FEASIBILITY STUDY FOR <OMITTED TEXT>

100.8 MW Wind Farm On Circuit J03
Stevens County, Kansas
SPP #GEN-2002-018

Xcel Energy Services, Inc.
Transmission Planning

December 13, 2002

Executive Summary

<OMITTED TEXT> has requested a feasibility study for the purpose of interconnecting 100.8 MW of wind generation in Stevens County, Kansas within the service territory of Pioneer Electric Cooperative. The proposed interconnection is on the 345 kV transmission circuit J03, originating from Amarillo, Texas and terminating at Finney Switching Station in Kansas. The interconnection point on this 345 kV transmission circuit is located northeast of the town of Hugoton, Kansas, approximately 2 miles east of the wind farm location.

Powerflow analysis has indicated that for the powerflow cases studied, it is feasible to interconnect the 100.8 MW wind farm without causing new thermal overloads within the local Xcel Energy transmission system. In order to maintain acceptable bus voltage at the interconnection facility, a line reactor will be required on the 345 kV transmission line terminating at this interconnection facility (see Figure 1). The cost and final size of the reactor will be determined by an EMTP[1] study to be conducted upon the signing of an Interconnection Agreement.

The requirements for interconnection consist of tapping the Xcel Energy 345 kV transmission circuit and building one 345 kV interconnection facility configured in a ring-bus. The facility will have three 345 kV line terminals: south in the direction of Potter County Interchange, north towards Finney Switching Station and finally, west to the <OMITTED> wind farm. To connect the wind farm to the proposed 345 kV interconnection facility, it is assumed that a new 345 kV transmission line will be required, with the interconnection point at the wind farm being located approximately two miles from the new Xcel Energy 345 kV interconnection facility. A Certificate of Convenience and Necessity from the Public Utility Commission of Kansas will be required for this new 345kV line.

The total cost for this one 345 kV interconnection facility is estimated at $ 7.05 million dollars, which is based on estimates provided by our engineering department. The cost includes the new 345 kV interconnection facility tapping circuit J03 and two miles of 345 kV transmission line from the interconnection facility to the wind farm interconnection point, inclusive of right-of-way.

This feasibility study takes into account 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 not built, this feasibility study may have to be revisited, changing the requirements necessary for interconnecting this <OMITTED TEXT> 100.8 MW wind farm.

This study examines the feasibility of interconnecting the new 100.8 MW wind farm on the local Xcel Energy transmission system and does not address any issues that exist in determining the available transmission capacity. In order to determine the available transmission capacity, the customer needs to request transmission service through the Southwest Power Pool (SPP) OASIS.

[1] Electro-Magnetic Transient Program

Introduction

<OMITTED TEXT> is proposing the interconnection of a 100.8 MW wind farm in Stevens County, Kansas that will be situated approximately 4.5 miles northeast of the City of Hugoton, Kansas. The proposed wind generating facility has a scheduled in-service date of March 31, 2004. This farm will interconnect to an existing 345 kV transmission line currently owned by Xcel Energy, Inc. with the interconnection point being located approximately two miles east of the wind farm. The farm will consist of approximately 56 individual wind turbine generators having a net generation capacity of 1.8 MW each.

The primary objective of this study was to determine the feasibility of interconnecting the facility and the level of acceptable generation (up to 100.8 MW) that could be added to the system without causing adverse impacts to the local Xcel Energy transmission system. In addition, this study addresses the issues of required construction inclusive of estimated costs, which are associated with the interconnection of this 100.8 MW of wind generation to the transmission system.

Study Approach

This study uses the 2004 April Minimum and Summer Peak Models along with the 2005 Summer Peak Model as presented to the SPP in January of 2002. The 2004 April Minimum was developed from the 2004 Spring Peak Model, while the 2004 Summer Peak Model was developed using the 2003 Summer Peak Model. In both 2004 models the load in Area 526 (SPS) was scaled to develop the models. In addition, modifications to these models include all the new proposed generation projects along with the necessary system reinforcements triggered by these projects, which in relation to this project are positioned ahead in the queue.

The transmission system of primary concern in this feasibility study includes the Texas Panhandle excluding the Amarillo Metro area and all the Xcel Energy transmission system south of the Amarillo Metro area. In addition, adverse impacts on the transmission systems of other companies, although located in close proximity to this project site, will not be evaluated in this feasibility study.

This powerflow study was performed using the Power Technologies, Inc. (PTI) Power System Simulator/Engineering (PSS/E) program and contains a steady-state analysis using AC Contingency Checking (ACCC) with a Fixed Slope Decoupled Newton–Raphson (FDNS) solution. Thermal and voltage limit checks are set in accordance with SPP criteria, which state that for system intact conditions bus, voltages must be maintained between 0.95 – 1.05 per-unit of their nominal value. Under single element contingencies, the voltages are allowed to deviate between 0.90 – 1.05 per-unit of their nominal value. Thermal limit checks are comprised of both an A-rating and a B-rating. The A-rating is for system intact conditions, while the B-rating is an emergency rating under single element contingencies.

A comparative study approach was used in determining impacts caused by the interconnection of the 100.8 MW wind farm for each of the respective cases. All base case models include both the proposed new generation projects and the system reinforcements associated with those projects, which are positioned ahead in the

queue, for the respective year/season studied. All additional cases have the <OMITTED TEXT> wind farm in service, and single element contingency violations within these cases were compared to their respective base case.

Results

The single element contingency analysis performed for this study did not indicate increased values in contingency loading on transmission circuits in the local area. In addition, new thermal overloads were non-evident in the local transmission system.

Interconnection Requirements

The minimal requirements for the interconnection of the wind farm are the construction of a new 345 kV interconnection facility and approximately two miles of 345kV transmission line from this proposed wind farm to the Xcel Energy interconnection facility. In addition, a line reactor at the 345kV interconnection facility (see Figure 1) will be required in order to maintain acceptable bus voltage on the 345kV bus following a disturbance. The final size of the reactor will be determined by an EMTP study. Finally, the wind farm needs to be sufficiently compensated so that the reactive power required by the wind farm is self-supplied for all respective levels of generation and not by the transmission owner.

Conclusion

Based on the results of this study, it is feasible to interconnect the 100.8 MW wind farm to the existing Xcel Energy transmission system without causing new thermal overloads within the local transmission system.

Estimated Costs

Table 1 below lists the costs associated with the interconnection of the <OMITTED TEXT> Wind, LLC 100.8 MW wind farm.

Table 1, Wind Farm Interconnection Costs

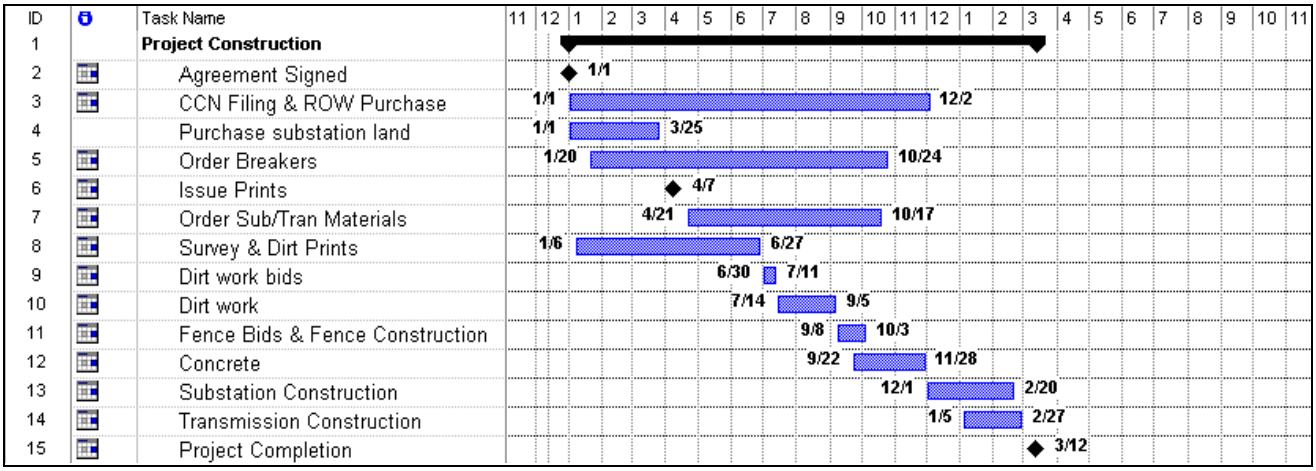
Estimated Costs	**Cost**
New 345 kV Interconnection Facility[2]	$ 5,723,275
Two miles Of New 345 kV Transmission Line[3]	$ 1,060,979
Right-Of-Way	$ 264,000
Total	***$ 7,048,254***

[2] The cost includes three 345kV breaker line terminals and associated equipment (control house, relays, metering, labor, etc.)
[3] Transmission line from the wind farm to the new switching station. The cost is estimated for two miles of 345 kV transmission line assuming no corner structures (i.e. straight line) are required. Cost to be adjusted accordingly pending exact configuration and location of site.

Construction Schedule

In order to complete all construction for this project in a timely manner, the estimated construction schedule is shown below and is contingent on the date an Interconnection Agreement is signed. If the agreement is not signed and construction funds have not been provided or approved prior to the date indicated, a new construction schedule would have to be drafted to accommodate any additional projects awaiting construction.

<OMITTED TEXT> 100.8MW Wind Farm Project Construction Schedule



Drawings

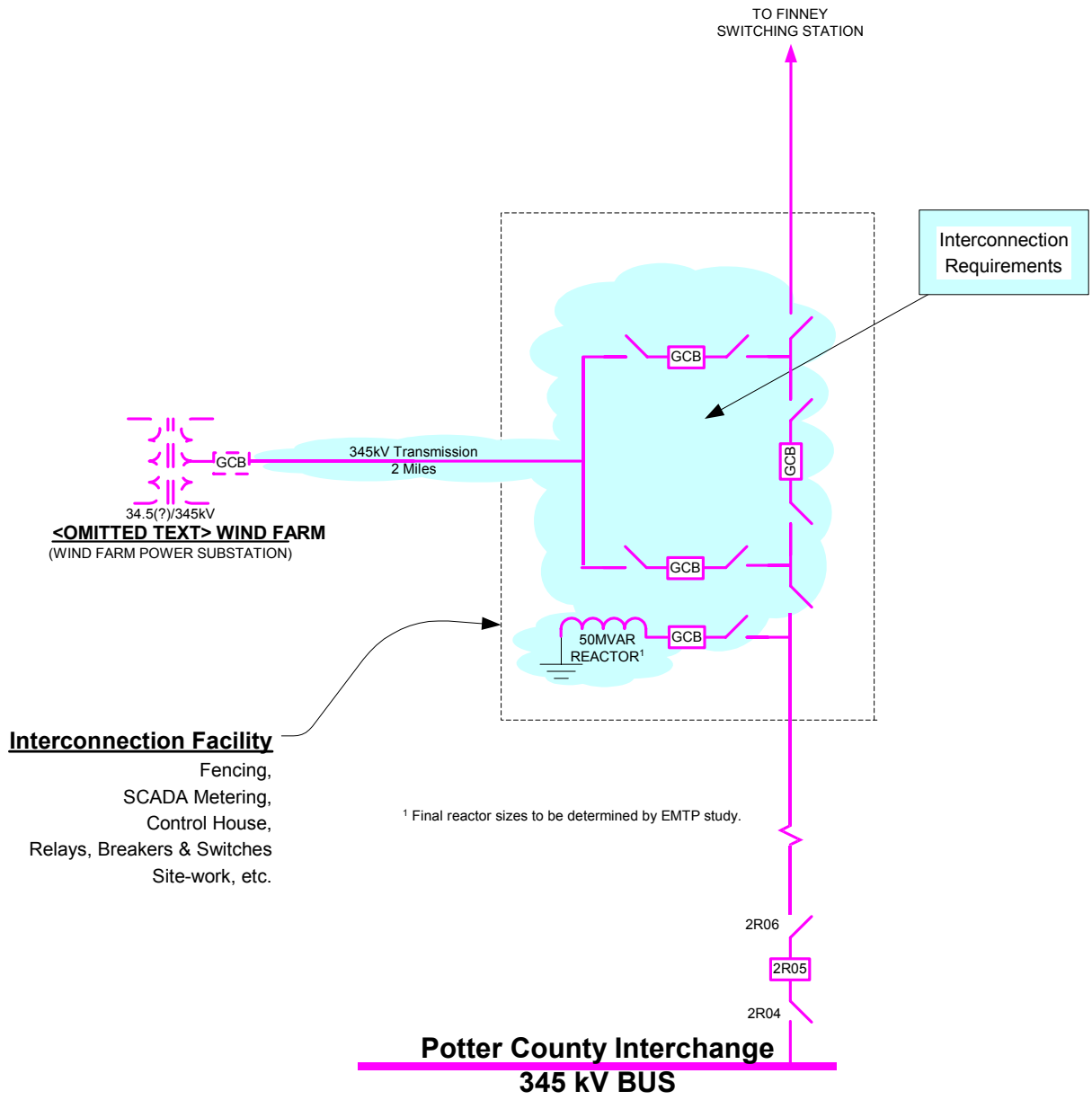


Figure 1, One-line Diagram of the 345 kV Interconnection Facility.

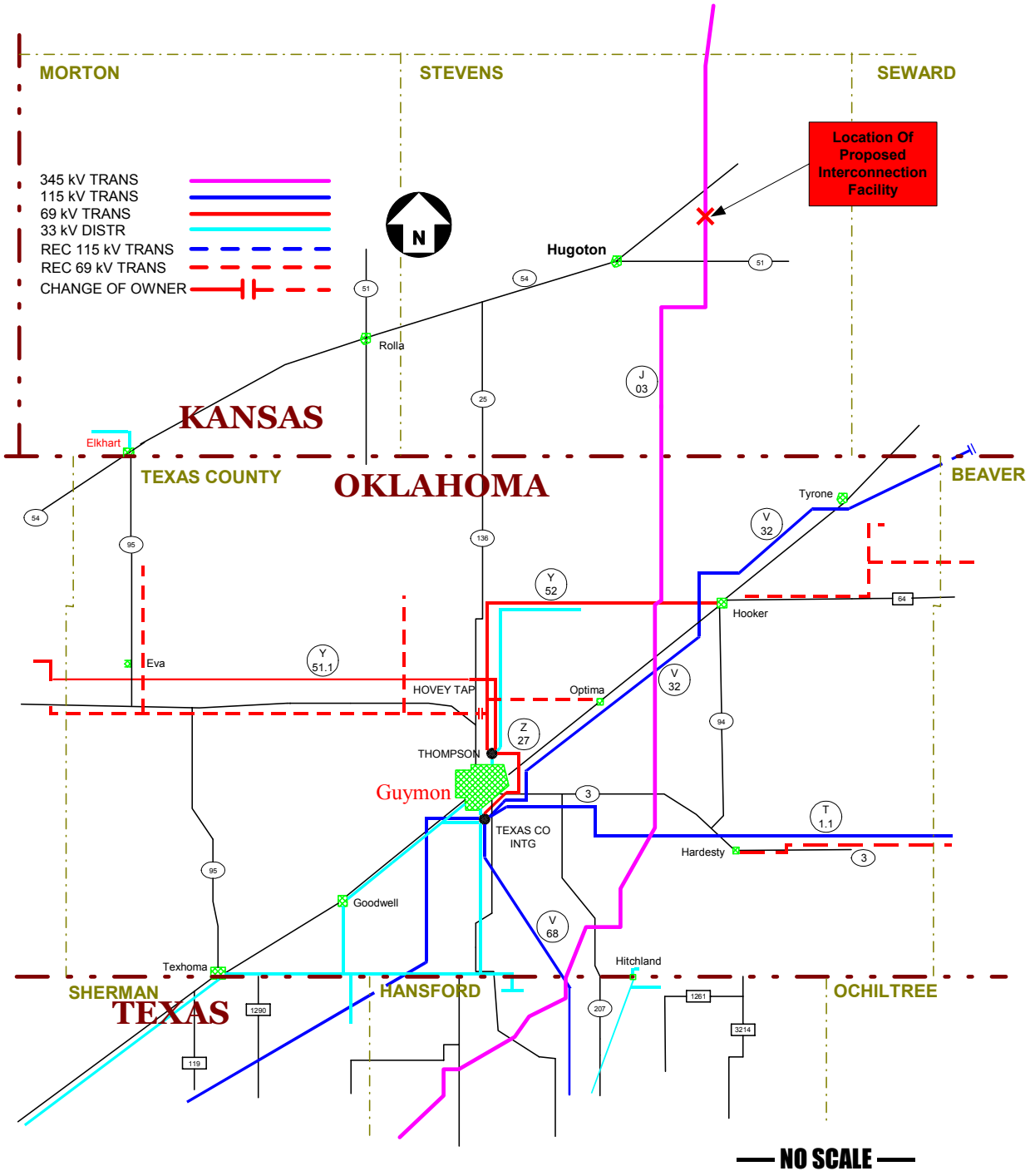


Figure 2, Local Transmission System