SPP Southwest Power Pool

Feasibility Study For Generation Interconnection Request GEN-2006-028

SPP Tariff Studies
(#GEN-2006-028)

December, 2006

Executive Summary

<OMITTED TEXT> (Customer) has requested a Feasibility study for the purpose of interconnecting 300MW/360MW (summer/winter rating) of generation within the control area of Westar Energy (Westar) in Lyon County, Kansas. The proposed method of interconnection is to interconnect into a new 345kV switching station that is proposed to be built to accommodate SPP generation interconnection (GI) request #GEN-2006-027. This station is proposed to be a 5 position breaker-and-a-half 345kV substation on the Lang-Morris County 345kV transmission line owned by Westar. The studied GI request, GEN-2006-028, will add two more terminals to this station. The proposed in-service date for the generation is May 1, 2009.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 300/360MW of generation with transmission system reinforcements within the local transmission systems.

The requirements to interconnect the 300/360MW of generation at a new switching station on the Lang-Morris County 345kV line will consist of adding two new generator terminals to the Westar 345kV switching station proposed to be built on the Lang-Morris County 345kV transmission line for request GEN-2006-027. The total minimum cost for adding the 345kV terminals to this station is $3,347,399 and is shown in Table 2. If the prior queued request, GEN-2006-027, withdraws from the SPP generation interconnection queue, then the interconnection costs for GEN-2006-028 will be the $21,298,275 and is shown in Table 3. Other Network Constraints in the Westar transmission system 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. These costs do not include building the 345kV lines/buswork from the Customer' facilities into the new 345kV substation.

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.

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.

Introduction

<OMITTED TEXT> (Customer) has requested a Feasibility study for the purpose of interconnecting 300MW/360MW (summer/winter rating) of generation within the control area of Westar Energy (Westar) in Lyon County, Kansas. The proposed method of interconnection is to add an additional two 345kV terminals to the 345kV switching station proposed to be built in the study for GEN-2006-027. This station includes five 345kV terminals in a breaker-and-a-half configuration in the existing Lang-Morris County 345kV transmission line. This line is owned by Westar. The proposed in-service date is May 1, 2009.

Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the plant into 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 300/360MW consist of adding two new GSUs by the Customer as part of its new facilities. The GSUs will have a high side of 345kV and a low side determined by each of the generator's voltage. The specifics of the number of generators and the generator configuration will be addressed in the Impact Study if the Customer wishes to pursue this request into an Impact Study. The GSUs will interconnect into the new Westar 345kV switching station via two new 345kV terminals. A specific layout for the Customer's 345kV facilities to serve the GSU and associated equipment has not been defined. The 345kV switching station will also have three generator terminals for GEN-2006-027 and two line terminals to Lang 345kV and Morris County 345kV substation.

The total estimated cost for Westar to add two additional 345kV generator terminals to the earlier proposed 345kV switching station for GEN-2006-027 is $3,347,399. This cost is shown in Table 2. If request GEN-2006-027 withdraws from the SPP generation interconnection queue, the cost to interconnect this request, GEN-2006-028, will be $21,298,275. This costs includes the construction of the new 345kV substation in a breaker-and-a-half configuration and to make transmission line modifications to the existing Lang-Morris County 345kV line. These costs are shown in Table 3. These estimates will be refined during the development of the impact study based on the final designs. Other Network Constraints in the Westar transmission system that were identified are listed in Table 4. This cost does not include building the 345kV facilities from the Customer substation into the new Westar 345kV substation. The Customer is responsible for these 345kV facilities up to the point of interconnection.

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

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 – 345kV-GSU voltage Substation facilities.	*
Customer – 345kV facilities between Customer facilities and Westar 345kV switching station	*
Customer - Right-of-Way for Customer facilities.	*
Total	*****

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

Table 2: Required Interconnection Network Upgrade Facilities

Facility	ESTIMATED COST (2006 DOLLARS)
Westar – Add two 345kV generator terminals to the 345kV switching station proposed to be built for G.I. request GEN-2006-027.	$3,347,399
Total	**$3,347,399**

Table 3: Required Interconnection Network Upgrade Facilities (if GEN-2006-027 withdraws)

Facility	ESTIMATED COST (2006 DOLLARS)
Westar – Build 345kV switching station in a breaker-and-a-half configuration. Initial layout of the station to have six 345kV circuit breakers, associated switches, steel, relaying and associated equipment. Station to include terminals to the three generators and line terminals to Lang and Morris County substations	$20,798,275
Westar – 345kV transmission work – Cutting in the Lang-Morris County 345kV line into the new switching station.	$500,000
Total	**$21,298,275**

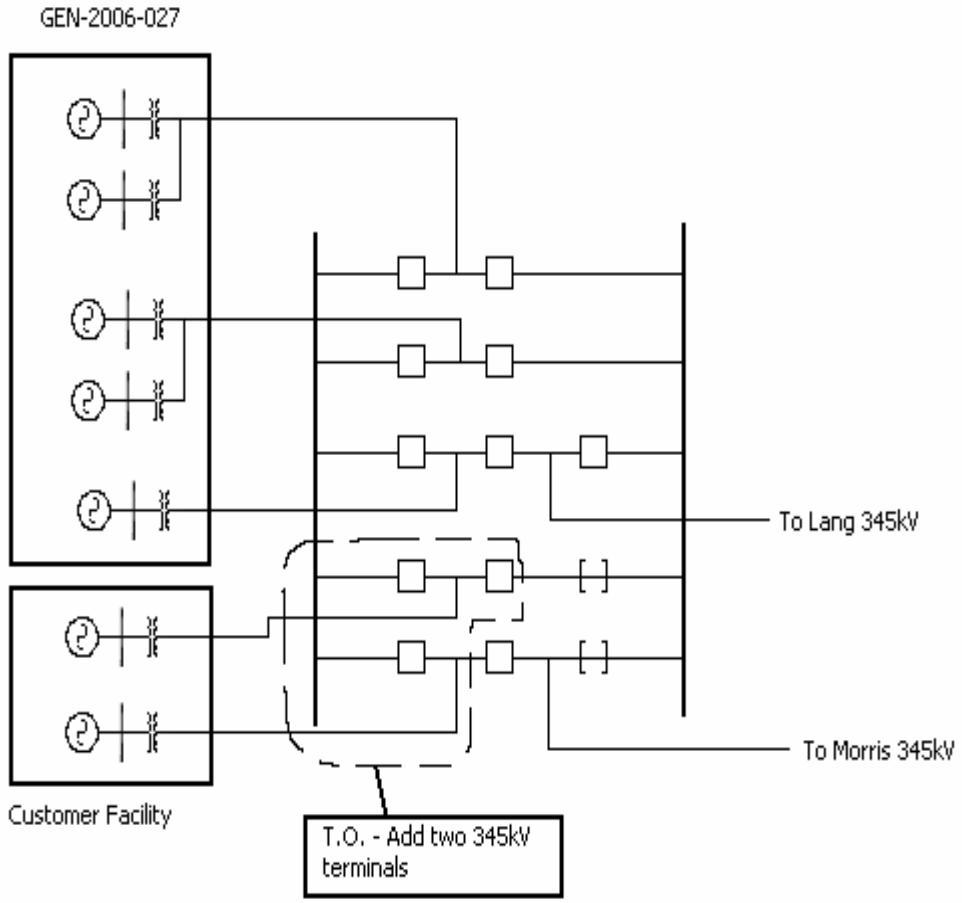

Figure 1: Proposed Interconnection
(Final substation design to be determined

Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2008 & 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 May 1, 2008. The available seasonal models used were through the 2016 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 300/360MW and location, additional criteria violations will occur on the existing Westar transmission systems under steady state and contingency conditions in the peak seasons.

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.

There are several other proposed generation additions in the general area of the Customer's facility. These 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.

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 Missouri Public Service (MIPU), Westar (WERE), Kansas City Power & Light (KCPL), West Plains (WEPL), Midwest Energy (MIDW), 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

NETWORK CONSTRAINTS
WERE - '95TH & WAVERLY - CAPTAIN JUNCTION 115KV CKT 1'
WERE - 'AUBURN ROAD - JEFFREY ENERGY CENTER 230KV CKT 1'
WERE - 'AUBURN ROAD - SHERWOD 115KV CKT 1'
WERE - 'CIRCLEVILLE - HOYT HTI SWITCHING JUNCTION 115KV CKT 1'
WERE - "CIRCLEVILLE - KING HILL N.M. COOP 115KV CKT 1'
WERE - 'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'
WERE - 'KELLY - KING HILL N.M. COOP 115KV CKT 1'
WERE - 'LAWRENCE HILL - MIDLAND JUNCTION 230KV CKT 1'
WERE - 'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'
WERE - 'MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1'
WERE - 'MOCKINGBIRD HILL SWITCHING STATION - STULL SWITCHING STATION 115KV CKT 1'
WERE - KCPL 'STILWELL - SWISSVALE 345KV CKT 1'
WERE - 'STULL SWITCHING STATION - TECUMSEH HILL 115KV CKT 1'

Table 5. Contingency Analysis

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
2008 SUMMER PEAK					
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	08sp	1076	119.5	0	'GEN-2006-027 – LANG 345kV'
'LAWRENCE ENERGY CENTER UNIT 5 - LAWRENCE HILL 230KV CKT 1'	08sp	478	104.9	0	'GILL ENERGY CENTER EAST (GEC3 GSU) 138/69/14.4KV TRANSFORMER CKT 1'
'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'	08sp	308	132.2	0	'MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1'
'LAWRENCE HILL - MIDLAND JUNCTION 230KV CKT 1'	08sp	359	101.9	185	'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'
2008 WINTER PEAK					
'CIRCLEVILLE - HOYT HTI SWITCHING JUNCTION 115KV CKT 1'	08wp	97	142.6	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'CIRCLEVILLE - KING HILL N.M. COOP 115KV CKT 1'	08wp	92	136.2	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	08wp	1076	123.6	0	'GEN-2006-027 – LANG 345kV'
'KELLY - KING HILL N.M. COOP 115KV CKT 1'	08wp	92	134.1	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'STILWELL - SWISSVALE 345KV CKT 1'	08wp	721	127.8	0	'LANG - WICHITA 345KV CKT 1'
2011 SUMMER PEAK					
'CIRCLEVILLE - HOYT HTI SWITCHING JUNCTION 115KV CKT 1'	11sp	97	136.5	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'CIRCLEVILLE - KING HILL N.M. COOP 115KV CKT 1'	11sp	92	123.2	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'KELLY - KING HILL N.M. COOP 115KV CKT 1'	11sp	92	120.1	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'LAWRENCE ENERGY CENTER UNIT 5 - LAWRENCE HILL 230KV CKT 1'	11sp	478	107.0	0	'GILL ENERGY CENTER EAST (GEC3 GSU) 138/69/14.4KV TRANSFORMER CKT 1'

Table 5: Contingency Analysis

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'	11sp	308	131.1	0	'MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1'
'MOCKINGBIRD HILL SWITCHING STATION - STULL SWITCHING STATION 115KV CKT 1'	11sp	92	127.0	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'STULL SWITCHING STATION - TECUMSEH HILL 115KV CKT 1'	11sp	92	133.6	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	11sp	1076	116.2	0	'GEN-2006-027 – LANG 345kV'
'SWISSVALE (SWISV10X) 345/230/14.4KV TRANSFORMER CKT 1'	11sp	440	110.0	150	'GEN-2006-027 – LANG 345kV'
'TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1'	11sp	560	101.1	179	'GEN:51442 1'
'LAWRENCE HILL - MIDLAND JUNCTION 230KV CKT 1'	11sp	359	101.0	240	'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'
2011 WINTER PEAK					
'95TH & WAVERLY - CAPTAIN JUNCTION 115KV CKT 1'	11wp	118	114.6	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'CIRCLEVILLE - HOYT HTI SWITCHING JUNCTION 115KV CKT 1'	11wp	97	151.7	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'CIRCLEVILLE - KING HILL N.M. COOP 115KV CKT 1'	11wp	92	146.9	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'KELLY - KING HILL N.M. COOP 115KV CKT 1'	11wp	92	144.8	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	11wp	1076	120.8	0	'GEN-2006-027 – LANG 345kV'
'STILWELL - SWISSVALE 345KV CKT 1'	11wp	721	106.6	262	'LANG - WICHITA 345KV CKT 1'
2016 SUMMER PEAK					
'AUBURN ROAD - JEFFREY ENERGY CENTER 230KV CKT 1'	16sp	565	120.7	0	'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'

Table 5: Contingency Analysis

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
'LAWRENCE HILL - MIDLAND JUNCTION 230KV CKT 1'	16sp	359	107.8	0	'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'
'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'	16sp	308	138.4	0	'MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1'
'MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1'	16sp	308	125.5	0	'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'
'SPSNORTH_STH'	16sp	800	107.0	0	'BASE CASE'
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	16sp	1076	115	0	'GEN-2006-027 – LANG 345kV'
'SPPSPSTIES'	16sp	899	102.9	164	'BASE CASE'
'AUBURN ROAD - SHERWOD 115KV CKT 1'	16sp	240	101.4	206	'HOYT - JEFFERY ENERGY CENTER 345KV 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 $3,347,399 for Westar's interconnection Network Upgrade facilities listed in Table 2. These costs exclude upgrades of other transmission facilities by Westar 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. If generation interconnection request #GEN-2006-027 withdraws from the GI queue, the interconnection costs for this request will be $21,298,275 as shown in Table 3. As stated earlier, 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.

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