

***System Impact Study for
Interconnection of 750 MW
Generation Facility in AEP
Control Area***

***Southwest Transmission Planning
(#O AIS 01 006)***

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Executive Summary

Customer has requested an Impact Study for the interconnection of a merchant plant in the AEP control area. The plant will have a maximum output of 750 MW in the summer and 815 MW in the winter. The projected in service date is 2004.

The principal objective of this study is to: 1) identify any system problems associated with the connection of the proposed plant, 2) determine potential system modifications that might be necessary to facilitate the installation of the plant while maintaining system reliability and stability, and 3) estimate the costs associated with those system modifications. The study includes a steady state contingency analysis, a transient stability analysis, and an analysis of whether the interrupting capabilities of the existing circuit breakers in the area are exceeded with the addition of this new generation.

For the purposes of this study, three seasons were studied, the 2004 summer peak, the 2004 winter peak, and the 2006 summer peak. Per information received from Customer, the point of delivery of the generated capacity of the new plant called for 100% of the output to be sent to the southern Arkansas area of Entergy.

The estimated cost of interconnecting the new proposed generator to the transmission system is \$6.649 million. This cost includes interconnection costs on the American Electric Power (AEP) system including modifications needed for short circuit problems and modifications needed for stability purposes.

The analysis in this document shows that to accommodate a transfer, modifications will be required on the AEP 345 kV, 138 kV, and 115 kV transmission systems to relieve certain criteria violations. These violations are listed in Tables 1, 2, and 3. The analysis also showed that a large number of facilities in other control areas were overloaded in the transfer case and not in the base case. Those facilities in the other control areas were not tabulated. Many of these problems are on systems not covered by the Southwest Power Pool (SPP) Tariff.

Introduction

Customer has requested an Impact Study for the interconnection of a merchant plant in the AEP control area. The plant will have a maximum output of 750 MW in the summer and 815 MW in the winter. The projected in service date is 2004.

The principal objective of this study is to: 1) identify any system problems associated with the connection of the proposed plant, 2) determine potential system modifications that might be necessary to facilitate the installation of the plant while maintaining system reliability and stability, and 3) estimate the costs associated with those system modifications. The study includes a steady state contingency analysis, a transient stability analysis, and an analysis of whether the interrupting capabilities of the existing circuit breakers in the area are exceeded with the addition of this new generation.

The steady-state analysis considers the impact of the new generation on transmission facility loading and transmission bus voltages for outages of single, double, and triple circuit transmission lines, autotransformers, and generators.

Stability analysis shows the effects of the new generation on the transient stability of SWEPCO and surrounding utility generators. Transient stability is concerned with recovery from faults on the transmission system that are in close proximity to generating facilities.

This study also includes a short circuit analysis that determines whether the interruption capabilities of existing circuit breakers are exceeded with the addition of the new generation.

Interconnection Facilities

Customer 345 kV Interconnection Station

AEP will construct the Customer 345 kV station near the proposed Customer facility plant to provide the interface between the plant and the transmission system. The switching facility will consist of a 345 kV yard. The 345 kV switchyard will contain six 345 kV breakers in a ring bus configuration, including six 345 kV line terminals. The proposed plant will utilize four terminals. The facility will include all metering, protection and SCADA systems. Customer will construct and own the generating plant and maintain the equipment including the GSU high-side transformer disconnects at the ownership boundary. Customer will also provide the property and initial site preparation for the construction of the facility. AEP will retain ownership and operating authority of the 345 kV switchyard up to the high-side GSU transformer disconnects.

The design and construction of the switching station will meet all AEP specifications for stations. Support structures and line terminal equipment will be designed to terminate the respective conductors from the generator step-up transformers. Bus work and disconnect switches will be designed to accommodate the loading requirements, and circuit breakers will be rated to ensure adequate load and fault interrupting capability. Metering equipment will be installed to monitor the plant output and will meet the required accuracy specifications. The estimated cost of the station is \$5,639,000.

Welsh Power System Stabilizers

Three power system stabilizers are required at the existing Welsh generating plant on Units 1, 2, and 3. Details of the analysis are discussed in the Stability Analysis section. The estimated cost of the installation of the three power system stabilizers is \$210,000.

Arsenal Hill Breaker Replacements

AEP will replace 69 kV circuit breakers 430, 480, 3720, and 8230 at Arsenal Hill station due to short circuit ratings violations caused by the added generation of the Customer facility. Details of the analysis are discussed in the Short Circuit Analysis section. The estimated cost of the breaker replacements is \$480,000.

South Shreveport Breaker Replacements

AEP will replace 138 kV circuit breakers 7260 and 7270 at South Shreveport station due to short circuit ratings violations caused by the added generation of the Customer facility. Details of the analysis are discussed in the Short Circuit Analysis section. The estimated cost of the breaker replacements is \$320,000.

Interconnection Costs

Listed below are the costs associated with interconnecting the Customer 750 MW generation facility to the transmission system.

SYSTEM IMPROVEMENT	COST (2001 DOLLARS)
Customer 345 kV station (includes six 345 kV breakers)	\$5,639,000
Install (3) power system stabilizers at the existing Welsh generating plant	\$210,000
Replace (4) 69 kV breakers at Arsenal Hill (430, 480, 3720, and 8230)	\$480,000
Replace (2) 138 kV breakers at South Shreveport (7260 and 7270)	\$320,000
TOTAL	\$6,649,000

A. Steady State Analysis

Study Methodology

The AEP and Southwest Power Pool (SPP) criteria state that the following conditions be met in order to maintain a reliable and stable system.

- 1) More probable contingency testing must conclude that
 - a) All facility loadings are within their emergency ratings and all voltages are within their emergency limits (0.90-1.05 per unit) and
 - b) Facility loadings can be returned to their normal limits within four hours
- 2) Less probable contingency testing.... shall conclude that
 - a) Neither uncontrolled islanding, nor uncontrolled loss of large amounts of load will result.

More probable contingency testing is defined as losing any single piece of equipment or multi-circuit transmission lines. Less probable contingency testing involves the loss of any two critical pieces of equipment such as 345 kV autotransformers and generating units or the loss of critical transmission lines in the same right-of-way.

The 2001 series Southwest Power Pool 2004 summer and winter peak base cases along with the 2006 summer peak case were used to model the transmission network and system loads. These cases were modified to reflect known firm point-to-point transmission requests that have been approved.

Per information received from Customer, the point of receipt of the generated capacity of the new plant called for 100% of the output to be sent to the southern Arkansas area of Entergy.

Using the created 2004 summer peak model and PTI's PSS/E program, single and select double contingency outages on the SPP system were analyzed to determine the necessary facilities to interconnect the proposed plant to the transmission system. This load flow analysis is described on the following pages.

Next, using the three created models and the ACCC function of PTI's PSS/E program, single and select double contingency outages on the SPP system were analyzed. Facilities in the western AEP (AEPW) control area found to be overloaded in the transfer cases with the proposed plant addition and not in the base cases were flagged and listed in Tables 1, 2, and 3. A large number of such facilities in other control areas were also found to be overloaded in the transfer case and not in the base case. Those facilities in the other control areas were not tabulated.

Load Flow Analysis

The discussion below is not a summary of all outages or criteria violations. It lists certain key flow results most relevant to the discussion. These load flow analysis results do not include any additions or changes found in the stability analysis or the short circuit analysis.

2004 summer peak base case with Customer generation added

Under normal operations in the base case, AEP's Fulton to Entergy's Patmos 115 kV line reaches 114% of the emergency rating of the conductor. There are also overloads of Central Louisiana Energy Company's (CLECO's) circuits and Entergy circuits. These overloads can be found in **Table 1**.

2004 summer peak case with Customer generation under contingency operation

For an outage of the Dolet Hills 345/161 kV autotransformer, the South Shreveport to Wallace Lake 138 kV line reaches 112% of its emergency rating. The double contingency, Southwest Shreveport to Longwood 345 kV line and Southwest Shreveport to Diana 345 kV line, results in the Longwood 345/138 kV autotransformer to reach 101% of its emergency rating, the Flournoy to Oak PHEC 138 kV line reaches 111% of its emergency rating, and the Arsenal Hill to Raines 138 kV line reaches 107% of its emergency rating. There are several other contingencies that cause overloads throughout the AEP, CLECO, and Entergy systems. They can be seen in **Table 1**.

Similar to the 2004 summer peak cases above, the 2004 winter case and the 2006 summer case show overloads in both the base case and under contingency operation. The results of these cases can be found in **Tables 2** and **3** respectively.

Table 1 – Overloaded SPP Facilities for 04SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
04SP	AEPW-AEPW	LONGWD4 to LONGWD7	493	101	DIANA 7 to SW SHV 7 and SW SH7 to LONGWD7 double contingency	Add second 345/138 kV autotransformer (450 MVA, continuous)

04SP	AEPW-AEPW	FLOURNY4 to OAKPH4	209	111	DIANA 7 to SW SHV 7 and SW SH7 to LONGWD7 double contingency	Rebuild 10.42 miles of 666 ACSR w/1590 ACSR, 138 kV and replace 750 Cu jumpers at Flournoy w/1590 ACSR jumpers

04SP	AEPW-AEPW	ARSHILL4 to RAINES4	234	107	DIANA 7 to SW SHV 7 and SW SH7 to LONGWD7 double contingency	Rebuild 5.32 miles of 2-266 ACSR bundle w/1590 ACSR, 138 kV

04SP	AEPW-AEPW	S SHV 4 to WALLAKE4	209	112	DOLHILL7 to DOLHILL6	Rebuild 11.18 miles of 666 ACSR and 795 ACSR w/1272 ACSR, 138 kV
04SP	AEPW-AEPW	CLAYTON4 to NASHOBA4	107	112	PITTSB7 to VALIANT7	Reconductor 11.57 miles of 3/0 CWC w/ 1272 ACSR, 138 kV
04SP	AEPW-AEPW	NASHOBA4 to BETHEL4	107	114	PITTSB7 to VALIANT7	Reconductor 22.43 miles of 3/0 CWC w/ 1272 ACSR, 138 kV
04SP	AEPW-AEPW	LSSOUTH4 to WILKES4	316	101	WILKES4 to WELSHRE4	Reset 800/5 CT's on CB 10800 to 1500/5 (2000/5 capability)

04SP	AEPW-AEPW	PATTERS4 to SNASHVL4	118	101	CADDO7 to 7ELDEHV	Rebuild 17.72 miles of 4/0 Cu w/1272 ACSR, 138 kV
04SP	AEPW-AEPW	LSSOUTH4 to PITTSB4	236	100	CHAPELH4 to WELSHRE4	Replace 600/5 CT's at CB 10390 at Pittsburg with 1200/5 devices
04SP	AEPW-AEPW	HUGO 2-FTOWNSON2	39	101	HUGOTAP4 to HUGO--4	Reset CT's at Hugo from 200/5 to 600/5
04SP	AEPW-AEPW	LONEOAK4 to SARDIS4	107	103	PITTSB7 to VALIANT7	Reconductor 14.1 miles of 3/0 CWC w/ 1272 ACSR, 138 kV
04SP	AEPW-AEPW	CLAYTON4 to SARDIS4	107	108	PITTSB7 to VALIANT7	Reconductor 1.46 miles of 3/0 CWC w/ 1272 ACSR, 138 kV

Table 1 (Cont.) – Overloaded SPP Facilities for 04SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload

04SP	CELE-AEPW	IPAPER4 to WALLAKE4	209	107	DOLHILL7 to DOLHILL6	Rebuild 6.86 miles of 666 ACSR w/1272 ACSR, 138 kV
04SP	AEPW-EES	FULTON3 to 3PATMOS#	174	114	Base Case (no contingencies with Customer on line)	Rebuild 7.1 miles of 666 ACSR w/1272 ACSR, 115 kV
04SP	AEPW-SWPA	BEHTEL4 to BRKNBW4	95.6	114	CADDO7 to 7ELDEHV	Reconductor 9.19 miles of 3/0 CWC w/ 1272 ACSR, 138 kV and reset CT from 400/5 to 1200/5 at Broken Bow
04SP	CELE-CELE	COCODR6 to COUGH4	386	105	VILPLT6 to WESTFORK6	
04SP	CELE-CELE	DOLHILL7 to DOLHILL6	700	105	CADDO7 to 7ELDEHV	
04SP	CELE-EES	FISHER4 to 3FISHER	83	104	CARROL6 to DOLHILL6	
04SP	CELE-EES	CARROL4 to 3RINGLD	125	107	Base Case (no contingencies with Customer on line)	
04SP	EES-EES	3COUCH to 3LEWIS#	159	113	Base Case (no contingencies with Customer on line)	
04SP	EES-EES	3LEWIS# to 3PATMOS#	159	122	Base Case (no contingencies with Customer on line)	
04SP	EES-EES	3SPRINGH to 3TAYLOR	120	135	3MAG-ST to 3MAG-E	
04SP	EES-EES	3COUCH to 3MAG-DW	108	160	3MAG-ST to 3MAG-E	

Table 1 (Cont.) – Overloaded SPP Facilities for 04SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
04SP	EES-EES	3MURF-S to 4MURFRE	60	103	Base Case (no contingencies with Customer on line)	
04SP	EES-EES	3RINGLD to 3SAILES	115	104	Base Case (no contingencies with Customer on line)	
04SP	EES-EES	3BLPNT to 3LAPLAC	228	111	4WGLEN to T300/331	
04SP	EES-EES	3LAPLAC To 3gypsy	228	113	4WGLEN to T300/331	
04SP	EES-EES	3STERL to 3MERIDN#	68	105	3MONTRO to 3MIST#	
04SP	EES-EES	4NEWTONB to 4HLYSPG#	112	106	CROCKET7 to TENRUSK7	
04SP	EES-EES	3SAILES to 3ADA	115	152	3MAG-ST to 3MAG-E	
04SP	EES-EES	3LR-S to 3LR-SPR	159	104	5BALNCB to 5PRICE	
04SP	EES-EES	3MINDEN to 3ADA	115	147	3MAG-ST to 3MAG-E	
04SP	EES-EES	3COUCH to 3MCNEIL	167	110	CADDO7 to 7ELDEHV	
04SP	EES-EES	4JASPER to 4HLYSPG#	112	105	CROCKET7 to 7GRIMES	
04SP	EES-EES	3CROS-S to 3MERIDN	68	104	6ANDRUS to ANDRUSK	

Table 1 (Cont.) – Overloaded SPP Facilities for 04SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused The Worst Overload	Upgrades Required to Relieve Overload
04SP	EES-EES	2PCG913 to 2VCMII	200	117	6PPG23 to 2PPC SO	
04SP	EES-EES	2VCMII to 2CT5	200	113	6PPG23 to 2PPC SO	
04SP	EES-EES	2RVISNO to 2CT5	200	108	6PPG23 to 2PPC SO	
04SP	EES-EES	4PTHUD to 2PT.HUD	100	104	6JAGUAR to 2JAG B	
04SP	EES-EES	2L637TP to 2CHAPAN	56	101	COCODR6 to VILPLT6	
04SP	EES-EES	2L658TP to 2L637TP	51	111	COCODR6 to VILPLT6	
04SP	EES-EES	2OPEL to 2L658TP	51	107	COCODR6 to VILPLT6	
04SP	EES-EES	3MAG-DW to 3TAYLOR	159	104	3MAG-ST to 3MAG-E	
04SP	EES-EES	3STEPHN to 3CAMD-S#	96	114	3ELDEHV to 8ELDEHV	
04SP	EES-EES	3LUCKY to 3HODGE	80	102	3RINGLD to 3SAILES	
04SP	EES-EES	3LR-FOU to 3LR-SPR	159	104	3LR-W to 3LR-WOD	
04SP	EES-EES	3LR-MAN to 3MABEL	319	102	3LR-HIN to 3LR-S	

Table 1 (Cont.) – Overloaded SPP Facilities for 04SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From –To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused The Worst Overload	Upgrades Required to Relieve Overload
04SP	EES-EES	3LR-E to 3LR-FOU	159	100	3LR-ROK to 3LR-BOY	
04SP	EES-EES	3LR-PIN to 3LR-WAL	159	102	3LR-W to 3LR-WOD	
04SP	EES-EES	5FLIPN to 5SUMMIT	162	111	5OSAGE# to EUREKA5	
04SP	EES-EES	5GRFOR to 5HARRW	223	109	5OSAGE# to EUREKA5	
04SP	EES-EES	5HARRE to 5SUMMIT	162	103	5OSAGE# to EUREKA5	
04SP	EES-EES	3B.WLSN To 3SPNPOT	199	101	3N.WLSN to 3VKSBRG	
04SP	EES-EES	3STERL to 3CROSN	80	10	3 CROS-S to 3MERIDN#	
04SP	EES-EES	3STEPHN to 3MCNEIL	96	101	MCLE U1 to 3MCLELN#	
04SP	EES-EES	6HARLSON to 2HARLSON #2	200	133	6HARLSON to 2HARLSON #1	
04SP	EES-EES	3LYNCH to 3MCMALMT	159	100	3JAX-N to 3SYLVN	
04SP	EES-EES	3LR- CHI to 3LR-MAN	319	100	3LR-HIN to 3LR-S	
04SP	EES-EES	3LR-W to 3LR-WOD	133	101	3LR-S to 3LR-SPR	
04SP	EES-EES	3SPRINGH to 3SAREPT	120	121	3MAG-ST to 3MAG-E	

Table 2 – Overloaded SPP Facilities for 04WP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
**** 04WP	AEPW-AEPW	LONEOAK4 to SARDIS4	122	102	PITTSB7 to VALIANT7	Reconductor 14.1 miles of 3/0 CWC w/ 1272 ACSR, 138 kV
**** 04WP	AEPW-AEPW	CLAYTON4 to SARDIS4	122	106	PITTSB7 to VALIANT7	Reconductor 1.46 miles of 3/0 CWC w/ 1272 ACSR, 138 kV
**** 04WP	AEPW-AEPW	CLAYTON4 to NASHOBA4	122	109	PITTSB7 to VALIANT7	Reconductor 11.57 miles of 3/0 CWC w/ 1272 ACSR, 138 kV
**** 04WP	AEPW-AEPW	NASHOBA4 to BETHAL4	122	110	PITTSB7 to VALIANT7	Reconductor 22.43 miles of 3/0 CWC w/ 1272 ACSR, 138 kV
04WP	AEPW-AEPW	PITTSB2 to FERNDTP2	72	101	PERDUE4 to LHAWKIN4	Replace 600 A switches w/ 1200 A devices
**** 04WP	AEPW-EES	FULTON3 to 3PATMOS#	197	107	Base Case (no contingencies with Customer on line)	Rebuild 7.1 miles of 666 ACSR w/1272 ACSR, 115 kV
04WP	AEPW-EES	SNASHVL4 to 4MURFRE	105	101	CADDO7 to 7ELDEHV	Replace 400 A wavetrap at South Nashville with 1200 A device
04WP	AEPW-SWPA	BETHEL4 to BRKNBW4	95.6	118	CADDO7 to 7ELDEHV	Reconductor 9.19 miles of 3/0 CWC w/ 1272 ACSR, 138 kV and reset CT from 400/5 to 1200/5 at Broken Bow
04WP	CELE-CELE	COCDR6 to COUGH4	386	104	COCODR6 to VILPLT	
04WP	CELE-CELE	DOLHILL7 to DOLHILL6	700	102	CADDO7 to 7ELDEHV	

Table 2 (Cont.) – Overloaded SPP Facilities for 04WP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
04WP	CELE-EES	CARROL4 to 3RINGLD	125	105	Base Case (no contingencies with Customer on line)	
04WP	EES-EES	3COUCH to 3LEWIS#	159	122	Base Case (no contingencies with Customer on line)	
04WP	EES-EES	3MURF-S to 4MURFRE	60	116	Base Case (no contingencies with Customer on line)	
04WP	EES-EES	3RINGLD to 3SAILES	115	107	Base Case (no contingencies with Customer on line)	
04WP	EES-EES	3SAILES to 3ADA	115	111	3SPRINGH to 3TAYLOR	
04WP	EES-EES	3MINDEN to 3ADA	115	110	3MAG-ST to 3MAG-E	
04WP	EES-EES	3COUCH to 3MCNEIL	167	115	CADDO7 to 7ELDEHV	
04WP	EES-EES	3MURFS-3MURFE#	98	103	CADDO7 to 7ELDEHV	
04WP	EES-EES	7ELDEHV to 8ELDEHV	896	105	LYDIA7 to VALIANT7	
04WP	EES-EES	3STEPHN to 3MCNEIL	96	118	3ELDEHV to 8ELDEHV	
04WP	EES-EES	2VCMII to 2CT5	200	102	6PPG23 to 2PPC SO	
04WP	EES-EES	3ELLIOT to 3S GREN	85	105	6TILTOB to 3TILTOB	

Table 2 (Cont.) – Overloaded SPP Facilities for 04WP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
04WP	EES-EES	3STERL to 3CROSN	80	106	3HRMTG to 3CARMEL	
04WP	EES-EES	3SAILES to 3TEXASE	80	102	3DANVLL to 3JONSBRO	
04WP	EES-EES	3STERL to 3MERIDN#	60	100	3HIL0 to 3ELDEHV	
04WP	EES-EES	3MCLEAN# to 3SMACKO	96	105	3STEPHN to 3MCNEIL	

Table 3 – Overloaded SPP Facilities for 06SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
**** 06SP	AEPW-AEPW	ROCKHILL4 to TATUM4	209	102	DIANA 7 to SW SHV 7 and SW SH7 to LONGWD7 double contingency	Rebuild 6.52 miles of 666 ACSR w/1272 ACSR, 138 kV
06SP	AEPW-AEPW	LONGWD4 to LONGWD7	493	112	DIANA 7 to SW SHV 7 and SW SH7 to LONGWD7 double contingency	Add second 345/138 kV autotransformer (450 MVA, continuous)
06SP	AEPW-AEPW	S SHV 4 to WALLAKE4	209	125	DOLHILL7 to DOLHILL6	Rebuild 11.18 miles of 666 ACSR and 795 ACSR w/1272 ACSR, 138 kV and replace 800 A wavetrap at South Shreveport w/2000 A trap
**** 06SP	AEPW-AEPW	PATTERS4 to SNASHVL4	118	106	CADDO7 to 7ELDEHV	Rebuild 17.72 miles of 4/0 Cu w/1272 ACSR, 138 kV
**** 06SP	AEPW-OKGE	BONANZA5 TO BONANZT5	177	101	8ANO to FTSMITH8	Rebuild 0.06 miles of 397.5 ACSR w/1272 ACSR, 161 kV
06SP	CELE-AEPW	IPAPER4 to WALLAKE4	209	122	DOLHILL7 to DOLHILL6	Rebuild 6.86 miles of 666 ACSR w/1272 ACSR, 138 kV and reset the CT's at Wallace Lake from 900/5 to 1200/5
06SP	CELE-CELE	DOLHILL7 to DOLHILL6	700	114	CADDO7 to 7ELDEHV	
06SP	CELE-EES	CARROLL4 to 3RINGLD	125	100	Base Case (no contingencies with Customer on line)	
06SP	CELE-EES	FISHER4 to 3FISHER	83	110	6WINFLD to 6MONTGY	
06SP	EES-EES	7ELDEHV to 8ELDEHV	896	102	DOLHILL7 to DOLHILL6	

Table 3 (Cont.) – Overloaded SPP Facilities for 06SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
06SP	EES-EES	3COUCH to 3LEWIS#	159	130	Base Case (no contingencies with Customer on line)	
06SP	EES-EES	3MURF-S to 4MURFR	60	112	Base Case (no contingencies with Customer on line)	
06SP	EES-EES	3VKSBRG to 3VKSBW	161	103	3SE-VKS to 3BOVINA	
06SP	EES-EES	4MT.ZION to 4GRIMES	206	111	4WALDEN to 4APRIL	
06SP	EES-EES	3LR-S to 3LR-SPR	159	104	3LR-W to 3LR-WOD	
06SP	EES-EES	3ALTO to 3SWARTZ	114	100	3B.WLSN to 3VKSB-S	
06SP	EES-EES	3RINGLD to 3SAILES	115	139	7ELDEHV to 8ELDEHV	
06SP	EES-EES	3 SAILES to 3ADA	115	154	3MAG-E to 3MCNEIL	
06SP	EES-EES	3MINDEN to 3ADA	115	150	3MAG-E to 3MCNEIL	
06SP	EES-EES	3COUCH to 3MCNEIL	167	101	CADDO7 to 7ELDEHV	
06SP	EES-EES	3LUCKY to 3HODGE	80	102	CARROL4 to RINGLD4	
06SP	EES-EES	4LEACH to 4TOLEDO	144.6	100	COOPER4 to LEESV4	

Table 3 (Cont.) – Overloaded SPP Facilities for 06SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
06SP	EES-EES	L558T485 to 4MT.ZION	206	108	4WALDEN to 4GRIMES	
06SP	EES-EES	3STEPHN to 3CAMD-S#	96	112	3ELDEHV to 8ELDEHV	
06SP	EES-EES	3MAG-DW to 3TAYLOR	159	103	3MINDEN to 3ADA	
06SP	EES-EES	3SPRINGH to 3SAREPT	120	129	3MAG-E to 3MCNEIL	
06SP	EES-EES	3SPRINGH to 3TAYLOR	120	142	3MAG-E to 3MCNEIL	
06SP	EES-EES	3LR-CHI to 3LR-MAN	319	101	3LR-AUX to 3MABEL	
06SP	EES-EES	2RIVS NO to 1PPA T1	200	114	2RIVS to 2CT6	
06SP	EES-EES	2VCMIII to 2CT5	200	146	2RIVS to 2CT6	
06SP	EES-EES	7GRIMES to 4GRIMES #1	525	102	7GRIMES to 4GRIMES #2	
06SP	EES-EES	4NEWTONB to 4HLYSPG#	112	101	4CYPRESS to 4KOUNTZE	
06SP	EES-EES	2RIVS NO to 2CT5	200	141	2RIVS to 2CT6	
06SP	EES-EES	4OAKGROV to T 300/331	135	100	6MICHU to MICH U3	
06SP	EES-EES	3GRANV-N to 3GRNV-E	85	106	3GR-MID to 3GRNVIL	

Table 3 (Cont.) – Overloaded SPP Facilities for 06SP. 750 MW transfer to southern Arkansas region of Entergy. The upgrades (if available) are included.

Study Year	From -To Area(s)	Branch Over 100% Rate B	Rate B <MVA>	750MW Transfer Case %Loading	Outaged Branch That Caused Overload	Upgrades Required to Relieve Overload
06SP	EES-EES	3STEPHN to 3MCNEIL	96	103	3SMACKO to 3ELD-DO	
06SP	EES-SWPA	5JONES to HERGETT5	148	102	5WM-EHV to 8WM-EHV	
06SP	SWPA-EES	BULLSH5 to 5MIDWAY#	162	103	Base Case (no contingencies with Customer on line)	
06SP	EES-LAGN	3MINDEN to MINDEN3	67	125	3MINDEN to 3ADA	

B. Stability Analysis

Summary

- The study results indicate that the proposed Customer 815 MW (winter, net) generation cannot be accommodated with the base interconnection plan (or Option #1) that involves looped connection to an AEP-EES 345kV line. This is due to poor damping involving the proposed generation and other generators in the vicinity.
- The proposed generation exasperates the damping performance of the nearby generators, which becomes unsatisfactory with the addition of the proposed generation.
- Four additional interconnection options were investigated, as follows:

<u>Interconnection Plan</u>	<u>Description</u>	<u>Comments</u>
Option #1	Base plan	Inadequate to meet single-contingency criteria
Option #2	PSS gain increased to 30 for each proposed unit	Inadequate to meet single-contingency criteria
Option #3	Option #2 <u>plus</u> new PSS equipment at three Welsh units	Adequate for single-contingency criteria; Inadequate for one of the double-contingency scenarios tested
Option #4	Option #3 <u>plus</u> excitation system enhancements at three Welsh units	Adequate for all single- and double-contingency criteria
Option #5	Option #3 <u>plus</u> generation curtailments at Customer	Adequate for all single- and double-contingency criteria

In summary, Option #3 is adequate to meet single-contingency criteria, but either Option #4 or Option #5 is necessary to meet double-contingency criteria.

- **If Option #4 is chosen, the practicality of installing PSS and enhancing the existing excitation system at Welsh from the physical and technical effectiveness viewpoints will need to be verified. If Option #4 is impractical and Option #5 is undesirable, to meet double-contingency criteria it would be necessary to add transmission facilities to connect the Longwood 345 kV Station to the Entergy transmission network.**
- The installed cost for adding PSS at Welch generating units 1-3 is estimated at \$210,000 (i.e., \$70,000 per unit).
- If the proposed project moves forward, followup stability studies by AEP will be required based on dynamics data and modeling for the proposed generating units that could be revised to reflect equipment commissioning tests and field settings.
- This study addresses the impact of the proposed generation independent of any other merchant generation additions to the AEP System in the vicinity with the exception of those that have executed an Interconnection Agreement or those that have requested an unexecuted Interconnection Agreement be filed with FERC. If an Interconnection

Agreement for a new generation facility in the general vicinity is executed or significant transmission network changes occur within AEP or adjacent systems, prior to the execution of an Interconnection Agreement for this facility, then a new study would be required to reassess the impact of this generation addition, and the study results contained in this report would no longer be valid.

These study results would have to be shared with neighboring systems such as EES for a review of the impact on their systems, if Customer's plan to add generation firms up.