Wind Generation Interconnection Feasibility Study

For

Customer

80 MW of Wind Energy
Near Tucumcari, New Mexico
SPP #GEN-2001-036

Transmission Reliability & Assessment
Xcel Energy

November 12, 2001

Introduction

Customer has requested a generator interconnection for their facility to be located near Tucumcari, New Mexico. Customer requests interconnection on the 76 mile long 115 kV transmission line that serves Tucumcari, New Mexico. This transmission line terminates at the Curry County Interchange and Campbell Street Substation in Tucumcari. Customer plans to construct their own 115 kV transmission line to connect their project substation to the SPS transmission system.

Customer has requested a transmission in service date for their 80 MW facility of November 1, 2002.

This study determined the feasibility of the interconnection site and the level of acceptable generation that could be put on existing transmission facilities up to the requested amount of generation without causing an adverse impact. Alternative interconnections were not considered. This study did not examine any transfer capability issues that may be caused by the interconnection of the Facility. Such studies would be part of Customer's transmission service request, not part of this interconnection feasibility study.

Assumptions

The transmission models used for this study were the SPP system models for the 2003 spring and 2004 summer peak conditions. The loads on the 2004 summer model were scaled back by 3% to represent the expected 2003 summer conditions. A previous study had determined that the Potter County – Frio Draw 345 kV line and its associated 230 kV terminations in the Clovis, New Mexico area would not be needed prior to the interconnection in 2002.

Requests for generation interconnection prior to Customer's request include two facilities in the Clovis, New Mexico area, a 550 MW facility and a 185 MW facility. Since these request precede Customer's request for interconnection, the 2003 summer and the 2004 spring models had to include these plants. The 2003 spring model included only 185 MW facility due their proposed interconnection and in-service date. Powerflow and contingency analysis of these models determined the results of this feasibility study.

The Facility was modeled at or near unity power factor. This assumes that an equal amount reactive power required by the windfarm will be compensated for, or put back on the transmission system.

Study Method

Powerflow and contingency studies were performed using the Power System Analysis Program (PSS/E) developed by Power Technologies, Inc. This program has the capability of doing powerflow simulations, short circuit studies, stability studies, and contingency studies.

Powerflow studies without the Customer facility were used to determine the existing or expected conditions. These conditions were considered the reference or “base case” conditions for which comparisons would be made. Then the proposed 80 MW of wind generation were modeled to determine the system intact powerflow changes to the SPS transmission system.

Single contingency studies were performed with and without the added generation from the Customer facility. This type of study involves modeling the outage of each transmission element in the vicinity of the proposed interconnection one at a time and observing any overload or voltage problem created by the outage. Then, comparisons were made between the case models with and without the added generation from the Customer facility. Thus, if a transmission element overload is caused by the new windfarm, Customer is responsible for the costs to mitigate the overload.

Several case models were developed and evaluated. These case models reflect the anticipated 2003 and 2004 seasonal peak conditions. Please see the case model descriptions in Appendix B of this report.

Power Flow Results

The results of the powerflow studies for each case evaluated indicate that the 80 MW interconnection of the Customer facility will not cause any adverse loading or voltage problems for system intact conditions. However, system intact power flow results do not indicate the adverse impacts caused by the added facilities due to single contingency outages.

Comparative Contingency Study Results

In the 2003 spring cases the comparative contingency study indicated no problems prior to the interconnection of the 550 MW generation plant in the Clovis, New Mexico area. However, the results of the contingency studies for the case models starting in the 2003 summer season indicate that the power on the 230 kV interconnection lines of a previous requester would be increased by 3% under contingency conditions. This increase will cause a contingency overload of one of the 230 kV lines interconnecting the proposed for the 550 MW generating plant near Clovis, New Mexico with the loss of the other 230 kV line. Table 1 below reports the contingency loading conditions of the remaining 230 kV line connecting the Clovis Plant to the Roosevelt Interchange for the loss of the other 230 kV line before and after the Customer facility is added.

Table 1: Comparative Contingency Results

Season	Case	MW	Pre-Cont. Loading	Post-Cont. Loading	Percent Loading
2003 Spring	03G-000	0	14.9	97.8	22.1
	03G-001	80	24.1	128.7	28.5
2003 Summer	03SP-000	0	228.3	446.8	98.9
	03SP-001	80	234.7	459.2	101.6
2004 Spring	04G-00A	0	229.9	450.3	99.6
	04G-01A	80	236.3	462.8	102.4
2004 Summer	04SP-000	0	226.3	447.3	99.0
	04SP-001	80	231.7	457.9	101.3

The 2003 spring case, the loading values are for the 230 kV line between the Oasis Interchange and Roosevelt Interchange. The values under the “MW” heading are the generation level of the Customer facility; under the heading “Pre-Cont. Loading” is the loading of one of the 230 kV lines interconnecting the proposed 550 MW Clovis plant to Roosevelt Interchange; under the heading “Post-Cont. Loading” is the loading of the remaining 230 kV line connecting the 550 MW plant to Roosevelt Interchange; the “Percent Loading” is the post contingency percentage of the 230 kV line’s emergency rating.

Interconnection Requirements, Cost, and Construction Schedule

The cost estimates for the interconnection adding the Customer facility to Southwestern’s system are contained in Appendix D along with a preliminary one-line diagram of the construction required. The cost estimates assume that Customer will interconnect the Facility at the 115 kV level, adjacent to the existing 115 kV transmission line ROW on switching facilities of Southwestern’s construction.

Conclusion

This study has shown that the proposed Facility would be a viable source of wind generation on the SPS transmission system. The proposed interconnection of this 80 MW facility will not cause any adverse loading or voltage problems for system intact conditions. However, the Facility does cause a 3% increase in the contingency loading of the 230 kV lines interconnecting another facility to the Roosevelt Interchange. This increase will cause a contingency overload on the 230 kV interconnection of the previously proposed 550 MW generation plant.

The interconnection to the 550 MW generating facility is still under consideration and without final plans for their facilities. Therefore, conditions may change which may or may not mitigate the contingency overload. In the case where the contingency overload persists after final plans, Customer will be required to participate in the incremental upgrade of the 550 MW facility's interconnection.

Appendix

Powerflow Case Model Descriptions

Case Model Descriptions

The following is a brief description of the model changes between cases used in this study.

2003 Spring Base Case: #03G-000

- This base case models the existing transmission with only the planned improvements scheduled to be complete before the 2003 spring season. This case was used for comparative purposes. Therefore, the Customer facility was not included in this model.

Case: #03G-001:

- This case modeled the interconnection of the Customer facility interconnected to the 115 kV transmission line approximately 10 miles south of the Farmers' Electric Coop Interchange.
- The SPS system slack-generator at Tolk Station was allowed to slack back from 349.19 MW to 272.45 MW.
- The generation of the Customer facility was modeled at 80 MW at 0.99 lagging power factor.

2003 Summer Base Case: #03SP-000

- Scaling back the SPS loads in the SPP 2004 summer peak model by 3% developed this summer case. This case models the expected interconnection of the 550 MW generating plant near Clovis, New Mexico on the existing transmission. Only those planned improvements scheduled to be complete before the 2003 summer seasons have been included. This case was used for comparative purposes.
- The SPS system slack-generator at Tolk Station was settled to 527.8 MW after the 550 MW plant was in service.
- The generation of the Customer facility was not modeled.

Case: #03SP-001

- The Customer facility was modeled the same as the 2003 spring case where the interconnection point to the SPS transmission remained the same, and the slack-generator at Tolk Station again balanced to 467.7 MW.
- The generation of the Customer facility was modeled at 80 MW and at 0.99 lagging power factor.

2004 Spring Base Case: #04G-00A

- The Customer facility was not modeled in this case
- The slack-generator at Tolk Station again balanced to 224.5 MW.

Case: #04G-01A

- The Customer facility was modeled the same as the 2003 cases where the interconnection point to the SPS transmission remained the same, and the slack-generator at Tolk Station again balanced to 248.9 MW.
- The generation of the Customer facility was modeled at 80 MW and power factor corrected to 0.98 lagging.

2004 Summer Base Case: #04SP-000

- The Customer facility was not modeled.
- The slack-generator at Tolk Station was balanced to 327.1 MW.

Case: #04SP-001

- The Customer facility was modeled the same as the other cases where the interconnection point to the SPS transmission remained the same, and the slack-generator at Tolk Station again balanced to 266.8 MW.
- The generation of the Customer was modeled at 80 MW and power factor at 0.99 lagging.

Appendix

Estimated Costs

Scoping Estimate

A "Scoping Estimate" is provided by Xcel Energy for the convenience of the requesting entity (Requester). It is produced before engineering design has been completed. Xcel Energy will make every effort to produce a representative estimate that incorporates as many project-specific factors as possible. However, a Scoping Estimate is generally based on typical conditions encountered on past construction projects and uses historical cost data from other Xcel Energy projects which may or may not be directly comparable. A Scoping Estimate will only give a broad-based estimate of the possible costs that may be incurred during a potential construction project. Xcel Energy will not proceed to construction based on a Scoping Estimate. If a Requester wants a more definitive estimate of the cost of a project, an "Engineering Estimate" should be requested.

This form will be provided to the Requester prior to completion of the Scoping Estimate so that the Requester can verify the Project Scope and Assumptions information, below. Once the estimate is complete, Xcel Energy will fill in the "Estimated Costs" space at the bottom, and provide a copy of this form to the Requester.

Requester Name _Customer____ Phone ___
Address __

To generate this Scoping Estimate, Requester agrees to pay Xcel Energy : $ Paid to SPP

Requester: _____N/A_____10/30/01_____
Signature *Date*

The Requester should review the information detailed below and notify Xcel Energy in writing as soon as possible if any of these assumptions are incorrect.

Project Information:
Name: _Customer facility_____
Location: _Approximately 13 miles south of Tucumcari, New Mexico_____ _____
Scope: _1. 115 kV interconnection facility adjacent to existing Right-of Way nearest to project location.

Project Assumptions: include conditions and requirements set by Xcel Energy and responsibilities of Xcel Energy, and, as appropriate, the Requester. Attach additional pages if more room is needed.
__Customer will interconnect at a single 115 kV interconnection facility to the SPS transmission system. All required reactive power compensation will be provided by Customer on their energy collection network prior to the 115 kV interconnection. .

Scoping Estimate of Costs by Xcel Energy: _**$1,913,164.55**_____

Xcel Energy _____
Print Name

_____
Signature *Date*

Scoping Estimate

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Requester Name _Customer____ Phone ___
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To generate this Scoping Estimate, Requester agrees to pay Xcel Energy : $ Paid to SPP

Requester: _____N/A_____ 10/30/01_____
Signature *Date*

The Requester should review the information detailed below and notify Xcel Energy in writing as soon as possible if any of these assumptions are incorrect.

Project Information:
Name: _Customer facility_____
Location: _ _____ _____
Scope: _1. Curry – Tucumcari 115 kV line construction in and out of interconnection facility with 397.5 MCM ACSR lines.

Project Assumptions: include conditions and requirements set by Xcel Energy and responsibilities of Xcel Energy, and, as appropriate, the Requester. Attach additional pages if more room is needed.
__Customer will interconnect at a single 115 kV interconnection facility to the SPS transmission system.
_Customer will construct their own 115 kV line to interconnect to SPS transmission system

Scoping Estimate of Costs by Xcel Energy: _**$ 144,000**____

Xcel Energy _____
Print Name

_____
Signature *Date*

Summary Cost Estimate Customer 115kV Interconnection Facility				
Description				**Cost**
115kv Line OCB Installation		3	GCB's	$ 930,833.33
115kv P.T. Installation		1	Set of Pt's	$ 82,939.26
115kv Transfer Breaker		1	GCB's	$ 293,227.27
Control House and Bus Diff		1		$ 167,460.05
115kv Transfer bus and switch		3	$67,933	$ 203,798.38
Additional Relaying at Curry Co. Interchange		1		$ 60,000.00
Add Circuit Switcher at Tucumcari		1		$ 174,906.27
Subtotal				**$ 1,913,164.55**
Transmission Terminations to and from new facility		1		**$ 144,000.00**
Estimated Grand Total				**$ 2,057,164.55**
The man-hours for this project totals 7,500. The earliest start date for construction would be September 2002 and would take approximately 27 weeks to complete				