FACILITY STUDY

For

>OMITTED TEXT<

180 MW Wind Generating Facility
Chaves County, New Mexico
SPP #GEN-2001-033

March 28, 2003

Xcel Energy Services
Transmission Planning

Executive Summary

>Omitted Text< (the “Requester”) requested the interconnection of a Wind Energy Project >Omitted Text< to the Xcel Energy’s 230kV transmission system. This project is a new wind energy generation facility located approximately 12.5 miles west and 3 miles north of Elida, New Mexico. Xcel Energy evaluated the Requester’s request to interconnect this 180 MW wind facility to the transmission circuit K-50 in a System Impact Study completed October 8, 2002. The new >Omitted Text< Wind Energy Project >Omitted Text< 230/34.5 kV Substation will be located approximately 0.3 miles south of the 230kV interconnection facility point to circuit K-50. Phase 1 of the BWEP will consist of 46 Vesta V80 wind turbines with a limited output of 1.8 MW each, for a nominal output of 90 MW. Phase 2 of this project will add an additional 90 MW for a total maximum output to 180 MW, and will not alter the Xcel Energy scope.

Xcel Energy will construct a new 230kV switching station to accommodate the nominal power output of this new wind facility into the transmission grid. The switching station will connect to the Xcel Energy 230 kV transmission circuit K-50, which is the transmission circuit between Chaves County Interchange and Oasis Interchange. The switching station will include three circuit breakers in ring-bus configuration, with three 230 kV transmission line terminals. The switching station will include SCADA, electronic metering and complete system protection. The switching station will be owned and maintained by Xcel Energy. Relay modifications will be required at Chaves County and Oasis Interchanges.

The Requester will provide a contribution in aid of construction equal to the cost to design and build the new 230 kV switching station, the construction of approximately 0.3 miles of 230 kV line, and all costs associated with relay modifications at Chaves County and Oasis Interchanges required for this wind farm. Additionally, the Requester will design, build, own and maintain the 230 – 34.5 kV interconnection substation.

A transient Stability Analysis was performed indicating that close coordination between the proposed switched capacitor banks and the over/under voltage protection scheme of the wind turbines is required to prevent cascading trips of the wind turbines.

In addition, powerflow analysis indicated the need for reactive power support to mitigate adverse impacts on the Xcel Energy 230 kV transmission system during system intact and single contingency conditions. The proposed switched capacitor banks will maintain acceptable voltage levels for the Xcel Energy system and wind farm provided there is close coordination with the switched capacitors and the over/under voltage tripping of the wind turbines.

The total cost to perform the work identified is estimated to be $ 2,822,948.00.

Discussion

Transient Stability:

Power Technologies Incorporated (PTI), using system data provided by the Southwest Power Pool (SPP), performed the transient stability analysis for this wind energy project. The data included all load flow and generator related stability models for the eastern interconnection for the 2002 Summer Peak. The generator transient stability model information supplied for the Vestas V80 wind turbines was incorporated to complete the project's representation.

Transient stability tests were conducted for both three-phase and single-phase faults on select transmission lines. The faults were run with a 0.1-second steady-state run followed by the appropriate disturbance. A normal clearing time of 5 cycles and a delayed re-closing of 20 cycles were used with the fault finally being cleared 5 cycles later. Simulations were run for a minimum of 10 seconds to confirm proper machine damping.

Although the transmission system remained stable for all faults, an undesirable tripping of the wind turbines occurred for these faults. The levels and timing of the over/under voltage protection scheme as presented for the system impact study, will cause some or all of the wind turbines to trip too soon for the faults simulated. If the under-voltage protections of the wind turbines are defeated, the entire wind farm becomes unstable causing nearby system generation to become unstable as well. The results of the transient stability study indicated that close coordination between the switched capacitor banks and the over/under voltage protection scheme of the wind turbines is required to prevent cascading trips of the wind turbines.

Powerflow:

Powerflow analysis was performed for both phases of this project's development using the 2003 April Minimum and Summer Peak Models as presented to the Southwest Power Pool (SPP) in September of 2002. The analysis indicated reactive power compensation would be required at the wind farm's 34.5 kV collection bus so that the voltages would be supported at acceptable levels for system intact conditions. The proposed switched capacitor banks of (2) 15 MVAR capacitor banks for Phase-1, and (2) 17.5 MVAR capacitor banks for Phase-2 would provide adequate reactive power compensation to prevent system intact and single contingency adverse conditions.

Construction Projects:

The interconnection of the >Omitted Text< Wind Energy Project generating facility consists of the projects summarized in the table below:

Table 1: Required Interconnection Projects

Project	Description	Estimated Cost
1	Construct 230 kV Switching Station.	$ 2,181,948.00
2	Modify protective relays at Chaves County, or Oasis Interchange.	$ 60,000.00
3	Construct ~ 0.3 miles 230 kV Line to requester's substation	$ 381,000.00
4	Right-Of-Way and Permitting.	$ 200,000.00
	Total Cost:	**$2,822,948.00**

1. **Construction of 230 kV Switching Station:** See Appendix A for one-line diagram.

   1.1. Location: Xcel Energy will construct a new 230 kV switching station on the east side of the west section boundary of Section 1, Township 4 South, Range 29 East, where the 230 kV transmission line K-50 intersect with said boundary, approximately 12.5 miles west, and 3.3 miles north of Elida, New Mexico.

   1.2. Bus Design: The bus design for this new switching station will be a three-breaker / three-terminal 230 kV ring-bus.

   1.3. Line Terminals: The line terminals will be designed to accommodate 2,000 pounds per phase conductor at maximum tension heavy-load and two shield wires designed to accommodate 2,000 pounds each at maximum tension heavy-load.

   1.4. Control House: A control house approximately 12 feet by 20 feet will be installed to contain the metering, protection and control devices, terminal cabinets, and fiber-optic cable terminations, etc.

   1.5. Security Fence: The switching station will have a chain-link fence with steel posts set in concrete and a rock yard surface.

   1.6. Ground Grid: A complete ground-grid per ANSI/IEEE STD 80-1986 will be installed at the new Xcel Energy switching station.

   1.7. Site Grading: Company contractor, per company specification, will perform initial site grading and erosion control of the interconnection facility. Soil compaction shall be not less that 95% of laboratory density as determined by ASTM-D-698.

   1.8. System Protection and Control: Xcel Energy will design the protection scheme using appropriate relays with communication channel to provide the following protection of the Xcel Energy system:

      1.8.1. Line Protection: Primary and Back-up Line relaying will be installed.
      1.8.2. Bus Differential Protection.

1.9. Billing Metering: Xcel Energy will install bi-directional revenue-grade metering on the 230 kV transmission line from the switching station to the Requester's generating facility. This metering will be used to meter the output of the plant as well as provide to Xcel Energy billing for any auxiliary load when the wind generating facility is off-line.

1.10. The cost for the Xcel Energy Switching Station is estimated at $ 2,181,948.00.

2. Transmission Line:

2.1. Circuit K-50 Tap: Xcel Energy will tap the existing transmission circuit K-50 in and out of the new Xcel Energy 230 kV switching station.

2.2. 230 kV Line Terminations: Xcel Energy will terminate all 230 kV transmission circuits connecting to the new Xcel Energy switching station. The new Xcel Energy 230 kV transmission line shall dead-end on a transmission structure just outside the Requester's substation fence and slack span to the substation steel, where Xcel Energy will terminate the line.

2.3. New Line Construction: Xcel Energy will construct a single circuit, 230 kV transmission line from the Requester's substation to the new Xcel Energy 230 kV switching station, a distance of approximately 0.3 miles. The line shall be supported on single shaft steel structures. The phase conductors shall be single 795 ACSR with one – 3/8" fiber-optic shield wire. This transmission line construction cost is estimated at $ 381,000.00.

3. Relay Modifications at Chaves County, or Oasis Interchanges:

3.1. The existing relays at Chaves County Interchange, or Oasis Interchange will require replacement with compatible units with those at the new 230 kV switching station.

3.2. The estimated cost to modify these relays is $ 60,000.00.

4. Right-Of-Way:

4.1. Switching Station Site and New 230 kV Transmission Line: Xcel Energy or assigned contractor will perform all necessary tasks associated with the procurement of real estate for the new Xcel Energy switching station and transmission line, including land purchase, surveying, title search, etc.

4.2. Permitting: Xcel Energy will perform all tasks associated with permitting the new Xcel Energy switching station and transmission line including Environmental, Biological, Archaeological and any other require study.

4.3. The estimated cost associated with all Right-Of-Way issues is $ 200,000.00.

5. Construction Power and Distribution Service:

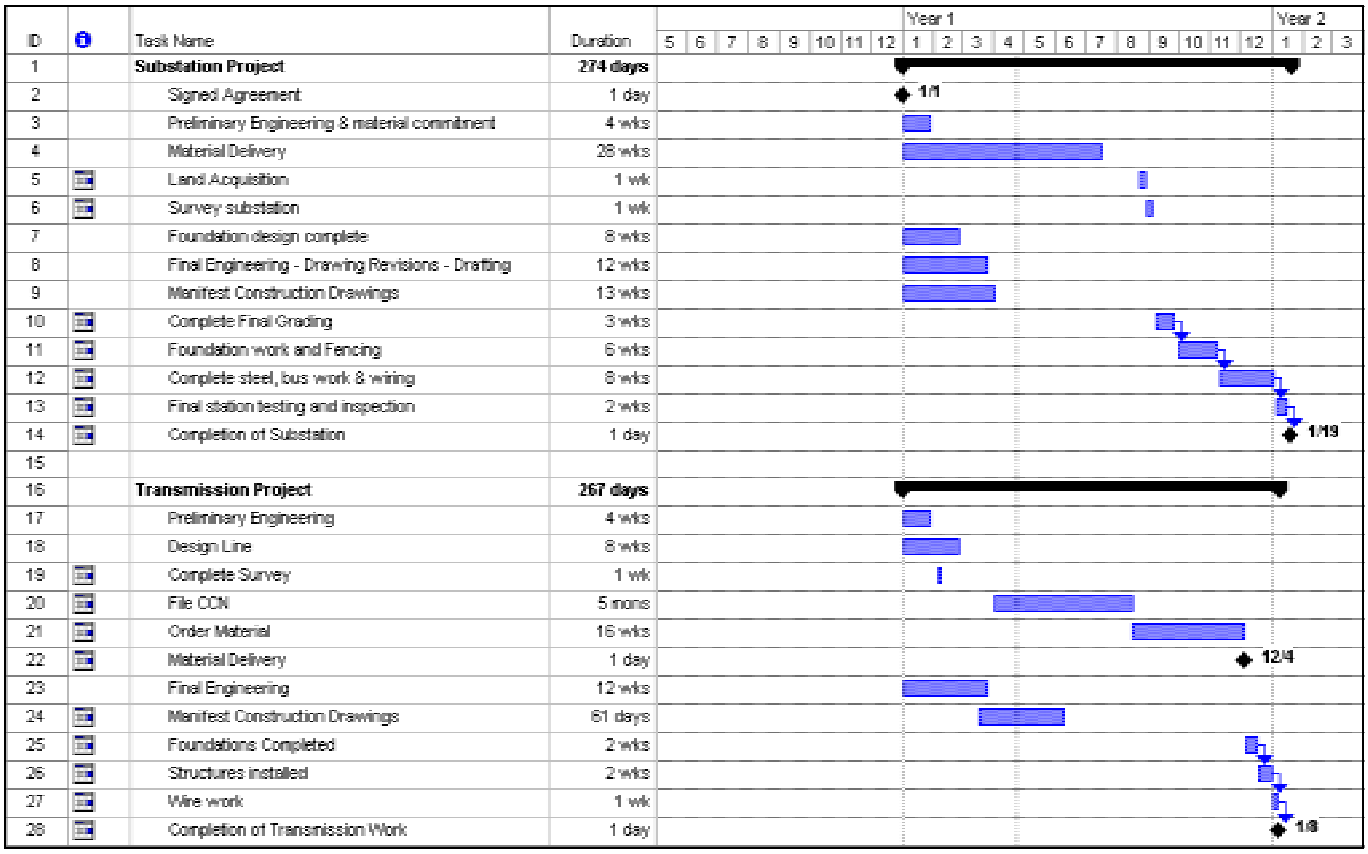
5.1. Both Construction and Station power in addition to any distribution service required for the wind facility are the sole responsibility of the Requester.

All additional cost for work not identified in this study is the sole responsibility of the Requester unless other arrangements are agreed on.

Should the location of the Requester's interconnection substation change, the estimated costs for transmission line construction and Right-Of-Way will be affected.

Engineering and Construction Schedule:

It is anticipated that the switching station, transmission line, and all associated components will be constructed and ready to receive power from the Requester's Wind Farm at approximately 13 months from the day an interconnection agreement is signed. An Engineering and Construction schedule is shown below:



ID	Task Name	Duration
1	**Substation Project**	**274 days**
2	Signed Agreement	1 day
3	Preliminary Engineering & material commitment	4 wks
4	Material Delivery	28 wks
5	Land Acquisition	1 wk
6	Survey substation	1 wk
7	Foundation design complete	8 wks
8	Final Engineering - Drawing Revisions - Drafting	12 wks
9	Manifest Construction Drawings	13 wks
10	Complete Final Grading	3 wks
11	Foundation work and Fencing	6 wks
12	Complete steel, bus work & wiring	8 wks
13	Final station testing and inspection	2 wks
14	Completion of Substation	1 day
15		
16	**Transmission Project**	**267 days**
17	Preliminary Engineering	4 wks
18	Design Line	8 wks
19	Complete Survey	1 wk
20	File CCN	5 mons
21	Order Material	16 wks
22	Material Delivery	1 day
23	Final Engineering	12 wks
24	Manifest Construction Drawings	61 days
25	Foundations Completed	2 wks
26	Structures installed	2 wks
27	Wire work	1 wk
28	Completion of Transmission Work	1 day

Appendix A

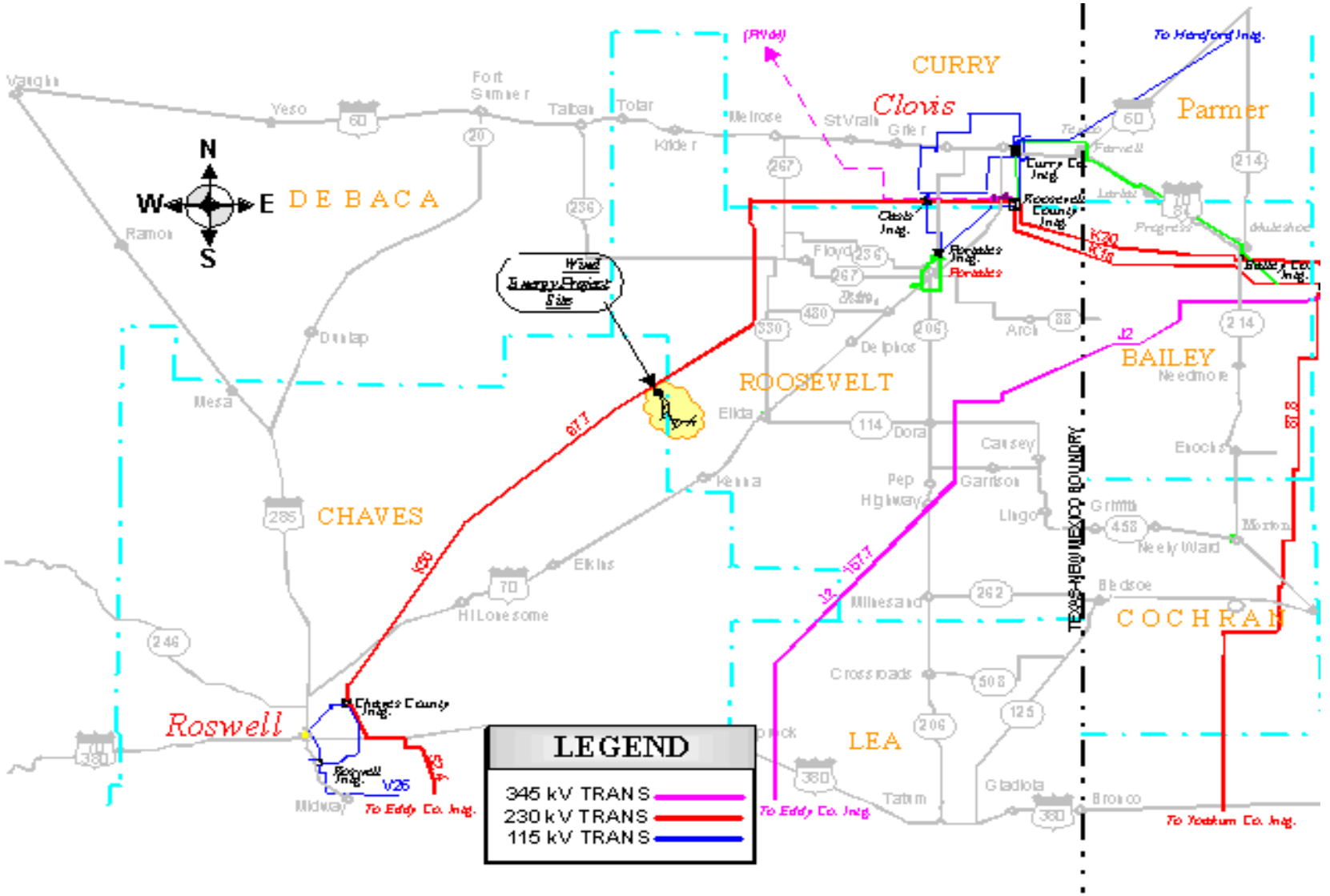


Figure A-1. >Omitted Text< Location & Area Transmission

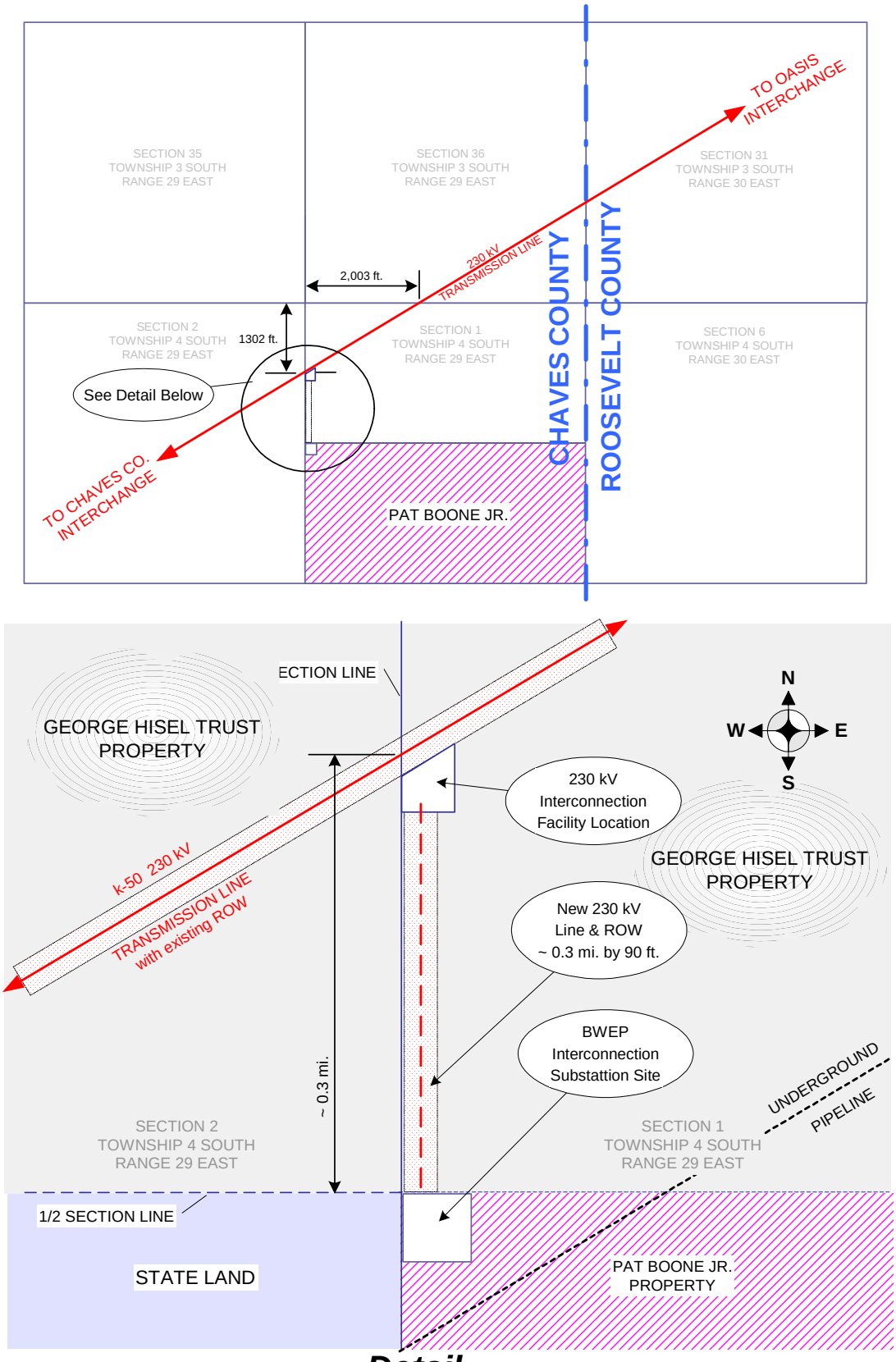


Figure A-2. >Omitted Text< Energy Interconnection Sighting

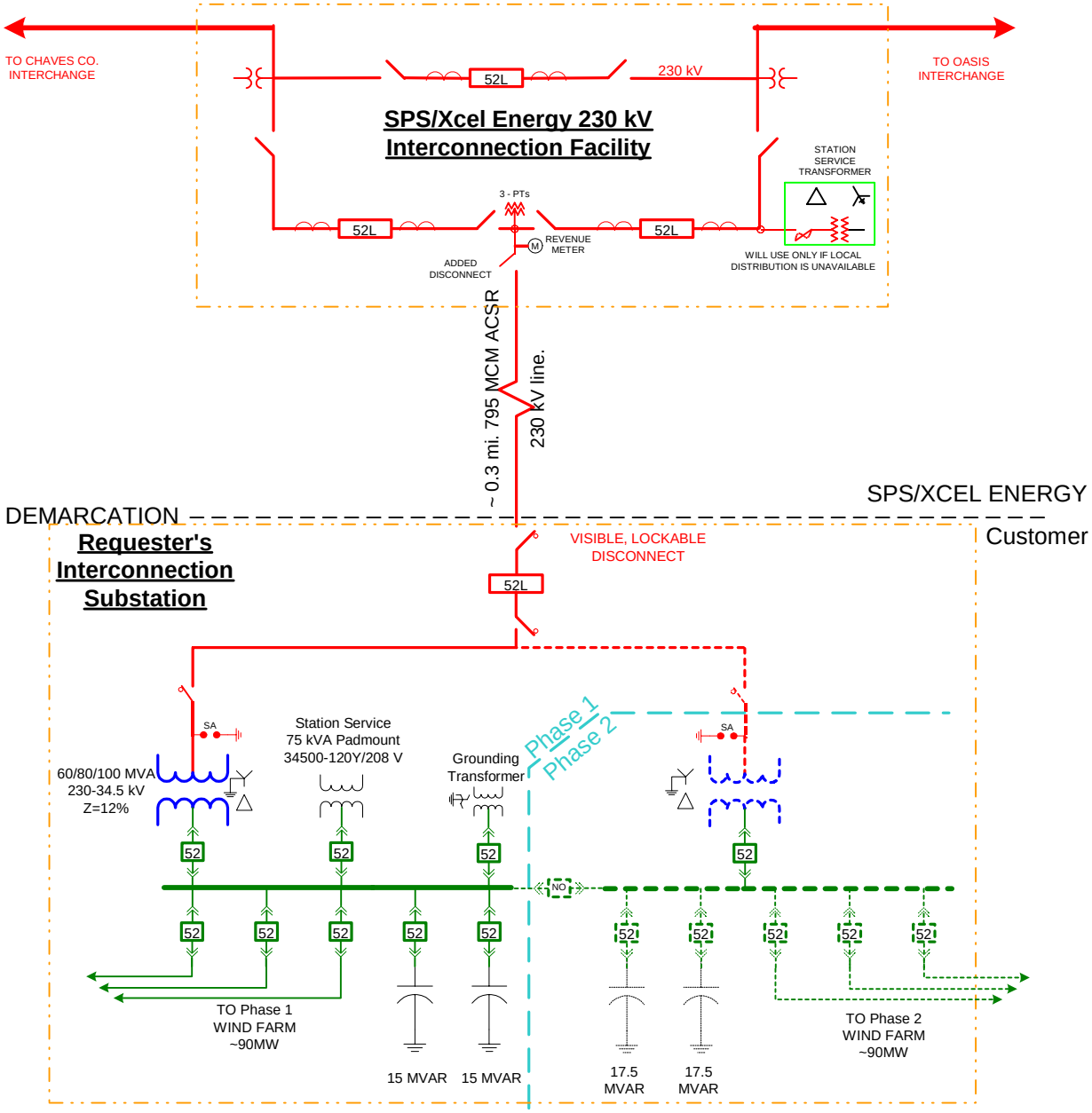


Figure A-3. Interconnection One-Line Diagram