



***Feasibility Study  
For  
Generation Interconnection  
Request  
GEN-2006-027***

***SPP Tariff Studies  
(#GEN-2006-027)***

**December, 2006**

## **Executive Summary**

<OMITTED TEXT> (Customer) has requested a Feasibility study for the purpose of interconnecting 310MW/380MW (summer/winter rating) of generation within the control area of Westar Energy (Westar) in Lyon County, Kansas. The proposed method of interconnection is to build a new 345kV switching station on the Lang-Morris County 345kV transmission line owned by Westar. The proposed in-service date is May 1, 2008.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 310/380MW of generation with transmission system reinforcements within the local transmission systems.

The requirements to interconnect the 310/380MW of generation at a new switching station on the Lang-Morris County 345kV line will consist of building a new 345kV breaker-and-a-half substation. The total minimum cost for building the 345kV switching substation and associated transmission line work required for stand alone interconnection is \$23,298,275. These costs are shown in Table 2. Other Network Constraints in the Westar transmission system 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. These costs do not include building the 345kV lines/buswork from the Customer' facilities into the new 345kV substation.

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.

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 310MW/380MW (summer/winter rating) of generation within the control area of Westar Energy (Westar) in Lyon County, Kansas. The proposed method of interconnection is to build a five terminal 345kV substation 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, 2008.

## 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 310/380MW consist of adding three 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 three new 345kV terminals. A specific layout for the Customer's 345kV facilities to serve the GCU and associated equipment has not been defined. The 345kV switching station will also have line terminals to Lang 345kV and Morris County 345kV substation.

The total estimated cost for Westar to construct 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 is \$23,298,275. Other Network Constraints in the Westar transmission system 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 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. **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.

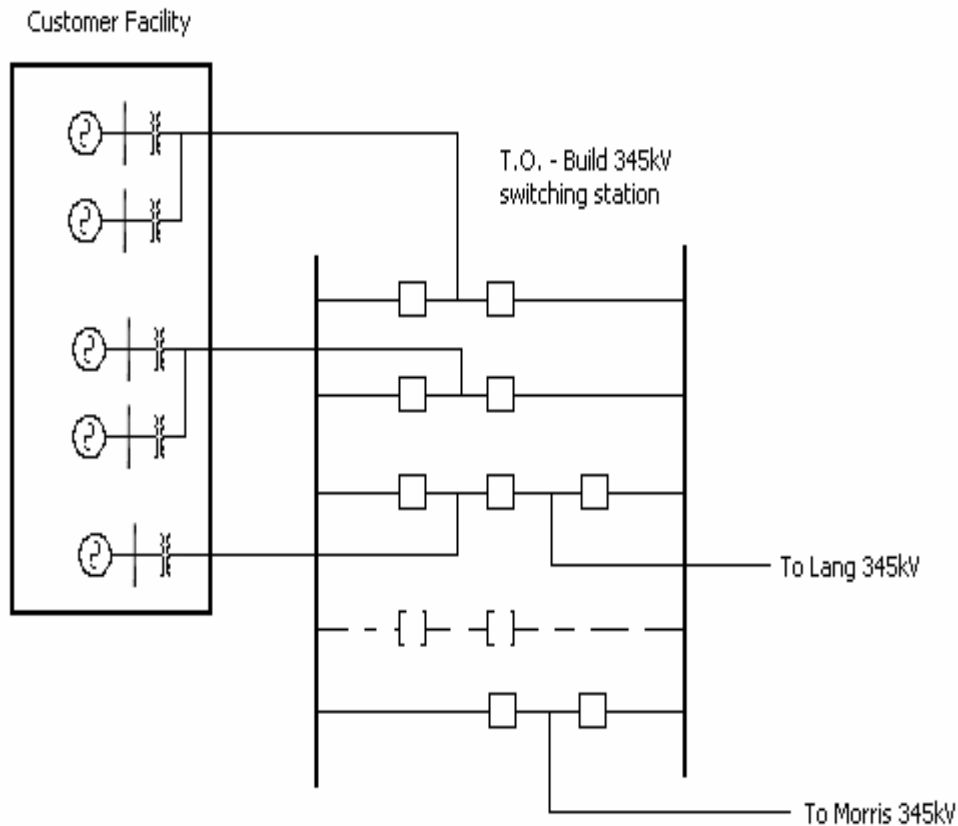
**Table 1: Direct Assignment Facilities**

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.	*
<b>Total</b>	*

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

**Table 2: Required Interconnection Network Upgrade Facilities**

Facility	ESTIMATED COST (2006 DOLLARS)
Westar – Build 345kV switching station in a breaker-and-a-half configuration. Initial layout of the station to have eight 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	\$22,798,275
Westar – 345kV transmission work – Cutting in the Lang-Morris County 345kV line into the new switching station.	\$500,000
<b>Total</b>	<b>\$23,298,275</b>



**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 310/380MW 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 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.

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 I hereafter referred to as NERC Table I) 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 3: Network Constraints**

NETWORK CONSTRAINTS
WERE - 'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'
WERE - 'JARBALO JUNCTION SWITCHING STATION - STRANGER CREEK 115KV CKT 1'
WERE - 'LAWRENCE HILL - MIDLAND JUNCTION 230KV CKT 1'
WERE - 'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'
WERE - STULL SWITCHING STATION - TECUMSEH HILL 115KV CKT 1'

**Table 4: Contingency Analysis**

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
<b>2008 SUMMER PEAK</b>					
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	08sp	1076	107.6	0	'GEN-2006-027 – LANG 345kV'
'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'	08sp	308	126.7	0	'MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1'
<b>2008 WINTER PEAK</b>					
STULL SWITCHING STATION - TECUMSEH HILL 115KV CKT 1'	08wp	92	121.9	0	'HOYT - STRANGER CREEK 345KV CKT 1'
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	08wp	1076	107.7	80	'GEN-2006-027 – LANG 345kV'
<b>2011 SUMMER PEAK</b>					
'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'	11sp	308	125.1	0	'MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1'
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	11sp	1076	102.3	270	'GEN-2006-027 – LANG 345kV'
<b>2011 WINTER</b>					
'SWISSVALE (SWISV10X) 345/230/14.4KV TRANSFORMER CKT 1'	11wp	440	115.1	294	'GEN-2006-027 – LANG 345kV'
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	11wp	1076	104.8	323	'GEN-2006-027 – LANG 345kV'
<b>2016 SUMMER PEAK</b>					
'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'	16sp	308	130.3	0	'MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1'
'JARBALO JUNCTION SWITCHING STATION - STRANGER CREEK 115KV CKT 1'	16sp	240	103.8	260	'GEN:56663 1'
'LAWRENCE HILL - MIDLAND JUNCTION 230KV CKT 1'	16sp	359	100.6	272	'LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1'
'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'	16sp	1076	102.3	278	'GEN-2006-027 – LANG 345kV'

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 \$23,298,275 for Westar's interconnection Network Upgrade facilities listed in Table 2. These costs exclude upgrades of other transmission facilities by Westar 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. As stated earlier, the 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**