Feasibility Study For Generation Interconnection Request GEN-2006-043

SPP Tariff Studies
(#GEN-2006-043)

May, 2007

Executive Summary

<OMITTED TEXT> (Customer) has requested a feasibility study for the purpose of interconnecting 300 MW of wind generation within the control area of American Electric Power (AEPW) in Rogers Mills County, Oklahoma. The Customer proposed two different methods of interconnection. One involved interconnecting into the existing Elk City 230 kV substation owned by AEPW. The other method involved building a new 230 kV switching station in the Elk City – Grapevine 230 kV transmission line in the portion owned by AEPW. The wind farm is proposed to be built in two phases, with both phases being in commercial operation by December, 2008.

For reasons discussed within this study, the Customer's first option was not a feasible alternative for interconnection. The proposed generation interconnection was studied with the Customer's second proposed option. Under the second proposed option, and with all previous queued projects in service, power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 300 MW of generation with transmission system reinforcements within the local transmission system.

However, due to the critical n – 1 contingencies at the point of interconnection that had no powerflow solution, a preliminary stability analysis was also run for the generation interconnection with all prior queued projects in service. Preliminary stability analysis indicates that the generation interconnection request may not be stable for the outage of the 230 kV line from the interconnect point to Elk City. In this case, additional transmission lines must be built from the interconnect point to a point away from the local Elk City transmission system. This additional line will have to be further addressed in an Impact Study if the Customer executes an Impact Study Agreement.

The requirement to interconnect the 300 MW of generation includes building a new 230 kV line terminal at a proposed 230 kV switching station to be built for one of the prior queued projects. The cost for adding a 230 kV terminal to this switching station is $500,000. If there were no prior queued projects in the area, the cost to the Customer would be $3,500,000 in order to construct the entire three breaker ring bus switching station. This switching station is to be located approximately 18 miles west of Elk City 230 kV substation on the Elk City – Grapevine 230 kV transmission line.

If all previous queued projects continue through the interconnection queue and execute an Interconnection Agreement with the Transmission Owner and SPP, the Customer may be required to pay for network upgrades which could include a new 230 kV or 345 kV transmission line from the interconnect point to either existing or proposed SPP infrastructure. At this point, it is not evident exactly what interconnection configuration the Customer will be required to pay for. More guidance will be provided in the Impact Study, if the Customer chooses to execute an Impact Study Agreement.

In order to maintain acceptable reactive power compensation, the customer will need to install 60 Mvars of 34.5 kV capacitor banks in the Customer's collector substation on the 34.5 kV bus. 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).

Other Network Constraints in the American Electric Power West (AEPW), Southwestern Public Service (SPS), Oklahoma Gas and Electric (OKGE) and Western Farmers Electric Cooperative (WFEC) transmission systems that may be verified with a transmission service request and associated studies are listed in Table 4. 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 the 230 kV connections from the Customer substation into the new 230 kV ring bus.

In Table 5, 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 AEPW and SPS control areas will be in service. 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 300 MW of wind generation within the control area of American Electric Power (AEPW) in Rogers Mills County, Oklahoma. The Customer proposed two different methods of interconnection. One involved interconnecting into the existing Elk City 230 kV substation, owned by AEPW. The other method involved building a new 230 kV switching station in the Elk City – Grapevine 230 kV transmission line in the portion owned by AEPW. The wind farm is proposed to be built in two phases, with both phases being in commercial operation by December, 2008.

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.

Customer requested that SPP and AEP investigate two options for the interconnection of the wind farm. The first option requested is to build a new 230 kV line terminal into AEPW's Elk City substation. Discussions with AEP have determined that the Elk City substation is landlocked. There is no room for expansion of the Elk City substation. Therefore, this option was not investigated any further.

The second option requested by the Customer involved a new substation to be built along the Elk City – Grapevine 230 kV transmission. This transmission line is a tie line between AEPW and Southwestern Public Service (SPS). The portion of the line to be interconnected is approximately 18 miles west of Elk City substation.

There are currently two generation interconnection requests on the Elk City – Grapevine 230 kV transmission line that are queued ahead of the present request. GEN-2006-002 is a 150 MW wind farm that has requested interconnection at a point on the Elk City – Grapevine 230 kV line approximately 12 miles west of Elk City. This interconnection involves a new 230 kV three breaker ring bus substation. This request is currently in Facility Study phase. The Feasibility and Impact Studies for this GI request can be viewed on SPP's OASIS. GEN-2006-035 is a 225 MW wind farm request that has requested interconnection at approximately the same location as GEN-2006-002. This request is currently in Impact Study phase and its Feasibility Study can also be viewed on the SPP OASIS. There are also a number of wind farm projects queued ahead of the study project near Grapevine substation in the SPS control area and wind farms east of Elk City in the AEPW control area.

With the prior queued requests of 375 MW wind generation and the present request of 300 MW of wind generation, obvious overloads are present on the Elk City – Grapevine 230 kV line, which has a rating of 351 MVA. A powerflow solution cannot be obtained for an outage of either side of the point of interconnection. Also, preliminary stability analysis has indicated that the Customer requested wind farm cannot be interconnected without the need for new transmission infrastructure. The Customer project and the prior queued projects turbines will all have unstable oscillations for a three phase fault and subsequent outage of the line from the new switching substation to Grapevine. At this point, it is not known what the maximum amount of wind generation, from a stability standpoint, that could be interconnected without additional transmission. This information can be obtained during the course of a full impact study for this interconnection request.

Taking this information into account, the study project was then analyzed under the assumption that one of the previous queued projects will withdraw from the queue. For this study it was assumed, for no particular reason, that GEN-2006-035 would withdraw. Using this assumption, the customer will be required to pay for an additional terminal to the 230 kV switching station. Under this assumption, the total interconnection costs are $500,000 and are shown in Table 2. If all prior queued projects withdraw, the cost to the Customer would be $3,500,000, the cost to build the three breaker ring bus, as shown in Table 3.

If all prior queued wind farms execute an Interconnection Agreement and go into service, the Customer will be required to pay for network upgrades to make the wind farm operate in a stable manner. The proposed network upgrades could include 230 kV or 345 kV facilities that will tie into existing or proposed SPP transmission facilities. If the Customer executes an Impact Study Agreement, a clearer picture can be presented as by that time both prior queued projects will have already gone through an impact/stability analysis.

The costs in Table 2 do not include the 230/34.5 kV substation that will collect energy from the Customer's wind turbine collection circuits. This cost does not include the 230 kV transmission line from the Customer's substation to the 230 kV switching station on the Elk City – Grapevine 230 kV line. Other Network Constraints in the American Electric Power West (AEPW), Southwestern Public Service (SPS), Oklahoma Gas and Electric (OKGE) and Western Farmers Electric Cooperative (WFEC) transmission systems that may be verified with a transmission service request and associated studies are listed in Table 4. These estimates will be refined during the development of the impact study based on the final designs.

The costs of interconnecting the generating facility to the AEPW transmission system are listed in Tables 1 and 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 (2007 DOLLARS)
Customer – 230/34.5 kV Substation facilities.	*
Customer – 230 kV transmission line from Customers' substation to the AEPW 230 kV switching station.	*
Customer – 34.5 kV, 60 Mvar capacitor bank(s) to be installed in the Customer 230/34.5 kV substation.	
Customer – Right-of-Way for Customer facilities.	
Total	*****

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

Table 2: Required Interconnection Network Upgrade Facilities (if Previous Queued Project withdraws)

FACILITY	ESTIMATED COST (2007 DOLLARS)
AEPW – Switching Station: Add 230 kV terminal to 230 kV switching station built for GEN-2006-002. Equipment to include breaker, switches, control relaying, high speed communications, metering and related equipment and all structures.	**$500,000**
Total	**$500,000**

Table 3: Required Interconnection Network Upgrade Facilities (if all Previous Queued Projects withdraw)

FACILITY	ESTIMATED COST (2007 DOLLARS)
AEPW – Switching Station: Build 230 kV three breaker switching station on the Elk City – Grapevine 230 kV line including disconnect switches, steel, and all associated equipment.	**$3,500,000**
Total	**$3,500,000**

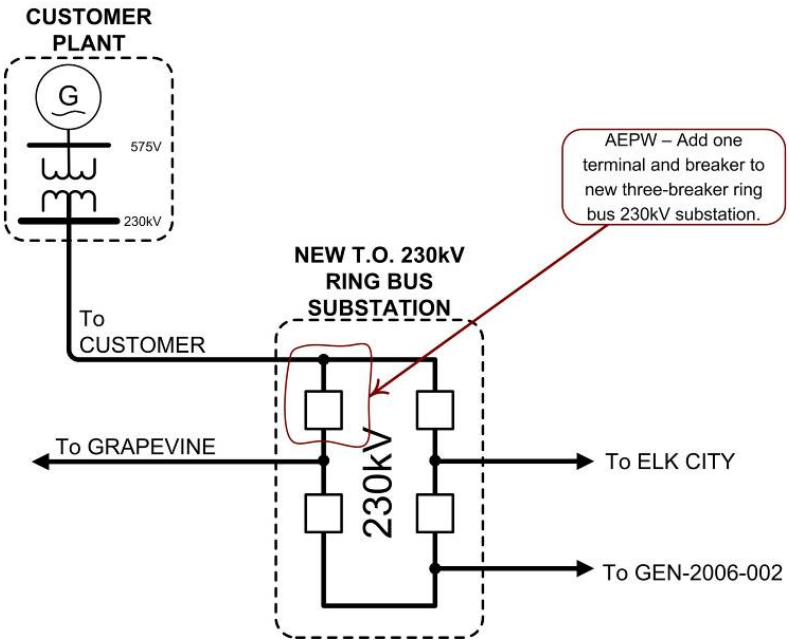

Figure 1: Proposed Interconnection
(Final substation design to be determined)

Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2008, 2009, and 2012 summer and winter peak models, and 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 August 1, 2008. The available seasonal models used were through the 2017 Summer Peak of which is the end of the current SPP planning horizon.

The analysis of the Customer's project indicates that, given the requested generation level of 300 MW and location, additional criteria violations will occur on the existing AEPW, SPS, OKGE and WFEC transmission systems under steady state and contingency conditions in the peak seasons. These network constraints are shown in Table 4.

With both prior queued projects on the Elk City – Grapevine 230 kV line assumed to be in service, serious issues arise for the interconnection of this GI request. A powerflow solution cannot be obtained for a single contingency line outage for either the Elk City or the Grapevine 230 kV terminal. A preliminary stability analysis concluded that the wind farms would oscillate uncontrollably for such contingencies. Therefore the wind farm was only studied under the assumption that one of the two prior queued wind farms would withdraw form the interconnection queue.

In Table 5, 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.

At this time in the Interconnection process, it is premature to determine what final interconnection configuration may be required. The interconnection configuration option will need to be studied in more detail in an in depth stability study of the generation interconnection request.

In order 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 60 Mvar of capacitor bank(s) in their substation on the 34.5 kV buses in the Customer substation. 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.

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 (WESTAR), 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.

Table 4: Network Constraints

AREA	ELEMENT
AEPW	'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'
AEPW	'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'
AEPW	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
AEPW	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
AEPW	'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'
AEPW	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'
AEPW	'COFFEE (RAYBURN) - JACKSONVILLE (SWE-RC-ETEC) 138KV CKT 1'
AEPW	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'
AEPW	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
AEPW	'JACKSONVILLE (SWE-RC-ETEC) - OVERTON 138KV CKT 1'
AEPW	'LINWOOD - MCWILLIE STREET 138KV CKT 1'
AEPW	'WF_TP_34 345.00 345/230KV TRANSFORMER CKT 1'
OKGE	'MUSKOGEE - PECAN CREEK 345KV CKT 1'
OKGE	'NORTHWEST (NORTWST2) 345/138/13.8KV TRANSFORMER CKT 1'
OKGE	'SOONER (SOONER5) 345/138/13.8KV TRANSFORMER CKT 1'
SPS	'CASTRO COUNTY INTERCHANGE - DEAF SMITH REC-#15 & #19 69KV CKT 1'
SPS	'CONWAY SUB - YARNELL SUB 115KV CKT 1'
SPS	'CUNNINGHAM STATION 230/115KV TRANSFORMER CKT 1'
SPS	'LEA COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
SPS	'LEA COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
SPS	'LUBBOCK POWER & LIGHT-HOLLY PLANT 230/69KV TRANSFORMER CKT 1'
SPS	'MOORE COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
SPS	'NICHOLS STATION - YARNELL SUB 115KV CKT 1'
SPS	'SPEARMAN INTERCHANGE - SPEARMAN SUB 115KV CKT 1'
WERE	'166TH STREET - JARBALO JUNCTION SWITCHING STATION 115KV CKT 1'
WERE	'166TH STREET - JARBALO JUNCTION SWITCHING STATION 115KV CKT 1'
WFEC	'2002-05T 138.00 - MOREWOOD SW 138KV CKT 1'
WFEC	'DILL JCT - ELK CITY 69KV CKT 1'
AEPW	American Electric Power West
SPS	Southwestern Public Service
WFEC	Western Farmers Electric Cooperative
WERE	Westar
OKGE	Oklahoma Gas and Electric

Table 5: Contingency Analysis

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
2008 Summer Peak					
'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	08SP	143	129.763	132	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	08SP	287	131.9939	151	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
'CONWAY SUB - YARNELL SUB 115KV CKT 1'	08SP	164	102.4649	196	'BASE CASE'
'NICHOLS STATION - YARNELL SUB 115KV CKT 1'	08SP	164	102.2485	205	'BASE CASE'
'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	08SP	72	106.5911	218	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	08SP	287	115.25	223	'KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	08SP	351	112.0769	235	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	08SP	319	100.9652	295	'BASE CASE'
NO SOLUTION OBTAINED	08SP			0	NICHOLS – YARNELL 115KV
NO SOLUTION OBTAINED	08SP			0	YARNELL – CONWAY 115KV
NO SOLUTOIN OBTAINED	08SP			0	WF_TAP – GRAPEVINE 230KV
NO SOLUTION OBTAINED	08SP			0	WF_TAP – ELK CITY 230KV
NO SOLUTOIN OBTAINED	08SP			0	ELK CITY 230/115KV TRANSFORMER
2008 Winter Peak					
'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	08WP	143	141.1955	85	'2002-05T 138.00 - MOREWOOD SW 138KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	08WP	287	142.0848	94	'SPP-SWPS-04A'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	08WP	287	132.5055	133	'CLARENDON REC - HEDLEY 69KV CKT 1'
'2002-05T 138.00 - MOREWOOD SW 138KV CKT 1'	08WP	158	118.6674	162	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	08WP	351	122.86	177	'SPP-SWPS-04A'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	08WP	319	122.4699	181	'BASE CASE'
'2002-05T 138.00 - MOREWOOD SW 138KV CKT 1'	08WP	130	113.5262	186	'BASE CASE'
'MOREWOOD SW 138/69KV TRANSFORMER CKT 1'	08WP	56	109.1729	207	'MOORELAND - MOREWOOD SW 138KV CKT 1'
'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	08WP	72	107.208	214	'2002-05T 138.00 - MOREWOOD SW 138KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	08WP	351	113.045	224	'CLARENDON REC - HEDLEY 69KV CKT 1'
'DILL JCT - ELK CITY 69KV CKT 1'	08WP	61	101.4921	287	'2002-05T 138.00 - MOREWOOD SW 138KV CKT 1'
'COFFEE (RAYBURN) - JACKSONVILLE (SWE-RC-ETEC) 138KV CKT 1'	08WP	265	113.7295	296	'SPP-AEPW-11'
'COFFEE (RAYBURN) - NEW YORK (RAYBURN) 138KV CKT 1'	08WP	265	105.6108	298	'SPP-AEPW-11'
NO SOLUTION OBTAINED	08WP			0	NICHOLS – YARNELL 115KV
NO SOLUTION OBTAINED	08WP			0	YARNELL – CONWAY 115KV
NO SOLUTOIN OBTAINED	08WP			0	WF_TAP – GRAPEVINE 230KV
NO SOLUTION OBTAINED	08WP			0	WF_TAP – ELK CITY 230KV
2009 Summer Peak					
'LINWOOD - MCWILLIE STREET 138KV CKT 1'	09SP	209	106.5819	0	'HARTS ISLAND - SOUTH SHREVEPORT 138KV CKT 1'
'LUBBOCK POWER & LIGHT-HOLLY PLANT 230/69KV	09SP	100	119.1539	0	'LUBBOCK POWER & LIGHT-SOUTHEAST - LUBBOCK SOUTH

Table 5: Contingency Analysis (continued)

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
TRANSFORMER CKT 1'					INTERCHANGE 230KV CKT 1'
'LUBBOCK POWER & LIGHT-SOUTHEAST 230/69KV TRANSFORMER CKT 1'	09SP	100	117.5592	0	'JONES STATION - LUBBOCK POWER & LIGHT-HOLLY PLANT 230KV CKT 1'
'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	09SP	143	129.4469	127	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	09SP	287	131.0309	157	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	09SP	72	109.0731	166	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'LUBBOCK POWER & LIGHT-WADSWORTH 230/69KV TRANSFORMER CKT 1'	09SP	100	105.2156	181	'LUBBOCK POWER & LIGHT-SOUTHEAST - LUBBOCK SOUTH INTERCHANGE 230KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	09SP	287	114.6235	227	'CLARENDON - CLARENDON REC 69KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	09SP	351	110.8998	242	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	09SP	319	103.5539	281	'BASE CASE'
'CONWAY SUB - YARNELL SUB 115KV CKT 1'	09SP	164	100.3723	282	'BASE CASE'
'NICHOLS STATION - YARNELL SUB 115KV CKT 1'	09SP	164	100.176	292	'BASE CASE'
NO SOLUTION OBTAINED	09SP			0	NICHOLS – YARNELL 115KV
NO SOLUTION OBTAINED	09SP			0	YARNELL – CONWAY 115KV
NO SOLUTOIN OBTAINED	09SP			0	WF_TAP – GRAPEVINE 230KV
NO SOLUTION OBTAINED	09SP			0	WF_TAP – ELK CITY 230KV
NO SOLUTOIN OBTAINED	09SP			0	ELK CITY 230/115KV TRANSFORMER
2009 Winter Peak					
'CUNNINGHAM STATION 230/115KV TRANSFORMER CKT 1'	09WP	168	113.8755	0	'LEA COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	09WP	143	156.8314	5	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'LEA COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	09WP	168	117.1228	82	'CUNNINGHAM STATION 230/115KV TRANSFORMER CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	09WP	287	151.9749	92	'2006-02T 230.00 - GRAPEVINE INTERCHANGE 230KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	09WP	287	129.1431	152	'HEDLEY - NORTH MEMPHIS REC 69KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	09WP	351	131.1605	162	'2006-02T 230.00 - GRAPEVINE INTERCHANGE 230KV CKT 1'
'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	09WP	72	108.3985	195	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	09WP	319	117.9561	204	'BASE CASE'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	09WP	351	108.8477	248	'HEDLEY - NORTH MEMPHIS REC 69KV CKT 1'
'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'	09WP	192	106.309	252	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'
'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'	09WP	192	104.923	263	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'
NO SOLUTION OBTAINED	09WP			0	NICHOLS – YARNELL 115KV
NO SOLUTION OBTAINED	09WP			0	YARNELL – CONWAY 115KV
NO SOLUTOIN OBTAINED	09WP			0	WF_TAP – GRAPEVINE 230KV
NO SOLUTION OBTAINED	09WP			0	WF_TAP – ELK CITY 230KV
NO SOLUTOIN OBTAINED	09WP			0	ELK CITY 230/115KV TRANSFORMER

Table 5: Contingency Analysis (continued)

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
2012 Summer Peak					
'166TH STREET - JARBALO JUNCTION SWITCHING STATION 115KV CKT 1'	12SP	97	999	0	'GEN542957 1'
'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	12SP	72	116.9278	38	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	12SP	143	133.492	115	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	12SP	287	129.9852	158	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	12SP	287	121.3898	192	'KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	12SP	351	110.1498	244	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	12SP	319	107.084	262	'BASE CASE'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	12SP	351	102.5746	285	'KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1'
'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'	12SP	170	101.0708	293	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'
NO SOLUTION OBTAINED	12SP			0	NICHOLS – YARNELL 115KV
NO SOLUTION OBTAINED	12SP			0	YARNELL – CONWAY 115KV
NO SOLUTOIN OBTAINED	12SP			0	WF_TAP – GRAPEVINE 230KV
NO SOLUTION OBTAINED	12SP			0	WF_TAP – ELK CITY 230KV
2012 Winter Peak					
'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	12WP	143	158.8029	0	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	12WP	351	999	13	'AMOCO TAP - CHILDRESS 69KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	12WP	287	137.5622	111	'GEN560002 1'
'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	12WP	72	111.9991	147	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	12WP	287	129.4568	150	'GEN509403 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	12WP	319	119.5839	196	'BASE CASE'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	12WP	351	117.3248	202	'TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1'
'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'	12WP	192	108.1051	239	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'
'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'	12WP	192	106.7239	250	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'
NO SOLUTION OBTAINED	12WP			0	NICHOLS – YARNELL 115KV
NO SOLUTION OBTAINED	12WP			0	YARNELL – CONWAY 115KV
NO SOLUTOIN OBTAINED	12WP			0	WF_TAP – GRAPEVINE 230KV
NO SOLUTION OBTAINED	12WP			0	WF_TAP – ELK CITY 230KV
NO SOLUTOIN OBTAINED	12WP			0	ELK CITY 230/115KV TRANSFORMER
2017 Summer Peak					
'CHEEK - DAYTONA BULK B 138KV CKT 1'	17SP	170	115.0927	0	'CROCKETT - GRIMES 345KV CKT 1'
'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	17SP	72	120.9311	0	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	17SP	143	130.7042	128	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'

Table 5: Contingency Analysis (continued)

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	17SP	287	129.2988	162	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	17SP	72	106.7944	176	'KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1'
'MOORE COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	17SP	252	102.6858	214	'HERRING TAP - RIVERVIEW INTERCHANGE 115KV CKT 1'
'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	17SP	287	116.6006	216	'KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	17SP	351	109.9553	246	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
'2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1'	17SP	319	102.5969	286	'BASE CASE'
'SPEARMAN INTERCHANGE - SPEARMAN SUB 115KV CKT 1'	17SP	161	100.1189	298	'HANSFORD 3 115.00 - TEXAS COUNTY INTERCHANGE 115KV CKT 1'
'MUSKOGEE - PECAN CREEK 345KV CKT 1'	17SP	478	106.7825	298	'CLARKSVILLE - MUSKOGEE 345KV CKT 1'
'JACKSONVILLE (SWE-RC-ETEC) - OVERTON 138KV CKT 1'	17SP	235	104.7888	299	'LEBROCK - TENASKA RUSK COUNTY 345KV CKT 1'
'CASTRO COUNTY INTERCHANGE - DEAF SMITH REC-#15 & #19 69KV CKT 1'	17SP	54	102.7674	299	'SPP-SWPS-24'
NO SOLUTION OBTAINED	17SP			0	NICHOLS – YARNELL 115KV
NO SOLUTION OBTAINED	17SP			0	YARNELL – CONWAY 115KV
NO SOLUTOIN OBTAINED	17SP			0	WF_TAP – GRAPEVINE 230KV
NO SOLUTION OBTAINED	17SP			0	WF_TAP – ELK CITY 230KV
NO SOLUTOIN OBTAINED	17SP			0	ELK CITY 230/115KV TRANSFORMER
NO SOLUTION OBTAINED	17SP			0	NICHOLS – YARNELL 115KV

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 $500,000 for Direct Assignment facilities and Network Upgrades. These costs exclude upgrades of other transmission facilities that were listed in Table 4 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 60 MVars of 34.5 kV capacitors in the Customer 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.

In Table 5, 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 Impact Study, a better determination of the interconnection facilities may be available.

The required interconnection costs listed in Table 2 and other upgrades associated with Network Constraints listed in Table 4 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.

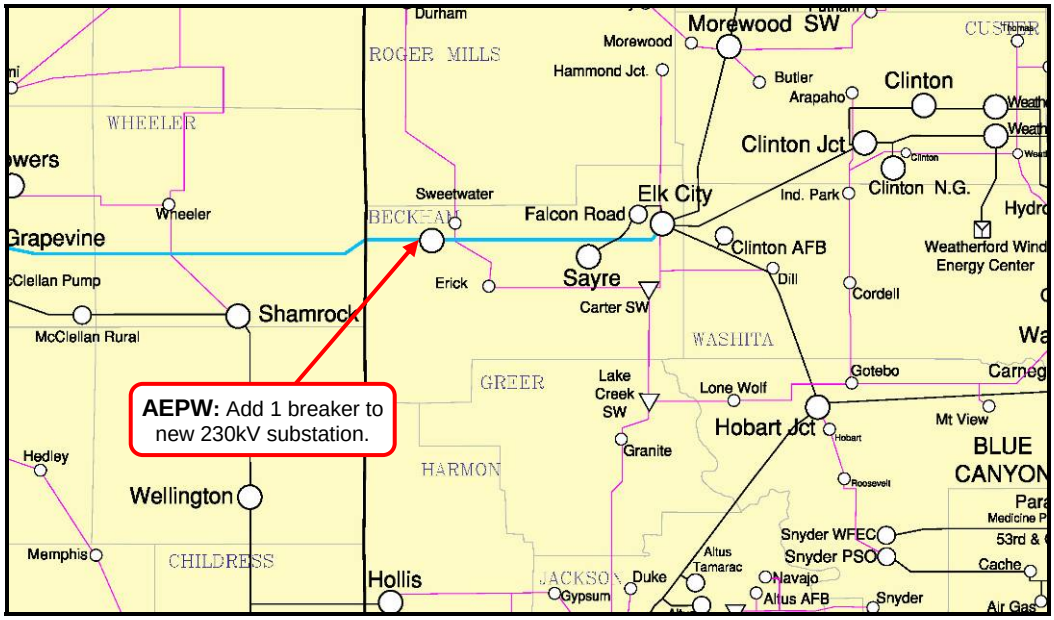

FIGURE 2. MAP OF THE LOCAL AREA