Monticello-Fargo Line Update
NM/MB Subregional Planning Group
July 22, 2009
Monticello-Fargo Line Update

• Minnesota Certificate of Need for three 345 kV Group 1 projects approved April 16, 2009

• Monticello – St. Cloud 345 kV segment most critical
  – Load-serving needs in St. Cloud area
  – Route Permit filed April 8, 2009
  – In-service date planned December 2011

• Route option refinement for St. Cloud-Red River segment

• Minnesota Route Permit application expected to be filed in October 2009

• Planned in-service dates for remaining segments
  – St. Cloud – Alexandria: 2013
  – Alexandria – Fargo: 2015
Group 1 Projects
Extensive Effort by Utilities, Regulators, Stakeholders
Fargo Line Optimization Study

Background

- Twin Cities-Fargo 345 kV line is one of four CapX2020 Group 1 lines
  - Initially proposed in 2002 TIPS Study
  - Proposal refined in 2006 TIPS Update for CapX2020
- Preliminary study work assumed Maple River as northern termination
- Detailed routing work raised concerns about land use and routing constraints
  - Number of critical lines in Maple River
  - OTP/MPC Pillsbury Wind Farm 230 kV interconnection line
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Study purpose

- Study parameters
  - Northward and southward transfer capability
    - Thermal limits
    - Stability limits
    - Manitoba loop flow
- Fargo area load-serving needs
- Losses
- System reliability & integrity
- Land use/high level routing constraints/flooding
- Overall goal: develop coordinated plan for development of the Fargo line in North Dakota that considers all relevant aspects of transmission planning (load serving, generation delivery, overall system reliability and expansion)
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Study Modeling

• Primary case used for steady state analysis: Off-peak case from Corridor Study analysis
  – Also used RES Update Study & CVS Study
  – Up-to-date information from MISO and MRO model-building processes

• Interface flows modeled at maximum simultaneous
  – MHEX: 2175 MW
  – NDEX: 2080 MW
  – MWEX: 1525 MW

• Pillsbury-Maple River 230 kV line and 400 MW of Pillsbury generation added to model

• Frontier 230/69 kV Substation added and Minnkota load reconfigured
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Study Modeling

• Dynamic models
  – ND load at 65 percent of 2880 MW
  – NDEX at 2450 MW (includes Big Stone II and associated outlet)

• Summer 2016 Off-Peak Dynamic model includes:
  – Watertown and Groton capacitors
  – Big Stone II generation (657 MW gross) and outlet facilities
  – BRIGO facilities
  – Brookings County-Brookings 345 kV line
  – Hampton-Rochester-La Crosse 345 kV line
  – Bemidji-Grand Rapids 230 kV line
  – Queued generation

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<tr>
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<th>Southwest MN wind at 1800MW</th>
<th>358 MW at Pillsbury</th>
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<tbody>
<tr>
<td></td>
<td>600 MW at Big Stone (G392)</td>
<td>150 MW at Rugby (G380)</td>
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<td>100 MW at Ladish (G645 &amp; G788)</td>
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Sites studied

- Flint – approximately 2 miles south of Sheyenne Substation
- Frontier – existing Minnkota Substation
- WAPA Fargo – existing WAPA Substation
- Bison – north of Mapleton
- Northwest Angle – 3.5 miles west of Maple River
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Sites studied
Fargo Line Optimization Study
Recommended plan

• Staged Development – only Phase I being pursued at this time

• Phase I
  – Route new line south and west of Fargo to new Bison Substation
  – Add Maple River-Cass County 345 kV line (potential initial operation at 230 kV)
  – Acquire Flint site for future use → secondary option to further develop Frontier site
Fargo Line Optimization Study
Recommended plan
Fargo Line Optimization Study
Recommended plan

• Phase II
  – Develop 345/230 kV Flint site (alternately develop Frontier; Flint preferred)
  – Develop Cass County-(Sheyenne)-Flint 230 kV (future 345 kV)
  – Construct Flint-Benton County 345/230 kV or Flint-Brookings County 345 kV line
  – Add Flint-Bison second circuit
  – Short Fargo area 230 kV reconductors
Fargo Line Optimization Study
Recommended plan
Fargo Line Optimization Study
Recommended plan

- Phase III
  - Convert Maple River-Cass County-Flint 230 kV to 345 kV
  - Add second circuit to Flint-Monticello 345 kV line
  - Other relatively minor reconductors
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Recommended plan
Fargo Line Optimization Study
Recommended plan

• Phase I
  – Yields 700 MW of southward capability and 700+ MW northward capability
  – 500 kV incremental loading concerns starting at 360 to 400 MW south flow
  – Southward transfer limited by Sheyenne-Audubon 230 kV loading for loss of Fargo-Alexandria 345 kV

• Phase II
  – Yields additional 600 MW southward capability
  – Southward transfer limited by Dorsey-Forbes 500 kV loading

• Phase III
  – Yields an additional 400 MW southward capability
Fargo Line Optimization Study
Fargo area load-serving

- Need is soon (~2014 to 2017 depending on load growth)
- Need date coordinates well with CapX2020 development timing
- Need new 115 kV source between existing Maple River and Sheyenne 230/115 kV sources
- Maple River-Cass County-Flint 230 kV development
  - Provides new injection point at Cass County (Fargo area would be served by four 115 kV injection points – WAPA Fargo, Maple River, Sheyenne, Flint)
  - Enhances transfer capability achieved with CapX2020 line by creating loop through Fargo area
  - Helps avoid through-flow (and overloads) on other network 230 kV facilities
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Losses

- Extending Fargo-St. Cloud-Monticello line to 345 kV system (Bison or Maple River) yields significant loss reduction
- Study investigated stopping on south side of Fargo and relying on 230 kV system to transmit power
- Loss savings are magnified as additional generation resources are interconnected
- Bison site had most optimal loss performance
- Phase II configurations resulted in significant additional loss savings (~60 to 90 MW)
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Other considerations

• Initial input from routing determined going around east side was possible
  – Airport routing concerns
  – Maple River determined to be undesirable endpoint
  – Not possible to pursue development south of Fargo as no incremental load-serving benefit achieved

• North sites slightly lower lying than south sites
Fargo Line Optimization Study
Conclusions

• Recommended plan provides roadmap for coordinated future development of bulk transmission to maximize benefits of Fargo-St. Cloud-Monticello line considering:
  – Fargo load-serving needs
  – Generation delivery benefits
  – Overall system reliability
  – Site-specific considerations