



***Facility Study
For
Generation Interconnection
Request
GEN-2006-020S***

***SPP Tariff Studies
(#GEN-2006-020S)***

May, 2007

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Xcel Energy performed the following Facility Study to satisfy the Facility Study Agreement executed by the requesting Customer and SPP for SPP Generation Interconnection request #GEN-2006-020S.



Facilities Study For
[Omitted Text]
18.9 MW Wind-Generated Energy Facility
Hansford County, Texas
SPP #GEN-2006-020S

April 30, 2007

Xcel Energy Services, Inc.
Transmission Planning

Executive Summary

[Omitted Text] (“Interconnection Customer”) has requested the connection of a wind energy facility to the Southwestern Public Service Company (SPS) (d/b/a Xcel Energy, Inc.) 115 kV transmission system in Hansford County. The Interconnection Customer’s substation is located adjacent SPS’s 115 kV transmission line (circuit V-30) approximately 18 miles from Texas County Interchange towards Moore County Interchange. A new 3-way load break switch will be installed at this location. The Southwest Power Pool (SPP) evaluated the request to connect this wind energy facility to the SPS transmission system in a System Impact Study completed in January 2007. This connection request was studied using nine (9) Suzlon S88 2.1 MW wind turbines for a total of 18.9 MW. The Interconnection Customer’s requested in-service date is February 2008 for generation testing, which is feasible.

Xcel Energy will require the Interconnection Customer to construct the Connection Facilities in compliance with the latest revision of the Xcel Energy Interconnection Guidelines for Transmission Interconnection Producer-Owned Generation Less than 20 MW, Version 1.0 dated June 15, 2006, and is available at http://www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-1_16699_24407-1428-0_0_0-0,00.html. This document describes the requirements for connecting new generation to the Xcel Energy operating company transmission systems including technical, protection, commissioning, operation, and maintenance. Xcel Energy will also require that the Interconnection Customer be in compliance with all applicable criteria, guidelines, standards, requirements, regulations, and procedures issued by the North American Electric Reliability Council, (NERC), Southwest Power Pool (SPP), and Federal Energy Regulatory Commission (FERC) or their successor organizations.

The Interconnection Customer is responsible for the cost of the Interconnection Facilities and any Direct Assigned Interconnection Facilities; inclusive of all construction required for the 115 kV transmission line from the Interconnection Customer’s substation to the 3-way Switch structure. The customer will be responsible for installing a wave trap in their substation on the 115 kV and will need to contact the project engineer for coordination. The metering will be installed at the customer’s control house at their substation.

It is anticipated that the construction of the new 3-way load break switch, for the acceptance of wind generated electric energy from the Interconnection Customer’s Wind Farm, will require approximately 6 months for completion from the day an interconnection agreement is signed and after all internal approvals, unless prior arrangements have been made. The cost of these upgrades, inclusive of the Interconnection Customer’s cost for the Interconnection Facilities required for the connection of this new wind energy generation facility, is shown below. See [Table 2](#) for a detail description of all the costs.

Upgrade	Cost
Network Upgrade:	\$ 247,050
Interconnection Facilities ¹ :	\$ 160,820
Total:	\$ 407,870

¹ Direct Assigned Cost To Requester

Discussion

A new 115 kV 3-way load break switch is required for the Interconnection of the Customer's wind-generated energy facility. It will be located in an existing 115 kV transmission line, (Circuit V-30) and adjacent to the Customer's Substation. The Interconnect Customer needs to provide the GPS coordinates for the point of service. The new 3-way switch will consist of three 115 kV phase over phase load break switches, which are rated 1200 amps with SCADA. A 115 kV transmission tap span will be built from the Customer's Substation to the new 115 kV 3-way switches.

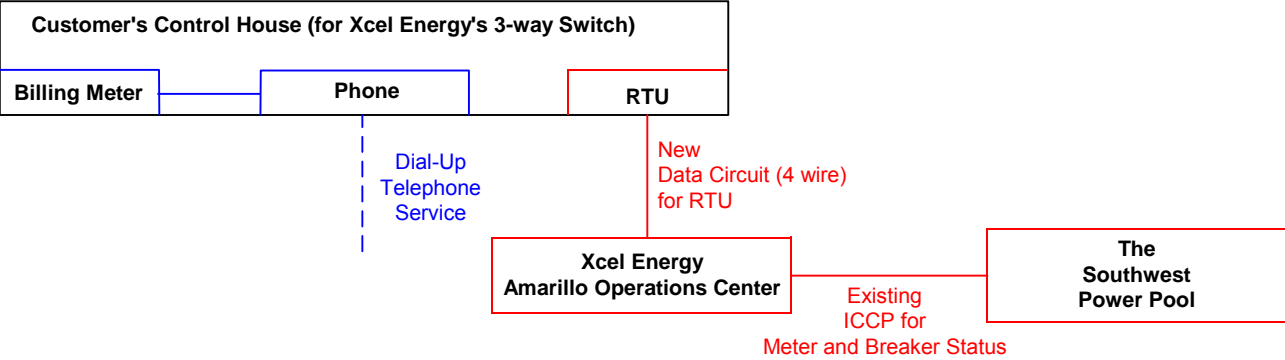
General Description of Modifications and New SPS² Facilities

1. **Construction of the New 3-way Load Break Switch:** See [Figure A-2](#) in [Appendix A](#) for one-line diagram.
 - 1.1. **Location:** The new 115 kV 3-way load break switches will be located on circuit V-30 adjacent to the Customer's Substation. These facilities are located approximately 18 miles southwest of Texas County Interchange, which is located in Section 2, Block 1, P.S.L. Survey, and Hansford County, Texas. See [Figure A-1](#) for a map of the local transmission system.
 - 1.2. **Switch Design:**
 - 1.2.1. The new 115 kV 3-way load break switches (1200 amps) with SCADA will be built to accommodate the output from the wind energy facility. The 3-way structure will have: One tap to the wind farm connection from their substation; a second one from the Texas County Interchange, and a third one to Moore County Interchange.
 - 1.3. **Control House:** Space in the customer's control house will be provided for Xcel Energy to house the new metering, control devices, terminal cabinets, and any communications cable terminations, etc. for the new 115 kV 3-way load break switch including DC power.
 - 1.4. **Line Reactors:** None.
 - 1.5. **Security Fence:** None.
 - 1.6. **Ground Grid:** None.
 - 1.7. **Site Grading:** None.
 - 1.8. **Station Power:** Customer's responsibility.
 - 1.9. **Relay and Protection Scheme:** There are not any changes required at Texas County Interchange or Moore County Interchange. Customer is required to install line arresters at each line termination. Settings on the grounding may change depending on the winding configuration. One line shows Y-Delta-Y.

² All modifications to SPS facilities will be owned, maintained and operated by SPS.

- 1.10. **Revenue Metering:** The cost to the customer is less because the metering is being installed on the 34.5 kV side of the customer’s transformer. A billing meter will be installed along with 2-ION 8600 meters unit, ANSI C12.1 accuracy class 0.2 (3 PTs IEEE C57.13 accuracy class 0.3 and 3 CTs IEEE C57.13 accuracy class 0.15) for full 3 phase 4-wire metering. The metering unit will have 175:1 PTs and 200/400:5 CTs. There will be two meters; one will be primary and the other will be back up, and each will have full 4 quadrant metering. Pulses out of the primary billing meter will be sent via SCADA to the Amarillo Control Center. Metering at Customer’s Substation in their control house will be installed to comply with present SPP market protocols.
- 1.11. **Disturbance Monitoring Device:** None required.
- 1.12. **Remote Terminal Unit (RTU):** A new RTU will be utilized with communications. An SEL 2020 will be installed for relay communication and other functions as required in the customer’s control house, which includes communications to the 3-way load break switch.
- 1.13. **Communications:** Communications from the new 3-way switch to the Amarillo Control Center will consist of a 4-wire telephone and data circuit. **It is the Requester’s responsibility to make arrangements with the local phone company to provide the four-wire data circuit and telephone circuit to the new 3-way load break switch and customer’s substation. Prior to any construction, the Requester is required to contact the Xcel Energy substation-engineering department for all details.**

A schematic outlining the proposed communications is provided below:



2. Transmission Line:

The Interconnection Customer will construct, own, operate, and maintain the new customer owned 115 kV transmission line/bus from the Interconnection Customer’s 115/34.5 kV substation to the new SPS 3-way load break switch. Figure A-2 shows the Point of Connection and Change of Ownership. **The Xcel Energy transmission design group will require an engineering review of the Interconnection Customer’s transmission line design prior to any construction by the Interconnection Customer or its contractor on the customer owned 115 kV transmission line or doing work in close proximity to any SPS transmission line, will require an engineering review in a timely manner before construction of the 115 kV transmission line begins. If the review has not been made or the design at any of the aforementioned locations is deemed inadequate, the crossing(s)**

and or termination into the new 3-way switch will be delayed until the matters are resolved. Xcel Energy will not be held responsible for these delays.

- 2.1. **115 kV Termination Structure:** The existing Xcel Energy overhead 115 kV transmission line (V-30) will be terminated in and out of the new 3-way load break switch. The transmission termination structures will be constructed in line with the existing 115 kV transmission line. The existing 115 kV line between the Texas County Interchange and Moore County Interchange will be re-terminated such that power flows through the proposed 3-way switch with a tap to the Wind Farm. The location of the 3-way load break switch will be in Section 2, Block 1, P.S.L. Survey, and Hansford County, Texas. The Interconnect Customer needs to provide the GPS coordinates for the point of service.
- 2.2. The third 115 kV transmission terminations will be on the substation side of the 3-way load break switch for the DWS Wind Farm. All circuits will be dead-ending on 115 kV structure for the new 3-way load break switch structure. See [Figure A-2](#).
- 2.3. The customer will install single-phase wave trap on their 115 kV in the substation. Customer is required to contact Xcel Energy substation-engineering department for all details. See [Figure A-2](#).
3. **Right-Of-Way:**
 - 3.1. **New 115 kV Transmission Line Taps:** See Figure A-1 for approximate location of the line taps and the 3-way switch site.
 - 3.2. **Permitting:** Permitting for the construction of the new 3-way switch is not required from the Public Utility Commission in the State of Texas.
 - 3.3. **3-Way Switch Location:** The new 3-way switch will be constructed in the existing 115 kV transmission circuit V-30. SPS will provide the Interconnection Customer with easement detailing the metes and bounds description for the required real estate. The Interconnection Customer will obtain all necessary signatures from landowner(s) for the easement needed on the land where the new SPS 3-way switch will be built.
4. **Construction Power and Distribution Service:** Both Construction and Station power, in addition to any distribution service required for the Interconnection Customer's wind-generated energy facility, are the sole responsibility of the Interconnection Customer. **Xcel Energy, Inc. cannot provide station power (retail distribution service) for the Interconnection Customer's substation if the location of the Interconnection Customer's substation lies outside of the Xcel Energy service area.**
5. **Project and Operating Concerns:** Close work between the Transmission group, the Interconnection Customer's Personnel, and local operating groups will be imperative to have this project in service on the scheduled date.

6. Short Circuit Study Results:

The Short Circuit Analysis was performed internally by Xcel Energy Services to determine the available fault current at the 115 kV at the new 3-way switch. These values may be used as a starting point for the determination of the available fault currents and interrupting capability of their facilities. The results are shown in [Table 1](#), and the impedances are in per-unit at the specified voltage.

Fault Location	Fault Current (A)		Impedance (p.u Ω) ³	
	Line-to-Ground	3-Phase	Z ⁺	Z ⁰
New 3-way Switch on 115 kV circuit V30	2,375	3,125	0.0401 + j0.1561	0.0753 + j0.2991

Estimated Construction Costs:

The projects required for the interconnection of the 18.9 MW wind energy generating facility consist of the projects summarized in [Table 2](#) shown below:

Project	Description	Estimated Cost
Network Upgrade		
1	No Relay Modifications at Texas County and Moore County Interchange	\$ 0
2	115 kV Transmission Line Work, Install 3-way load break switch.	\$ 247,050
Subtotal:		\$ 247,050
Interconnection Facilities (at the Interconnection Customer's Expense)		
3	Communications ⁴	\$ See footnote
4	Wave Trap on 115 kV ⁵	\$ See footnote
5	Remote Terminal Unit (RTU)	\$ 54,120
6	Revenue metering	\$ 17,700
7	115 kV Arresters	\$ 89,000
Subtotal:		\$ 160,820
Total Cost:		\$ 407,870

These costs were estimated using 2007 costs (2007 dollars) with no AFUDC⁶ added with an estimated accuracy is $\pm 20\%$.

Capital budget approval has not been sought for this project as of the date of this report. The required approval process may impact the projected in-service date requested by the Interconnection Customer.

³ Z⁺ – Positive Sequence Impedance in p.u on a 100 MVA base

Z⁰ – Zero Sequence Impedance in p.u on a 100 MVA base

⁴ It is the Requester's responsibility to provide both the data Circuit and both dial-up telephone circuits, see Section 1.13.

⁵ It is the Customer's responsibility to provide the wave trap and contact the project Engineer.

⁶ AFUDC - Allowance for Funds Used During Construction.

7. Engineering and Construction Schedule:

It is anticipated that the 3-way switch and all associated components will be constructed and ready to receive power from the Interconnection Customer's wind farm approximately 6 months from the day an interconnection agreement is signed and after all internal approvals, unless prior arrangements have been made. This is the earliest Xcel Energy can complete the project as a result of other scheduling considerations. A construction schedule is shown below.

ID	Task Name	Duration	Year 1												Year 2											
			10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
1	GEN 2006 - 020S, 18.9MW	190 days																								
2	Preliminary Engineering	8 wks																								
3	Order long lead material & equipment	28 wks																								
4	Transmission construction	2 wks																								

Appendix A

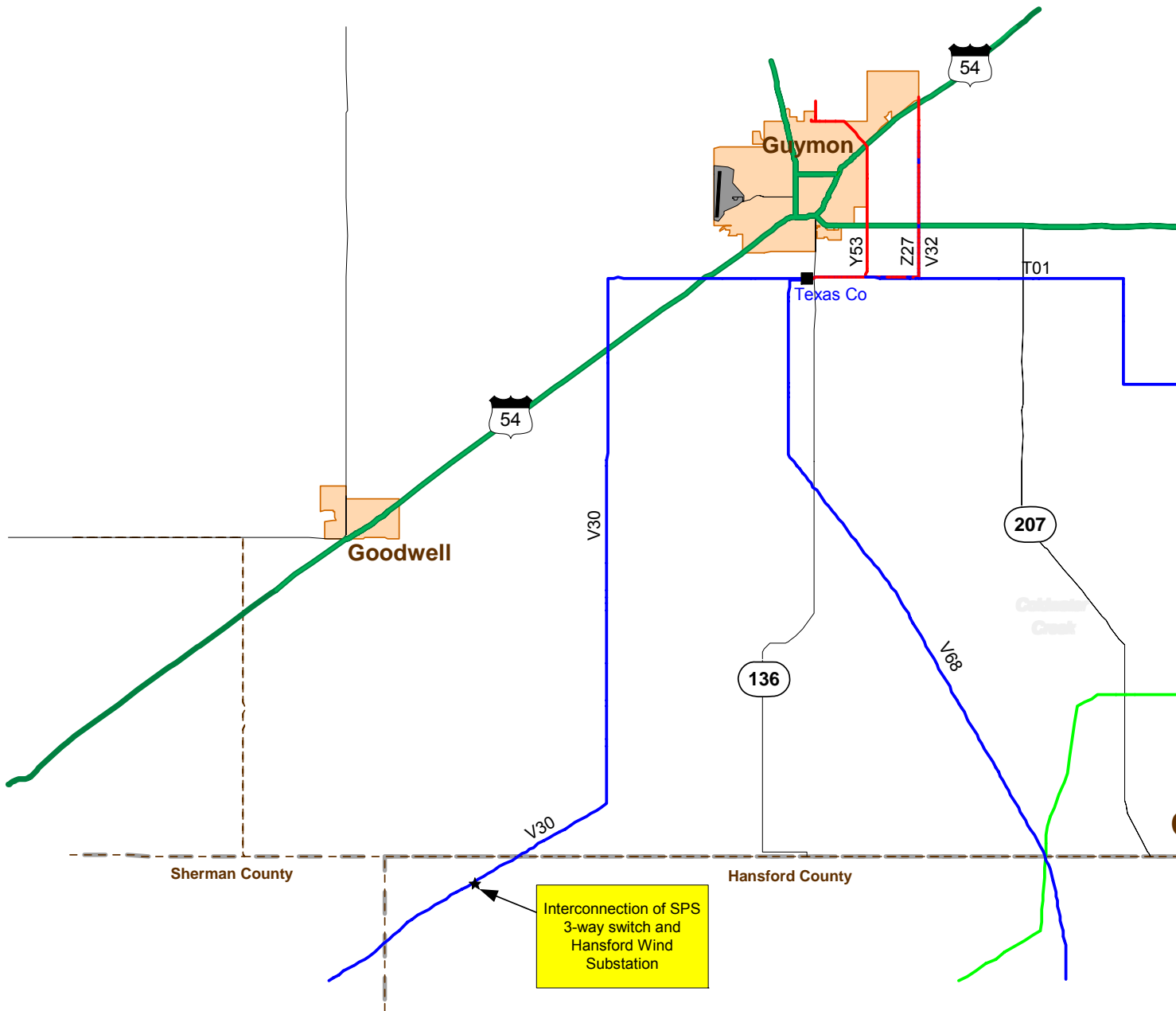


Figure A – 1. Location Map and proposed Interception Point to the Xcel Energy 115 kV Circuit V-30.

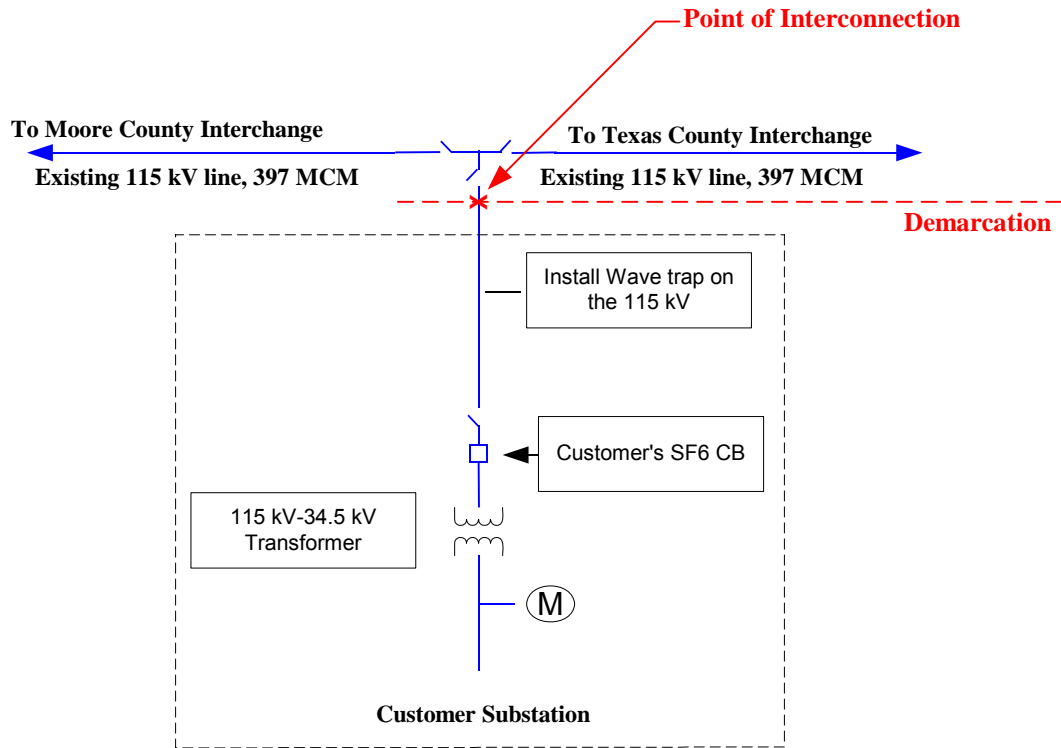


Figure A - 2. One-line diagram for Hansford Wind and a new 115 kV 3- way Switch in Hansford County.