Feasibility Study
For
Generation Interconnection Request
GEN-2007-027

SPP Tariff Studies
(#GEN-2007-027)

April, 2008

Executive Summary

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 150 MW of wind generation within the control area of Southwestern Public Service Company (SPS) located in Curry County, NM. The proposed method of interconnection is to construct a new 115 kV ring-bus switching station to be located on the existing Curry County Interchange – Norton Switching Station 115 kV transmission line, owned by SPS. The proposed in-service date of this request is December 1, 2009.

Powerflow analysis has indicated that for the powerflow cases studied, it is not possible to interconnect the 150 MW of generation with transmission system reinforcements within the local transmission system. The Curry County Interchange – Norton Switching Station 115kV line has a line is a radial with limited ratings, and cannot be rebuilt without significant outage time to existing customers For these reasons, the interconnection request was reduced to 60 MW. Powerflow analysis has indicated that for the powerflow cases studied at the reduced generation level, it is possible to interconnect the 60 MW of generation with transmission system reinforcements within the local transmission system. Powerflow analysis has indicated the need for the interconnection facility to meet the power factor requirements in FERC Order #661A. The generation facility will be required to meet a power factor of +/- 95% at the point of interconnection based on system voltage swings in the area for various contingencies. Whether this requirement can be met with capacitor banks or a portion must be dynamic will be analyzed in the Impact Study.

The requirement to interconnect the 60 MW of wind generation consists of constructing a new 115 kV ring-bus switching station, to be located on the Curry County Interchange – Norton Switching Station 115 kV transmission line. This new station will be constructed and maintained by SPS. The Customer did not propose a specific route for the 115 kV line extending to serve its 115/34.5 kV collection facilities. It is assumed that obtaining all necessary right-of-way for the new transmission line to serve its facilities will not be a significant expense.

The total minimum cost for building the required facilities necessary to interconnect this 60 MW of generation is $2,500,000. These costs are shown in Tables 1 and 2. Network constraints in the American Electric Power West (AEPW) and SPS transmission systems that were identified are shown in Table 3. These Network constraints will have to be verified with a Transmission Service Request (TSR) and associated studies. Network Constraints are in the local area of the new generation when this generation is sunk throughout the SPP footprint for the Energy Resource (ER) Interconnection request. With a defined source and sink in a Transmission Service Request, this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements. This cost does not include building the 115 kV line from the Customer 115/34.5 kV collector substation into the point of interconnection. This cost also does not include the Customer's 115/34.5 kV collector substation or the necessary reactive compensation.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer for future analyses including the determination of lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. If the loading of a facility is higher, the level of ATC will be lower.

There are several other proposed generation additions in the general area of the Customer's facility. It was assumed in this preliminary analysis that not all of these other projects within the SPS control area will be in service. Those previously queued projects that have advanced to nearly complete phases were included in this Feasibility Study. In the event that another request for a generation interconnection with a higher priority withdraws, then this request may have to be re-evaluated to determine the local Network Constraints.

The required interconnection costs listed in Tables 1 and 2 and other upgrades associated with Network Constraints do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through Southwest Power Pool's OASIS.

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Introduction

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 150 MW of wind generation within the control area of Southwestern Public Service Company (SPS) located in Curry County, NM. The proposed method of interconnection is to construct a new 115 kV ring-bus switching station to be located on the existing Curry County Interchange – Norton Switching Station 115 kV transmission line, owned by SPS. The proposed in-service date of this request is December 1, 2009.

Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the generating plant to the area transmission system. The Feasibility and other subsequent Interconnection Studies are designed to identify attachment facilities, Network Upgrades and other Direct Assignment Facilities needed to accept power into the grid at the interconnection receipt point.

Because the original request of 150 MW of generation exceeded the current facility limitations of the SPS transmission system near the point of interconnection and due to operational difficulties in rebuilding these facilities, the requested generation level was reduced to 60 MW. The requirement to interconnect the 60 MW of wind generation into the proposed substation consists of constructing a new 115 kV ring-bus switching station. The new switching station will be located on the Curry County Interchange – Norton Switching Station 115 kV transmission line. This new station will be constructed and maintained by SPS. The Customer did not propose a specific route for the 115 kV line extending to serve its 115/34.5 kV collection facilities. It is assumed that obtaining all necessary right-of-way for the new transmission line to serve its facilities will not be a significant expense.

A one-line drawing depicting the proposed method of interconnection is shown by Figure 1.

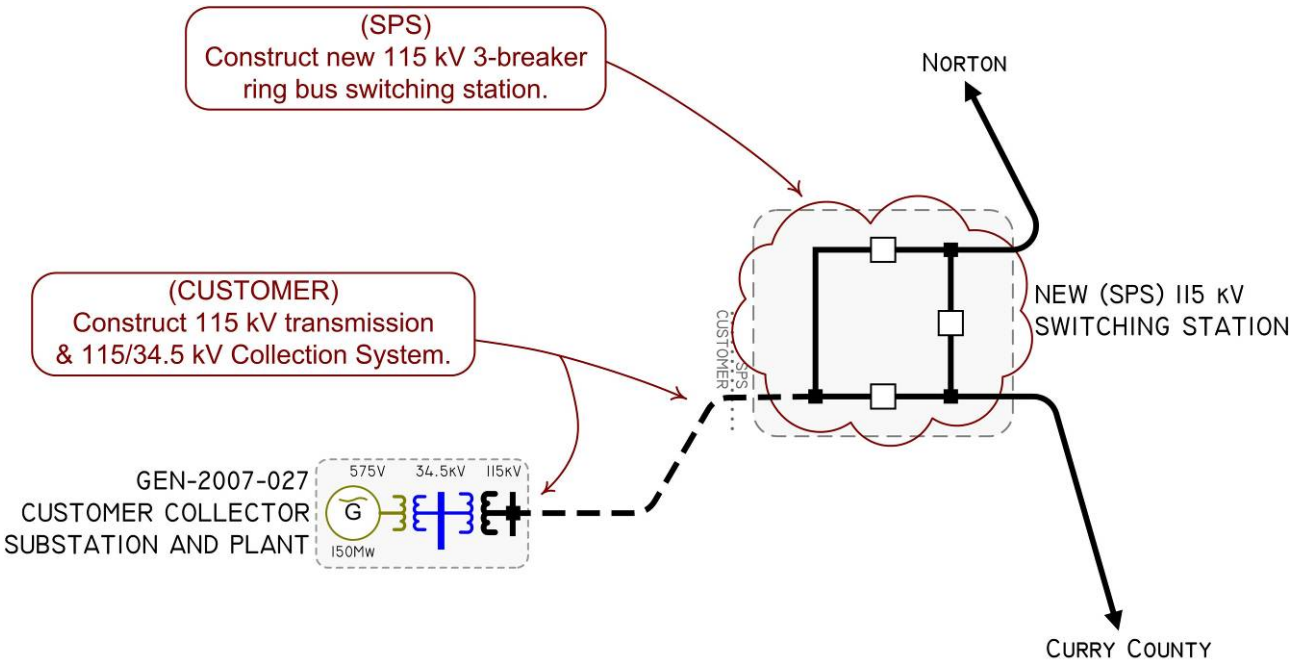

Figure 1: Proposed Method of Interconnection

(Final design to be determined)

Interconnection Estimated Costs

The minimum cost for constructing a new 115 kV ring-bus switching station on the Curry County Interchange – Norton Switching Station 115 kV transmission line and terminating the transmission line serving GEN-2007-027 facilities is estimated at $2,500,000. These costs are listed in Tables 1 and 2. These estimates will be refined during the development of the System Impact Study based on the final designs. This cost does not include building the Customer's 115 kV transmission line extending from the point of interconnection to serve its 115/34.5 kV collection facilities. This cost also does not include the Customer's 115/34.5 kV collector substation or the necessary reactive compensation, all of which should be determined by the Customer. The Customer is responsible for these 115 kV – 34.5 kV facilities up to the point of interconnection. Other Network Constraints in the American Electric Power West (AEPW) and SPS transmission systems that were identified are shown in Table 3.

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: Direct Assignment Facilities

FACILITY	ESTIMATED COST (2008 DOLLARS)
CUSTOMER – (1) 115/34.5 kV Customer collector substation facilities.	*
CUSTOMER – (1) 115 kV transmission line from Customer collector substation to the proposed station to be located on the Curry County Interchange – Norton Switching Station 115 kV transmission line.	*
CUSTOMER – Reactive compensation to maintain +/- 95% power factor at the point of interconnection.	
CUSTOMER – Right-of-Way for all Customer facilities.	*
TOTAL	*****

** Estimates of cost to be determined.*

Table 2: Required Interconnection Network Upgrade Facilities

FACILITY	ESTIMATED COST (2008 DOLLARS)
SPS – (1) 115 kV 3-Breaker Ring-Bus Switching Station. Station to include breakers, switches, control relaying, high speed communications, metering and related equipment, and all structures.	$2,500,000
TOTAL	**$2,500,000**

** Estimates of cost to be determined.*

Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2009 winter peak model, the 2012 summer and winter peak models, and the 2017 summer peak model. The output of the Customer's facility was offset in each model by a reduction in output of existing online SPP generation. This method allows the request to be studied as an Energy Resource (ER) Interconnection request. The proposed in-service date of the generation is December 1, 2009. The available seasonal models used were through the 2017 Summer Peak of which is the end of the current SPP planning horizon.

Following current practice, this analysis was conducted assuming that previous queued requests in the immediate area of this interconnect request were in service. The analysis of the Customer's project indicates that, given the reduced requested generation level of 60 MW and location, additional criteria violations will occur on the existing AEPW and SPS transmission systems under steady state and contingency conditions in the peak seasons. Table 3 lists these overloaded facilities.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than one contingency, only the highest loading on the facility for each season is included in the table.

Voltage violations for load serving buses within the SPP footprint were also observed for some of the contingencies listed in Table 3. These voltage violations have not been listed in this report.

In order to maintain an acceptable voltage schedule at the point of interconnection for various contingencies, the Interconnection Customer will be required to install power factor compensation equipment to maintain a +/- 95% power factor at the point of interconnection. This power factor is required due the interconnection request being located on a long radial line with an in service wind farm. The fluctuation of output in both the in service wind farm and the proposed wind farm will cause significant voltage fluctuation on the 115kV line. The Impact Study will provide guidance as to whether this may be met with capacitor banks or if a portion must be dynamic (SVC or STATCOM).

There are several other proposed generation additions in the general area of the Customer's facility. Some of the local projects that were previously queued were assumed to be in service in this Feasibility Study. Not all local projects that were previously queued and 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”.

Using the created models and the ACCC function of PSS\E, single contingencies in portions or all of the modeled control areas of Sunflower Electric Power Corporation (SUNC), Missouri Public Service (MIPU), Westar Energy (WERE), Kansas City Power & Light (KCPL), West Plains (WEPL), Midwest Energy (MIDW), Oklahoma Gas and Electric OKGE, American Electric Power West (AEPW), Grand River Dam Authority (GRDA), Southwestern Public Service Company (SPS), Western Farmers Electric Cooperative (WFEC) and other control areas were applied and the resulting scenarios analyzed. This satisfies the ‘more probable’ contingency testing criteria mandated by NERC and the SPP criteria.

Powerflow Results

Table 3: Network Constraints

AREA	OVERLOADED ELEMENT
AEPW	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
AEPW	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1
AEPW/SPS	ELK CITY - GRAPEVINE INTERCHANGE 230KV CKT 1
SPS	BUSHLAND INTERCHANGE 230/115KV TRANSFORMER CKT 1
SPS	DOUD SUB - SOUTH PLAINS REC-YUMA 115KV CKT 1
SPS	LAMB COUNTY REC-SOUTH OLTON - PLANT X STATION 115KV CKT 1
SPS	SOUTH PLAINS REC-YUMA - WOLFFORTH INTERCHANGE 115KV CKT 1
AEPW	AMERICAN ELECTRIC POWER WEST
SPS	SOUTHWESTERN PUBLIC SERVICE COMPANY

Table 4: Contingency Analysis

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
09WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	108	6	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
09WP	ELK CITY - GRAPEVINE INTERCHANGE 230KV CKT 1	351	110	21	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
09WP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	100	55	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
12SP	BUSHLAND INTERCHANGE 230/115KV TRANSFORMER CKT 1	172	108	0	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
12SP	DOUD SUB - SOUTH PLAINS REC-YUMA 115KV CKT 1	161	105	0	LUBBOCK SOUTH INTERCHANGE - WOLFFORTH INTERCHANGE 230KV CKT 1
12WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	103	21	SPP-SWPS-02: ELK CITY - GRAPEVINE INTERCHANGE 230KV CKT 1, and ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12WP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	104	31	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
17SP	DOUD SUB - SOUTH PLAINS REC-YUMA 115KV CKT 1	161	113	0	LUBBOCK SOUTH INTERCHANGE - WOLFFORTH INTERCHANGE 230KV CKT 1
17SP	BUSHLAND INTERCHANGE 230/115KV TRANSFORMER CKT 1	172	110	0	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
17SP	SOUTH PLAINS REC-YUMA - WOLFFORTH INTERCHANGE 115KV CKT 1	197	105	0	LUBBOCK SOUTH INTERCHANGE - WOLFFORTH INTERCHANGE 230KV CKT 1
17SP	LAMB COUNTY REC-SOUTH OLTON - PLANT X STATION 115KV CKT 1	161	102	24	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1

Note: When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. If the loading of a facility is higher, the level of ATC will be lower.

Conclusion

The minimum cost of interconnecting the Customer's interconnection request is estimated at $2,500,000 for Direct Assignment Facilities and Network Upgrades. At this time, the cost estimates for other Direct Assignment facilities including those in Tables 1 and 2 have not been defined by the Customer. As stated earlier, some but not all of the local projects that were previously queued are assumed to be in service in this Feasibility Study. These costs exclude upgrades of other transmission facilities that were listed in Table 3 of which are Network Constraints.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than one contingency, only the highest loading on the facility for each season is included in the table.

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. At the time of the System Impact Study, a better determination of the interconnection facilities may be available.

The required interconnection costs listed in Tables 1 and 2 and other upgrades associated with Network Constraints do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through Southwest Power Pool's OASIS.

Appendix A: Point of Interconnection Area Map

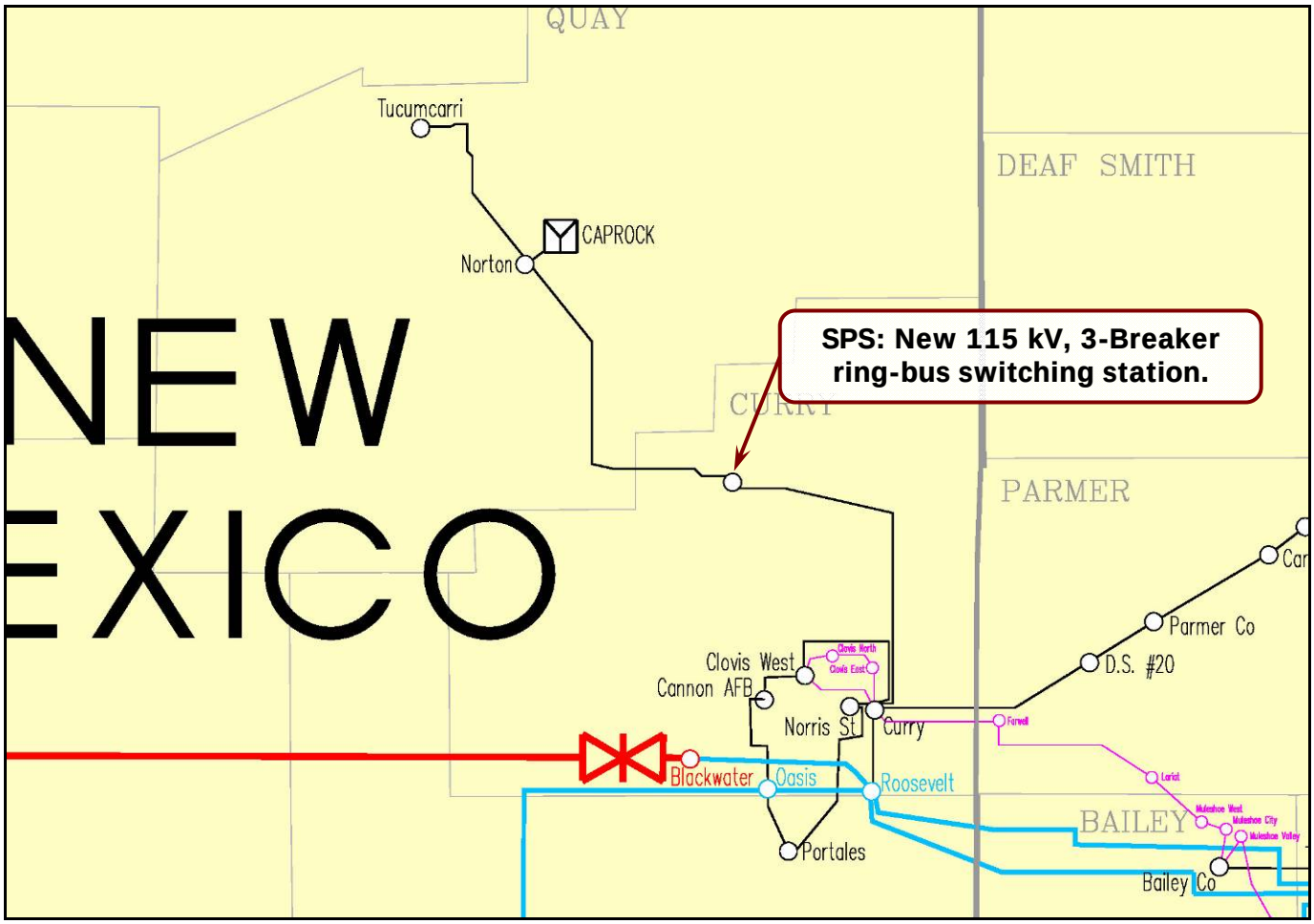

Figure 2: Point of Interconnection Area Map