



# **SPP** *Southwest Power Pool*

## *System Impact Study For Transmission Service Requested By Western Resources Generation Services*

*From GRDA To AECI*

*For a Reserved Amount Of 40 MW  
From 1/1/02  
To 1/1/04*

*SPP Coordinated Planning*

# Table of Contents

<b>1. EXECUTIVE SUMMARY .....</b>	<b>3</b>
<b>2. INTRODUCTION.....</b>	<b>4</b>
<b>3. STUDY METHODOLOGY .....</b>	<b>5</b>
A. DESCRIPTION.....	5
B. MODEL UPDATES.....	5
C. TRANSFER ANALYSIS.....	5
<b>4. STUDY RESULTS .....</b>	<b>6</b>
TABLE 1 - SPP FACILITY OVERLOADS CAUSED BY THE GRDA TO AECI 40 MW TRANSFER .....	7
TABLE 2 – NON-SPP FACILITY OVERLOADS CAUSED BY THE GRDA TO AECI 40 MW TRANSFER.....	8
TABLE 3 – PREVIOUSLY ASSIGNED AND IDENTIFIED SPP FACILITIES IMPACTED BY THE GRDA TO AECI 40 MW TRANSFER.....	9
<b>5. CONCLUSION.....</b>	<b>10</b>
<b>APPENDIX A .....</b>	<b>11</b>

## **1. Executive Summary**

Western Resources Generation Services (WRGS) has requested a system impact study for long-term Firm Point-to-Point transmission service from Grand River Dam Authority (GRDA) to Associated Electric Cooperative Inc. (AECI). The period of the transaction is from 1/1/02 to 1/1/04. The request is for OASIS reservation 253380 in the amount of 40 MW.

Due to the existence of higher priority requests starting on or after 1/1/2003, the WRGS Point-to-Point transmission service was previously studied for the period of 1/1/2002 to 1/1/2003. For the remaining period of the transaction from 1/1/2003 to 1/1/2004, higher priority requests exist. Analysis for the remaining period is provided without the higher priority requests included.

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the additional 40 MW transfer while maintaining system reliability.

The GRDA to AECI transfer overloads new facilities as well as impacts facilities that have been identified as limiting constraints for previously studied transfers. Tables 1 and 2 list the new overloads caused by the 40 MW transfer. Table 3 lists the previously assigned and identified facilities impacted by the 40 MW transfer.

Facilities found in Table 3 limit the ATC to zero, and as a result service cannot be provided for the requested service period due to the delay in construction of the required system upgrades.

## **2. Introduction**

Western Resources Generation Services (WRGS) requested an impact study for transmission service from GRDA to AECL.

The principal objective of this study is to identify the restraints on the SPP Regional Tariff System that may limit the transfer to less than 40 MW. This study includes steady-state contingency analyses (PSS/E function ACCC) and Available Transfer Capability (ATC) analyses.

The steady-state analyses consider the impact of the 40 MW transfer on transmission line loading and transmission bus voltages for outages of single and selected multiple transmission lines and transformers on the SPP system.

### **3. Study Methodology**

#### **A. Description**

Two analyses were conducted to determine the impact of the 40 MW transfer on the system. The first analysis was conducted to identify any new overloads caused by the 40 MW transfer. The second analysis was done to ensure that available capacity exists on previously identified circuits.

The first analysis was to study the steady-state analysis impact of the 40 MW transfer on the SPP system. The second step was to study Available Transfer Capability (ATC) of the facilities identified in the steady-state analysis impact. The steady-state analysis was done to ensure current SPP Criteria and NERC Planning Standards requirements are fulfilled. The Southwest Power Pool (SPP) conforms to the NERC Planning Standards, which provide the strictest requirements, related to thermal overloads with a contingency. It requires that all facilities be within emergency ratings after a contingency.

The second analysis was done to determine the impact of the transfer on previously assigned and identified facilities.

#### **B. Model Updates**

SPP used six seasonal models to study the 40 MW request. The SPP 2001 Series Cases: 2001/02 Winter Peak, 2002 Summer Peak, 2002/03 Winter Peak, 2003 Spring Peak, 2004 Summer Peak, and 2004/2005 Winter Peak were used to study the impact of the 40 MW transfer on the SPP system during the transaction period of 1/1/02 to 1/1/04.

The chosen base case models were modified to reflect the most current modeling information. The cases were modified to reflect future firm transfers during the request period that were not already included in the January 2001 base case series models.

#### **C. Transfer Analysis**

Using the created models and the ACCC function of PSS/E, single and select double contingency outages were analyzed. Then full AC solution was used to obtain the most accurate results possible. Any facility overloaded, using MVA ratings, in the transfer case and not overloaded in the base case was flagged. The PSS/E options chosen to conduct the Impact Study analysis can be found in Appendix A.

## **4. Study Results**

Tables 1, 2, and 3 contain the analysis results of the System Impact Study. The tables identify the seasonal case in which the event occurred; the emergency rating of the overloaded circuit (Rate B), the contingent loading percentage of circuit with and without the studied transfer, the estimated ATC value using interpolation if calculated, any SPP identification or assignment of the event, and any solutions received from the transmission owners.

Table 1 shows the new facility overloads caused by the 40 MW transfer. Upgrades associated with these new overloads can be directly assigned to the GRDA to AECI 40 MW transfer. Available solutions are given in the table.

Table 2 documents overloads on Non SPP Regional Tariff participants' transmission systems caused by the 40 MW transfer.

Table 3 documents the 40 MW transfer impact on previously assigned and identified facilities. Available solutions are given in the table.

**Table 1** - SPP Facility Overloads caused by the GRDA to AECI 40 MW Transfer

Study Year	From Area To Area	Branch Over 100% Rate B	Rate B <MVA>	No Transfer %Loading	Transfer Case %Loading	Outaged Branch That Caused Overload	ATC	Solution
01WP		NONE						
02SP	SWPA-SWPA	<b>ROBERT S. KERR TO VAN BUREN, 161KV</b> 52782 RS KERR5 161 to 52722 VAN BUR5 161 CKT 1	167	100.0	100.2	<b>BONANZA TAP TO AES, 161KV</b> 55261 BONANZT5 161 to 55262 AES 5 161 CKT1	0	Replace Four 600A Disconnect Switches with 1200A Switches
02SP	WERE-WERE	<b>MIDLAND 230/115KV TRANSFORMER</b> 56855 MIDLAND6 230 to 57252 MIDLAND3 115 CKT 1	308	100.0	100.1	<b>LAWRENCE HILL 230/115KV TRANSFORMER</b> 56853 LAWHILL6 230 to 57250 LWRNCHL3 115 CKT1	0	WERE Transmission Operating Directive
02WP		NONE						
03G		NONE						
04SP	GRRD-GRRD	<b>PENSACOLA TO GRAY TAP, 69KV</b> 54428 PENZA 269.0 to 54465 GRAY TP269.0 CKT 1	47	99.6	102.4	<b>AFTON TO CLEORA TAP, 69KV</b> 54433 AFTON 269.0 to 54492 CLEORTP269.0 CKT1	6	Rebuild Line
04SP	GRRD-GRRD	<b>PENSACOLA TO GRAY TAP, 69KV</b> 54428 PENZA 269.0 to 54465 GRAY TP269.0 CKT 1	47	98.9	101.3	<b>GROVE TO JAY, 138KV</b> 53951 GROVE 4 138 to 53971 JAY 4 138 CKT1	18	"
04WP	WERE-WERE	<b>TECUMSEH HILL EAST BUS TO STULL SWITCH. STAT., 115KV</b> 57182 TECHILE3 115 to 57270 STULL T3 115 CKT 1	92	99.9	100.1	<b>HOYT TO STRANGER CREEK, 345KV</b> 56765 HOYT 7 345 to 56772 STRANGR7 345 CKT1	21	WERE Transmission Operating Directive 803

**Table 2 – Non-SPP Facility Overloads caused by the GRDA to AECI 40 MW Transfer**

Study Year	From Area To Area	Branch Over 100% Rate B	Rate B <MVA>	No Transfer %Loading	Transfer Case %Loading	Outaged Branch That Caused Overload
01WP	AECI-AECI	96067 5CHAMO I 161 to 96626 2CHAMO I 69.0 CKT 1	50	99.9	100.8	96061 5BOONE 161 to 96493 2BOONE 69.0 CKT1
01WP	AECI-AECI	96076 5FAIRPT 161 to 96249 2FAIRPT 69.0 CKT 2	42	94.9	100.1	96076 5FAIRPT 161 to 96249 2FAIRPT 69.0 CKT1
01WP	AECI-AECI	96087 5HICKCK 161 to 96226 2HICKRY 69.0 CKT 1	56	98.3	105.4	96094 5LOCUST 161 to 96278 2LOCUST 69.0 CKT1
01WP	AECI-AECI	96087 5HICKCK 161 to 96226 2HICKRY 69.0 CKT 1	56	98.9	104.8	96087 5HICKCK 161 to 96094 5LOCUST 161 CKT1
01WP	AECI-AECI	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT 1	56	99.0	101.2	96113 5SRIVER 161 to 96349 2SRIVER 69.0 CKT2
01WP	AECI-AECI	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT 1	56	98.3	100.5	96113 5SRIVER 161 to 96349 2SRIVER 69.0 CKT1
01WP	AECI-AECI	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT 1	56	98.3	100.2	31408 OVERTON 345 to 31409 OVERTON 161 CKT1
02WP	SJLP-SJLP	69703 ST JOE 5 161 to 69701 MIDWAY 5 161 CKT 1	164	98.8	100.9	96039 7FAIRPT 345 to 96076 5FAIRPT 161 CKT3
02WP	AECI-AECI	96067 5CHAMO I 161 to 96626 2CHAMO I 69.0 CKT 1	50	99.9	100.9	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT1
02WP	AECI-AECI	96067 5CHAMO I 161 to 96626 2CHAMO I 69.0 CKT 1	50	99.9	100.9	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT2
02WP	AECI-AECI	96067 5CHAMO I 161 to 96626 2CHAMO I 69.0 CKT 1	50	100.0	100.6	96057 5BARNET 161 to 96618 2BARNET 69.0 CKT1
02WP	AECI-AECI	96076 5FAIRPT 161 to 96249 2FAIRPT 69.0 CKT 1	42	95.6	100.8	96076 5FAIRPT 161 to 96249 2FAIRPT 69.0 CKT2
02WP	AECI-AECI	96076 5FAIRPT 161 to 96249 2FAIRPT 69.0 CKT 2	42	96.3	101.5	96076 5FAIRPT 161 to 96249 2FAIRPT 69.0 CKT1
02WP	AECI-AECI	96087 5HICKCK 161 to 96226 2HICKRY 69.0 CKT 1	56	99.1	106.9	96087 5HICKCK 161 to 96094 5LOCUST 161 CKT1
02WP	AECI-AECI	96087 5HICKCK 161 to 96226 2HICKRY 69.0 CKT 1	56	98.6	106.4	96094 5LOCUST 161 to 96278 2LOCUST 69.0 CKT1
02WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 1	29	99.5	100.4	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT1
02WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 1	29	98.8	100.3	96061 5BOONE 161 to 96493 2BOONE 69.0 CKT1
02WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 2	29	99.4	100.3	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT1
02WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 2	29	98.7	100.2	96061 5BOONE 161 to 96493 2BOONE 69.0 CKT1
02WP	AECI-AECI	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT 1	56	99.9	101.8	31408 OVERTON 345 to 31409 OVERTON 161 CKT1
02WP	AECI-AECI	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT 1	56	99.6	101.7	96113 5SRIVER 161 to 96349 2SRIVER 69.0 CKT1
02WP	AECI-AECI	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT 1	56	99.6	101.2	96059 5BIG CK 161 to 96099 5MONTCT 161 CKT1
03G	AECI-AECI	96099 5MONTCT 161 to 96575 2MONTGY 69.0 CKT 1	56	98.3	100.3	96059 5BIG CK 161 to 96591 2BIG CK 69.0 CKT1
04SP	SWPA-AECI	52690 CARTHG 269.0 to 96649 2JASPER 69.0 CKT 1	47	99.9	101.0	96042 7HUBEN 345 to 96045 7MORGAN 345 CKT1
04SP	SWPA-AECI	52690 CARTHG 269.0 to 96649 2JASPER 69.0 CKT 1	47	99.8	100.8	96042 7HUBEN 345 to 96088 5HUBEN 161 CKT1
04SP	SWPA-AECI	52690 CARTHG 269.0 to 96649 2JASPER 69.0 CKT 1	47	99.5	100.8	59216 BUTLER_5 161 to 96689 2BUTLER 69.0 CKT1
04SP	AECI-AECI	96120 5THMHIL 161 to 96172 2TMHILL 69.0 CKT 2	84	97.9	100.4	96044 7MCCRED 345 to 96049 7THOMHL 345 CKT1
04SP	EES-EES	99263 3LEWIS # 115 to 99230 3COUCH 115 CKT 1	159	99.8	100.1	50024 CARROLL4 138 to 99167 3RINGLD 115 CKT1
04SP	EES-EES	99263 3LEWIS # 115 to 99230 3COUCH 115 CKT 1	159	99.8	100.1	53306 PATTERS4 138 to 53321 SNASHVL4 138 CKT1
04SP	EES-EES	99303 3PATMOS# 115 to 99263 3LEWIS # 115 CKT 1	159	99.9	100.2	99627 8KEO 50 500 to 99788 8WM-EHV 500 CKT1
04WP	AMRN-AMRN	31408 OVERTON 345 to 31409 OVERTON 161 CKT 1	300	99.9	100.3	96061 5BOONE 161 to 96519 5MLRSBG 161 CKT1
04WP	SWPA-AECI	52690 CARTHG 269.0 to 96649 2JASPER 69.0 CKT 1	52	99.6	100.6	57968 STILWEL7 345 to 57981 LACYGNE7 345 CKT1
04WP	SWPA-AECI	52690 CARTHG 269.0 to 96751 2REEDS 69.0 CKT 1	43	99.6	100.3	57968 STILWEL7 345 to 57981 LACYGNE7 345 CKT1
04WP	SWPA-AECI	52690 CARTHG 269.0 to 96751 2REEDS 69.0 CKT 1	43	99.5	100.3	59468 AUR124 5 161 to 59499 CPK446 5 161 CKT1
04WP	SWPA-AECI	52690 CARTHG 269.0 to 96751 2REEDS 69.0 CKT 1	43	99.4	100.1	52692 SPRGFLD5 161 to 59479 LAR382 5 161 CKT1
04WP	AECI-AECI	96087 5HICKCK 161 to 96226 2HICKRY 69.0 CKT 1	56	97.2	104.2	96094 5LOCUST 161 to 96278 2LOCUST 69.0 CKT1
04WP	AECI-AECI	96087 5HICKCK 161 to 96226 2HICKRY 69.0 CKT 1	56	97.8	103.5	96087 5HICKCK 161 to 96094 5LOCUST 161 CKT1
04WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 1	29	99.6	101.0	96061 5BOONE 161 to 96493 2BOONE 69.0 CKT1
04WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 1	29	99.9	100.4	96090 5KINGDM 161 to 96523 5WLMSBG 161 CKT1
04WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 1	29	99.6	100.1	96099 5MONTCT 161 to 96523 5WLMSBG 161 CKT1
04WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 2	29	99.5	100.9	96061 5BOONE 161 to 96493 2BOONE 69.0 CKT1
04WP	AECI-AECI	96090 5KINGDM 161 to 96517 2KINGDM 69.0 CKT 2	29	99.8	100.3	96090 5KINGDM 161 to 96523 5WLMSBG 161 CKT1
04WP	AECI-AECI	96098 5MOCITY 161 to 96154 1MOCTN2 100 CKT 2	34	99.3	101.3	96091 5LATHRP 161 to 96302 2LATHRP 69.0 CKT1
04WP	AECI-AECI	96153 1MOCTN1 100 to 96098 5MOCITY 161 CKT 1	34	99.2	101.3	96091 5LATHRP 161 to 96302 2LATHRP 69.0 CKT1
04WP	AECI-AECI	96153 1MOCTN1 100 to 96304 2MOCITY 69.0 CKT 1	34	99.2	101.3	96091 5LATHRP 161 to 96302 2LATHRP 69.0 CKT1
04WP	AECI-AECI	96154 1MOCTN2 100 to 96304 2MOCITY 69.0 CKT 2	34	99.3	101.3	96091 5LATHRP 161 to 96302 2LATHRP 69.0 CKT1
04WP	EES-EES	99389 4MURFRE 138 to 99387 3MURF-S 115 CKT 1	60	99.7	100.1	50045 DOLHILL7 345 to 50046 DOLHILL6 230 CKT1
04WP	EES-EES	99389 4MURFRE 138 to 99387 3MURF-S 115 CKT 1	60	99.8	100.1	53526 CROCKET7 345 to 53637 TENRUSK7 345 CKT1



**Table 3** – Previously Assigned and Identified SPP Facilities Impacted by the GRDA to AECI 40 MW Transfer

Study Year	From Area To Area	Branch Over 100% Rate B	Rate B	No Transfer %Loading	Transfer Case %Loading	Outaged Branch That Caused Overload	ATC	Assignment	Solution	Estimated Cost	New Rating	% Increase In Rating
01WP	AEPW-AEPW	IPC JEFFERSON TO LIEBERMAN, 138KV 53548 IPCJEFF4 138 to 53420 LIEBERM4 138 CKT 1	143	105.5	105.6	LONGWOOD TO WILKES, 345KV 53424 LONGWD 7 345 to 53620 WILKES 7 345 CKT1	0	SPP Flowgate	#1 Replace Switches @ Lieberman	60,000	163	14.0%
02SP	KACP-KACP	LA CYGNE TO STILWELL, 345KV 57981 LACYGNE7 to 57968 STILWEL7 CKT 1	1251	101.6	102.3	WEST GARDNER TO LA CYGNE, 345KV 57965 W.GRDNR7 345 to 57981 LACYGNE7 345 CKT1	0	SPP Flowgate	#2 Add Second LaCygne-Stilwell 345kV line and add LaCygne and Stilwell Terminals	17,000,000	N/A	N/A
02WP	AEPW-AEPW	IPC JEFFERSON TO LIEBERMAN, 138KV 53548 IPCJEFF4 138 to 53420 LIEBERM4 138 CKT 1	143	101.0	101.1	LONGWOOD TO WILKES, 345KV 53424 LONGWD 7 345 to 53620 WILKES 7 345 CKT1	0	SPP Flowgate	See Previous Upgrade #1		163	14.0%
03G		NONE										
04SP	KACP-KACP	LA CYGNE TO STILWELL, 345KV 57981 LACYGNE7 to 57968 STILWEL7 CKT 1	1251	108.4	109.1	WEST GARDNER TO LA CYGNE, 345KV 57965 W.GRDNR7 345 to 57981 LACYGNE7 345 CKT1	0	SPP Flowgate	See Previous Upgrade #2		N/A	N/A
04SP	AEPW-AEPW	CHEROKEE REC TO KNOX LEE, 138KV 53522 CHEROKE4 138 to 53557 KNOXLEE4 138 CKT 1	235	102.2	102.3	Multiple Outage Contingency SOUTHWEST SHREVEPORT TO LONGWOOD, 345KV 53454 SW SHV 7 345 to 53424 LONGWD 7 345 CKT 1 SOUTHWEST SHREVEPORT TO DIANA, 345KV 53454 SW SHV 7 345 to 53528 DIANA 7 345 CKT 1	0		Reconductor 3.25 miles of 666 ACSR with 1272 ACSR.	981,000		
04SP	SWPA-SWPA	BUFORD TAP TO BULL SHOALS, 161KV 52661 BUFRTDP5 161 to 52660 BULL SH5 161 CKT 1	167	100.1	100.7	BULL SHOALS TO MIDWAY, 161KV 52660 BULL SH5 161 to 99825 5MIDWAY# 161 CKT1	0		#4 Replace three 600A switches @ Bull Shoals w/ 1200 A switches. Resag conductor and replace structures as necessary.	150,000	223	33.5%
04WP		NONE										
Total Estimated Costs of Known Solutions										18,191,000		

## **5. Conclusion**

The previously assigned and identified facilities limit the ATC to zero due to the inability to upgrade the constraints as required. For the summer months, the ATC is zero due the loading of the La Cygne to Stilwell, La Cygne to West Gardner Flowgate. The facility cannot be relieved through system upgrades in the time period available; therefore, the request will be refused.

## Appendix A

### PSS/E CHOICES IN RUNNING LOAD FLOW PROGRAM AND ACCC

#### BASE CASES:

Solutions - Fixed slope decoupled Newton-Raphson solution (FDNS)

1. Tap adjustment – Stepping
2. Area interchange control – Tie lines only
3. Var limits – Apply immediately
4. Solution options -  Phase shift adjustment
  - Flat start
  - Lock DC taps
  - Lock switched shunts

#### ACCC CASES:

Solutions – AC contingency checking (ACCC)

1. MW mismatch tolerance –0.5
2. Contingency case rating – Rate B
3. Percent of rating – 100
4. Output code – Summary
5. Min flow change in overload report – 1 MW
6. Excl'd cases w/ no overloads form report – YES
7. Exclude interfaces from report – NO
8. Perform voltage limit check – YES
9. Elements in available capacity table – 60000
10. Cutoff threshold for available capacity table – 99999.0
11. Min. contng. case Vltg chng for report – 0.02
12. Sorted output – None

#### Newton Solution:

1. Tap adjustment – Stepping
2. Area interchange control – Tie lines only
3. Var limits - Apply automatically
4. Solution options -  Phase shift adjustment
  - Flat start
  - Lock DC taps
  - Lock switched shunts