



***Feasibility Study  
For  
Generation Interconnection  
Request  
GEN-2007-003***

***SPP Tariff Studies  
(#GEN-2007-003)***

**September 2007**

## **Executive Summary**

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 30 MW of generation within the control area of Sunflower Electric Power Corporation (SUNC) located in Sherman County, Kansas. The proposed method of interconnection is to add a new 115 kV breaker and line terminal at the City of Goodland substation, owned by the City of Goodland, Kansas. The proposed in-service date is September 1, 2007.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 30 MW of generation with transmission system reinforcements within the local transmission system.

The requirement to interconnect the 30 MW of generation consists of adding a new 115 kV breaker and line terminal into the City of Goodland substation, located within the control area of SUNC. The Customer did not propose a specific route for the 115 kV line extending to serve its 115/12.47 kV switching 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.

The total minimum cost for building the required facilities for this 30 MW of generation is \$497,594. These costs are shown in Tables 1 and 2. Network constraints in Midwest Energy (MIDW) and West Plains (WEPL) 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. This cost does not include building the 115 kV line from the Customer 115/12.47 kV switching substation into the point of interconnection. This cost also does not include the Customer's 115/12.47 kV switching 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.

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 MIDW, SUNC, and WEPL 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.

## **Introduction**

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 30 MW of generation within the control area of Sunflower Electric Power Corporation (SUNC) located in Sherman County, Kansas. The proposed method of interconnection is to add a new 115 kV breaker and line terminal at the City of Goodland substation, owned by the City of Goodland, Kansas. The proposed in-service date is September 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 30 MW consist of adding a new 115 kV breaker and line terminal into the City of Goodland substation, located within the control area of SUNC. The Customer did not propose a specific route of its 115 kV line to serve its 115/12.47 kV switching system facilities. It is assumed that obtaining all necessary right-of-way for construction of the Customer 115 kV transmission line and the 115/12.47 kV switching substation will not be a significant expense.

The total minimum cost for adding a new breaker and terminating the transmission line serving GEN-2007-003 facilities is estimated at \$497,594. These are listed in Tables 1 and 2. These cost 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 115 kV transmission line extending from the point of interconnection to serve its 115/12.47 kV switching facilities. This cost also does not include the Customer's 115/12.47 kV switching substation, all of which should be determined by the Customer. The Customer is responsible for these 115 – 12.47 kV facilities up to the point of interconnection. Network constraints in the local transmission systems that were identified are shown in Table 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 facilities are shown in Figure 1.

## Interconnection Estimated Costs

TABLE 1: Direct Assignment Facilities

OWNER	REQUIRED FACILITY	ESTIMATED COST (2007 DOLLARS)
CUSTOMER	(1) 115/12.47 kV Customer switching facilities.	*
CUSTOMER	(1) 115 kV transmission line from Customer switching facilities to the City of Goodland substation.	*
CUSTOMER	Right-of-Way for all Customer facilities.	*
CITY OF GOODLAND	(1) 115 kV breaker and line terminal for GEN-2007-003 at the City of Goodland substation.	\$497,594
<b>TOTAL</b>		<b>*</b>

\* Estimates of cost to be determined.

TABLE 2: Required Interconnection Network Upgrade Facilities

OWNER	REQUIRED FACILITY	ESTIMATED COST (2007 DOLLARS)
	None identified at this time.	*
<b>TOTAL</b>		<b>*</b>

\* Estimates of cost to be determined.

## Proposed Interconnection Method

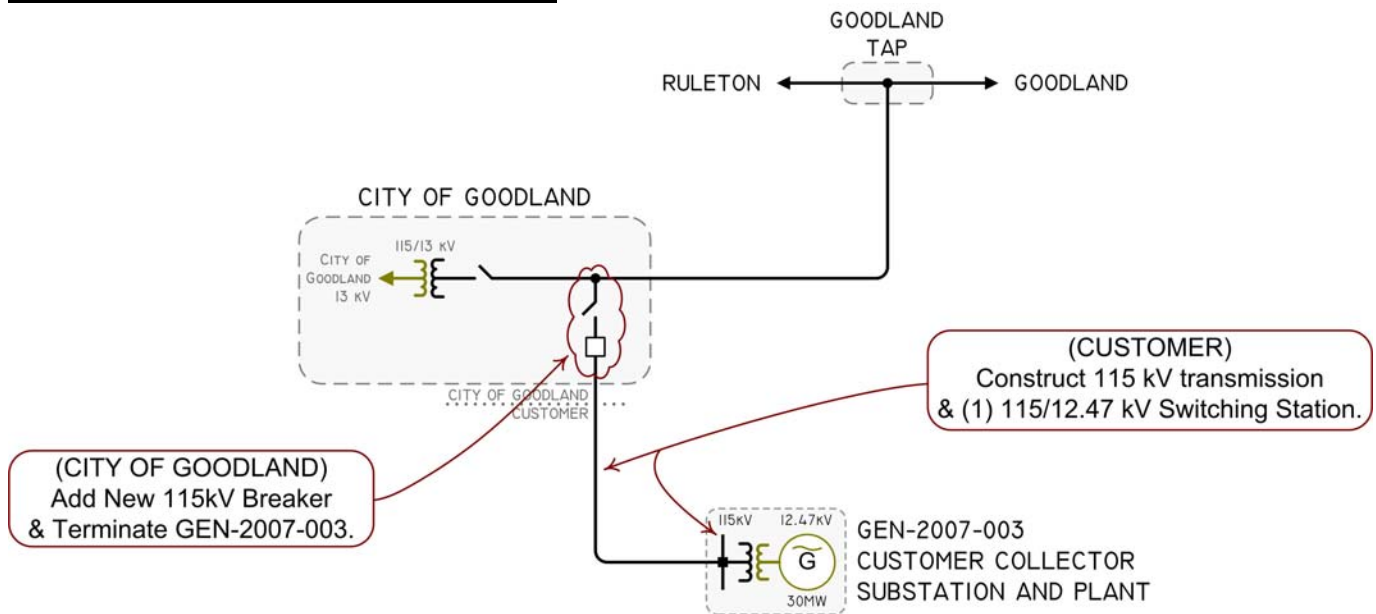


FIGURE 1: Proposed Method of Interconnection (Final design to be determined)

## **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 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 1, 2007. 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 30 MW and location, additional criteria violations will occur on the existing Midwest Energy (MIDW) and West Plains (WEPL) 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.

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 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 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.

## Powerflow Results

**TABLE 4: Network Constraints**

<b>AREA</b>	<b>OVERLOADED ELEMENT</b>
WEPL	GREAT BEND TAP - SEWARD 115KV CKT 1
WEPL	HARPER - MEDICINE LODGE 138KV CKT 1
WEPL	MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1
MIDW/WEPL	MULLERGREN - S HAYS6 230.00 230KV CKT 1
WEPL	SEWARD - ST JOHN 115KV CKT 1
MIDW	Midwest Energy
WEPL	West Plains

**TABLE 5: Contingency Analysis**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
08SP	SEWARD - ST JOHN 115KV CKT 1	79	113	0	CIRCLE - MULLERGRENN 230KV CKT 1
08WP	MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1	65	115	0	SPP-SWPS-04A: LAMAR – FINNEY SWITCHING STATION 345KV CKT 1, FINNEY SWITCHING STATION – POTTER COUNTY INTERCHANGE 345KV CKT 1
08WP	MULLERGRENN - S HAYS6 230.00 230KV CKT 1	147	112	0	KNOLL 230 - SMOKYHILLS 230.00 230KV CKT 1
08WP	HARPER - MEDICINE LODGE 138KV CKT 1	71	106	0	SPP-SWPS-04A: LAMAR – FINNEY SWITCHING STATION 345KV CKT 1, FINNEY SWITCHING STATION – POTTER COUNTY INTERCHANGE 345KV CKT 1
09SP	SEWARD - ST JOHN 115KV CKT 1	79	121	0	CIRCLE - MULLERGRENN 230KV CKT 1
09SP	MULLERGRENN - S HAYS6 230.00 230KV CKT 1	147	111	0	KNOLL 230 - SMOKYHILLS 230.00 230KV CKT 1
09SP	GREAT BEND TAP - SEWARD 115KV CKT 1	89	102	0	CIRCLE - MULLERGRENN 230KV CKT 1
09WP	MULLERGRENN - S HAYS6 230.00 230KV CKT 1	147	112	0	KNOLL 230 - SMOKYHILLS 230.00 230KV CKT 1
09WP	SEWARD - ST JOHN 115KV CKT 1	79	111	0	CIRCLE - MULLERGRENN 230KV CKT 1
12SP	SEWARD - ST JOHN 115KV CKT 1	79	108	0	GREENSBURG - JUDSON LARGE 115KV CKT 1
12WP	MULLERGRENN - S HAYS6 230.00 230KV CKT 1	147	104	0	KNOLL 230 - SMOKYHILLS 230.00 230KV CKT 1
17SP	None identified at this time.				

*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.*

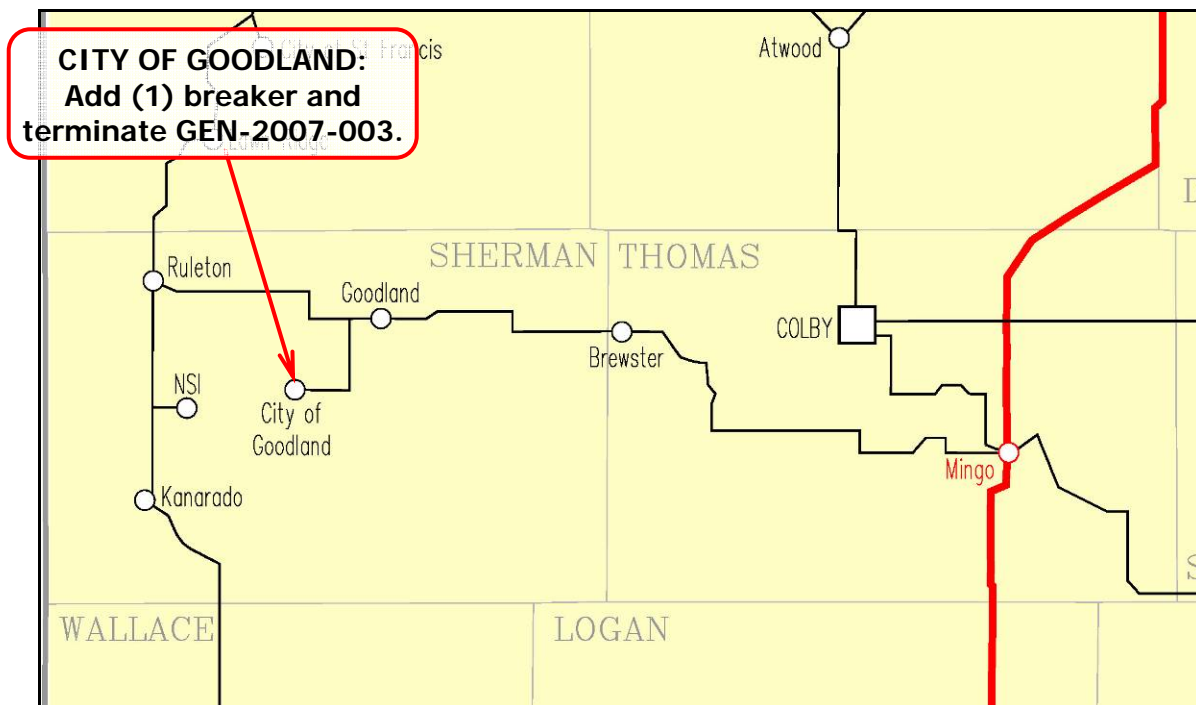
## Conclusion

The minimum cost of interconnecting the Customer's interconnection request is estimated at \$497,594 for Direct Assignment Facilities and Network Upgrades listed in Tables 1 and 2. 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, 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.



**FIGURE 2. Point of Interconnection Area Map**