



***Facility Study
For
Generation Interconnection
Request
GEN-2006-031***

SPP Tariff Studies

(#GEN-2006-031)

July 2007

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Midwest Energy (MIDW) performed the following Facility Study to satisfy the Facility Study Agreement executed by the requesting Customer and SPP for SPP Generation Interconnection Request #GEN-2006-031.

FINAL REPORT – FACILITY STUDY
GENERATOR INTERCONNECTION REQUEST 2006-031
GOODMAN ENERGY CENTER

Prepared by

Midwest Energy, Inc.

As Directed by

Southwest Power Pool

Introduction

A Large Generator Interconnection request was submitted to Southwest Power Pool (SPP) on August 16, 2006 in connection with the planned peaking generating facility. This new resource is to be constructed on a site located at 1713 230th Avenue northwest of Hays, Kansas and is to be connected to the Midwest Energy, Inc. transmission system at the 115kV bus of the Knoll substation. This report is prepared by Midwest Energy, Inc. (Midwest) in its role as the Transmission Owner.

SPP subsequently completed its initial Feasibility Study and a System Impact Study. Those results were made available to Midwest as the Transmission Owner. This last stage of the interconnection process, requiring a more detailed Facility Study, will form the basis for the development of an Interconnection Agreement between the Transmission Owner, the Interconnection Customer and the Transmission Provider (SPP).

SPP has delegated completion of this Facility Study to Midwest as the Transmission Owner. This Facility Study is primarily intended to address the following:

- Identify requirements for the installation of the Interconnection Customer's Interconnection Facilities required to connect the proposed facility to the transmission system.
- Identify requirements and estimated costs of modifications to the Transmission Owner's Interconnection Facilities to accommodate interconnection of the proposed generating facility and the resulting cost responsibility.
- Review short circuit requirements as they relate to the construction of the Interconnection Facilities noted above.

Overview - Connection to Transmission Owner's Facilities

The Interconnection Request submitted by the Interconnection Customer requested connection of the proposed generating facility to the 115kV system owned and operated by Midwest in the vicinity of its existing Knoll substation. The new generating facilities are to be constructed on a site directly across the road from the Knoll substation, on property already owned by the Interconnection Customer.

Prior to submittal of the Interconnection Request, Midwest had already committed to the upgrade of its existing 115kV transmission line from Knoll to South Hays to Heizer to 230kV operation. The line was designed and installed for 230kV operation, but initially energized at 115kV. Growing concerns with voltage stability in central Kansas lead to a study of the best ways to improve the voltage on the 115kV system in the area, and the upgrade project was the preferred solution. As a result of this upgrade, that leaves an existing terminal on the 115kV ring bus at Knoll substation available for other uses, and the Interconnection Customer has requested the use of this open position by the new generating facility. As the Transmission Owner, Midwest has consented to the re-use of this terminal, with modification, by the Interconnection Customer.

The Interconnection Customer will be responsible for the construction of all facilities required to connect the new generating facility to the open terminal in Knoll substation, as well as any modifications required in Knoll substation to accommodate this new use of the existing terminal. This study is intended to set forth the requirements the Interconnection Customer must meet in order to complete the interconnection, including a description of the facilities required, and estimates of the costs and cost responsibility for such new facilities.

A one-line diagram of the proposed facility and its connection to the Knoll substation are shown in Attachment A hereto.

Interconnection Customer's Required Interconnection Facilities

The Interconnection Customer has provided information indicating that the generating equipment will include nine natural gas fueled internal combustion reciprocating generating units, each rated 8.4MW, for a total plant generating capability of 76MW. The units will operate at a nominal voltage of 13.8kV, and the project includes the installation of two generator step-up (GSU) transformers each with a top rating of 65MVA.

The Transmission Owner will require that the Interconnection Customer construct and pay for a 115kV transmission line between the GSU facilities at GMEC and the open terminal at the Knoll substation. The Interconnection Customer will also be responsible for the cost of the terminal, protection and grounding facilities at the GSU substation. More specifically, the Interconnection Facilities to be provided by the Interconnection Customer will include, but are not limited to, the following:

- a. Single circuit 115-kV transmission line using 1-795 ACSR Drake conductor per phase.
- b. One (1) 1/2" EHS-7 OHGW shall be used.
- c. One (1) 1/2" OPGW shall be used.
- d. Porcelain insulators shall be used unless otherwise approved by the Transmission Owner.
- e. Tangent structures shall be wood pole H-frame construction.
- f. Dead-end/Angle structures shall be wood 3-pole guyed construction.
- g. Foundations shall be direct-embedded construction.

The estimated installed cost of this transmission line is \$266,000. The estimate accuracy is +/- 20% and is expressed in 2007 US dollars. This estimate includes engineering, surveying, materials, and construction necessary to complete the installation.

The Interconnection Customer will also be required to construct as part of its Interconnection Facilities, at its sole expense, the following facilities at the GSU substation to connect the transmission line to the GSU substation:

- a. Furnish and Install approximately five 3-phase support structures.
- b. Furnish and Install one A-Frame Dead-end structure.

- c. Furnish and Install two 115kV Circuit Switchers with horizontal blades and motor operators.
- d. Furnish and Install all bus work in GSU substation.
- e. Furnish and Install Ground Grid in GSU substation.
- f. Furnish and Install protective relay panel(s) in GMEC Plant Switchgear room.
- g. Furnish and Install Primary and Backup SEL Relays.
- h. Furnish and Install all necessary Test Switches, Fuses and Aux. Relays for line protection.
- i. Furnish and Install ADSS fiber cable from A-Frame dead end structure into relay panel with all patch panels and splice boxes as required.
- j. Furnish and Install communication cables required to interface with plant.
- k. All required MWE standards, documents, drawings, and design requirements shall be provided before engineering is initiated.

The estimated installed cost of the terminal facilities at the GSU substation is \$396,900. The estimate accuracy is +/-20% and is expressed in 2007 US dollars. This estimate includes engineering, materials, and construction necessary to install these facilities.

This estimate does **not** include the following:

- l. SEL-2032 which is part of the generating facilities.
- m. All control cable requirements for the Circuit Switcher and Transformers which will be supplied and installed as part of the GSU substation.
- n. All RTU requirements that are part of the GSU substation and/or the generation project, and are the responsibility of the Interconnection Customer.
- o. All foundation work which will be furnished and installed as part of the GSU substation and/or the generation project.
- p. The cost of the GSU transformers.

All Interconnection Customer's Interconnection Facilities shall be installed at the sole expense of the Interconnection Customer, and shall remain the property of the Interconnection Customer.

Transmission Owner's Interconnection Facilities

The Interconnection Customer shall be responsible for the design, procurement and installation of all Interconnection Facilities required to be installed in the Transmission Owner's Knoll substation. The Transmission Owner will provide access to the Knoll substation for construction work on or about October 1, 2007. However, this date is entirely dependent upon completion of the work by the Transmission Owner related to the conversion of the Knoll-South Hays-Heizer line from 115kV to 230kV operation. This work will be completed at the sole discretion of the Transmission Owner.

All design and specifications for equipment to be installed, including protective relays and their settings, shall be approved by the Transmission Owner or his authorized representative prior to procurement or installation. The Transmission Owner will require that its authorized representative be present during all construction activities inside the Knoll substation, and that

the contractor observe all safety requirements of the Transmission Owner and its representatives and its consultants. All decisions regarding construction sequencing, clearances, lockout tagging, and safety shall be made by the Transmission Owner upon advance request by the Interconnection Customer or his designated representatives and contractors. Requests for outages may have to be submitted to the Southwest Power Pool (SPP) in its role as the regional Transmission Provider. All decisions in these matters of the Transmission Owner and/or the Transmission Provider, as appropriate, are final. The Interconnection Customer shall reimburse the Transmission Owner for all expenses associated with the construction supervision, inspection, outage scheduling, testing and commissioning of the facilities installed in the Knoll substation.

The following facilities shall be installed in the Knoll substation at the sole expense of the Interconnection Customer:

- a. Replacement of one relay panel for protection of the 115kV line to the Interconnection Customer's proposed Interconnection Facility.
- b. Furnish and Install Primary and Backup SEL Relays.
- c. Furnish and Install all necessary Test Switches, Fuses and Aux. Relays.
- d. Furnish and Install ADSS fiber cable from Dead-end structure into relay panel with all patch panels and splice boxes as required.
- e. Furnish and Install communication cables and expansion/upgrade of existing RTU in Knoll substation.
- f. Removal of one existing Wave Trap and re-instate bus as required
- g. Field verification of existing wiring.
- h. All required MWE standards, documents, drawings, and design requirements shall be provided before engineering is initiated. Coordination will be required with the Transmission Owner's 230kV upgrade project with SEL equipment for communications interface.

The estimated installed cost of the MWE Knoll Terminal Upgrade is \$145,700. The estimate accuracy is +/-20% and is expressed in 2007 US dollars. The estimate includes engineering, materials, and construction necessary to install the above referenced facilities.

The estimate does **not** include the following:

- i. SEL-2032 which will be supplied as part of the Transmission Owner's 230kV upgrade project.
- j. In the event an RTU upgrade is not feasible, the cost of a new RTU is not included in the above estimate.
- k. Replacement of existing line dead end structure; it is assumed it will be modified and re-used.
- l. Replacement or upgrade of the existing 115kV oil circuit breakers in the Knoll substation if they are determined to be inadequate during the design phase.
- m. Existing control cables will be re-used as available. No new cables are included in the estimate other than the fiber optic cable.

Upon completion of the construction, inspection, testing and commissioning of the Transmission Owner's Interconnection Facilities such Interconnection Facilities shall be transferred to the Transmission Owner at no additional cost, and shall remain the property of the Transmission Owner thereafter.

Short Circuit Analysis

In connection with this facility study the Transmission Owner conducted an analysis of the short circuit capabilities of both the existing system and the system including the new generating facility to determine the requirements to be placed on all Interconnection Facilities installed hereunder.

The following assumptions were utilized in the preparation of a short circuit analysis for the proposed project:

- 230 kV Upgrade from Knoll to South Hays to Mullergren in service, including the new 230/115kV autotransformer at South Hays substation.
- Line impedance between Knoll 115 kV Tap and GSU ignored.
- Smoky Hill Interconnection not in service.
- GSU transformers solidly grounded on 115 kV (wye connected) side; Delta connection on 13.8 kV side of GSU.
- Assumed standard zero sequence model for GSU transformers.
- 2 GSU transformers in parallel, modeled with open tie breaker at 13.8 kV between the secondary sides of the two GSU transformers.
- 6 generators at one GSU secondary, 3 generators at the other GSU secondary.
- Generator and GSU Electrical Characteristics provided by Interconnection Customer.
- Assumed standard zero sequence model for 115/34 kV Knoll Autotransformer.

The following information is provided for the design purposes of the Interconnection Customer:

Knoll Substation Bus	Fault Type	Before Generator Interconnection	After Generator Interconnection
115kV	3-Phase ⁽¹⁾	5.82 kAmps	7.32 kAmps
	SLG ⁽²⁾	6.64 kAmps	8.65 kAmps
34kV	3-Phase ⁽¹⁾	4.76 kAmps	5.01 kAmps
	SLG ⁽²⁾	5.04 kAmps	5.31 kAmps

(1) Maximum available three-phase symmetrical fault current magnitude.

(2) Maximum available single-line-to-ground symmetrical fault current magnitude.

Based on the available fault current contribution from the proposed generator interconnection as well as the existing transmission grid, and the assumption that the Smoky Hill wind farm interconnection was not in service, Midwest Energy, Inc. will require that all 115kV and 34kV circuit breakers at the Knoll substation have a fault interrupting rating of at least 20,000 amps (20 kAmps). At the present time, all breakers installed at the Knoll substation meet or exceed this requirement.

Metering, Telemetry and Control Requirements

The electric metering installed by the Interconnection Customer will be designed to meet the requirements of the Transmission Provider as to accuracy, availability, and redundancy applicable to the project. The requirements of the Transmission Provider shall include, but is not limited to, those set forth in the current revision of Meter Technical Protocols for the SPP Energy Imbalance Market.

The Interconnection Customer shall also make available certain telemetered values representing instantaneous real and reactive power production and time-integrated production values from the facility, as well as status information related to the interconnection facilities for breaker status, instantaneous voltage at the interconnection, etc. This information will be made available in an electronic format compatible with the Supervisory Control system of the Transmission Owner.

These requirements will be more fully addressed in a Large Generator Interconnection Agreement.

As a Transmission Owner, Midwest is required to comply with certain operating standards, including those related to reactive power supply and voltage control from generating resources. The Interconnection Customer must have the ability to operate the generating equipment in voltage control modes as required by the Transmission Owner.

Summary

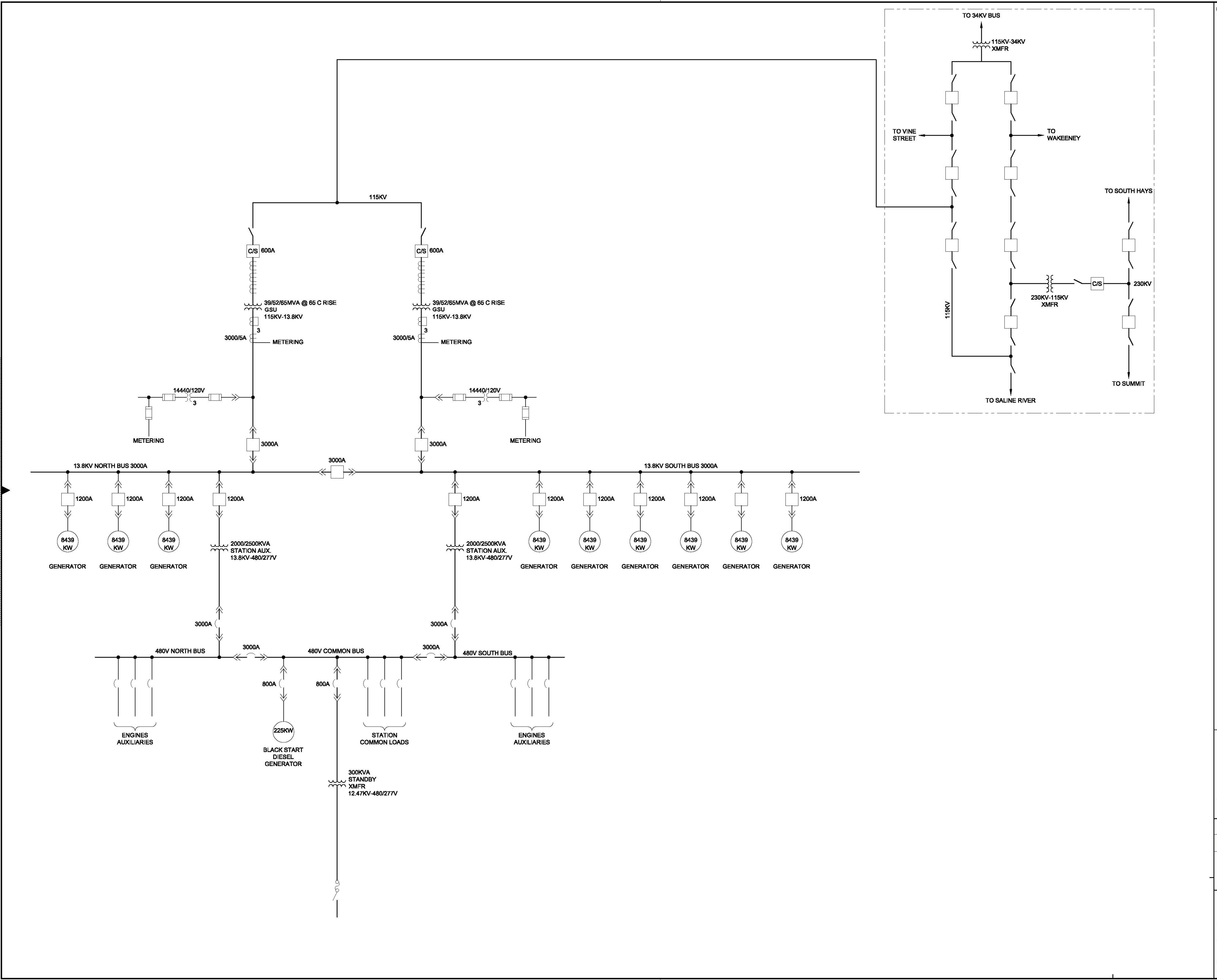
The foregoing Facility Study was developed in conjunction with the Large Generator Interconnection procedures as required by the Southwest Power Pool (SPP). As the regional Transmission Provider, SPP assumes the lead role in assessing the feasibility of the requested interconnection in terms of the ability of the regional transmission grid to accept an injection of real and reactive power pursuant to a valid interconnection request.

This Facility Study is intended to supplement the analysis performed by the SPP and in particular focus on the facilities required to effectuate the interconnection of the new generating resource. The requirements for construction of the Interconnection Customer's and the Transmission Owner's Interconnection Facilities are described in the preceding sections, and will form the basis for development of the required Large Generator Interconnection Agreement between the SPP, the Interconnection Customer, and the Transmission Owner.

Attachment A

One-Line Diagram

Scale for Metering
 Millimeters
 Inches



no.	date	by	ckd	description



date APRIL 12, 2007
 designed S. LESNIAK
 detailed S. LESNIAK
 checked

ONE LINE DIAGRAM

project 44259 contract
 drawing E-001 rev. sheets
 sheet of sheets
 file 44259E001.DWG

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