2008/2009: The Challenge

Build 250 miles of 345-kV Transmission across North Dakota in 4 years with a budget of $308 million.
2014: The Results

After 5½ years and $353 million, the CGF line was turned over to operations on August 7, 2014.
Who is Minnkota Power?

A generation and transmission (G&T) cooperative owned by 11 distribution cooperatives who, in turn, serve more than 116,000 meters or approximately 350,000 people.

Service area covers 33 counties encompassing about 35,000 square miles.
Minnkota also serves as operating agent for the Northern Municipal Power Agency (NMPA).

NMPA provides service to 14,000 additional customers in 12 North Dakota and Minnesota towns.
Milton R. Young Unit 1 was built along with major transmission projects.
Square Butte was formed to provide energy to Minnesota Power and Minnkota.

Minnkota Allocation of Young 2 Energy

- 1977: 0%
- 1985: 25%
- 2009: 50%
- 2014: 72.5%
Coyote Station added to serve NMPA.

Young 2 Energy

Line up rated to 345-kV

30 years of service from those investments in western North Dakota.
Why Do We Need The Center to Grand Forks Project?

- Load growth
- Transmission grid reliability
- Reallocation of assets
To meet load growth needs

- A Young 3 plant was in the planning stages
- A new transmission line would be required to handle the additional generation
Grid Reliability

North Zone
45% of load
4 major transmission lines

South Zone
55% of load
10 major transmission lines
Grid Reliability

Alternative Evaluation Study

- CGF Line address the longstanding need to improve voltage support to the northern Red River Valley region

2010 Flood Damage
Asset Reallocation

Benefits from the reallocation

- Minnkota cancels plans for $1.3 billion plant
- Future energy requirements met by transferring 50% of Young 2 to Minnkota
- Minnesota Power develops wind resources required to meet Minnesota renewable standards

Lowest cost alternative to meet the load growth and grid reliability needs!
CGF Project – Start to Finish

- Identify Project Area
- Collect Project Area Data
- Initial Site Visit
- Begin Public Outreach

- ND PSC Application
- Develop Environmental Assessment
- Public Meetings
- Macro-Corridors (MCS and AES)

- Permit/Approval Applications
- Engineering Design
- Project Construction

Public Outreach and Permits throughout Project
Design Specifications

- 345-kV mono pole self weathering steel
- 250 miles
- Height: 130 to 140 feet
- Span length: 1,000 feet
- Concrete foundations
  - 7 to 10 feet in diameter
  - 30 to 60 feet deep
Conductor Selection

“Drake”
795 ACSR

“Suwannee”
959.6 ACSR/TW

Suwannee selected due to:
- 19% Lower losses
  - Contribution to CIP program (240% of annual supply side target)
  - Lowest installed cost over life of project per RUS calculations

Increased capacity
- 10% improvement for reasonable cost
The 4 year plan:

Multiple parallel paths:

- Federal (AE, MCS, EA w/Scoping)
- State (Corridor Compatibility, Route Permit)
- ROW Acquisition (Survey Permission, Options)
- Design (Representative soil borings)
- Material Acquisitions & Contracting
Vigorous Public Process

- 25 project meetings at multiple locations along the route
- Separate corridor hearings at 3 locations
- Route permit hearings at 3 locations
ROW Acquisition:

- Used options prior to Route Permit being issued
- 452 landowners negotiated voluntary easements
- 1 landowner required Eminent Domain process
ROW Success Factors:

• Land valuation on a per county basis
• Separate pole payment
• Temporary construction easements
• Liberal crop damage and land damage payment plans
• Voluntary “buy the farm”
ROW Challenges

• Land values increasing by double digit amounts in the acquisition time frame

• Existing wind project leases requiring impact mitigation

• ROW/crop damage for total project ~ $76k/mile
Structure Footprint

Over the entire length of the line, only about 5 acres of cropland are taken out of agricultural production.
Environmental Review Challenges
USFWS Region 6

- Whooping Crane impact mitigation

- Line marking new line
  - 180 miles within 1 mile of suitable habitat
  - 120 miles within 95% sighting corridor

- Required compensatory mitigation
  - 120 miles of marking on existing lines
Whooping Crane Sighting Corridor

New Line

Existing Line
Bird Flight Diverter
Challenges with marking existing line

- Additional ice loading

1997 Blizzard Hanna

1.5” radial ice
Adding BFD’s to existing lines may exceed design margins under icing conditions.
1997 Blizzard Hanna

- 543 poles broken
- 101 aluminum structures damaged
Challenges with marking existing line

• Only 20 miles of existing assets determined suitable for marking

• Caught between two federal agencies for Section 7 determination

• Minnkota proposed OH to UG conversation of distribution lines as an alternative mitigation plan
Challenges with marking existing line

- OH to UG deemed to be 100% effective
- 50 miles of OH to UG contracted through 4 local distribution cooperatives
Cost of delays

- $4.2 million in direct costs
- RUS funding 10% spending limit prior to final determination
- $16 million in indirect costs
  - Lost opportunity for low bid
  - Material supply disruption
- Moved start of construction from spring 2011 to 2012
Construction Challenges: Where to Start?

Heated concrete for winter construction
Construction Challenges

- 7 artesian wells discovered
  - Impact to foundation construction
  - Sealing with expandable foam
Construction Challenges

• Matting issues
  - Avoiding “prescriptive” matting
  - 50-mile work zone concept
  - Under-estimating matting needs

Project purchased > 10,000 mats
Constructon Challenges

• Line stringing performance without helicopter crews
Construction Challenges

• Impact of pole manufacturer not shipping in construction sequence

• Trucking optimized for supplier - not the project

• Foreign language impact on project coordination
Construction Challenges

• Environmental constraints on construction activity at the Missouri River crossing
  ▪ Raptor nesting
  ▪ Piping Plover activity
  ▪ November 1 to March 30 construction window
Construction Challenges

- Concrete truck drivers DOT hours limit was a critical path item
- Extreme temperatures challenged the ability to deliver from fixed plants
Construction Challenges

- Wire reel size not optimized resulting in a high percentage of waste (>6%)

- OPGW delivered on wood reels causing issues toward the end of the project
Cold weather impacts created many challenges
Construction Challenges

- Grand Forks Airport Issues
  - Control air space 65 ft A.G.L south of airport with no glide slope
  - UND Aviation school – inexperienced pilots
  - WAPA 230 kV line crossing in the height restricted area
Conclusion

• Project completed safely

• 3,850 truck loads of material

• >100,000 cubic yards of concrete placed

• Final all in cost of $1.4M/mile
Planned Transmission Projects – Line Miles and Average Cost per Mile

Average cost for 13 projects completed in 2013

Line Miles
- Average Cost in Millions of Dollars per Mile

CGF
Project Team Members

Minnkota Power
Your Touchstone Energy® Partner

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QUALITY STEEL POLES. DELIVERED.

Stanley Consultants Inc.
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

Tri-State Drilling Inc.

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Questions?