Feasibility Study for Generation Interconnection Request for >Omitted Text< Wind Project

SPP Coordinated Planning
(#GEN-2002-005)

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Executive Summary

>Omitted Text< has requested interconnection for a >Omitted Text< MW wind farm near >Omitted Text<, OK. The wind farm will be connected to the Western Farmers Electric Cooperative's (WFEC) transmission system via a new switching station near Elk City, OK

Powerflow analysis shows that the addition of the generation causes slight overloads on the local WFEC system. Without the addition of new facilities and/or the replacement of existing facilities, the total output of the wind farm would be limited to >Omitted Text< MW. It should be noted that this study does not serve as an ATC study of available transmission capacity. The customer must request transmission service through the SPP OASIS in order to operate the facility.

Connection of the wind farm to the WFEC transmission system requires the creation of a new switching station, comprising three 138-kV circuit breakers (and associated equipment), in a ring-bus configuration. The cost estimate for this new station, include necessary metering equipment, is $1.5 million.

Introduction

>Omitted Text< Wind Project LLC has requested interconnection for a 120 MW wind farm to be developed near >Omitted Text<, OK. The wind farm will be interconnected to the WFEC transmission system via new switching station located on the >Omitted Text< line, about >Omitted Text< miles south of Morewood (see Appendix A). This line is a tie between WFEC >Omitted Text< and Public Service Oklahoma [>Omitted Text<).

This Feasibility Study investigated the effect of the new generation on system performance during normal and contingency conditions. For purposes of this study, the power was absorbed into the system by lowering generation in the PSO system.

Since this was a Feasibility study, transient analyses (i.e., stability and short circuit) were not conducted.

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

Steady State Analysis

A steady state analysis was conducted for the facility. The steady-state analysis considered the impact of a >Omitted Text< MW transfer on transmission line loadings in the local area of the wind farm. This study does not take into account ATC analysis, which is performed when a customer requests transmission service on Southwest Power Pool's OASIS. The latest version of the Southwest Power Pool 2005 summer peak base case was used for this study.

Single contingency analysis was conducted for the >Omitted Text< project. That analysis indicated that the addition of the >Omitted Text< MW of generation creates the potential for a slight overload on the Morewood 138/69-kV transformer (which has a 50 MVA emergency rating) and a high loading on the Elk City-Morewood 138-kV circuit (with a rating of 150 MVA). The results of the loadflow simulations are:

Condition	Loadings
Base case w/o wind farm	Morewood-Elk City 45.9 MW Morewood 138/69 10.3 MW
Outage Elk City 230/138; w/o wind farm	Morewood-Elk City 61.6 MW Morewood 138/69 15.6 MW
Base case w/ wind farm	Morewood-Elk City 136.2 MW Morewood 138/69 21.0 MW
Outage Elk City 230/138 w/ wind farm	Morewood-Elk City 145.2 MW Morewood 138/69 14.5 MW
Outage Elk City-Wind farm; w/ wind farm	Morewood 138/69 52.4 MW

Powerflow Analysis Methodology

The 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 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.

Conclusions

Since the proposed >Omitted Text< wind farm (at its maximum output of >Omitted Text< MW) causes only slight overloads it is recommended that the wind farm be developed at a reduced output level to eliminate the need for costly system modifications. Based on projected loading conditions (for Summer 2005) the reduced output level would have to be >Omitted Text< MW, at maximum. If the wind farm project proceeds to the System Impact Study stage, a more pronounced reduction in output may be required to account for load growth in the Morewood area. These mentions of maximum output are based on the concept of firm service with one contingency (i.e., a single outage condition). If the customer is willing to be considered a non-firm interconnection, there may be some options for connection of the full 120 MW. But a “non-firm” connection would entail that at least a portion of the wind farm output would have to be tripped automatically for a single contingency.

The minimum required cost is for construction of a new 138-kV switching station to permit interconnection of the wind farm into the WFEC system.