Feasibility Study
For
Generation Interconnection Request
GEN-2007-042

SPP Tariff Studies
(#GEN-2007-042)

June, 2008

Executive Summary

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 360 MW of wind generation within the control area of Southwestern Public Service Company (SPS) located in Hansford County, Texas. The proposed interconnection point is on the proposed Hitchland 345 kV substation, owned by SPS. The proposed in-service date is September, 2010.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 360 MW of generation with transmission system reinforcements within the local transmission system. The need for reactive compensation for this interconnection request will be evaluated in the Impact Study based on the wind turbine manufacturer and type requested by the Customer. Dynamic Stability studies performed as part of the System 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 requirement to interconnect the 360 MW of wind generation on the proposed Hitchland 345kV substation consists of adding a new 345 kV circuit-breaker and line terminal at Hitchland. The new substation will be constructed and maintained by SPS. The Customer did not propose a specific route for the 345 kV line extending to serve its 345/34.5 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.

It has been determined that GEN-2007-042 along with the prior queued projects in the area cannot be interconnected without the addition of the following proposed 345kV lines; 1) Comanche – Wichita, 2) GEN-2003-013 – Woodward, 3) a double circuit 345kV line from Hitchland – Woodward, 4) a double circuit 345kV line from Woodward – Northwest, 5) 345kV circuit from Woodward – Comanche. The GEN-2003-013 – Woodward 345kV line has been assigned to the Customer for GEN-2006-049. A 345kV circuit from Hitchland – Woodward has been assigned to GEN-2006-044. The Comanche – Wichita 345kV line has been assigned to the Customer for GEN-2005-012. The second Hitchland – Woodward 345kV line and Woodward - Comanche 345kV line have been assigned to the Customer for GEN-2007-041. The second Woodward – Northwest 345kV line has also been assigned to the Customer for GEN-2007-041. Withdrawal or suspension of any prior queued projects in the local area will require a restudy to evaluate the new assignees of such network upgrades.

The total minimum cost for building the required facilities for this 360 MW of generation is $2,000,000. These costs are shown in Tables 1 and 2. This cost does not include building the 345 kV line from the Customer 345/34.5 kV collector substation into the point of interconnection. This cost also does not include the Customer's 345/34.5 kV collector substation or possible need for reactive compensation. Network constraints in the Southwestern Public Service Company (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.

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 areas 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 360 MW of wind generation within the control area of Southwestern Public Service Company (SPS) located in Hansford County, Texas. The proposed interconnection point is on the proposed Hitchland 345 kV substation, owned by SPS. The proposed in-service date is September, 2010.

Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the generation 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 requirement to interconnect the 360 MW of wind generation on the proposed Hitchland 345kV substation consists of adding a new 345 kV circuit-breaker and line terminal at Hitchland. The new substation will be constructed and maintained by SPS. The Customer did not propose a specific route for the 345 kV line extending to serve its 345/34.5 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.

With the addition of this interconnection request, there are approximately 2,640 MW of wind generation on the 345kV line from Lamar – Finney – Potter. There are also approximately 1,000 MW of wind generation on the 115kV and 230kV transmission systems that are connected at Hitchland. It was determined that a base case powerflow model could not be created to include the Customer's interconnection request without the addition of 1) Comanche – Wichita, 2) GEN-2003-013 – Woodward, 3) a double circuit 345kV line from Hitchland – Woodward, 4) a double circuit 345kV line from Woodward – Northwest, 5) 345kV circuit from Woodward – Comanche.

Other Network Constraints in the Southwestern Public Service Company transmission systems that were identified are shown in Table 3. 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.

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

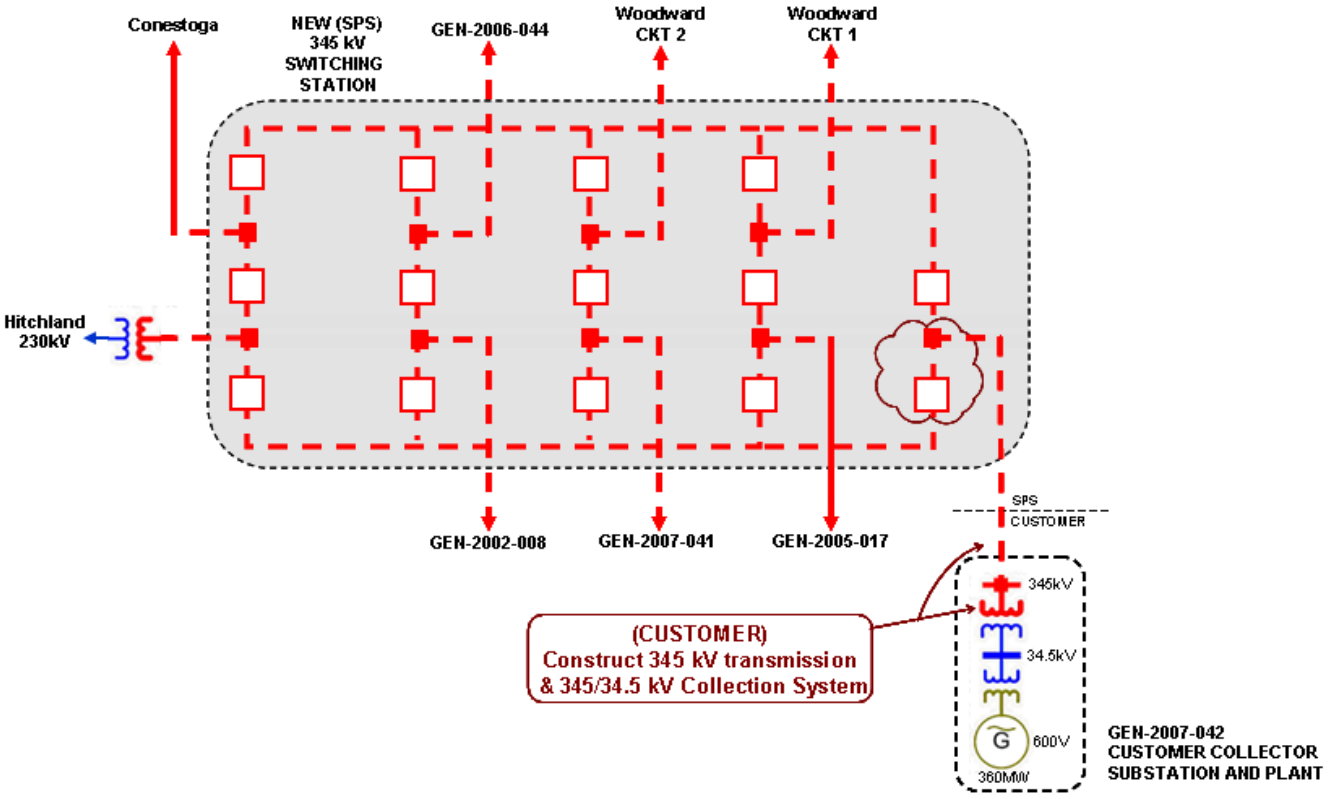

Figure 1: Proposed Method of Interconnection

(Final design to be determined)

Interconnection Estimated Costs

The minimum cost for adding a new 345 kV circuit-breaker and line terminal serving GEN-2007-042 facilities is estimated at $2,000,000. 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 345 kV transmission line extending from the point of interconnection to serve its 345/34.5 kV collection facilities. This cost also does not include the Customer's 345/34.5 kV collector substation or the possible need for reactive compensation, all of which should be determined by the Customer. The Customer is responsible for these 345 kV – 34.5 kV facilities up to the point of interconnection.

It has been determined that GEN-2007-042 along with the prior queued projects in the area cannot be interconnected without the addition of both the proposed 345kV line from Comanche – Wichita, GEN-2003-013 – Woodward, double circuit Hitchland – Woodward, double circuit Woodward - Northwest and the proposed 345kV circuit from Woodward – Comanche. The GEN-2003-013 – Woodward 345kV line has been assigned to the Customer for GEN-2006-049. The Hitchland – Woodward 345kV line has been assigned to GEN-2006-044. The Comanche – Wichita 345kV line has been assigned to GEN-2005-012. The second circuit from Hitchland – Woodward 345kV and the second circuit from Woodward – Northwest and the Woodward - Comanche 345kV line have been assigned to the Customer for GEN-2007-041. Withdrawal or suspension of any prior queued projects in the local area will require a restudy to evaluate the new assignees of such network upgrades.

The costs of interconnecting the facility to the SPS 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.

Table 1: Direct Assignment Facilities

FACILITY	ESTIMATED COST (2008 DOLLARS)
CUSTOMER – 345/34.5 kV substation facilities.	*
CUSTOMER – 345 kV line between Customer substation and new SPS 345 kV switching station.	*
CUSTOMER – Possible reactive compensation to be determined during impact study.	*
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 (2007 DOLLARS)
SPS – 345 kV circuit-breaker and line terminal to be built for generation request #GEN-2007-042 on the proposed Hitchland 345 kV substation. Work to include associated switches, control relaying, high speed communications, metering and related equipment and all related structures.	$2,000,000
TOTAL	**$2,000,000**

* *Estimates of cost to be determined.*

Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of 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 September, 2010. 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 requested generation level of 360 MW and location, additional criteria violations will occur on the existing 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.

The need for reactive compensation will be determined during the Impact Study. The need for reactive compensation will be based on the Customer's choice of wind turbine make and manufacturer. Dynamic Stability studies performed as part of the System 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.

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	CLINTON JUNCTION - ELK CITY 138KV CKT 1
AEPW	ELDORADO - LAKE PAULINE 69KV CKT 1
AEPW	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
AEPW/SPS	ELK CITY 230KV - GRAPEVINE INTERCHANGE 230KV CKT 1
OKGE	NORTHWEST - CIMARRON 345KV CKT 1
OKGE	NORTHWEST (NORTWST2) 345/138/13.8KV TRANSFORMER CKT 1
OKGE/WFEC	NORTHWEST - MOORELAND 345KV CKT 1
OKGE/WFEC	NORTHWEST - MOORELAND 345KV CKT 2
SPS	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
SPS	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
SPS	HAPPY INTERCHANGE - TULIA TAP 115KV CKT 1
SPS	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1
SPS	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
SPS	KRESS INTERCHANGE - TULIA TAP 115KV CKT 1
SPS	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
SPS	PLANT X STATION 230/115KV TRANSFORMER CKT 1
SPS/WEPL	TEXAS COUNTY INTERCHANGE PHASE SHIFT TFMR - EAST LIBERAL 115KV CKT 1
SUNC	DIGHTON TAP - MANNING TAP 115KV CKT 1
SUNC	DOBSON - PILE 115KV CKT 1
SUNC	PILE - SCOTT CITY 115KV CKT 1
SUNC/WEPL	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
WEPL	MEDICINE LODGE - SUN CITY 115KV CKT 1
WEPL	MULLERGREN - SPEARVILLE 230KV CKT 1
WEPL/MIDW	MULLERGREN - S HAYS6 230KV CKT 1
WFEC/SPS	MOORELAND - HITCHLAND 345KV CKT 1
WFEC/SPS	MOORELAND - HITCHLAND 345KV CKT 2
AEPW	American Electric Power West
MIDW	Midwest Energy
OKGE	Oklahoma Gas and Electric
SPS	Southwestern Public Service Company
SUNC	Sunflower Electric Power Corporation
WEPL	West Plains
WFEC	Western Farmers Electric Cooperative

Table 4: Contingency Analysis

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
12SP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	230	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12SP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	142	0	HITCHLAND - MOORELAND 345KV CKT 1
12SP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	133	0	HOLCOMB - SETAB 345KV CKT 1
12SP	MULLERGREN - SPEARVILLE 230KV CKT 1	355	127	0	2003-13 - MOORELAND 345KV CKT 1
12SP	MULLERGREN - S HAYS6 230.00 230KV CKT 1	147	127	0	CIRCLE - MULLERGREN 230KV CKT 1
12SP	NORTHWEST (NORTWST2) 345/138/13.8KV TRANSFORMER CKT 1	493	125	0	NORTHWEST (NORTWST3) 345/138/13.8KV TRANSFORMER CKT 1
12SP	ELK CITY 230KV - GRAPEVINE INTERCHANGE 230KV CKT 1	351	123	0	TUCO INTERCHANGE (TUCOXX4) 345/230/13.2KV TRANSFORMER CKT 1
12SP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	120	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12SP	NORTHWEST - MOORELAND 345KV CKT 2	1052	120	0	NORTHWEST - MOORELAND 345KV CKT 1
12SP	NORTHWEST - MOORELAND 345KV CKT 1	1052	119	0	NORTHWEST - MOORELAND 345KV CKT 2
12SP	NORTHWEST - CIMARRON 345KV CKT 1	717	115	0	TUCO INTERCHANGE (TUCOXX4) 345/230/13.2KV TRANSFORMER CKT 1
12SP	PLANT X STATION 230/115KV TRANSFORMER CKT 1	252	109	112	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
12SP	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1	635	100	347	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2
12SP	MOORELAND - HITCHLAND 345KV CKT 1	1052	100	355	2003-13 - MOORELAND 345KV CKT 1
12SP	MOORELAND - HITCHLAND 345KV CKT 2	1052	100	355	2003-13 - MOORELAND 345KV CKT 1
12WP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	282	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12WP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	164	0	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
12WP	ELK CITY 230KV - GRAPEVINE INTERCHANGE 230KV CKT 1	351	144	0	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
12WP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	138	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	MEDICINE LODGE - SUN CITY 115KV CKT 1	80	136	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	MOORELAND - HITCHLAND 345KV CKT 1	1052	136	0	HITCHLAND - MOORELAND 345KV CKT 2
12WP	MOORELAND - HITCHLAND 345KV CKT 2	1052	136	0	HITCHLAND - MOORELAND 345KV CKT 1
12WP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	131	0	2003-013 - MOORELAND 345KV CKT 1
12WP	NORTHWEST - MOORELAND 345KV CKT 1	1052	129	0	MOORELAND - NORTHWEST 345KV CKT 2
12WP	NORTHWEST - MOORELAND 345KV CKT 2	1052	129	0	MOORELAND - NORTHWEST 345KV CKT 1
12WP	NORTHWEST - CIMARRON 345KV CKT 1	717	124	0	OKLAUNION - TUCO INTERCHANGE 345KV CKT 1
12WP	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1	118	121	0	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
12WP	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1	118	120	0	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
12WP	HAPPY INTERCHANGE - TULIA TAP 115KV CKT 1	118	114	0	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
12WP	KRESS INTERCHANGE - TULIA TAP 115KV CKT 1	118	111	9	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
12WP	MULLERGREN - S HAYS6 230KV CKT 1	147	109	102	CIRCLE - MULLERGREN 230KV CKT 1
12WP	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1	118	108	108	SWISHER COUNTY INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
17SP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	224	0	LAKE PAULINE - RUSSELL 138KV CKT 1
17SP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	142	0	HITCHLAND - MOORELAND 345KV CKT 1
17SP	MULLERGREN - SPEARVILLE 230KV CKT 1	355	129	0	MINGO - SETAB 345KV CKT 1

TABLE 4: Contingency Analysis (continued)

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
17SP	MULLERGREN - S HAYS6 230KV CKT 1	147	128	0	MINGO - SETAB 345KV CKT 1
17SP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	124	0	HITCHLAND - MOORELAND 345KV CKT 1
17SP	DIGHTON TAP - MANNING TAP 115KV CKT 1	98	122	0	MINGO - SETAB 345KV CKT 1
17SP	ELK CITY 230KV - GRAPEVINE INTERCHANGE 230KV CKT 1	351	121	0	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
17SP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	119	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	DOBSON - PILE 115KV CKT 1	198	118	0	HOLCOMB - SETAB 345KV CKT 1
17SP	MOORELAND - HITCHLAND 345KV CKT 1	1052	117	0	HITCHLAND - MOORELAND 345KV CKT 2
17SP	MOORELAND - HITCHLAND 345KV CKT 2	1052	117	0	HITCHLAND - MOORELAND 345KV CKT 1
17SP	PILE - SCOTT CITY 115KV CKT 1	198	116	0	HOLCOMB - SETAB 345KV CKT 1
17SP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	139	47	NICHOLS STATION - YARNELL SUB 115KV CKT 1
17SP	NORTHWEST - MOORELAND 345KV CKT 2	1052	112	53	HITCHLAND - MOORELAND 345KV CKT 1
17SP	NORTHWEST - MOORELAND 345KV CKT 1	1052	112	56	HITCHLAND - MOORELAND 345KV CKT 2
17SP	TEXAS COUNTY INTERCHANGE PHASE SHIFT TFMR - EAST LIBERAL 115KV CKT 1	119	104	283	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
17SP	MULLERGREN - SPEARVILLE 230KV CKT 1	330	101	307	BASE CASE

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 $2,000,000 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. In addition to the Customer's proposed interconnection facilities, the Customer may be responsible for installing reactive compensation in the Customer's substation for reactive support. 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

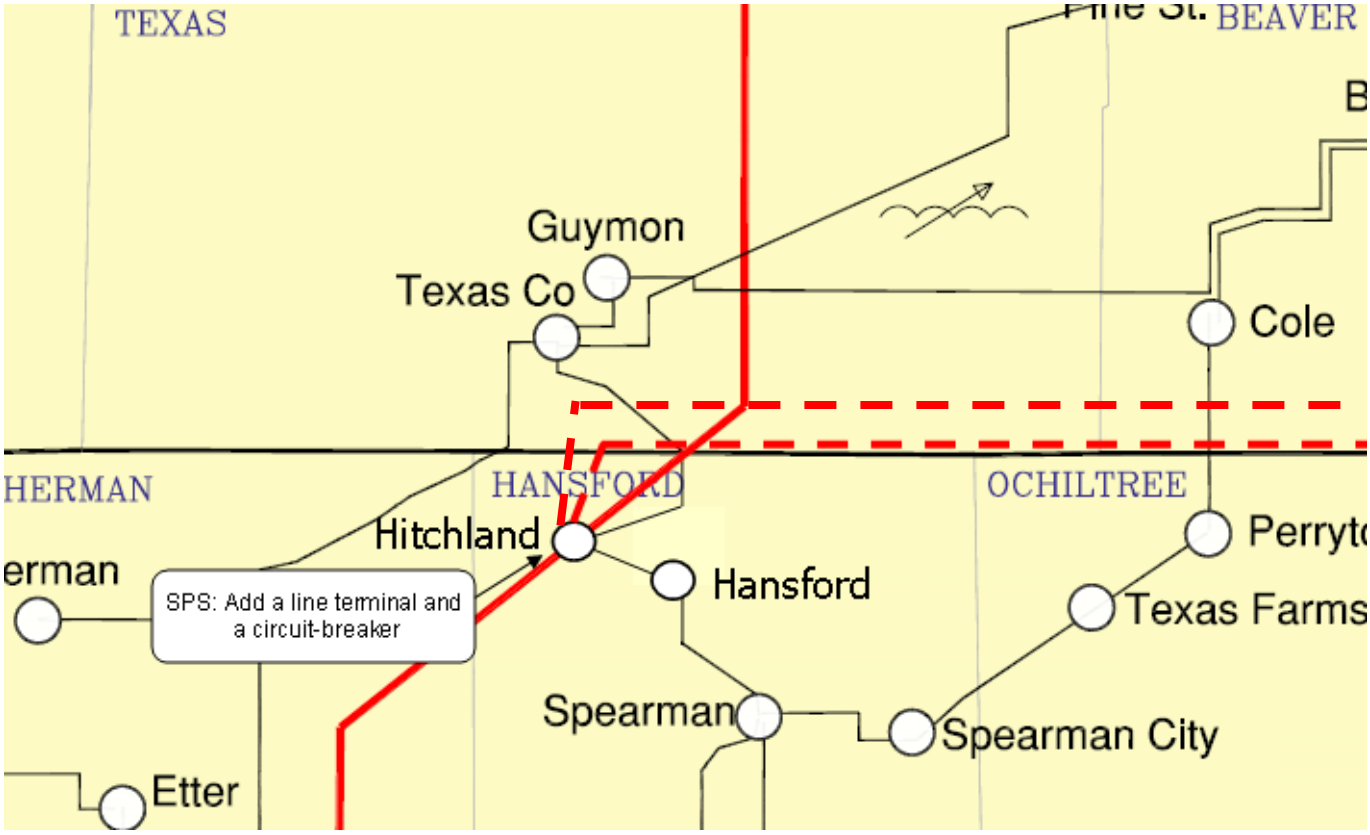

Figure 2: Point of Interconnection Area Map