Southwest Power Pool

Impact Study for Generation Interconnection Request GEN–2001–024

SPP Tariff Studies
(#GEN-2001-024)

October, 2006

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Pterra Consulting Inc. (Pterra) performed the following Impact Study to satisfy the Impact Study Agreement executed by the requesting customer and SPP for SPP Generation Interconnection request Gen-2001-024.

An Interconnection Agreement was executed for this request in July, 2004. The Interconnection Agreement was subsequently placed into suspension under the provisions of the LGIA.

This study is a restudy based on the Customer requesting to bring the LGIA out of suspension with a new plant configuration. The plant was originally studied as a combined cycle plant. In this study, the plant was studied as a series of simple cycle combustion turbines.

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.

Interconnection Facilities

No new interconnection facilities were found to be needed because of the Impact Study. Costs for the Interconnection Facilities were given in the original Interconnection Agreement. These estimates have been refined as follows in Table 1 and Table 2.

Table 1: Direct Assigned Facilities

Facility	ESTIMATED COST (2006 DOLLARS)
AEPW – Install Dead-End Tower in AEP Tontitown substation to terminate Interconnection Customer's line; Add interconnection metering	$338,000
Total	**$338,000**

Table 2: Interconnection Facility Network Upgrades

Facility	ESTIMATED COST (2006 DOLLARS)
AEPW – Add 161kV bus, breaker, and switches in the existing Tontitown Substation for a new terminal.	$537,700
Total	**$537,700**

Pterra Consulting

Report No. R131-06

"Impact Study for Generation Interconnection Request GEN-2001-024"

Submitted to

The Southwest Power Pool

October 2006

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Report No. R131-06

"Impact Study for Generation Interconnection Request GEN-2001-024"

1. Executive Summary

The Southwest Power Pool (SPP) contracted Pterra LLC (Pterra) to perform stability analyses for a proposed 510 MW plant (summer rating) or 540 MW (winter rating). The plant ("the Project") consists of six simple cycle gas / combustion turbines (CTs), each rated 85 MW (summer) / 90 MW (winter). The Project would be located in Washington County, Arkansas (AEPW Control Area) and would be interconnected at the existing Tontitown 161kV substation as shown in *Figure 1*.

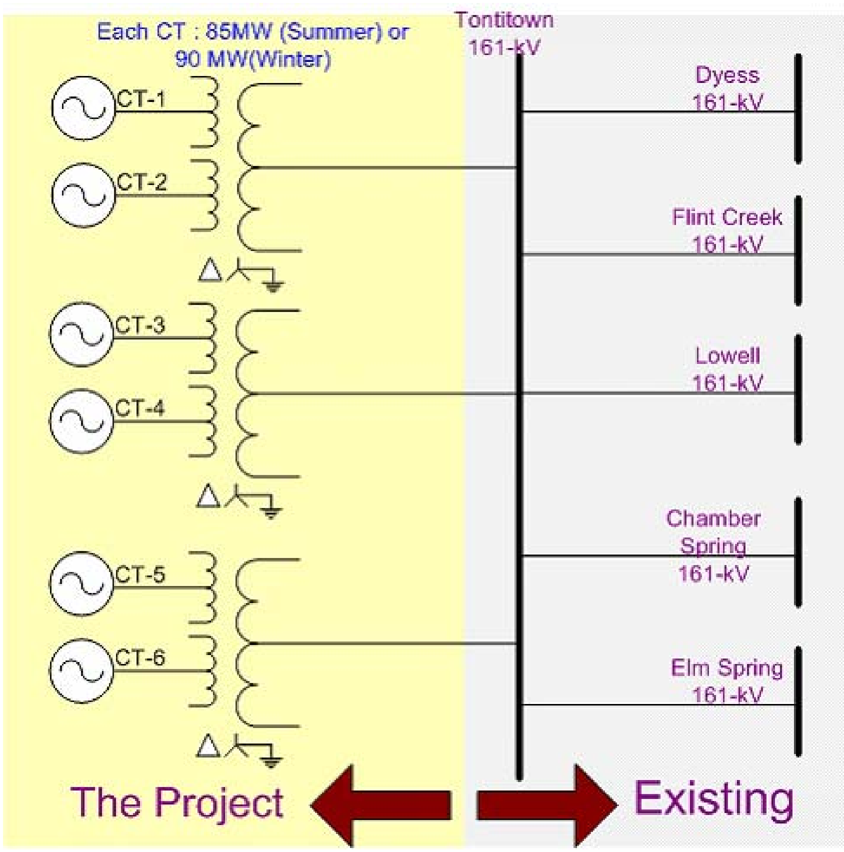

Figure 1 Interconnection Plan for GEN-2001-024 (the Project) to the Tontitown 161 kV System

Eighteen (18) contingencies were considered for the transient stability simulations which included three phase faults as well as single-line-to-ground faults at the locations defined by SPP.

The stability simulation shows stable results for both 2007 Winter Peak and 2011 Summer Peak dispatch scenarios.

2. Introduction

2.1 Project Overview

Southwest Power Pool (SPP) contracted Pterra LLC (Pterra) to perform stability analyses for a proposed 510 MW plant (summer rating) or 540 MW (winter rating). The plant ("the Project") consists of six simple cycle gas / combustion turbines (CTs), each rated 85 MW (summer) / 90 MW (winter). The Project would be located in Washington County, Arkansas (AEPW Control Area) and would be interconnected at the existing Tontitown 161kV substation. A new position in the existing breaker-and-a half bus will be installed. The illustration of the Project connection is shown in *Figure 2*.

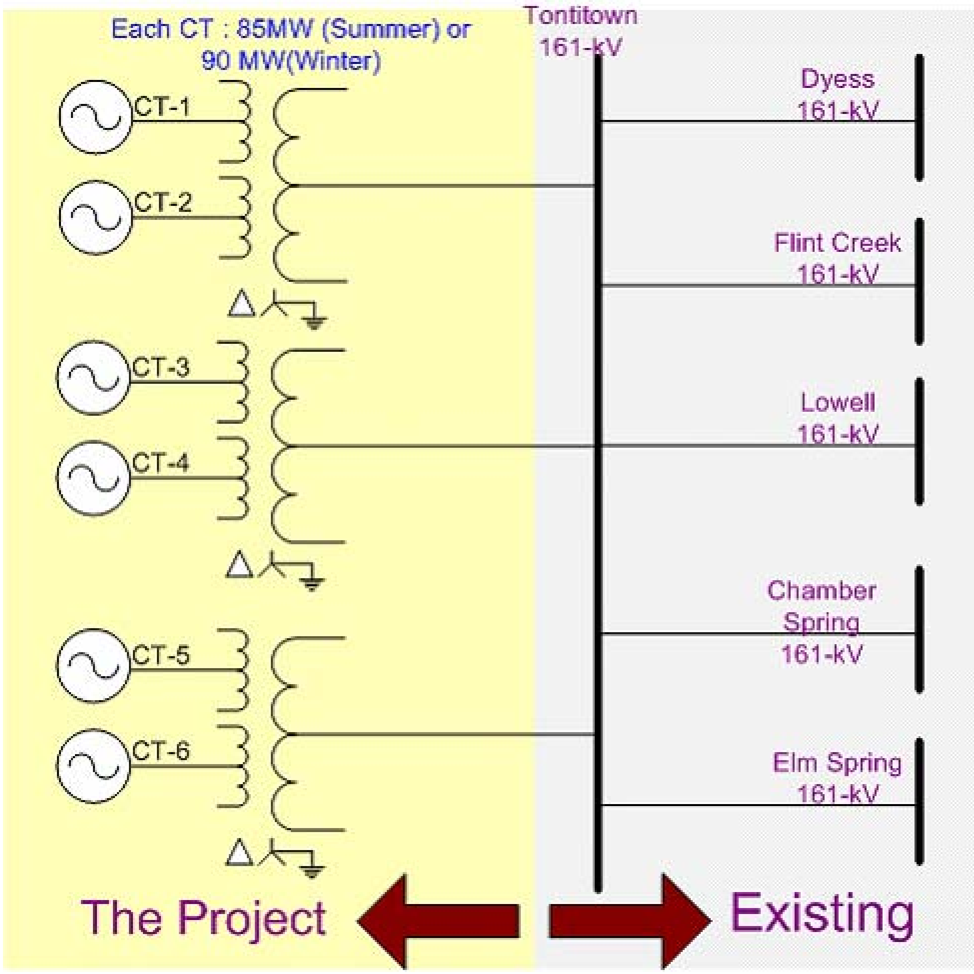

Figure 2 Interconnection Plan for GEN-2001-024 (the Project) to the Tontitown 161 kV System

2.2 Objective

The objective of the study is to determine the impact on system stability of connecting the Project to SPP’s 161 kV transmission system.

3. Stability Analysis

The study was performed with two dispatch scenarios provided by SPP:

1. 2007 Winter Peak Case and
2. 2011 Summer Peak Case.

In order to accommodate the MW power injection from the Project into the system, existing generation was adjusted in the following control areas: AEP & AEPW (summer rating), AEP, AEPW, & Entergy (winter rating).

In addition to the base cases, SPP provided the Project data consisting of generating units and their generating step-up transformers. This data is provided in Appendix A of this report.

3.1 Dynamic Model of the Project

SPP provided the machine dynamic model of the Project. This data is provided in Appendix A.

3.4 Contingencies Simulated

Eighteen (18) contingencies were considered for the transient stability simulations which included three phase faults as well as single-line-to-ground faults at the locations defined by SPP. Single-line-to-ground faults were simulated by applying a fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice. Table 1 shows the list of simulated contingencies. The table also shows the fault clearing time and the time delay before re-closing for all the study contingencies.

Table 1 List of Simulated Contingencies and Result Summary of Dynamic Response for 2007 Winter Peak and 2011 Summer Peak Scenarios

#	Fault and Contingency Description	2007 Winter Peak	2011 Summer Peak
1	FLT13PH – 3-phase fault Fault on the Tontitown (53170) – Chambers Spring (53154), 161kV line, near Tontitown. a. Apply Fault at Tontitown (53170). b. Clear Fault after 3.5 cycles by removing the line from 53170 - 53154.	Stable	Stable

#	Fault and Contingency Description	2007 Winter Peak	2011 Summer Peak
	c. Wait 30 cycles, and then re-close the line into the fault from the Chambers Spring end. d. Leave fault on for 3.5 cycles, then trip the line in (b) and remove fault.		
2	FLT21PH – 1-phase fault • Same as FLT13PH above	Stable	Stable
3	FLT33PH – 3-phase fault Fault on the Tontitown (53170) – Flint Creek (53139), 161kV line, near Tontitown. a. Apply Fault at Tontitown (53170). b. Clear Fault after 3.5 cycles by removing the line from 53170 - 53139. c. Wait 30 cycles, and then re-close the line in (b) into the fault from the Tontitown end. d. Leave fault on for 3.5 cycles, then trip the line in (b) and remove fault.	Stable	Stable
4	FLT41PH – 1-phase fault • Same as FLT33PH above.	Stable	Stable
5	FLT53PH – 3-phase fault Fault on the Tontitown (53170) – Lowell (53144), 161kV line, near Tontitown. a. Apply Fault at Tontitown (53170). b. Clear Fault after 3.5 cycles by removing the line from 53170 - 53144. c. Wait 30 cycles, and then re-close the line in (b) into the fault from the Lowell end. d. Leave fault on for 3.5 cycles, then trip the line in (b) and remove fault.	Stable	Stable
6	FLT61PH – 1-phase fault • Same as FLT53PH above.	Stable	Stable

#	Fault and Contingency Description	2007 Winter Peak	2011 Summer Peak
7	FLT73PH-3-phase Fault Fault on the Tontitown (53170) – Dyess (53131), 161kV line, near Tontitown. a. Apply Fault at Tontitown (53170). b. Clear Fault after 3.5 cycles by removing the line from 53170 - 53131. c. Wait 30 cycles, and then re-close the line in (b) into the fault from the Dyess end. d. Leave fault on for 3.5 cycles, then trip the line in (b) and remove fault.	Stable	Stable
8	FLT81PH – 1-phase fault • Same as FLT73PH above.	Stable	Stable
9	FLT93PH-3-phase Fault Fault on the Tontitown (53176) – Chambers Spring (53155), 345kV line, near Tontitown. a. Apply Fault at Tontitown (53176). b. Clear Fault after 3.5 cycles by removing the line from 53176 - 53155 c. Wait 30 cycles, and then re-close the line in (b) into the fault from the Chambers Spring end. d. Leave fault on for 3.5 cycles, then trip the line in (b) and remove fault.	Not Performed[1]	Stable
10	FLT101PH – 1-phase fault • Same as FLT93PH above.	Not Performed	Stable
11	FLT111PH – 1-phase fault Fault on the Tontitown (53170) – Chambers Spring (53154), 161kV line, near Chambers Spring a. Apply Fault at Chambers Spring (53154).	Stable	Stable

[1] 345 kV line from Tontitown (53176) – Chambers Spring (53155) is not available in the 2007 winter peak case.

#	Fault and Contingency Description	2007 Winter Peak	2011 Summer Peak
	b. Open the Tontitown end after 3.5 cycles (faults stays on at Chambers Spring). c. Wait 15 cycles, then open the line from Chambers Spring-Flint Creek and clear the fault.		
12	FLT121PH – 1-phase fault Fault on the Tontitown (53170) – Flint Creek (53139), 161kV line, near Flint Creek. a. Apply Fault at Flint Creek (53139). b. Open Tontitown end after 3.5 cycles (faults stays on at Flint Creek). c. Wait 9 cycles, then open the line from Siloam Springs-Flint Creek and clear the fault.	Stable	Stable
13	FLT131PH– 1-phase fault Fault on the Tontitown (53170) – Lowell (53144), 161kV line, near Tontitown. a. Apply Fault at Tontitown (53170). b. Open Lowell end after 3.5 cycles (faults stays on at Tontitown). c. Wait 15 cycles, then open the line from Tontitown-Flint Creek and clear the fault.	Stable	Stable
14	FLT141PH – 1-phase fault Fault on the Tontitown (53170) – Flint Creek (53139), 161kV line, near Tontitown. a. Apply Fault at Tontitown (53170). b. Open Flint Creek end after 3.5 cycles (faults stays on at Tontitown). c. Wait 9 cycles, then open the line from Tontitown-Lowell and clear the fault.	Stable	Stable
15	FLT153PH – 3-phase fault With the Flint Creek (53140)-East Centerton(53172) 345kV line out of service; Fault on the Flint Creek (53139)-East Centerton (53133) 161kV line near East Centerton.	Stable	Stable

#	Fault and Contingency Description	2007 Winter Peak	2011 Summer Peak
	a. Apply Fault at East Centerton (53133). b. Clear Fault after 3.5 cycles by removing the line from 53133 – 53183-53187-53139. c. Wait 30 cycles, and then re-close the line into the fault from the East Centerton end. d. Leave fault on for 3.5 cycles, then trip the line in (b) and remove fault.		
16	FLT161PH – 1-phase fault • Same as FLT153PH above.	Stable	Stable
17	FLT173PH – 3-phase fault Fault on the Flint Creek (53140)-GRDA (54450) 345kV line near Flint Creek. a. Apply Fault at Flint Creek (53140). b. Clear Fault after 3.5 cycles by removing the line from 53140 - 54450.	Stable	Stable
18	FLT181PH – 1-phase fault • Same as FLT173PH above.	Stable	Stable

3.5 Simulation Results and Conclusion

Stability simulations were performed with a 0.5-second steady-state run followed by the appropriate disturbance as described in Table 1. Simulations were run for 20-second duration to confirm proper machine damping. The simulation shows stable results for both 2007 Winter Peak and 2011 Summer Peak dispatch scenarios. Simulation plots are provided in a separate CD-ROM.