System Feasibility Study for Interconnection of a >Omitted Text< >Omitted Text< 130 MW Wind Farm Generation Facility in the Vicinity of Weatherford, Oklahoma

Southwest Transmission Planning
(#OAIP 02 002)

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Executive Summary

>Omitted Text< has requested a Feasibility Study for the interconnection of a wind farm in the Weatherford, Oklahoma vicinity. The plant will have a maximum output of 130 MW. The proposed facility would be connected to the Jenson Road (OG&E)-Hinton Station-Weatherford Junction Station 138 kV line. The projected in service date is December 2003.

According to the *Southwest Power Pool FERC Electric Tariff Fourth Revised Volume No.* 1, the principal objective of this study is "to make a preliminary determination of the type and scope of Attachment Facilities, other Direct Assignment Facilities and system upgrades that are needed to accept power into the grid at the interconnection receipt point necessary to accommodate the Generation Interconnection Request, and to provide the Generation Interconnection Customer a preliminary estimate of the time required to construct any necessary facilities and upgrades and the Generation Interconnection Customer's cost responsibility, estimated for such facilities and upgrades." The feasibility study is a steady state contingency analysis.

For the purposes of this study, six seasons were studied, the 2003 winter peak, the 2004 spring peak, the 2005 summer peak, the 2005 winter peak, 2008 summer peak, and the 2008 winter peak. In all the cases the plant's output was exported as follows: 130 MW to Public Service Company of Oklahoma (PSO).

The estimated directly assigned cost of interconnecting the new >Omitted Text< facility to the transmission system is $2.1 million in 2002 dollars. This project will take approximately 12 months from the time that an Interconnection Agreement is signed for construction. This cost includes interconnection costs on the American Electric Power (AEP) system, based on steady state analysis. A system impact study, which includes a stability and short circuit analysis, if the wind farm implementation is pursued, may result in additional interconnection costs.

The analysis in this document shows that for PSO to accept the 130 MW, upgrades will be required on the adjacent transmission systems to relieve certain criteria violations during contingency operation. Facilities found to be overloaded in the transfer cases with the proposed plant addition and not in the base cases were flagged and listed in the table on **Page 9** of this document.

Introduction

>Omitted Text< has requested an Impact Study for the interconnection of a wind farm in the Weatherford, Oklahoma vicinity. The plant will have a maximum output of 130 MW. The proposed facility would be connected to the Jenson Road(OG&E)-Hinton Station-Weatherford Junction Station 138 kV line. The plant will have a maximum output of 130 MW. The projected in service date is December 2003.

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The steady-state analysis considers the impact of the new generation on transmission facility loading and transmission bus voltages for outages of single, double, and triple circuit transmission lines, autotransformers, and generators.

Interconnection Facilities

>Omitted Text< 138 kV Interconnection Station

AEP will construct the >Omitted Text< 138kV station near the proposed wind farm to provide the interface between the plant and the transmission system. The facility will be located on the Jenson Station (OG&E) to Weatherford Junction Station 138 kV line, approximately 3 miles from Weatherford Junction Station. The switching facility will consist of a 138 kV yard. The 138 kV switchyard will contain three 138 kV breakers in a ring bus configuration, including three 138 kV line terminals. The facility will include all metering, protection and SCADA systems. >Omitted Text< will provide the property and initial site preparation for the construction of the facility. >Omitted Text< will construct and own the generating plant and maintain the equipment including the GSU high-side transformer disconnects at the ownership boundary. AEP will retain ownership and operating authority of the 138 kV switchyard up to the high-side GSU transformer disconnects.

The design and construction of the switching station will meet all AEP specifications for stations. Support structures and line terminal equipment will be designed to terminate the respective conductors from the generator step-up transformers. Bus work and disconnect switches will be designed to accommodate the loading requirements, and circuit breakers will be rated to ensure adequate load and fault interrupting capability. Metering equipment will be installed to monitor the plant output and will meet the required accuracy specifications. The estimated cost of the station is $2,100,000. This does not include the cost for the land. This project will take approximately 12 months from the time that an Interconnection Agreement is signed for construction.

Interconnection Costs

Listed below are the costs associated with interconnecting the >Omitted Text< 130 MW generation facility to the transmission system. There may be additional costs dependent on a stability and short circuit analyses.

Interconnection Facilities	COST (2002 DOLLARS)
>Omitted Text< 138 kV station (includes three 138 kV breakers). This cost does not include land.	$2,100,000
TOTAL	**$2,100,000**

The figure on **Page 7** shows a one-line diagram of the immediate PSO system near the proposed FPL interconnection site.

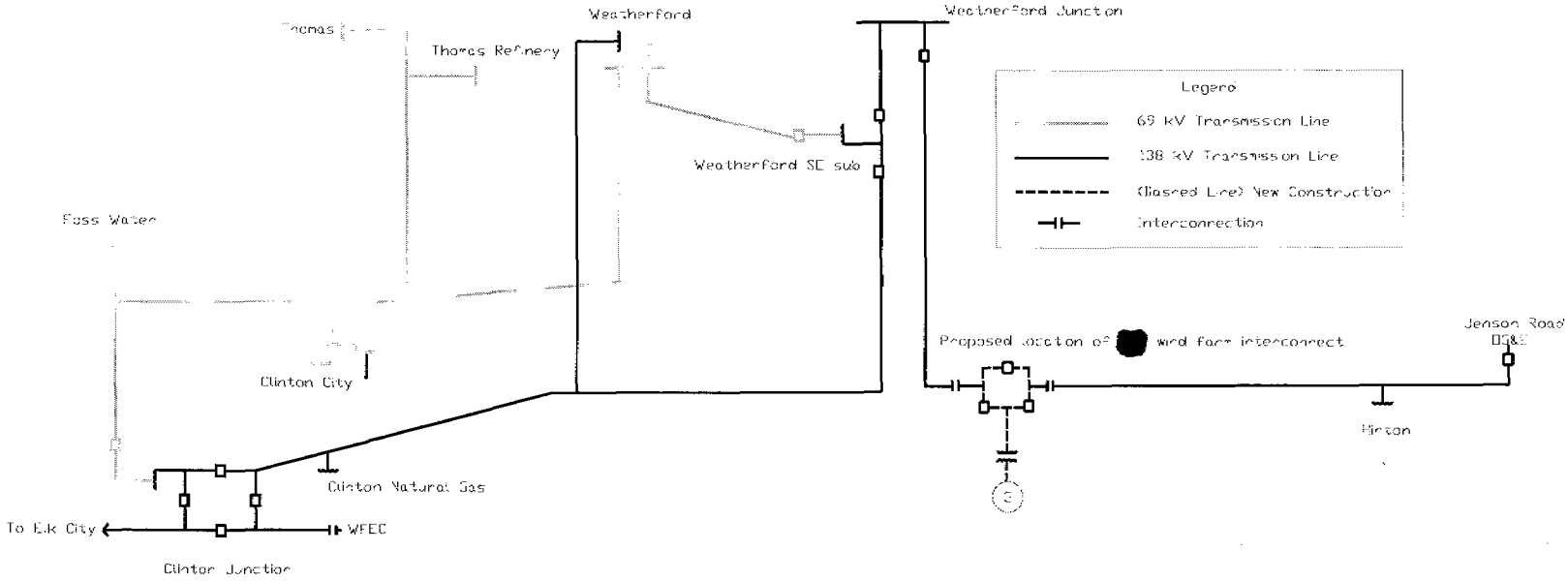

Figure: Area one-line with proposed [redacted] wind farm interconnection

Steady-State Analysis

Study Methodology

The AEP and Southwest Power Pool (SPP) criteria state that the following conditions 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) Neither uncontrolled islanding, nor uncontrolled loss of large amounts of load will result.

More probable contingency testing is defined as losing any single piece of equipment or multi-circuit transmission line. Less probable contingency testing involves the loss of any two critical pieces of equipment such as 345 kV autotransformers and generating units or the loss of critical transmission lines in the same right-of-way.

The 2002 series Southwest Power Pool 2003 winter peak, 2004 spring peak, 2005 summer and winter peak, and 2008 summer and winter peak base cases were used to model the transmission network and system loads. These cases were modified to reflect known firm point-to-point transmission requests that have been approved.

Per information received from >Omitted Text<, the point of receipt of the generated capacity of the new wind farm called for 100% of the output to be absorbed by the PSO system.

Using the created models and the ACCC function of PTI's PSS/E program, single and select double contingency outages on the SPP system were analyzed. Facilities found to be overloaded in the transfer cases with the proposed plant addition and not in the base cases were flagged and listed in the following table.

Table 1 – Overloaded SPP Facilities for all cases. 130 MW generation absorbed by PSO. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	130MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
05SP	OKGE-OKGE	DRAPER 345/138 KV AUTOTRANSFORMER #1	493	102	DRAPER 345/138 KV AUTOTRANSFORMER #1	
05SP	WFEC-WFEC	CARTERJ2 to DILL JT24	26	100	BRANTLY2 to MORWOOD2	
08SP	SPS-SPS	LUBE2 to CLUTTER2	59	104	LUBS2 to LUBS3	
08SP	WFEC-WFEC	RUSSEL 138/69 KV AUTOTRANSFORMER	25	127	ANADARK4 to PARADSE4	
08SP	WFEC-WFEC	ANADARK2 to BLANCHD2	34	103	FRANKLIN 138/69 KV AUTOTRANSFORMER	
08SP	WFEC-WFEC	CARTERJ2 to DILL JT24	26	101	GOTEBO 2 to MTNVIEW2	
08SP	OKGE-WFEC	MIDWEST4 to FRNKLNS4	215	101	SUNSHIN4 to TUTTLE 4	
08WP	SPS-SPS	LE-BUCK2 to LE-SNDR2	54	106	LE-SNA 115/69 KV AUTOTRANSFORMER	
08WP	SWPA-AECI	CARTHG 2-2REEDS	43	100	CARTHAG5 to LAR382 5	