SPP Southwest Power Pool

Feasibility Study For Generation Interconnection Request GEN-2006-025

SPP Tariff Studies
(#GEN-2006-025)

October, 2006

Executive Summary

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 150MW of generation within the control area of Southwestern Public Service (d/b/a Xcel Energy) (SPS) in Motley County, Texas. The proposed point of interconnection is a new switching station in the existing Tuco-Oklaunion 345kV transmission line, a tie line between SPS and American Electric Power (AEP). This generation interconnection is in addition to the Customer's previously proposed 150MW of generation at the same point of interconnection as studied in GEN-2005-015. The proposed in-service date is October 1, 2007.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 150MW of generation with transmission system reinforcements within the local transmission systems. In order to maintain acceptable bus voltages in the local area, the customer will need to install a 20Mvar capacitor bank in the Customer's collector substation on the 34.5kV bus and an additional 20Mvar capacitor bank on the 34.5kV bus of the Customer's original generation interconnection request (GEN-2005-015). Dynamic Stability studies performed as part of the impact study will provide additional guidance as to whether the required reactive compensation can be static or a portion must be dynamic (such as a SVC).

The requirements to interconnect the incremental 150MW of generation at the new switching station on the Tuco-Oklaunion 345kV line will consist of adding no new facilities if the Customer agrees to parallel the 345/34.5kV substation transformer for this interconnection with the identical 345/34.5kV substation transformer from request GEN-2005-015. The Customer did not propose a specific 345kV line extending to serve its 345-34.5kV facilities. It is assumed that obtaining all necessary right-of-way for the new switching station will not be a significant expense.

The total minimum cost for building the incremental required facilities for this 150MW of generation is $0. If the Customer does not follow through with request GEN-2005-015 into an Interconnection Agreement, then the associated costs with interconnecting that request will shift to request GEN-2006-025. These costs amount to $5,659,783 as shown in Table 2. Other Network Constraints in the AEP and SPS transmission systems that may be verified with a transmission service request and associated studies are listed in Table 3. These 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 (TSR), this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements. This cost does not include building 345kV line from the Customer substation into the new 345kV ring bus. This cost does not include the Customer's 345-34.5kV substation or the two 34.5kV, 20Mvar capacitor banks.

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. With higher queued generation projects in the local area modeled in this case, there were a number of contingencies involving some SPS tie lines in which no power flow solution was obtained. This result indicates the need for new facilities that can be determined in a transmission service request. These contingency analyses will have to be re-evaluated as part of a TSR with additional transmission facilities between AEP and the remainder of SPP.

There are several other proposed generation additions in the general area of the Customer's facility. It was assumed in this preliminary analysis that these other projects within the AEPW, SPS and WFEC service territories 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.

Introduction

<OMITTED TEXT> (Customer) has requested a feasibility study for the purpose of interconnecting an additional 150MW of generation within the control area of Southwestern Public Service (d/b/a Xcel Energy) (SPS) in Motley County, Texas. The proposed method of interconnection is to build a new 345kV ring bus switching station in the existing Tuco-Oklaunion 345kV line. This request of 150MW is in addition to the Customer's original request of 150MW to be interconnected at the same point as studied in GEN-2005-015. The proposed in-service date is October 1, 2007.

Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the 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.

The requirements for interconnection of the additional 150MW consist of building no new facilities. The Customer's substation transformer's 345kV high side can be paralleled by the Customer with the substation transformer for request GEN-2005-015. This 150MW and the original 150MW will share the Customer's 345kV connection, whether that connection is transmission line or substation bus, to the 345kV ring bus to be constructed by SPS for GEN-2005-015. It is assumed that obtaining all necessary right-of-way for the substation construction will not be a significant expense.

The total cost for building a new 345kV 3-breaker ring switching station, the required interconnection facility for GEN-2005-015, is estimated at $5,659,783. The incremental cost for adding the additional 150MW for GEN-2006-025 is $0. Other Network Constraints in the AEPW, SPS and WFEC systems that were identified are listed in Table 3. These estimates will be refined during the development of the impact study based on the final designs. This cost does not include building the 345kV facilities from the Customer substation into the new SPS 345kV switching station. The Customer is responsible for these 345kV facilities, whether the facilities are transmission line or substation bus, up to the point of interconnection. This cost also does not include the Customer's 345-34.5kV substation, which should be determined by the Customer.

The costs of interconnecting the facility to the AEPW transmission system are listed in Table 1 & 2. **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.

A preliminary one-line drawing of the interconnection and direct assigned facilities are shown in Figure 1.

Table 1: Direct Assignment Facilities

Facility	ESTIMATED COST (2006 DOLLARS)
Customer – 345-34.5 kV Substation facilities.	*
Customer – 345kV transmission line facilities between Customer facilities and SPS 345kV switching station	*
Customer - Right-of-Way for Customer facilities.	*
Customer – Two (2) 34.5kV, 20MVAR capacitor bank in Customer substation	*
Total	*****

Note: *Estimates of cost to be determined by Customer.

Table 2: Required Interconnection Network Upgrade Facilities

Facility	ESTIMATED COST (2006 DOLLARS)
SPS – Build 345kV, 3-breaker ring bus switching station. Station to include breakers, switches, control relaying, high speed communications, all structures and metering and other related equipment (needed for GEN-2005-015)	$3,837,900
SPS – Right-of-Way for new SPS 345kV switching station (needed for GEN-2005-015)	$47,000
SPS – 345kV, 20Mvar line reactor in new 345kV switching station on the Oklaunion terminal (needed for GEN-2005-015)	$1,774,883
SPS – Facilities for incremental 150MW for GEN-2006-025	$0
Total for GEN-2005-015 and GEN-2006-025	**$5,659,783**

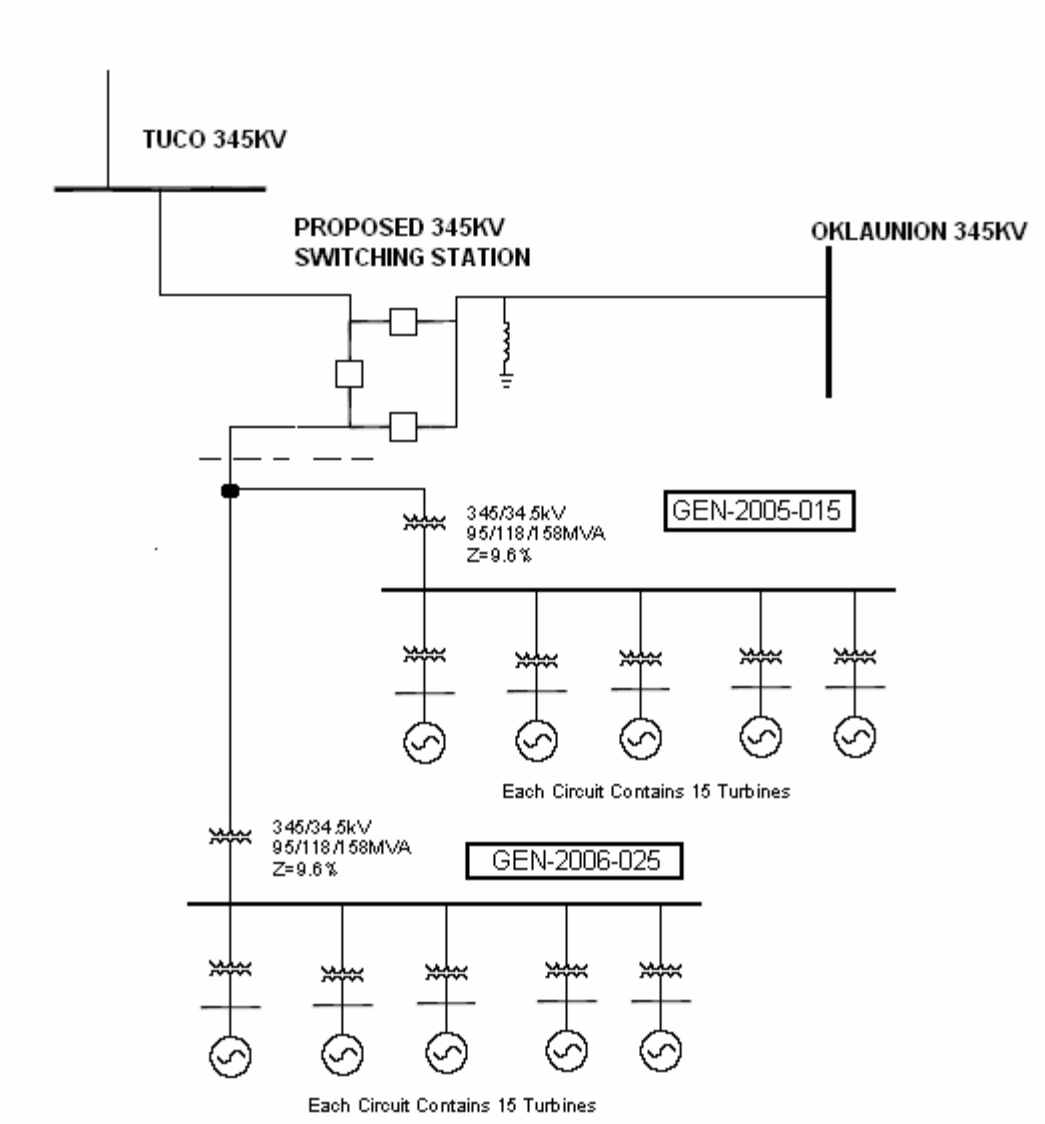

Figure 1: Proposed Interconnection
(Final substation design to be determined

Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2007 winter peak, 2008 & 2011 summer and winter peak, and 2016 summer peak models. 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 October 1, 2007. The available seasonal models used were through the 2016 Summer Peak of which is the end of the current SPP planning horizon.

The transmission network models used for this request included certain proposed upgrades on the SPS transmission system including a 100Mvar capacitor bank and a 150Mvar SVC at the Tuco 230kV bus. A prior queued project near Tuco also provided reactive support in an area that in past studies has lacked such support. This resulted in a low number of voltage violations that usually occur for transactions in this area.

The analysis of the Customer's project indicates that, given the requested generation level of 150MW and location, additional criteria violations will occur on the existing AEPW, SPS, and WFEC transmission systems under steady state and contingency conditions in the peak seasons.

There are several other proposed generation additions in the general area of the Customer's facility. Local projects that were previously queued were assumed to be in service in this Feasibility Study. Those local projects that were previously queued and have advanced to nearly complete phases were included in this Feasibility Study.

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.

In order to maintain adequate voltage in the area of the interconnection and to maintain a zero reactive power flow exchanged at the point of interconnection, additional reactive compensation is required at the point of interconnection. The Customer will be required to install 40MVAR of capacitor banks in their substation on the 34.5kV buses in the Customer substation. A total of two (2) 20MVAR banks are required. Dynamic Stability studies performed as part of the impact study will provide additional guidance as to whether the reactive compensation can be static or a portion must be dynamic (such as a SVC or STATCOM). It is possible that an SVC or STATCOM device will be required at the Customer facility because of FERC Order 661A Low Voltage Ride Through Provisions (LVRT) which went into effect January 1, 2006. FERC Order 661A orders that wind farms stay on line for 3 phase faults at the point of interconnection even if that requires the installation of a SVC or STATCOM device.

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 American Electric Power, Southwestern Public Service Company (d/b/a Xcel Energy, Inc.), Oklahoma Gas & Electric (OKGE), West Plains Electric (WEPL) and Western Farmers Electric Cooperative were applied and the resulting scenarios analyzed. This satisfies the ‘more probable’ contingency testing criteria mandated by NERC and the SPP criteria.

Table 3: Network Constraints

NETWORK CONSTRAINTS
AEP - 'ELK CITY (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
SPS - 'TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1'

Table 4: Contingency Analysis

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC	CONTINGENCY
'ELK CITY (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	2008 SP	287	101.1	145	SPP-AEPW-03' - Outage of LES-OKU 345kV
SHAMROCK 69kV bus	2008 SP		89.2	100	SPP-AEPW-03' - Outage of LES-OKU 345kV
TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1'	2016 SP	560	126.4	0	Tolk #2 outage
ERICK 69kV bus	2016 SP		89.5	100	Tolk #2 outage
SWEETWATER 69kV bus	2016 SP		87.7	100	Tolk #2 outage

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 total project is estimated at $5,659,783 for SPS's interconnection Network Upgrade facilities listed in Table 2. Incremental costs for interconnection facilities to interconnect the GEN-2006-025 generation request are $0. These costs exclude upgrades of other transmission facilities by WFEC, AEP, OKGE, and WEPL listed in Table 3 of which are Network Constraints. At this time, the cost estimates for other Direct Assignment facilities including those in Table 1 have not been defined by the Customer. In addition to the Customer's proposed interconnection facilities, the Customer will be responsible for installing two (2) 34.5kV, 20Mvar capacitor banks in the Customer substation for reactive support. As stated earlier, local projects that were previously queued are assumed to be in service in this Feasibility Study.

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.

The required interconnection costs listed in Table 2 and other upgrades associated with Network Constraints listed in Table 3 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 requests transmission service through Southwest Power Pool's OASIS.

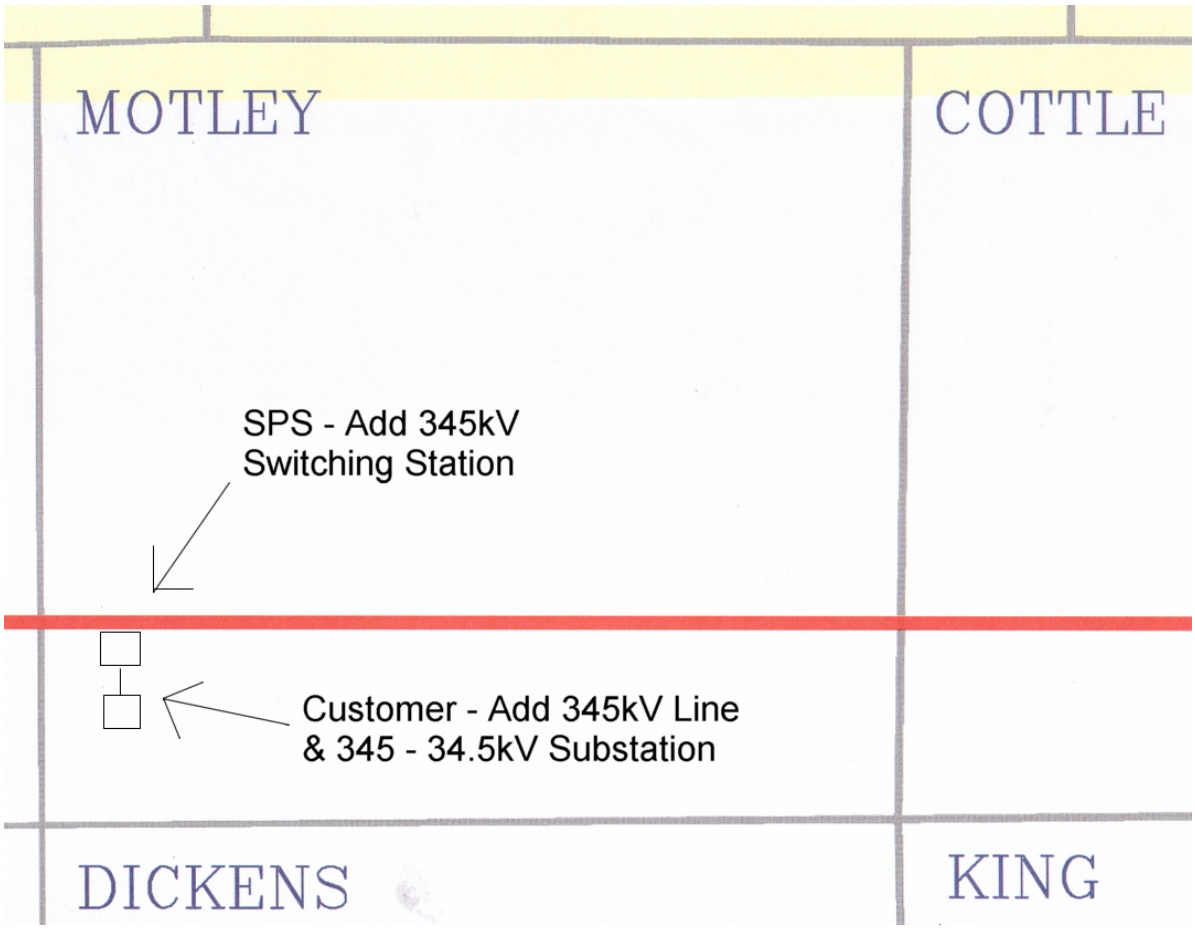

FIGURE 2. MAP OF THE LOCAL AREA