U.S. Department of Energy
National Electric Transmission Congestion Study Workshop

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Hilton St. Louis Airport, 10330 Natural Bridge Road, St. Louis, Missouri 63134

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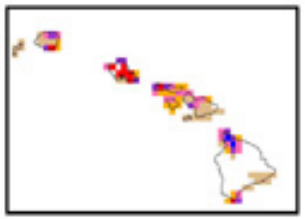
Overview

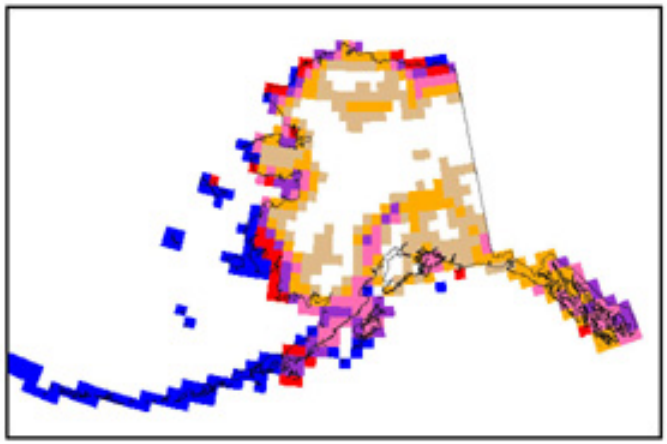
- ND Electric Energy Resources
- Need for New Transmission
  - Interconnection Difficulties
  - Transmission Constraints
- Regional Transmission Projects Update
- Capacity Deliverability between RTOs

ND Electric Energy Resources

- ND Ranked #1 in U.S. for Wind Energy Potential
  - 1991 Pacific Northwest Labs study found ND Wind could potentially supply 36% of U.S. electric energy consumption.
  - 1,400 MW installed wind capacity
  - 6,000 additional MW Permitted or announced
  - High Capacity Factors
- Hydropower
  - 500 MW installed hydro capacity
- Lignite Coal
  - 4,000 MW installed capacity
  - Mine-mouth generation
  - 300 Year supply at present consumption rates
  - Carbon Sequestration
  - ND meets all federal ambient air quality standards.

United States - Wind Resource Map





Source: "Wind Energy Resource Atlas of the United States", 1987

Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

[a] Wind speeds are based on a Weibull k value of 2.0

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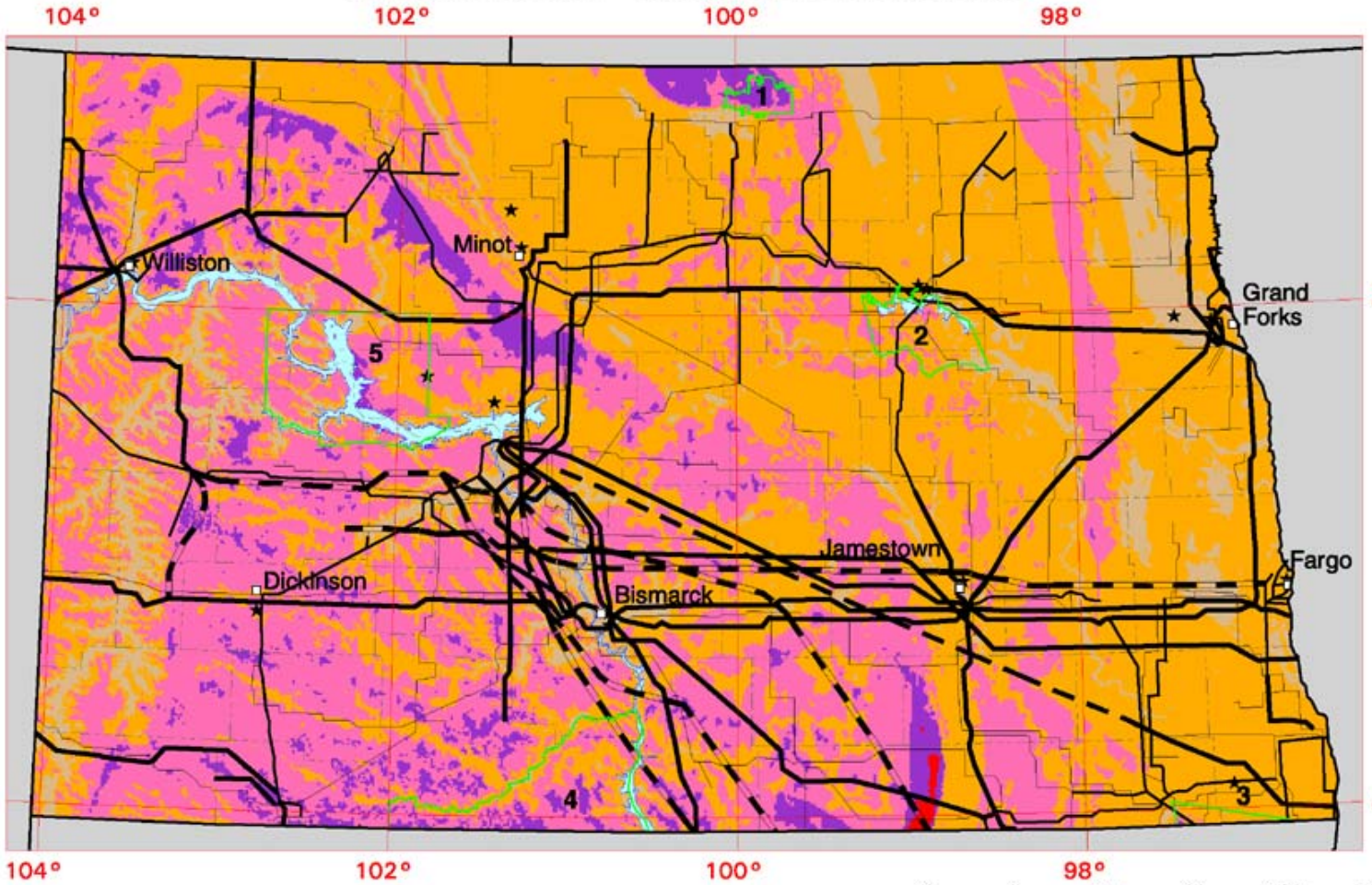
North Dakota - Wind Resource Map



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★ Meteorological Station with Wind Data
□ City or Town

Transmission Line Voltage

- 69 Kilovolts
- 115 Kilovolts
- 230 Kilovolts
- 345 Kilovolts
- Under Construction

Indian Reservations

1. Turtle Mountain
2. Devil's Lake Sioux
3. Lake Traverse
4. Standing Rock
5. Fort Berthold

40 0 40 80 120 160 Kilometers
25 0 25 50 75 100 Miles

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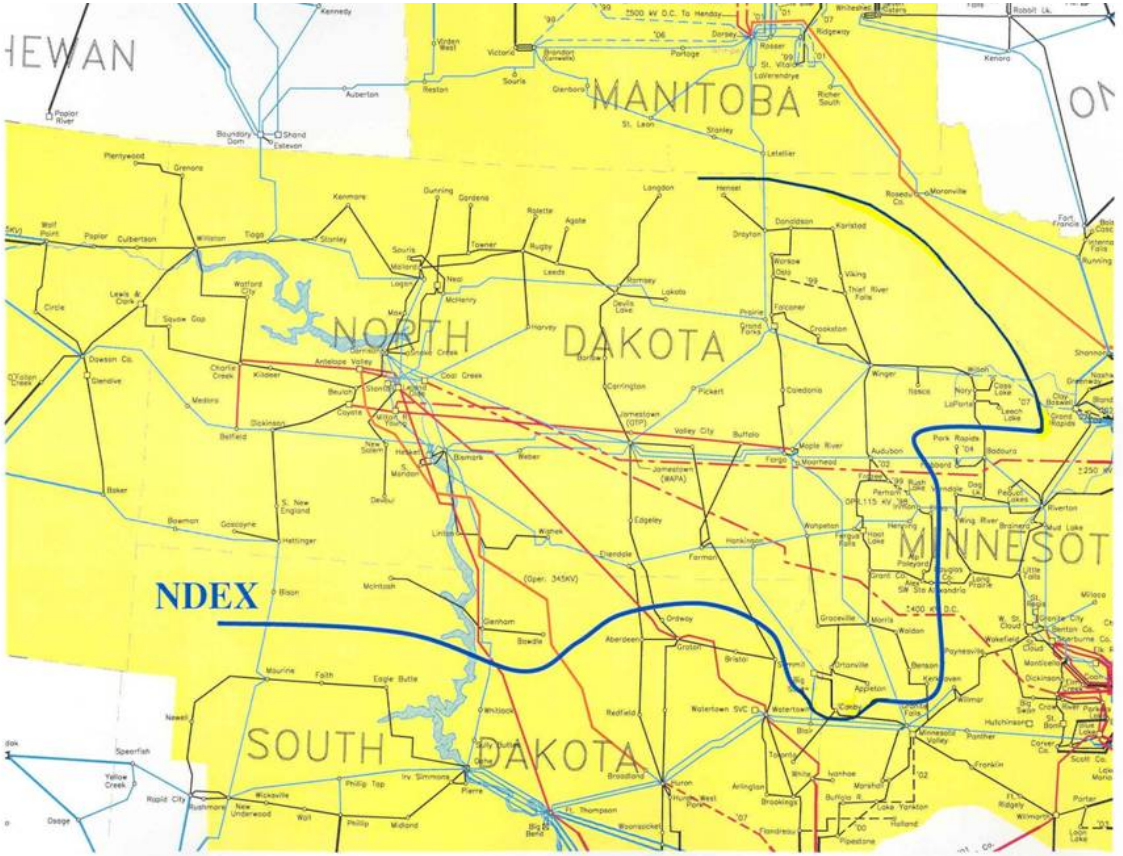
Need for New Transmission - Interconnection Difficulties

- Inability to interconnect hinders ND wind development
- MISO Interconnection Queue process improved, but still overwhelmed with wind interconnection requests from upper great plains region.
  - MN requests total 9,083 MW
  - SD requests total 2,882 MW
  - ND requests total 2,638 MW

Interconnection Difficulties (Cont)

- MISO estimates years to obtain interconnection.
  - Regional transmission constraints
  - Overwhelmed interconnection queue
- Most ND wind interconnects with non-MISO participants.
  - WAPA/Basin and Minnkota Interconnections
  - Opportunities for further non-MISO interconnections are limited
- Not enough local load or transmission export capability to accommodate interconnection requests.
  - Approximately ¾ of ND Electric Energy Exported
  - NDEX stability constraint between Dakotas and MN
  - Further constraints between MN and loads east
  - Need to maintain minimum base load generation levels

North Dakota Export Limit (NDEX)



- Stability Operating Constraint
- Historically Observed at Approximately 1,950 MW
- Managed with Operating Agreements

Regional Transmission Projects

- Cap-X 2020 Phase I (4 Projects)
  - Fargo-Monticello 345 kV
  - Brookings – Twin Cities 345 kV
  - Bemidji – Grand Rapids 230 kV
  - Rochester – La Crosse 345 kV
- Brookings – Big Stone – Ellendale 345 kV MVPs
- Center – Grand Forks 345 kV
  - Minnkota/MN Power 250 KVDC sale.
- Western ND Oil Field 230/345kV Additions

Capacity Deliverability Between RTOs

- Capacity Deliverability describes the ability to move energy from a resource to the customer
- Access to a more diverse mix of resources allows better optimization of resource commitment and dispatch
- Given potential retirements and tight timelines to comply with EPA regulations, deliverability is a more urgent issue
- Although the transfer capability exists, artificial non-physical (rule based) barriers inhibit such movement
- A recent study indicates up to 4,000 MW of additional transfer capabilities from MISO to PJM might be possible, resulting in up $2 Billion in reduced costs for consumers

Conclusions

- Resolving the North Dakota Export Constraint (NDEX) is in the National Interest.
- Additional new transmission is needed for the upper great plains region to provide clean, long-term and low-cost domestic energy sufficient to significantly contribute to national energy supply.
- It is time to look into artificial barriers inhibiting capacity deliverability between RTOs.

Further Reading

- MISO Interconnection Queue: https://www.midwestiso.org/Planning/GeneratorInterconnection/Pages/InterconnectionQueue.aspx
- North Dakota DPP Cycle 6 & 7 Definitive Planning Phase Study: https://www.midwestiso.org/Library/Repository/Study/Generator%20Interconnection/GI-DPP-2011-JAN-ND-SIS_Report.pdf
- MN Group 5 Generator Interconnection System Impact Study (MISO): https://www.misoenergy.org/_layouts/MISO/ECM/Redirect.aspx?ID=102240
- MAPP/MISO Seams Study: MISO final report expected shortly.
- MISO/Brattle Group capacity deliverability study: Final report expected shortly.
- MISO 2011 Midwest Transmission Expansion Plan (MTEP 11) with MVP Portfolio Analysis Report: https://www.midwestiso.org/Planning/TransmissionExpansionPlanning/Pages/MTEP11.aspx