

Dakotas Wind Transmission Study

Public Meetings

Pierre, South Dakota
June 15, 2004

Bismarck, North Dakota
June 16, 2004



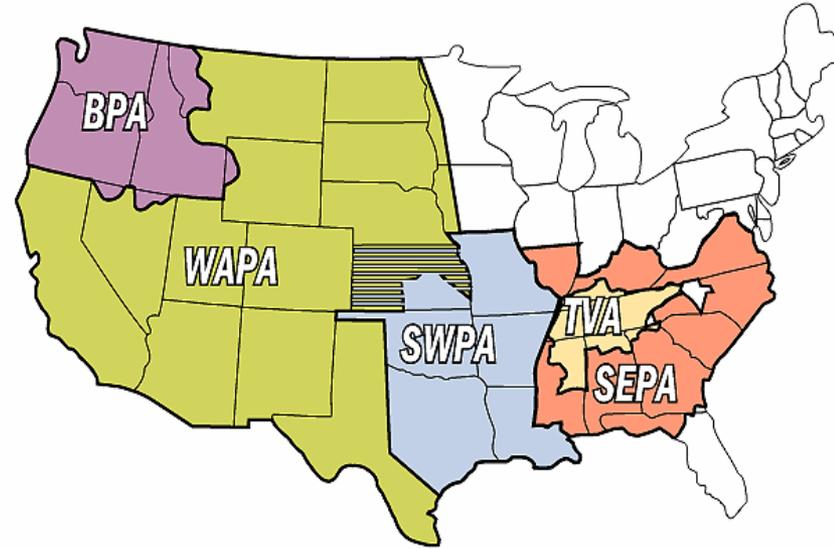
Overview



- Background
- Related Study Work
- Public Comments
- Study Objectives
- Draft Study Scope
- Summary

Western Area Power Administration

- ❖ One of four power marketing administrations within the U.S. Department of Energy
- ❖ Western markets and transmits federally produced hydroelectric power in fifteen central and western states
- ❖ Western's 683 wholesale power customers include cooperatives, municipalities, public utility districts, and project use customers.

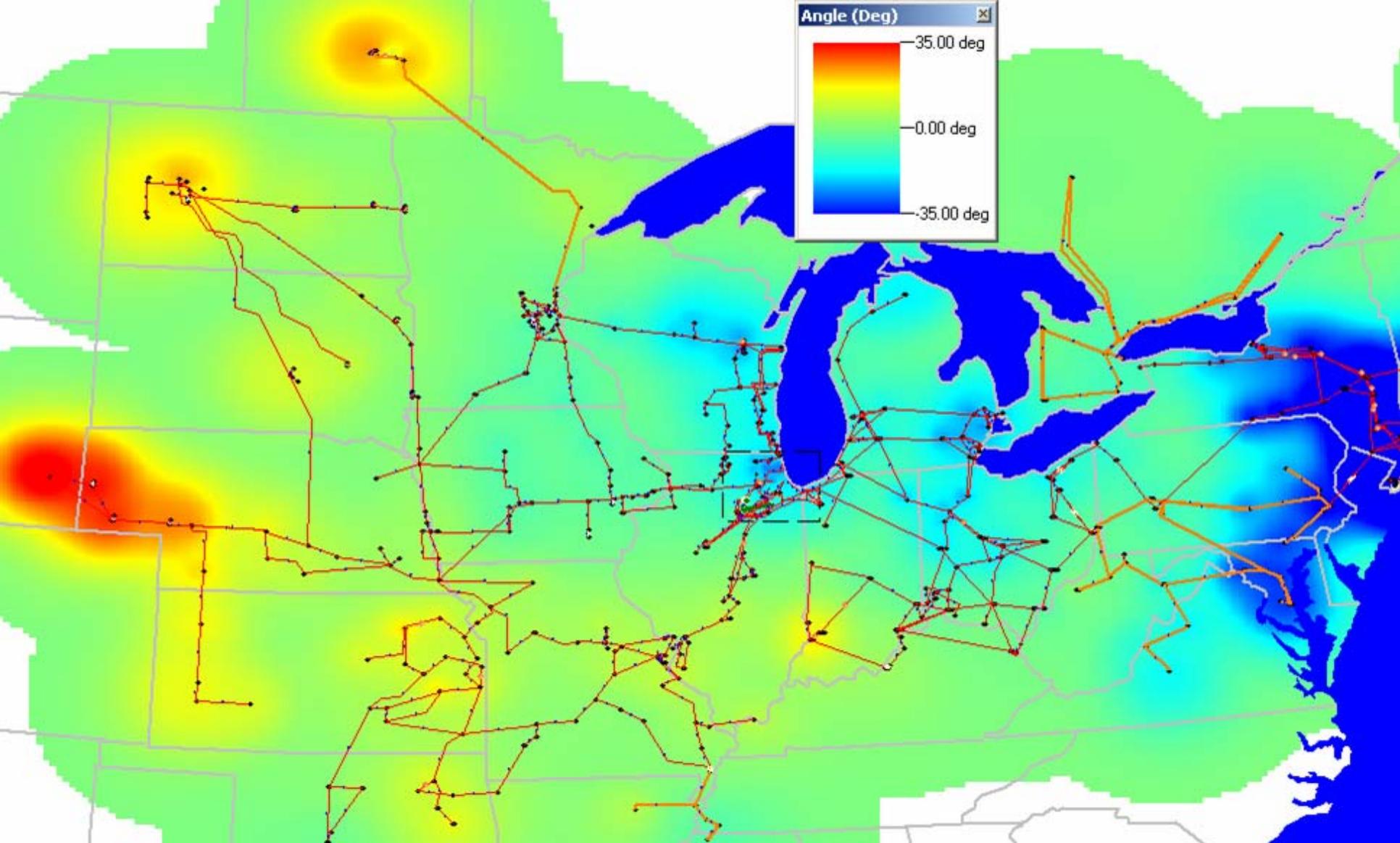


Upper Great Plains Region

- ❖ Western operates, with Basin Electric Power Cooperative and Heartland Consumer Power District, an integrated transmission and generation system in a large control area
 - 7800 miles of transmission
 - 4,000 in South Dakota
 - 2,200 in North Dakota
 - 102 Substations
 - 45 in South Dakota
 - 22 in North Dakota
- ❖ Upper Great Plains markets over 10,000 GWh of energy annually from 8 power plants in the Missouri River Basin

Study Background

- ❖ Congress passed legislation which included funding for Western to perform a “transmission study on the placement of 500 MW of wind energy in North Dakota and South Dakota”
- ❖ The Dakotas lead the nation in wind resources; 110 MW currently installed
- ❖ Already an exporting region; transmission is limited by both stability and thermal loading



Existing High Voltage AC Transmission with Phase Angles

Source: PowerWorld

Constrained Interface Examples

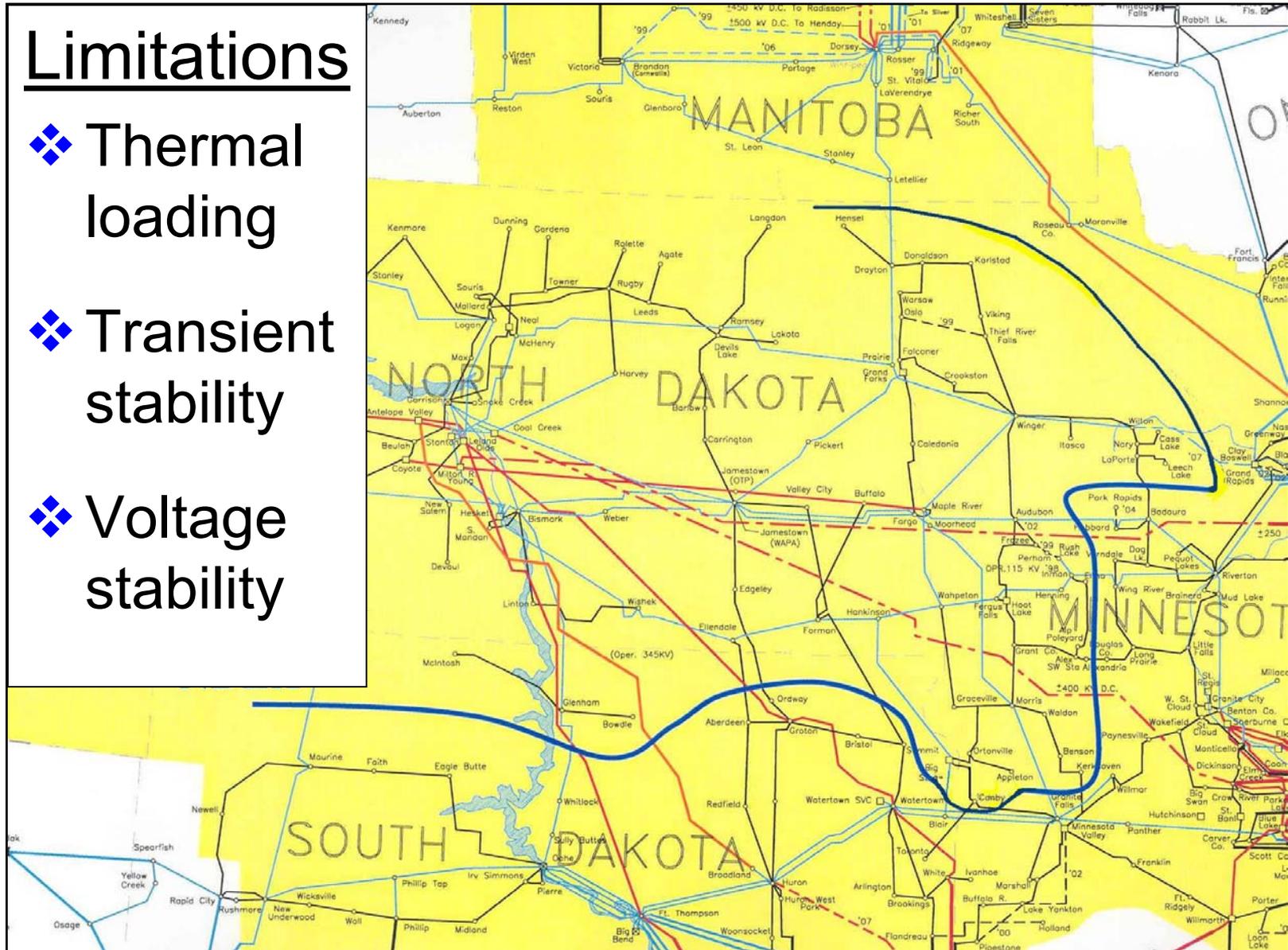


MAPP, August 2001

North Dakota Export Boundary

Limitations

- ❖ Thermal loading
- ❖ Transient stability
- ❖ Voltage stability



Related Study Work

- ❖ A number of transmission studies related to the development of wind power in North and South Dakota have been completed including:
 - Montana-Dakotas Regional Study
 - Interconnection Studies
- ❖ Several are currently under way including:
 - Red River Valley TIPS
 - Resource Coalition
 - MISO NW Exploratory

Montana-Dakotas Regional Study

- ❖ Identified transmission reinforcements necessary to accommodate new wind generation in North or South Dakota. Five different sites were studied (Hettinger, Jamestown, Minot, Ft Thompson, Watertown)
 - Factors taken into account included thermal performance, transmission losses, impact on constrained interfaces, and cost
- ❖ Full study available at:
 - <http://www.wapa.gov/ugp/study/default.htm>

Dakotas Wind Transmission Study

Objectives

- ❖ Perform transmission studies on the placement of 500 MW of wind power in North and South Dakota;
- ❖ Recognize and build upon prior related technical work, coordinate with current work;
- ❖ Solicit and incorporate public comments; and
- ❖ Produce meaningful, broadly supported results through a technically rigorous, inclusive study process.

Public Comments

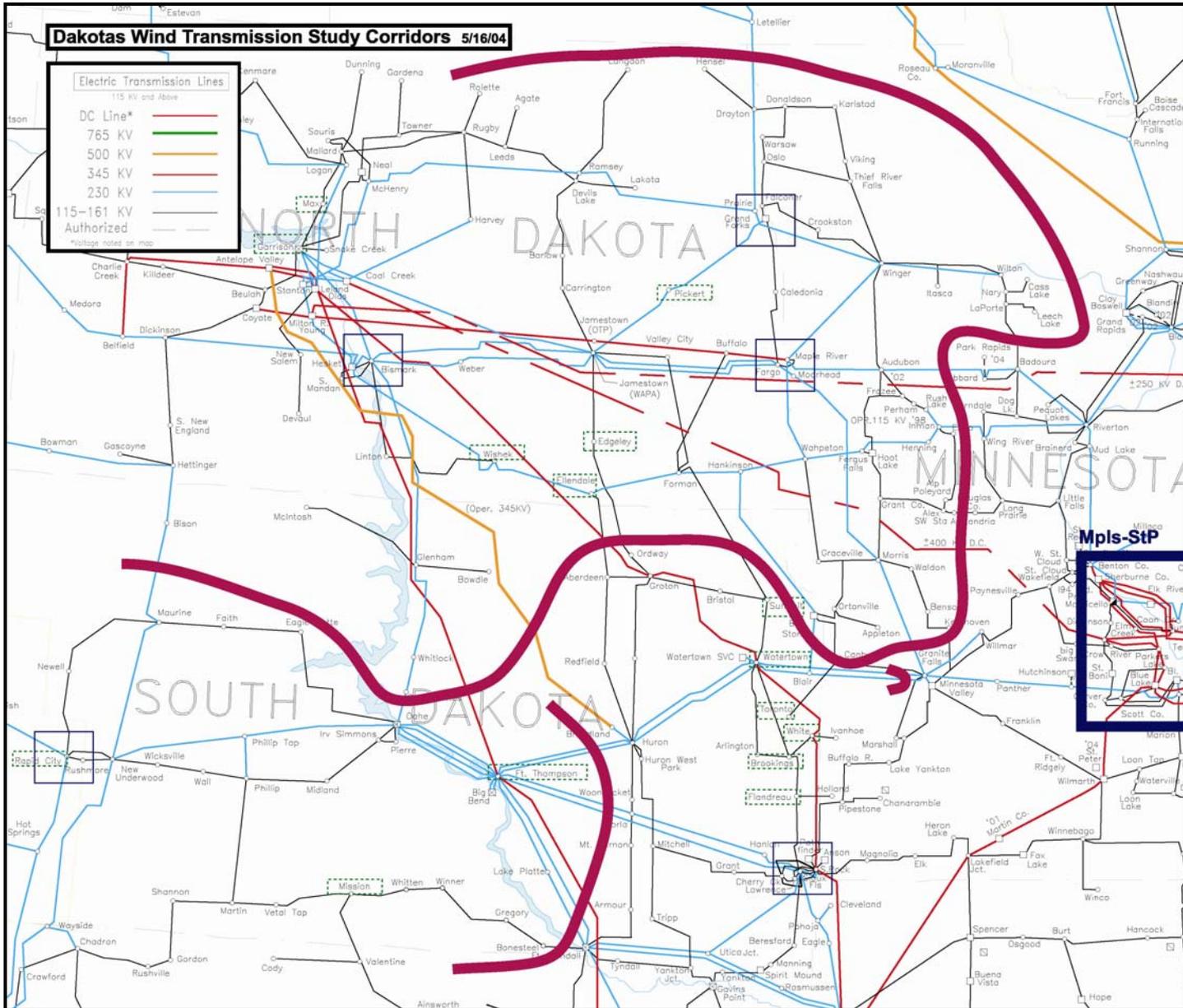
- ❖ 70 public comments were received;
all were carefully reviewed & considered
- ❖ 15 citizens, 9 landowners, 2 publications, 13 elected officials/boards, 9 utilities, 22 stakeholders
- ❖ Summary and individual public comments available at:
 - <http://www.wapa.gov/ugp/study/default.htm>

Draft Study Scope

1. Analyze Non-Firm Transmission Potential Relative to New Wind Generation
2. Assess Potential of Transmission Technologies Relative to New Wind Generation
3. Study Interconnection of New Wind Generation
4. Study the Delivery to Market of New Wind Generation

Analyze Non-Firm Transmission Potential Relative to New Wind Generation

- ❖ The existing total transfer capability across the major paths in the Dakotas is already reserved under long-term contracts;
 - ❖ The scheduled amount of capacity is often less than the total amount, leaving unused capacity in many hours of the year;
- ⇒ Study the possibility of delivering wind energy through long-term, non-firm access, with curtailment of power during critical periods.



Analyze Non-Firm Transmission Potential Relative to New Wind Generation

- ❖ Three key corridors will be studied:
 - North Dakota Export Boundary
 - Watertown to Granite Falls 230 kV
 - Group of 8 lines between Ft. Thompson & Ft Randall
- ❖ Evaluate and compare administratively committed and actual usage across each corridor using actual historical data & modeled projected data;
- ❖ Evaluate & develop wind power production profiles for the Dakotas;
- ❖ Evaluate & compare transmission usage and wind generation profiles;
- ❖ Develop annual flow duration curves, assess the opportunity to deliver non-firm wind energy; and
- ❖ Run sensitivity cases.

Analyze Potential of Transmission Technologies Relative to New Wind Generation

- ❖ Study technology-based solutions that can increase the use of existing transmission lines
- ❖ Technologies to be studied include:
 - Static Var Compensation
 - Series Compensation
 - Phase-Shifting
 - Dynamic Line Ratings
 - Reconductoring

Study Interconnection of New Wind Generation

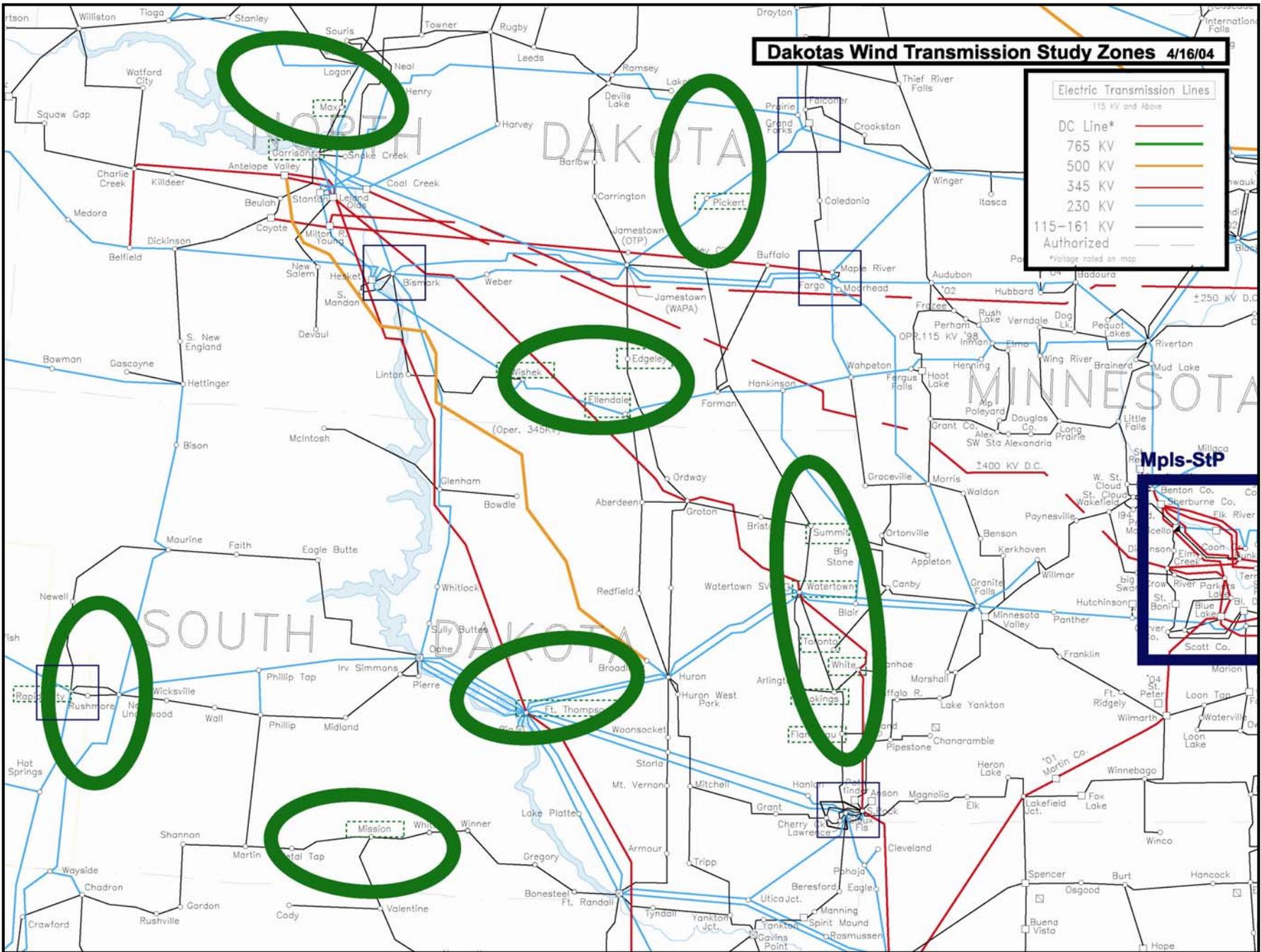
- ❖ Evaluate seven wind generation zones for interconnection
 - Developed from the public comments, wind resource maps, the Western interconnection queue, tribal projects, and developer projects;
- ❖ Determine the local impacts of new wind generation for each site at four wind generation levels of 50, 150, 250, and 500 megawatts; and
- ❖ Study impacts including steady state power flow analysis, constrained interface analysis, short circuit analysis, and dynamic stability analysis.

Dakotas Wind Transmission Study Zones 4/16/04

Electric Transmission Lines
115 KV and Above

DC Line*	—
765 KV	—
500 KV	—
345 KV	—
230 KV	—
115-161 KV	—
Authorized	—

*Voltage noted on map



Study the Delivery to Market of New Wind Generation

- ❖ Perform aggregate delivery studies on the four most favorable interconnection zones in Task 3;
- ❖ Develop several delivery scenarios for the new wind power based upon markets both inside and outside of the Dakotas;
- ❖ Identify the incremental transmission delivery capability of each zone along with the necessary transmission improvements for each level of generation;
- ❖ Complete both steady state and stability analysis and evaluate losses; and
- ❖ Rank transmission improvement options by technical feasibility, right-of-way impact, and cost.

Dakotas Wind Transmission Study Status

- ❖ *Completed* – Review of related technical work
- ❖ *Completed* – Request for public comments, public comments received & summarized
- ❖ *Completed* – Draft study scope
- ❖ *5/20 to 6/21* – Public review of draft study scope
- ❖ *6/15* – Public meeting Pierre
- ❖ *6/16* – Public meeting Bismarck
- ❖ *July/August* – Select study consultant
- ❖ *September* – Begin transmission study

Summary

- ❖ A draft study scope has been prepared by building on prior related technical work and incorporating the public comments
 - The full draft study scope is available at:
<http://www.wapa.gov/ugp/study/default.htm>
- ❖ Western welcomes your comments on the draft study scope through June 21, 2004.

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- ❖ Western Area Power Administration Website for the Dakotas Wind Transmission Study Project:

<http://www.wapa.gov/ugp/study/DakotasWind/Default.htm>