SPP Southwest Power Pool

Facility Study for Generation Interconnection Request GEN–2006–019

SPP Tariff Studies
(#GEN-2006-019)

June 2007

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), City Utilities of Springfield (CU) performed the following Facility Study to satisfy the Facility Study Agreement executed by the requesting customer and SPP for SPP Generation Interconnection request Gen-2006-019. The request for interconnection was placed with SPP in accordance SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system.

Generation Interconnection

Facility Study

For

GEN-2006-019

City Utilities of Springfield, MO

June 18, 2007

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Executive Summary

Pursuant to the Southwest Power Pool's (SPP) Open Access Transmission Tariff (OATT) and at the request of SPP, City Utilities of Springfield, MO (SPRM) performed the following Facility Study to satisfy the Facility Study Agreement executed by the requesting Customer for SPP Generation Interconnection request Gen-2006-019. The request for interconnection was placed with SPP in accordance with Attachment V of its Tariff which covers new large generation interconnections on SPP's transmission system.

SPP has requested a Facility Study for interconnecting a steam turbine with ratings of 370 MVA and 300 MW with station service load of 25 MW resulting in net generation of 275 MW. The proposed Point of Interconnection (POI) for this new generation is at a new 161 kV terminal that must be added in the existing Southwest Power Station switch yard that is owned and operated by City Utilities. A second new terminal will also be added in this switch yard to serve the Station Service Transformer #2 that will provide power to this new plant. The proposed In-Service Date for the proposed interconnection facilities is May 1, 2010.

The requirements for interconnection consist of expanding the 161 kV bus and adding two line terminals in the existing Southwest Power Station switch yard. In addition, replacement of one breaker is required. This replacement is due to a lack of interrupting capability of the breaker given the increase in available fault current associated with this proposed generation. Therefore, the current estimate of Network Upgrade costs associated with this proposed generation is $3,200,000. Other Customer Direct Assignment costs associated with the proposed interconnection including items such as

the generator step-up transformer (GSU), station service transformer and associated power lines must be determined by the Customer.

Introduction

<OMITTED TEXT> (Customer) has requested a Facility Study for the purpose of interconnecting a coal-fired steam turbine with a net output of 275 MW in the service territory of City Utilities in Greene County, Missouri. The plant addition consists of one steam unit. The proposed 161 kV POI is at the existing Southwest Power Station switch yard in Greene County. This facility is owned by City Utilities. The proposed In-Service Date is May 1, 2010. SPP has requested that City Utilities develop a Facility Study in accordance with Attachment V in the SPP OATT.

The purpose of this study is to identify the facilities and associated cost estimates that are required to interconnect the new generation with the 161 kV system of City Utilities. This study was developed in conjunction with SPP Feasibility and Impact Studies for Generation Interconnection Request GEN-2006-019.

Based on the power flow analysis as documented in the Impact Study, Network Constraints were identified in the modeled areas of City Utilities and Westar Energy while the new generation is sunk throughout the entire SPP footprint for the Energy Resource (ER) Interconnection request. This dispatch methodology is commonly used to evaluate a Generation Interconnection request in a timely manner. With a defined source and sink in a Transmission Service Request (TSR), this list of Network Constraints will be refined to account for the actual Network Upgrade requirements. A TSR representing

the anticipated dispatch from this new generation facility is currently being evaluated as part of aggregate transmission service studies at SPP.

Interconnection Facilities

The primary objective of this study is to identify facility requirements to interconnect the proposed generation facilities to the existing transmission network. The Point of Interconnection (POI) for the new generation is in the Southwest Power Station 161 kV switch yard. City Utilities will extend its existing 161 kV bus and add new 161 kV terminals to accommodate the new generation facility. In Figure 1, the new bus and terminals are illustrated in the one-line of the Southwest Power Station switch yard. The Direct Assignment Facilities listed in Table 1 are to be defined and cost estimates developed by the Interconnection Customer. The Network Upgrades listed in Table 2 are required in the Southwest Power Station switch yard.

The total cost for City Utilities to add new 161 kV network terminals in the Southwest Power Station switch yard (the Transmission Provider's Interconnection Facilities) is estimated at $3,200,000. This cost does not include the Customer building 161 kV lines into the existing Southwestern Power Station yard terminals. The Customer is responsible for the 161 kV lines up to the POI. This cost does not include the Customer's step-down transformers and the cost should be estimated by the Customer.

This Facility Study does not guarantee the availability of transmission service necessary to deliver the additional generation to any specific point inside or outside the SPP transmission system. The transmission network facilities may not be adequate to deliver

the additional generation output to the transmission system. If the Customer requests firm transmission service under the SPP OATT, Network Upgrades may be required to provide the requested service.

Table 1: Direct Assignment Facilities

Facility	Estimated Cost (2007 Dollars)
Customer – 161 kV step-down facilities.	*
Customer – 161 kV facilities between Customer step-down facilities and Southwest Power Station switch yard terminals.	*
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)
SPRM – Add 161 kV bus, breakers, switches, metering in Southwest Power Station switch yard, and replace one 161 kV breaker.	$3,200,000
Total	$3,200,000

The approximate time lines listed below for the project are based on City Utilities' time for engineering, average procurement and good weather during construction. The amount of time may change if consultants are hired to perform the work.

Engineering	12 weeks
Procurement	24 weeks
Construction	12 weeks
Total	48 weeks

Short Circuit Fault Duty Evaluation

It is standard practice for City Utilities to recommend replacing a circuit breaker when the current through the breaker for a fault exceeds 100% of its interrupting rating without recloser de-rating applied, as determined by the latest edition of ANSI/IEEE C37.5, C37-010 & C37.04 breaker rating methods. City Utilities does not use automatic reclosing. For this generation interconnection, one of City Utilities' breakers was found to exceed its interrupting capability after the addition of the Customer's 275 MW net generation and associated facilities. This 161 kV breaker that needs to be replaced is located in the Southwest Power Station (SWPS) switch yard. As a result, costs associated with the replacement of this breaker as listed in Table 3 were included in the total estimated Network Upgrade cost listed in Table 2.

Table 3: Required Breaker Replacements

Station	Breaker Position	Breaker Number	Breaker Rating (Amps)	Three Phase Fault (Amps)	Single Phase Fault (Amps)
SWPS	Sta. Aux/SWTP	161-28	31,500	27,869	31,686

A short circuit study was performed as part of the Facility Study to determine if fault current levels exceeded equipment ratings at both local facilities and neighboring transmission owners after connecting a 370 MVA generator at SWPS in Greene County, Missouri. The proposed generation connection was modeled as a terminal off of an expanded 161 kV breaker-and-a-half bus configuration at the existing power station site. A one-line diagram is included as Figure 1.

The short circuit analysis indicates the proposed connection of the new generator unit would increase fault current levels and short circuit duties on equipment within City Utilities and surrounding systems. The study identifies one location on the system of City Utilities where 161 kV interrupting equipment will need to be replaced or upgraded. Based on the protection device ratings and comments provided by neighboring utilities, the increase in fault current levels does not exceed their equipment interrupting ratings.

A short circuit model representing the expected system conditions for the summer of 2010 was used as the basis for the study. The model was based on the latest SPP circuit data including the new generation facility. This model was updated with system reinforcements available in the latest SPP 2010 load flow summer case and planned transmission interconnections that were considered electrically close to the system of City Utilities. Substation equipment ratings and connection impedances were solicited from neighboring utilities that are connected to local transmission lines. This data was used to evaluate the impact of new generation on the fault duty or interrupting capability of previously installed equipment such as circuit breakers and switches.

The study was conducted using ASPEN OneLiner software. This software places a three-phase and a single-phase-to-ground fault on each transmission line. For each fault, the worst-case fault current level was compared to the interrupting devices' rating. The worst-case fault conditions were calculated using the generator's subtransient reactive component and assumed all generation was on-line with zero ohms of fault impedance. The fault current calculations were performed with and without the new generator in service.

Table 3 contains a list of available bus fault levels after the new generator connection at the Southwest Power Station switch yard is added. As a result of the Customer's requested generation addition, the three-phase fault level would increase by approximately 17.6% to 27,869 amps and the single-phase fault level would be increased approximately 23.3% to 31,686 amps. The increase in available fault current does pose a problem for one 161 kV breaker at Southwest Power Station switch yard since all of the breakers have an interrupting rating of 31,500 amps or greater. Other 161 kV substations

on the system of City Utilities that experienced significant increases in fault current were still within acceptable interrupting capabilities.

The 69 kV system of City Utilities was also evaluated and generally had less than a 3% increase in fault current levels. No 69 kV upgrades are assignable to this request for generation interconnection. No deficiencies were found in 345 kV equipment.

City Utilities does not have a complete list of equipment ratings for substations owned by others. However, representatives of all transmission owners who have modeled control areas and interconnections with City Utilities were contacted regarding this matter. Based on the information received from these representatives, no substations were found to have fault current levels in excess of the equipment ratings.

Figure 1

Proposed Generation Interconnection

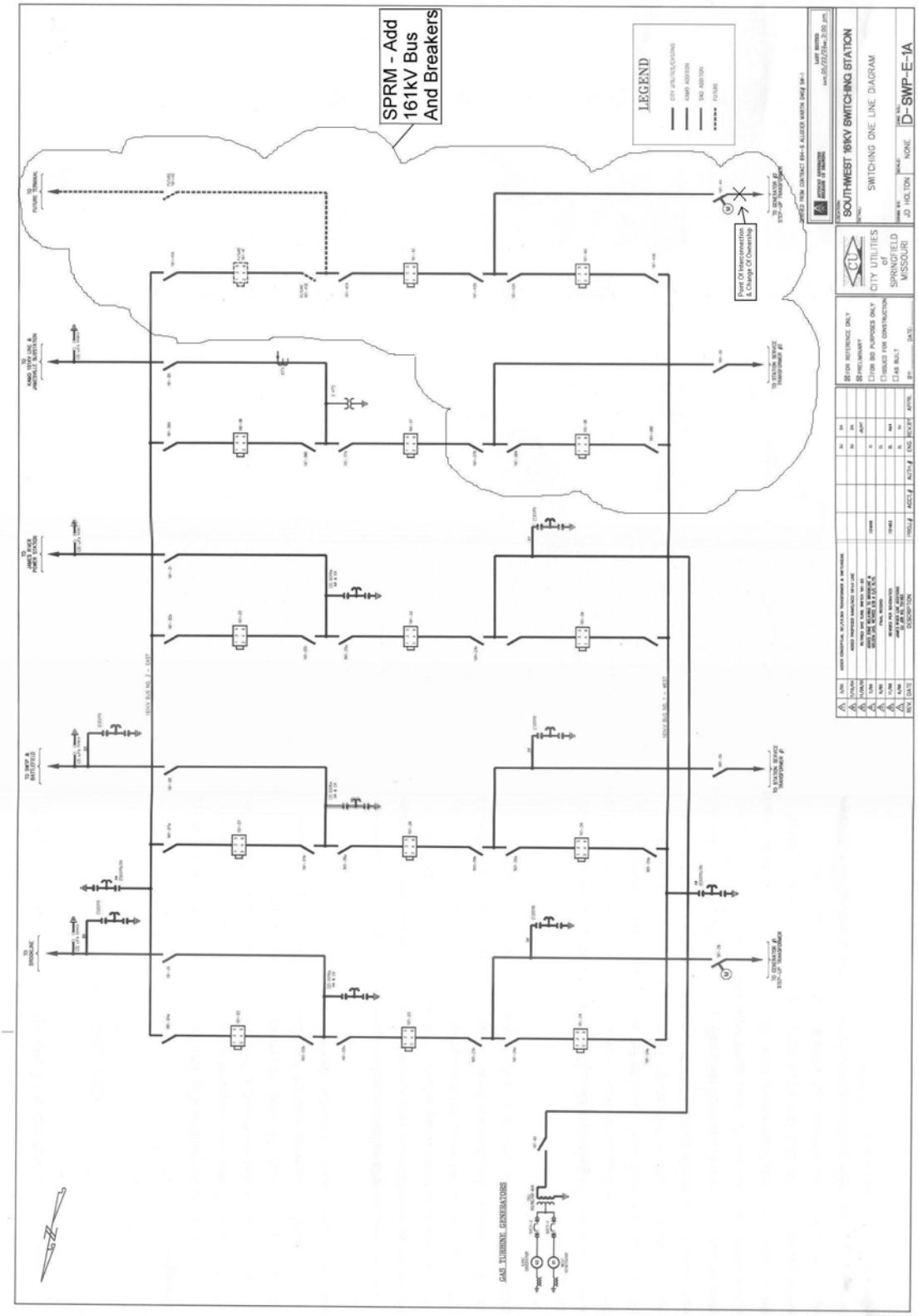

Figure 2

Map of the Local Area