ADDENDUM TO:
FEASIBILITY STUDY OF
SOUTHWESTERN PUBLIC SERVICE COMPANY'S
2003 RENEWABLE ENERGY RFP

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Executive Summary

The report summarizes the results of two additional wind portfolios considered in the Southwestern Public Service Company's (SPS) 2003 Renewable Energy Request for Proposals (RFP). The report is an addendum to the Feasibility Study for Southwestern Public Service Company's 2003 Renewable Energy RFP dated June 30, 2004. The MW sizes of the two additional portfolios studied are 145.4 MW and 305.4 MW.

Powerflow analysis has indicated that transmission system reinforcements will be required for the two additional renewable energy portfolios. The costs required for the necessary transmission system reinforcements for the two portfolios E and F are $6,490,391 and $7,525,073, respectively. The estimated completion time for the construction of all these transmission system reinforcements, for the two portfolios, will typically be 16 months.

A detailed list of required transmission system reinforcements for the respective portfolios is listed in Table 1, along with the estimated cost of each item. These cost figures are for transmission system reinforcements necessary to mitigate both voltage and thermal violations. Additionally, Table 2 shows the estimated cost numbers for both portfolios with and without prior transmission service requests, for the powerflow models considered in this study. As indicated in the initial report, once the selection of the winning portfolio is determined, the list of system reinforcements noted in Table 1 will undergo further powerflow analysis along with transient stability analysis to determine any additional requirements, which in turn may change the cost estimates provided.

Cost numbers have not been provided for network upgrades related to generator interconnections because not all of the bidders have completed the required generation interconnection process through the Southwest Power Pool (SPP). Those costs will be added on top of the cost provided, but are very bidder specific.

Table of Contents

Introduction

This addendum is a supplement to the report "*Feasibility Study of Southwestern Public Service Company's 2003 Renewable Energy RFP*", issued on June 30, 2004. The primary objective is to determine the necessary requirements for network transmission service of two additional renewable energy portfolios. The study addresses major system impacts associated with the transmission of power from each portfolio and in no way serves to establish impacts specifically attributed to a particular project site. This means that the impacts as a result of the Southwest Power Pool generator interconnection process are not tabulated as part of this report since not all the bidders have completed that process. Brief descriptions of the two additional portfolios evaluated in this study are provided below.

Portfolio E

This portfolio is comprised of two different project sites located in the state of New Mexico. One site is 120 MW of wind-generated electric energy interconnecting to the 230kV transmission line between Oasis Interchange and Chaves County Interchange. The second site will interconnect 25.4 MW to the 230kV bus at Roosevelt County Interchange. The combined output of these project sites as it pertains to this specific portfolio is 145.4 MW.

Portfolio F

This portfolio includes the project sites noted in Portfolio E, along with the addition of a third site located in Texas. The third site is located in the Texas Panhandle interconnecting 160 MW of wind-generated electric energy to the 230kV transmission bus at Bushland Interchange. The combined output of this project site along with the output of Portfolio E is 305.4 MW.

Study Approach

This Feasibility Study uses the 2004 Southwest Power Pool series models, comprised of the 2007 and the 2010 Summer Peak models. As in the initial feasibility study, the 2007 Summer Peak cases were studied with and without prior transmission service requests, while the 2010 Summer Peak cases included prior transmission service requests. Both the 2007 and 2010 Summer Peak models include the renewable resources of the White Deer Wind Farm located in White Deer, TX and the Cielo Caprock Wind Farm, south of Tucumcari, NM. The existing SPS generation was re-dispatched in accordance with the guidelines set forth by the combined efforts of the SPP, Xcel Energy Marketing and Transmission Planning. No other generation interconnection requests presently in the SPP study queue, other than those in the portfolios mentioned above, are included in the generation patterns of this study.

This powerflow study was performed using the Power Technologies, Inc. (PTI) Power System Simulator/Engineering (PSS/E) release 29.4.0 program and contains a steady-state analysis using AC Contingency Checking (ACCC) with a Fixed Slope Decoupled Newton–Raphson (FDNS) solution. Voltage limit

checks are set in accordance with existing planning criteria, which states 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 – 1.10 per-unit of their nominal value. The thermal limit checks are comprised of both an A and B seasonal rating. The A-rating is for system intact conditions, while the B-rating is an emergency rating for single element contingencies.

Results

The contingency analysis performed was for single contingencies looking only at the SPS control area. The SPP footprint will be considered during subsequent studies, when the final network designation of generation is made and a formal request for network transmission service is received.

The power output for each of the respective project sites was set with the directions specified by the requestor of this study; however, none of the projects sites have a specified power factor. In this study, the generator power factor for each of the project sites was set to approximately 98% leading (absorbing) which are typical values observed from other wind energy generating facilities.

The results of this study have shown that there is a need for additional reactive power support on the transmission system in New Mexico. This is a result of local generation being replaced by induction type generators and prior transmission service requests, which in turn reduces the total available reactive power in the region as a direct result of the displaced generation. In both portfolios E and F, additional shunt capacitor banks are required in order to mitigate contingencies that produce voltage collapse in the absence of this reactive power. Despite the fact that the addition of these capacitor banks resolves issues pertaining to reactive power reserves, the dynamic aspect of the displaced reactive power is lost with the introduction of these static capacitor banks. In order to determine if some of these static banks need to be replaced by some type of dynamic resource, transient stability studies will be needed to confirm this requirement and would be considered in subsequent studies.

Finally, two other system reinforcements are required in order to provide the flexibility needed in the re-dispatching of the Nichols generating units. These reinforcements include upgrading the two Nichols 230/115kV autotransformers and the construction of a new one-mile long 230kV transmission line between Nichols and Harrington Station.

As for the problems with the north-south interface encountered with the previous portfolios (A-D), these two additional studies did not show north-south flows requiring the construction of a new transmission line as a direct result of these portfolios. The increase in north-south flows, however, could be evident if a different generation dispatch is utilized. This too would need to be considered in subsequent studies.

Cost Estimates

This study does not intend to address the necessary cost estimates specific to the interconnection of the individual project sites that make up these portfolios. It is assumed that the projects sites have gone or will go

through the SPP interconnection process where the interconnection cost for each specific project site will be determined.

The items listed below in Table 1 are the necessary transmission system reinforcements for the interconnection of the respective portfolios. Included in the table, beneath each portfolio name, are markers ("o", "x" and "+") indicating the system reinforcements required in the specific portfolio for each of the powerflow models studied. The markers give an indication as to whether the portfolio was studied with or without prior transmission service requests. The cost of each system reinforcement is listed in Table 1.

Table 1, Itemized Cost Estimates of Required System Reinforcements [1]

Required Transmission System Reinforcement	Estimated Cost	Portfolio	
		E	F
New 230kV Transmission Line, Harrington – Nichols (1 mi)	$ 484,114		x+
ROW: 230kV Line, Harrington – Nichols	$ 30,000		x+
Substation Upgrades, Harrington–Nichols 230kV Line	$ 520,568		x+
Upgrade Both Nichols Station 230/115kV autotransformers	$ 3,990,391	ox+	ox+
New 28.8 MVAr Bus Shunt, Chaves County Int. 230kV	$ 700,000	x+	x+
New 28.8 MVAr Bus Shunt, Chaves County Int. 115kV	$ 600,000	x+	x+
New 28.8 MVAr Bus Shunt, Oasis Int. 115kV	$ 600,000	+	+
New 28.8 MVAr Bus Shunt, Pecos Int. 115kV	$ 600,000	+	+

The ROW cost numbers shown in Table 1 includes all monies required for the purchase of land necessary for the new transmission line, all necessary surveying, environmental studies, archeological studies and any damages to facilities during the construction of the transmission line. Additionally, and for discussion purposes only, one may assume that the approximate cost to interconnect one of these portfolios is approximately $10,000,000 to $12,000,000. The exact interconnection cost figure for each project site, and hence each portfolio, will be determined once each project site completes the SPP interconnection process.

Table 2 below shows the total estimated cost for the transmission system reinforcements for each of the respective portfolios. The estimated cost is with and without prior transmission service requests for the powerflow models studied. All estimated cost figures were provided by the various engineering departments and will be fine-tuned during any subsequent studies. As a result of the large number of generation patterns, any changes made to the generation pattern used in these models could yield different transmission system reinforcements. Additional generation patterns could also be considered; however, these will also have to be considered in any subsequent studies.

[1] o - Item required in 2007 Summer Peak Model **without** Prior Transmission Service Requests.
x - Item required in 2007 Summer Peak Model **with** Prior Transmission Service Requests.
+ - Item required in 2010 Summer Peak Model **with** Prior Transmission Service Requests.

Table 2, Total Estimated Portfolio Cost [2]

	o	x	+
Portfolio E	$ 3,990,391	$ 5,290,391	$ 6,490,391
Portfolio F	$ 3,990,391	$ 6,325,073	$ 7,525,073

Engineering and Construction

For the different powerflow cases studied, Table 3 below shows the approximate time frame that is expected for the completion of the system reinforcements required to interconnect both portfolios. In addition to engineering and construction, the construction of new transmission lines involves the approval of a Certificate of Convenience and Necessity (CCN). Although the filing process for a CCN is done concurrently with the engineering process, construction cannot begin until the CCN is approved by the respective state utility commission. It is anticipated that a CCN filing could take anywhere from 1½ to 2½ years depending on the complexity of the filing.

Table 3, Estimated Engineering and Construction Time [2]

		Portfolio	
Required Transmission System Reinforcement	Estimate Construction Time	E	F
New 230kV Transmission Line, Harrington – Nichols (1 mi)	10 months		x+
ROW: 230kV Line, Harrington – Nichols			x+
Substation Upgrades, Harrington–Nichols 230kV Line			x+
Upgrade Both Nichols Station 230/115kV autotransformers	16 months	ox+	ox+
New 28.8 MVAr Bus Shunt, Chaves County Int. 230kV	10 months	x+	x+
New 28.8 MVAr Bus Shunt, Chaves County Int. 115kV	10 months	x+	x+
New 28.8 MVAr Bus Shunt, Oasis Int. 115kV	9 months	+	+
New 28.8 MVAr Bus Shunt, Pecos Int. 115kV	9 months	+	+

Conclusions

This study shows that these two additional renewable energy portfolios will require significantly less transmission system reinforcements than those previously studied. The transmission system reinforcement of greatest cost for these two portfolios is the upgrade of the Nichols 230/115 kV autotransformers. However, this upgrade is required regardless of the portfolios chosen, inclusive of those previously studied. This upgrade is required to provide the necessary flexibility in dispatching the Nichols Station generating units.

[2] See footnote 1

Recommendations

This study report is provided to outline the system reinforcements that will be required for each respective portfolio and to serve as additional guidance for the evaluation of each portfolio by some party other than the Transmission Planning group. A recommendation as to the best performing portfolio was not within the scope of this study and as such, no recommendation of this type will be made.