Wind generation potential
  - Aging 69 kV infrastructure
### Proposed Transmission Projects

#### Zone 2: South East Minnesota (2010-2014)

<table>
<thead>
<tr>
<th>#</th>
<th>Project Description</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lake City – Wabasha 69kV line</td>
<td>Rebuild existing 69kV line from Lake City to Wabasha</td>
<td>2011</td>
<td>Reliability</td>
</tr>
<tr>
<td>2</td>
<td>Prescott Cap bank</td>
<td>Add a new 10 MVAR capacitor bank</td>
<td>2014</td>
<td>Reliability</td>
</tr>
<tr>
<td>3</td>
<td>Pleasant Valley – Byron 161kV</td>
<td>New 161kV line from Pleasant Valley – Byron (RIGO)</td>
<td>2011</td>
<td>Generation</td>
</tr>
<tr>
<td>4</td>
<td>2(^{nd}) 161 kV line Byron-West Side Energy Park (SMMPA to build)</td>
<td>Complete the double circuit 161 kV from Byron-Maple Leaf-Cascade Creek</td>
<td>2011</td>
<td>Generation</td>
</tr>
<tr>
<td>5</td>
<td>Colvill transformer</td>
<td>Colvill 112 MVA 115/69kV transformer, including new breakers</td>
<td>2011</td>
<td>Generation</td>
</tr>
<tr>
<td>6</td>
<td>Colvill – Byllesby 69kV</td>
<td>Colvill to Byllesby 69kV line 477 ACSR</td>
<td>2011</td>
<td>Generation</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change

---

**Map Legend**
- **500 kV**
- **345 kV**
- **230 kV**
- **161 kV**
- **115 kV**
- **69 kV**
Potential Transmission Projects

Zone 2: South East Minnesota (2015-2019)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spring Creek – Lake City 161 kV line</td>
<td>Build 161 kV line along existing 69 kV line corridor (double circuit).</td>
<td>2015-2019</td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change
Proposed Transmission Projects

Zone 3: West Central Area

- St. Cloud is the largest load center in the area.
- CAPX 2020 Fargo-Monticello line will help support the area.
- Max Generation: 2976 MW
- CAPX 2020 Fargo line will provide the bulk power transmission anchor for the reliability of the whole planning zone.

Issues
- St. Cloud transmission maxed out
- Minimal growth in the west
- Small wind development in the west
# Proposed Transmission Projects

**Zone 3: West Central Area (2010-2014)**

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Benton Co. – Mayhew Lake 115kV</td>
<td>Re-Terminate one of the Benton – Granite City circuit into Mayhew Lake substation, by building 4 miles of new 115 kV line.</td>
<td>2012</td>
<td>Reliability</td>
</tr>
<tr>
<td>2</td>
<td>St. Cloud – Granite City 115kV</td>
<td>Eliminate the 3 terminal line between Granite City, Benton County and St. Cloud</td>
<td>2012</td>
<td>Reliability</td>
</tr>
<tr>
<td>4</td>
<td>Sauk River – West St Cloud 115kV</td>
<td>Upgrade Sauk River to West St Cloud 115kV line to 795 ACSR</td>
<td>2011</td>
<td>Reliability</td>
</tr>
<tr>
<td>5</td>
<td>Maple Lake – Watkins 69kV</td>
<td>Rebuild Maple Lake to Watkins 69kV line to 477 ACSR</td>
<td>2012</td>
<td>Reliability</td>
</tr>
<tr>
<td>6</td>
<td>Sherco Data Center</td>
<td>Add new data center to the Sherco Substation</td>
<td>TBD</td>
<td>Load</td>
</tr>
<tr>
<td>7</td>
<td>Grove Lake – Glenwood 69kV</td>
<td>Rebuild existing 69 kV line to 477 ACSR</td>
<td>2011</td>
<td>Reliability</td>
</tr>
<tr>
<td>8</td>
<td>Paynesville – Belgrade 69kV</td>
<td>Rebuild existing 69 kV line to 477 ACSR</td>
<td>2015</td>
<td>Reliability</td>
</tr>
<tr>
<td>9</td>
<td>Douglas County 69 kV work</td>
<td>2nd 115/69 kV transformer at Douglas County</td>
<td>2011</td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change
Potential Transmission Projects

Zone 3: West Central Area (2015-2019)

- Possible 69 kV condition upgrades outside of the St. Cloud area.
- Possible wind development could drive upgrades in the west.
Proposed Transmission Projects

Zone 4: Sioux Falls Area

- Sioux Falls is the largest load center in this area.
- Close proximity to the Buffalo Ridge area.
- Wind generation is heavily located around this area.

Issues
- Expansion of medical campus planned in central and west Sioux Falls
- Large amounts of wind generation potential west of the city.
- At western edge of NSP System/MISO
## Proposed Transmission Projects

### Zone 4: Sioux Falls Area (2010-2014)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New 115 kV Lawrence substation</td>
<td>Convert existing Lawrence 115/69/34.5 kV substation to 115/34.5 kV, breaker and a half configuration</td>
<td>2014</td>
<td>Reliability</td>
</tr>
<tr>
<td>2</td>
<td>Sioux Falls new 115 kV substation</td>
<td>Relocate existing Sioux Falls substation and convert from 69/13.8 kV to 115/13.8 kV</td>
<td>2014</td>
<td>Reliability</td>
</tr>
<tr>
<td>3</td>
<td>West Sioux Falls – Sioux Falls – Lawrence 69 kV Line Conversion to 115 kV</td>
<td>Convert existing West Sioux Falls – Sioux Falls – Lawrence 69 kV line to 115 kV (795 ACSS) and minimal substation termination work at West Sioux Falls</td>
<td>2014</td>
<td>Reliability</td>
</tr>
<tr>
<td>4</td>
<td>Louise Substation</td>
<td>Add new 115 kV substation on south side of Sioux Falls</td>
<td>2011</td>
<td>Distribution</td>
</tr>
</tbody>
</table>

**Note:** Project scope and timing subject to change.
Proposed Transmission Projects

Zone 4: Sioux Falls Area (2015-2019)

- Potential need for bulk supply source on the west side of the city of Sioux Falls sometime after 2019
- Growing load around the 115 kV loop
- Wind development may accelerate need for additional bulk supply sources around Sioux Falls in the future
Proposed Transmission Projects

Zone 5: Northern Wisconsin Area

- Eau Claire is the largest load center in the area.
- Primarily rural load.
- Minimal small customer load growth
- Major transmission expansion under construction in Eau Claire

Issues
- Northern Wisconsin transmission maxed out
- Substantial major industrial expansion under consideration in northern Wisconsin
Proposed Transmission Projects
Zone 5: Northern Wisconsin Area (2010-2014)

Note: Project scope and timing subject to change
Proposed Transmission Projects
Zone 5: Northern Wisconsin Area (2015-2019)

1. Bayfield Loop 115 kV
   Comments: Rebuild existing Iron River – Gingles 34.5 kV loop to 115 kV with some Distribution underbuild
   Drivers: Load Shed

Note: Project scope and timing subject to change
Proposed Transmission Projects

Zone 6: Southern Wisconsin Area

- Lacrosse is the largest load center in the area.
- Made up of agricultural and smaller communities.
- CAPX 2020 creates a bulk supply source to the city of La Crosse in 2015.
- NSP System highly interconnected with Dairyland Power Coop in this area
Proposed Transmission Projects
Zone 6: Southern Wisconsin Area (2010-2014)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New transformer at Monroe County</td>
<td>Monroe County new 70 MVA 161/69kV transformer, including new breakers</td>
<td>2011</td>
<td>Reliability</td>
</tr>
<tr>
<td>2</td>
<td>Camp McCoy – Cataract 69 kV line rebuild</td>
<td>Rebuild 4 miles of 1/0 ACSR 69 kV line to 477 ACSR</td>
<td>2011</td>
<td>Reliability</td>
</tr>
<tr>
<td>3</td>
<td>Coulee transformer upgrade and ring bus</td>
<td>Replace Coulee 161/69kV transformer #5 with 112 MVA unit</td>
<td>2011</td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change
**Proposed Transmission Projects**

**Zone 6: Southern Wisconsin Area (2015-2019)**

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>La Crosse – West Salem 69kV</td>
<td>Rebuild La Crosse to West Salem 69kV line to 477 ACSS</td>
<td>2016</td>
<td>Reliability</td>
</tr>
<tr>
<td>2</td>
<td>La Crosse transformer upgrade</td>
<td>Replace La Crosse 161/69kV transformer #2 with 112 MVA unit</td>
<td>2016</td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change
Proposed Transmission Projects

Zone 7: North Dakota Area

- Fargo and Grand Forks are the primary load centers.
- New Bison substation for the CAPX Group 1 projects
- Issues
  - Large amounts of wind proposed west of Fargo in North Dakota
Proposed Transmission Projects

Zone 7: North Dakota Area (2010-2014)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maple River – Cass County 345kV</td>
<td>Maple River – Cass County, new 345kV line (operated at 230kV) and Cass County 230/115kV transformer</td>
<td></td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change
Proposed Transmission Projects

Zone 7: North Dakota Area (2015-2019)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maple River – Cass County 345kV extension</td>
<td>Extend Maple River – Cass County 345 kV Line to Flint Substation (via double-circuit with Maple River – Sheyenne 230 kV line)</td>
<td>Reliability</td>
</tr>
<tr>
<td>2</td>
<td>Cass County – Red River 115kV</td>
<td>Cass County to Red River 115kV, upgrade to 795 ACSS</td>
<td>Reliability</td>
</tr>
<tr>
<td>3</td>
<td>Maple River – Cass County – Flint 230kV</td>
<td>Maple River – Cass County – Flint 230 kV line, convert to 345 kV</td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change

500 kV  
345 kV  
230 kV  
161 kV  
115 kV  
69 kV
Proposed Transmission Projects

Zone 8: Minnesota Valley Area

- Mankato is the primary load center
- New Helena substation for the CAPX 2020 Group 1 projects
- Issues
  - Local load serving
  - Wind interconnection interest
- New 345/115/69 kV substation is planned between Wilmarth and Helena substations for load serving purposes. The proposed in-service date for this project is 2012
Proposed Transmission Projects

Zone 8: Minnesota Valley Area (2010-2014)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>ISD</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fenton 69 kV interconnection</td>
<td>New 69 kV in and out at Fenton</td>
<td>2010</td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change
Proposed Transmission Projects
Zone 8: Minnesota Valley Area (2015-2019)

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Comments</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Worthington</td>
<td>Possible new 161/115 kV or 115/69 kV source at Nobles</td>
<td>Reliability</td>
</tr>
</tbody>
</table>

Note: Project scope and timing subject to change.
St. Paul Northern suburbs

- Large loads in this area are at Apache, Arden Hills, Lexington and Goose Lake.

- Several contingencies would require shedding load to comply with TPL-003 standard requirements.

- The plan requires
  1) adding 2nd 345/115 kV transformer at Chisago County.
  2) Upgrading Apache – Riverside line to higher capacity
  3) Convert Goose Lake – Kohlman Lake 115 kV line to double circuit.
  4) Convert Kohlman Lake – Long Lake 115 kV line to double circuit.
Minneapolis Valley Area

- This area is mostly impacted by High flows due to proximity of wind resources.
- The existing loads in this area would need to be shed after n-1 conditions to meet NERC TPL-003 standard.
- The proposed plan is to upgrade 27 miles of Minnesota Valley – Maynard – Kerkhoven tap line to higher capacity by 2014.
Fargo Area

- The largest loads in this area are Sheyenne, Cass County and Moderow substations served by the 115 kV lines in the area.
- Several transmission contingencies would require shedding load during peak and off peak conditions to meet NERC TPL-003 standard.
- The proposed plan is to build 0.5 miles of double circuit 345 kV (operated at 230 kV) line into Cass County substation, and install a 230/115 kV transformer at Cass County.
- Alternatively a new 345 kV line from Maple River to Cass County substation with 345/115 kV transformer at Cass County is also being considered.
20-Year Scenario Assessment

- Assessment of transmission needs in NSP area for potential future renewable policies
- 4 scenarios based on possible upper Midwest renewable energy policies and generation patterns
- EHV overlay address potential national renewable policy
20-Year Scenario Assessment Analysis

- Resource availability
  - Variety of potential locations for new generation resources
    - Most likely to develop outside the Twin Cities metropolitan area.
  - Assumed new nuclear power plants on NSP system unlikely during next 20 years
  - Assumed small scale distributed generation will continue in their present role in resource or transmission needs
  - Solar technology is starting to be installed, but will likely develop in the sunnier American southwest
Wind Resource Map

2010 20-Year Vision Plan

- 2010 Vision Study was localized to the NSP region
- For the 20-Year Vision Plan the facilities shown were verified to still be the next likely transmission buildout.
- The facilities were common to all generation scenarios studied
- The following slides describe the 2009 Bridge Study analysis which was a broad regional 20-year vision plan
2009 Bridge Study Strategic Vision: Scenario 1
High Internal Renewable

- **Scenario 1-- High Minnesota only renewable development**
  - Normal load growth
  - Minnesota will continue RES obligation
  - Surrounding states do not expand above their present minimal RES obligations, or develop internally and require no delivery from Minnesota or North and South Dakota

- **Statistics**
  - 1,100 miles of 345 kV double circuit
  - 110 miles of 500 kV
  - Total estimated cost of: ~$4 billion
2009 Bridge Study Strategic Vision: Scenario 2
Sub-Regional Renewable

- Scenario 2-- Sub-Regional renewable development
  - Normal load growth
  - Upper Midwest (MN, WI, IA, ND, SD) all develop an obligation similar to the MN RES
  - States outside the Upper Midwest also expand on or initiate their present renewable obligations

- Statistics
  - 1,200 miles of 345 kV double circuit
  - 110 miles of 500 kV
  - 730 miles of 765 kV
    - Total estimated cost of: ~$6.7 billion
Scenario 3 -- Non-renewable long-range future

- Scenario 1, with the same renewable expansion through the year 2016
- Beginning in 2017, assume RPS requirements in Western MISO and throughout Eastern Interconnect are scaled back
- US does not initiate a carbon reduction initiative, Minnesota will repeal its coal plant moratorium

Statistics

- 1,000 miles of 345 kV double circuit
- 110 miles of 500 kV
- 100 miles of 765 kV
  - Total Estimated Cost of: ~ $4 billion
Scenario 4 — Low load growth
- Flat load growth
- Upper Midwest (MN, WI, IA, ND, SD) all develop an obligation similar to the MN RES
- States outside the Upper Midwest also expand on or initiate their present renewable obligations
- Transmission similar to Scenario 2 due to the similar regional renewable expansion

Statistics
- 1,100 miles of 345 kV double circuit
- 110 miles of 500 kV
- 570 miles of 765 kV
- Total Estimated Cost of: ~ $6 billion
Regional
Extra-High Voltage

Transmission Overlays

- NSP System situated between some of the nations best wind and potential central Midwest and Eastern load serving entities
- Potential National Renewable Energy Standard
- Potential “interstate highways” to ship great plains wind generation under study
Various study/proposals

- MISO Renewable Generation Outlet Study (RGOS 1 and 2)
  www.midwestiso.org/home
- Green Power Express
  www.itctransco.com/projects/thegreenpowerexpress.html
- SMARTTransmission Study
  wwwqa.smartstudy.biz/
- Joint Coordinated System Plan (JCSP)
  www.nyiso.com/public/services/planning/crpp.jsp
Transmission Overlay

Proposals

- **NSP Involvement**
  - NSP is participating in the overlay studies
    - To ensure the NSP system and local area are properly represented
    - To ensure customer focus, cost effectiveness, operational reliability and regional policymaker alignment
    - NSP believes it can best look out for these interests by directly participating in these studies.
Develop regional transmission system to support renewable portfolio standards

- Phase I – Minnesota, Wisconsin, Illinois, and Iowa (approximately 15,000 MW)
- Phase II – RPS increases in Phase I states and remaining MISO states not in Phase I (approximately 22,000 MW)
- www.midwestiso.org/page/Expansion+Planning
RGOS Wind Scenarios

- **Zones**
  - 20 energy zones within UMTDI plus additional 9 zones added in IL
  - UMTDI zones to serve UMTDI states, no export
  - IL zones to serve IL (Ameren, ComEd)
  - Zones established at 750MW-1500MW capacity each
  - Indicative scenarios used 18-22 zones

- **Two primary transmission build outs developed for each scenario based on indicative work**
  - 345 kV and 765 kV (with 345)

<table>
<thead>
<tr>
<th>Scenario A</th>
<th>Scenario B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario has higher concentration of zones in the ND/SD compared to B</td>
<td>Scenario has higher concentration of zones in MN/IA compared to A</td>
</tr>
</tbody>
</table>
15 GW Scenario A

* MISO RGOS Phase I Study
15 GW Scenario B

* MISO RGOS Phase I Study
25 GW Scenario A

* MISO RGOS Phase I Study
25 GW Scenario B

* MISO RGOS Phase I Study
Green Power Express Proposal

* ITC’s Green Power Express
Joint Coordinated System Plan

Figure 1-3: 20% Wind Energy Scenario Conceptual Transmission Overlay
(The Strategic Midwest Area Transmission Study)

SMARTTransmission Study


- **Purpose**: examine transmission infrastructure needed to support renewable energy development and transport to consumers in the Upper Midwest, the Ohio River Valley, and farther East.

- **Status**: Study report has been published.
  - www.smartstudy.biz
Links to additional information on Transmission Plans

- The Minnesota Transmission Owners
  - www.minnelectrans.com
- The CAPX 2020 projects
  - www.capx2020.com
- The Midwest Independent Transmission System Operator, Inc. (MISO)
  - www.midwestiso.org
- Green Power Express
  - www.itctransco.com/projects/thegreepowerexpress.html
- MN renewable Energy standard studies
  - www.minnelectrans.com/reports.html
- Regional Generation Outlet Studies
  - www.midwestmarket.org/publish/folder/6871db_117a25bcaa6_-798d048324a
- Joint Coordinated System Plan
  - www.jcspstudy.org
- SMARTransmission
  - wwwqa.smartstudy.biz/