
# *Feasibility Study For Generation Interconnection Request GEN-2006-042*

***SPP Tariff Studies***
***(#GEN-2006-042)***

**April, 2007**

## Executive Summary

<OMITTED TEXT> (Customer) has requested a Feasibility study for the purpose of interconnecting 600 MW nominal rating of coal fired generation within the control area of Oklahoma Gas & Electric (OKGE) in LeFlore County, Oklahoma. The proposed method of interconnection is to build a new 345kV three-breaker ring bus switching station approximately 12 miles south of the existing Fort Smith – Muskogee 345kV transmission line, which is owned by OKGE. The proposed tap point of the Fort Smith – Muskogee 345kV line would be approximately 12 miles west of Fort Smith substation. The proposed in-service date is June 1, 2012.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 600 MW of generation with transmission system reinforcements within the local transmission system.

The requirement to interconnect the 600 MW of generation includes building a new 345kV three breaker ring bus switching station near the Customer plant site in LeFlore County, Oklahoma. This switching station will be the point of interconnection. From the 345kV switching station, OKGE will build two separate 345kV, 12 mile transmission lines, built on separate towers, that will extend from the Customer plant to a point on the Fort Smith – Muskogee 345kV transmission line. This proposed point is approximately 12 miles west of Fort Smith substation.

The total minimum cost for building the required facilities for this 600 MW of generation is $29,000,000. These costs are shown in Table 2. Other Network Constraints in the OKGE transmission systems 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. This cost does not include building the 345 kV connections from the Customer generator into the new 345 kV ring bus.

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 area 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.

## Introduction

<OMITTED TEXT> (Customer) has requested a Feasibility study for the purpose of interconnecting 600 MW nominal rating of coal fired generation within the control area of Oklahoma Gas & Electric (OKGE) in LeFlore County, Oklahoma. The proposed method of interconnection is to build a new 345kV three-breaker ring bus switching station approximately 12 miles south of the existing Fort Smith – Muskogee 345kV transmission line, which is owned by OKGE. The proposed tap point of the Fort Smith – Muskogee 345kV line would be approximately 12 miles west of Fort Smith substation. The proposed in-service date is June 1, 2012.

## 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 600 MW consist of constructing a new 345 kV three-breaker ring-bus substation near the plant site. The substation will have 345kV line terminals to Muskogee, Fort Smith, and the GSU for the unit. This substation will serve as the point of interconnection (POI). From the POI, OKGE will build two 345kV line on separate towers to a point on the Fort Smith – Muskogee 345kV line approximately 12 miles west of Fort Smith substation. Each of these 345kV lines will be approximately 12 miles in length. At this proposed point, the Fort Smith – Muskogee transmission line will be opened and looped through the new 345kV substation at the plant site. The Customer will be responsible for the 345kV connections from its generator to the 345kV ring bus.

The total cost for building a new 345 kV three breaker ring switching station and the twenty four miles of new 345kV line construction, is estimated at $29,000,000. Other Network Constraints in the OKGE transmission systems 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 345 kV facilities from the Customer generator into the new 345 kV ring bus.

The costs of interconnecting the generating facility to the OKGE transmission system are listed in Tables 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 (2007 DOLLARS) |
|---|---|
| Customer – 345/24.0 kV Substation facilities. | * |
| Customer – 345 kV generator leads between the Customer facility and the new 345 kV ring bus. | * |
| 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 (2007 DOLLARS) |
|---|---|
| OKGE – Build 345 kV, 3-breaker ring-bus switching station. Station to include breakers, switches, control relaying, high speed communications, metering and related equipment and all structures | **$18,000,000** |
| OKGE – Build twenty-four miles of 345kV transmission line between the 345kV switching station and a point on the Muskogee – Fort Smith 345kV line. Includes all transmission terminations at both ends. | **$21,000,000** |
| **Total** | **$29,000,000** |

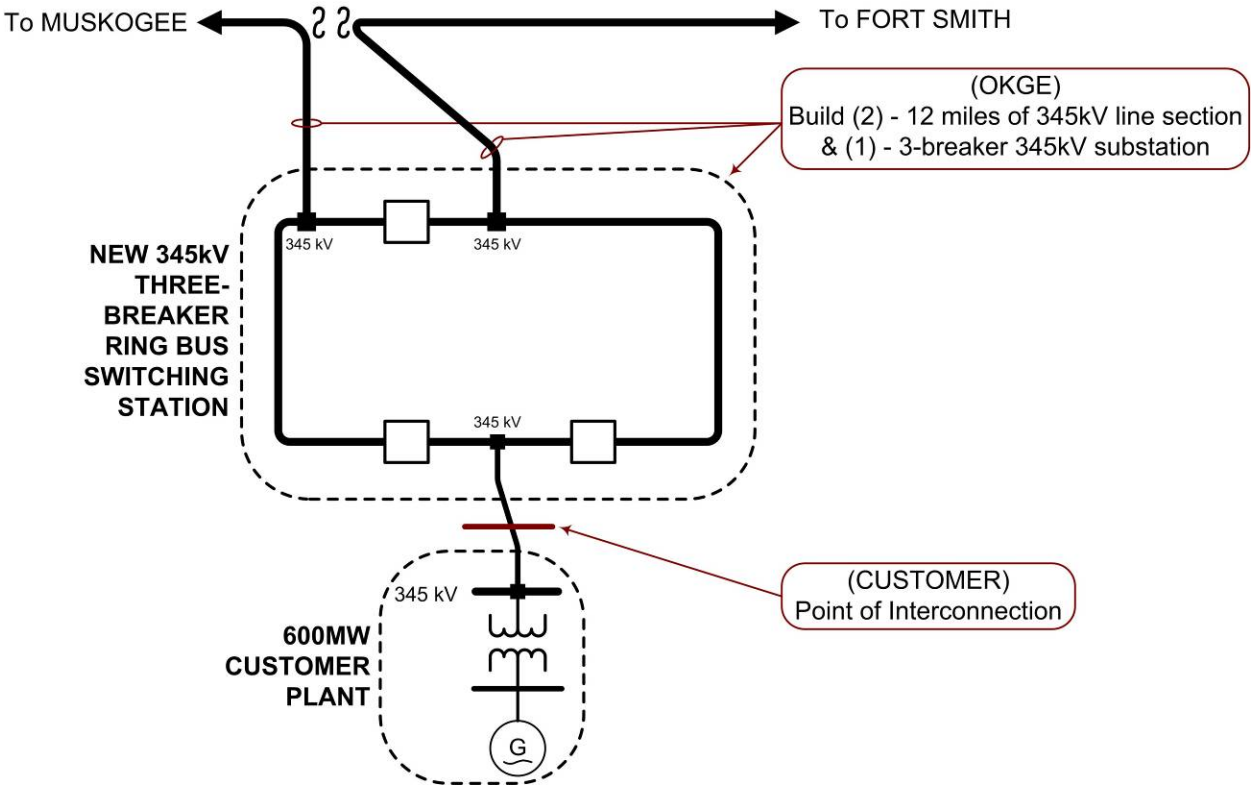


**Figure 1: Proposed Interconnection**
**(Final substation design to be determined)**

## Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2012 summer and winter peak, and 2017 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 June 1, 2012. 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 600 MW and location, additional criteria violations will occur on the existing OKGE 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. Some of the 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 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 3: Network Constraints**

| AREA | ELEMENT |
|---|---|
| OKGE | 'COLONY - FT SMITH 161KV CKT 1' |
| OKGE | 'ARKOMA - FT SMITHW 161KV CKT 1' |
| OKGE | 'MUSKOGEE - PECAN CREEK 345KV CKT 1' |
| OKGE | '3RDST - ARKOMA 161KV CKT 1' |
| OKGE | 'BATTLEFIELD - COLONY 161KV CKT 1' |
| OKGE | Oklahoma Gas and Electric |

## Table 4: Contingency Analysis

| ELEMENT | SEASON | RATE (MVA) | LOADING (%) | ATC (MW) | CONTINGENCY |
|---|---|---|---|---|---|
| **2012 SUMMER PEAK MODEL** | | | | | |
| 'COLONY - FT SMITH 161KV CKT 1' | 12SP | 335 | 113 | 0 | 'FT SMITH - QUANEX TAP 161KV CKT 1' |
| 'ARKOMA - FT SMITHW 161KV CKT 1' | 12SP | 335 | 114 | 20 | 'AES - TARBY 161KV CKT 1' |
| | | | | | |
| **2012 WINTER PEAK MODEL** | | | | | |
| NONE | | | | | |
| | | | | | |
| **2017 SUMMER PEAK MODEL** | | | | | |
| 'COLONY - FT SMITH 161KV CKT 1' | 17SP | 335 | 122 | 0 | 'FT SMITH - QUANEX TAP 161KV CKT 1' |
| 'MUSKOGEE - PECAN CREEK 345KV CKT 1' | 17SP | 478 | 112 | 0 | 'CLARKSVILLE - MUSKOGEE 345KV CKT 1' |
| '3RDST - ARKOMA 161KV CKT 1' | 17SP | 335 | 110 | 171 | 'AES - TARBY 161KV CKT 1' |
| 'BATTLEFIELD - COLONY 161KV CKT 1' | 17SP | 335 | 102 | 468 | 'FT SMITH - QUANEX TAP 161KV 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 $29,000,000 for Direct Assignment facilities and Network Upgrades listed in Tables 1 and 2. These costs exclude upgrades of other transmission facilities that were 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, some but not all of 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.

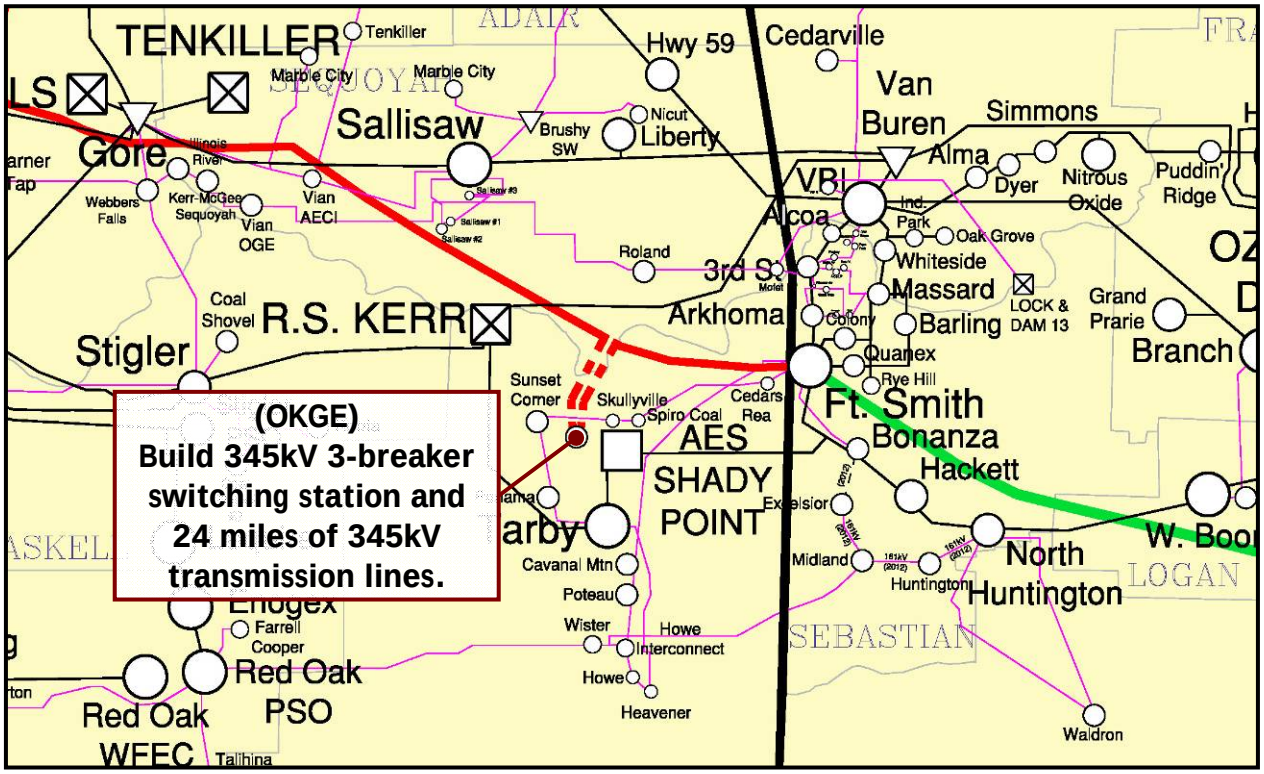


**FIGURE 2. MAP OF THE LOCAL AREA**