SPP Southwest Power Pool

Feasibility Study for Generation Interconnection Request For GEN-2002-022

SPP Coordinated Planning (#GEN-2002-022)

August 2003

Executive Summary

<OMITTED TEXT> (Customer) has requested a feasibility study for the purpose of interconnecting 240 MW (in blocks of 80 MW) of wind generation in Oldham County, Texas within the service territory of Southwestern Public Service Company (SWPS). The proposed point of interconnection is at the Bushland 230kV Interchange. The Bushland Interchange is located approximately just west of Amarillo, Texas.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 240 MW wind farm without significant transmission system reinforcements within the local Xcel Energy transmission system. In order to maintain acceptable bus voltage, the customer has proposed to install a 15MVAR capacitor bank on the 34.5 kV system. Dynamic Stability studies will provide guidance as to whether the reactive compensation can be static or must be dynamic (such as a SVC). The Dynamic Stability type of analysis is typically performed during the System Impact Study.

The requirements for interconnection consist of building a 230kV interconnection facility configured in a single breaker and bus extension. If the customer's substation facility will be built close to Bushland Interchange (less than one mile), a Certificate of Convenience and Necessity from the Public Utility Commission of Texas will not be required.

The total cost for this 230kV interconnection facility is estimated at $990,000 dollars, which is based on estimates provided by the Southwestern Public Service Company engineering department. The cost includes building 230kV from the customer substation facility into the Bushland Interchange, which was estimated at 1/2 mile (this could vary once the customers substation is located) and the cost to connect the 230kV into Bushland Interchange.

This feasibility study does not take into account static system reinforcements triggered by other generation projects that are positioned ahead in the queue. In the event that these generation projects and the system reinforcements triggered by these projects are built, this feasibility study may have to be revisited, potentially changing the requirements necessary for interconnecting this customer's 240 MW wind farm.

The costs do not include any costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer requests transmission service through Southwest Power Pool's OASIS.

Introduction

The Customer has requested a Feasibility Study for interconnection of a 240MW wind generation facility in Oldham County, Texas. The requested point of interconnection is approximately 14 miles west-southwest of Amarillo, Texas at the Southwestern Public Service Company's 230kV Bushland Interchange. The projected in-service date of the facility is November 2005.

Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the plant to the area transmission system and estimated costs of system modifications needed to alleviate the system problems.

The Feasibility and other subsequent Interconnection Studies are designed to identify attachment facilities and other direct assignment facilities needed to accept power into the grid at the interconnection receipt point. The Customer has proposed that the interconnection would be via a simple tap of the 230kV Bushland Interchange substation with a radial 230kV line to their wind farm. The tap will consist of a single breaker feeding the radial line to the wind farm and a bus extension of the 230kV Bushland Interchange. Tapping the 230kV Bushland Interchange would require an extension of the bus to accommodate the extra breaker.

The costs of interconnecting the facility to the SWPS transmission system are listed in Table 1. **These costs do not include any cost that might be associated with short circuit study results or dynamic stability study results**. These costs will be determined when and if a System Impact Study is conducted.

Table 1: Interconnection Facilities

Facility	Transmission Owner	ESTIMATED COST (2003 DOLLARS)
Expand Bushland Interchange bus to accommodate an extra breaker for customer's facility and ½ mile of 230kV line to the customer's wind farm	SWPS	$990,000

Powerflow Analysis

A powerflow analysis was conducted for the facility using various seasonal representations. The output of the Customer's facility was offset in each model by a reduction in output of SWPS generation. Modified versions of the 02 Series Southwest Power Pool 2004 Summer Peak, 2004 Spring Peak, and 2009 Summer Peak base case were used for this study. The in-service date of the facility is estimated as sometime in the fall of 2005. SPP currently only has available models for the 2004 season and no models for seasons between 2004 and 2009. It was decided that the representation in the 2004 seasons would be sufficiently similar to that in a 2005 season model. Also, an autumn case was not studied as it is assumed that the loading and generation levels of a spring season case are sufficiently similar to an autumn model.

The analysis of the customer's project shows that the proposed location can handle the 240MW of output under steady state conditions without system upgrades in all seasons out to the end of SPP's planning horizon. There are several other proposed wind generation additions in the general area of the Customer's facility. It was assumed in the analysis that not all of these other projects were in service. Those previously queued projects that have advanced to nearly complete phases were included in this feasibility study.

Powerflow Analysis Methodology

The Southwest Power Pool (SPP) criteria states that: The transmission system of the SPP region shall be planned and constructed so that the contingencies as set forth in the Criteria will meet the applicable *NERC Planning Standards* for System Adequacy and Security – Transmission System Table l hereafter referred to as NERC Table l) and its applicable standards and measurements.
Thus, the following conditions must be met in order to maintain a reliable and stable system:

1) More probable contingency testing must conclude that:

   a) All facility loadings are within their emergency ratings and all voltages are within their emergency limits (0.90-1.05 per unit) and
   b) Facility loadings can be returned to their normal limits within four hours

2) Less probable contingency testing shall conclude that:

   a) Uncontrolled islanding does not result
   b) Uncontrolled loss of large amounts of load will not result

More probable contingency testing is defined as losing any single piece of equipment or multi-circuit transmission lines. Less probable contingency testing involves the loss

of any two critical pieces of equipment such as 345kV autotransformers and generating units or the loss of critical transmission lines in the same right-of-way.

Using the created models and the ACCC function of PSS\E, single contingencies in the SWPS control area were applied and the resulting scenarios analyzed. This satisfies the 'more probable' contingency testing criteria mandated by NERC and the SPP criteria.

Conclusion

The minimum cost of interconnecting the Customer project is $990,000. However, as stated earlier, previously queued projects were assumed to not be in service in this feasibility study. If any of those projects are constructed, then this feasibility study may have to be revisited to determine the impacts of this customer's project on other SWPS transmission facilities.

These interconnection costs do not include any cost that may be associated with short circuit or transient stability analysis. These studies will be performed if the Customer signs a system impact study agreement.

The costs do not include any costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer requests transmission service through Southwest Power Pool's OASIS.