System Impact Study for Transmission Service Request from Cogentrix to Ameren & Entergy

SPP/WSCC
Transmission Planning
(#OAIP 99004)

August 14, 1999

Table of Contents

Executive Summary

PECO Energy has requested a system impact study for long-term firm point to point transmission service from a merchant plant in the vicinity of Public Service Company of Oklahoma's (PSO's) Riverside Power Station. Yearly transmission service for 800 MW has been requested for 2001. Two separate requests were made for 400 MW each, OASIS request # 121376 from CSW to Entergy and OASIS request # 121377 from CSW to Ameren.

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the two 400 MW transfers while maintaining system reliability and stability. For the purposes of this study the two 400 MW transfers were studied together.

The analysis in this document shows that to accommodate an 800 MW transfer, upgrades will be required on the CSW 69kV and 138kV transmission systems. These upgrades include reconductoring of a 138kV transmission line, changing out disconnect switches and changing out jumpers. The total cost of these upgrades in 1999 dollars is $775,000.

The SPP and CSW shall use due diligence to add necessary facilities or upgrade the Transmission system to provide the requested transmission service, provided PECO Energy agrees to compensate CSW for such costs pursuant to the terms of section 27 of the SPP Open Access Transmission Tariff. Expedited procedures for new facilities are available to PECO Energy per section 19.8 of the SPP Open Access Transmission Service Tariff.

Engineering and construction of any new facilities or modifications will not start until after a transmission service agreement and/or construction agreement is in place and CSWS receives the appropriate authorization to proceed from the SPP after they receive authorization from the transmission customer.

Introduction

PECO Energy has requested a impact study for transmission service from a merchant plant in the vicinity of Public Service Company of Oklahoma's (PSO's) Riverside Power Station. Yearly transmission service for 800 MW has been requested for 2001. The total generation capability of the plant is 900 MW.

The principal objective of this study is to identify the restraints on the system that may limit the transfer to less than 800 MW. This study includes steady-state contingency analysis (PSS/E function ACCC) and Available Transfer Capability (ATC) analysis.

The steady-state analysis considers the impact of an 800 MW transfer on transmission line loading and transmission bus voltages for outages of single, double, and triple circuit transmission lines, autotransformers, and generators on the CSW system.

ATC analysis shows the amount of First Contingency Incremental Transfer Capabilities (FCITC) between the given study systems and what if any the limitations are for transferring up to 800 MW.

Study Methodology

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

1) More probably 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 circuit transmission lines. Less probable contingency testing involves the loss of any two critical pieces of equipment such as 345kV autotransformers and generating units or the loss of critical transmission lines in the same right-of-way.

A 2000 summer peak case and a 2000 winter peak case were used to model the transmission network and system loads. A base Southwest Power Pool Case for 2001 summer and winter peaks were not available at the time of this study. These cases were modified to reflect expected changes due to be in service by 2001 that were not included in the base cases.

Using the created models and the ACCC function of PSS\E, single and select double contingency outages on the CSW system were analyzed. Shown in table 1 and table 2 are the outages that caused overloads and the upgrades needed to solve the overloading problems in both the summer and winter cases.

The contingency that caused the most problems was a less probable contingency. This contingency consists of the three 345kV lines coming out of Riverside 345kV substation and one 138kV line out of Riverside 138kV substation. The four lines are in the same right-of-way for 1.6 miles, while the three 345kV lines are in the same right-of-way an additional 2.1 miles.

The most troublesome problem caused by the above outage is the overloading of the single 345/138kV autotransformer at Riverside 345kV substation. The transfer capability from the merchant would be limited to 625 MW, regardless of what system the transfer was with. If this outage occurs, generation will have to be curtailed at the plant, unless the 138kV line from Riverside Station to Wekiwa substation was converted to 345kV. This conversion would alleviate all overloading conditions caused by the outage.

In both the summer and winter peak studies a few problems were found on systems other than CSW. In the 2001 summer peak study the jointly owned line from CSW's Riverside substation to OG&E's Beeline substation overloads during several outages. In the 2001 winter peak study the OG&E owned line from Bristow to Bluebell loads to 100.4% of its emergency rating during the outage of the three 345kV lines out of Riverside 345kV substation that are in the same right-of-way.

Table No. 1: 2001 Summer Peak Transmission Service Study – 800 MW

Conditions:
1) 2001 Summer Peak 2) 126th & Harvard Generation modeled – 800 MW

Using ACCC function of PSS\E

Load flow case description	Overloaded lines/ Buses with low voltage	Solutions
Base Case	None	None
Prattville – Sand Springs 138kV feeder 81-818 out	Explorer Glenpool (OG&E) – Riverside 138kV – 102.7% of emergency	Rebuild 4.71 miles of 795 ACSR with 1272 ACSR
Tulsa North – Northeastern Station 345kV feeder 90-909 out	Tulsa Power Station (TPS) – Carson Tap 138kV – 102.4% of emergency	Replace 600A switches (CB 1333A) at TPS
Explorer Glenpool (OG&E) – Riverside 138kV feeder 81-523 out	TPS – Carson Tap 138kV – 114% of emergency TPS – Oaks 138kV – 102.9% of emergency	Replace 600A switches (CB 1333A) at TPS Replace 600A switches (CB 1329A) at TPS
TPS – Sand Springs 138kV feeder 81-808 out	TPS – Oaks 138kV – 105.5% of emergency	Replace 600A switches (CB 1329A) at TPS
TPS – Sand Springs & Denver – Sand Springs 138kV feeders 81-812 & 81-524 out	TPS – Carson Tap 138kV – 105.7% of emergency	Replace 600A switches (CB 1333A) at TPS
Riverside Station 1.52 mile 138kV Triple circuit, 81-522 to TPS, 81-513 to 96th & Yale, and 81-809 to South Hudson out	Explorer Glenpool (OG&E) – Riverside 138kV – 100.2% of emergency	Rebuild 4.71 miles of 795 ACSR with 1272 ACSR
Sand Springs to TPS 2.2 mile Double Circuit, 138kV fdrs 81-812 & 81-808	Explorer Glenpool (OG&E) – Riverside 138kV – 104.9% of emergency	Rebuild 4.71 miles of 795 ACSR with 1272 ACSR
Riverside South same Right of Way 345kV lines 90-902 to Oneta, 90-907 to Arcadia, & 345kV line to Muskogee and 138kV line 81-544 to Kimberly Clark	Riverside – Weleetka (SWPA) 138kV – 105.7% of emergency TPS – Carson Tap 138kV – 111.1% of emergency Riverside 345/138kV Autotransformer 128.9% of emergency TPS – Riverside 138kV – 104% of emergency Riverside to Explorer Glenpool (OG&E) – 111.9% of emerg. TPS to 36th & Lewis 138kV – 104% of emergency	Rebuild 46.13 miles of 266.8 ACSR with 795 ACSR Replace 600A switches (CB 1333A) at TPS Convert Riverside to Wekiwa line to 345kV Replace 600A switches (CB 1313A) at TPS Rebuild 4.71 miles of 795 ACSR with 1272 ACSR Replace 1200A switches at TPS & 36th & Lewis

Table No. 2: 2001 Winter Peak Transmission Service Study – 800 MW

Conditions:

1) 2001 Winter Peak

2) 126th & Harvard Generation modeled – 800 MW

Using ACCC function of PSS\E

Load flow case description	Overloaded lines/ Buses with low voltage	Solutions
Base Case	None	None
Riverside – Tulsa Power Station 2.93 mile double circuit, 81-521 & 81-550	Riverside – TPS 138kV line 81-522 – 100.6% of emergency	Replace 600A switches (CB 1313A) at TPS
Riverside South same Right of Way 345kV lines 90-902 to Oneta, 90-907 to Arcadia, & 345kV line to Muskogee and 138kV line 81-544 to Kimberly Clark	Riverside 345/138kV Autotransformer 129% of emergency TPS – Riverside 138kV line 81-522 – 106.6% of emergency Bristow – Bluebell 138kV (OG&E owned) – 100.4% of emerg.	Convert Riverside to Wekiwa line to 345kV Replace 600A switches (CB 1313A) at TPS OG&E owned

Available Transfer Capability Existing System (No Improvements)

ATC studies were run using default participation points for both Entergy and Ameren. To accomplish this, the generation was scaled down among all available on-line generators at both companies. The purpose of these studies was to ensure that the desired power transfer (800 MW) could be accomplished while maintaining system reliability.

Results for the studies are shown in Table 3. The complete TLTG outputs for both summer and winter cases are attached.

As shown in the tables the amount of First Contingency Incremental Transfer Capability available is less than 800 MW in the seasons studied.

TABLE 3: AVAILABLE TRANSFER CAPABILITIES

2001 Summer Peak Transfer – 800 MW		FCITC (MW)	Limiting Constraints	Contingency
From	To			
CSW	Ameren (400 MW) & Entergy (400 MW)	45	Tulsa Power Station – Carson Tap 138kV (PSO); Switches	Tulsa Power Station - Oaks 138kV (PSO)
2001 Winter Peak Transfer – 800 MW		**Transfer Capability (MW)**	**Limiting Constraints**	**Contingency**
From	**To**			
CSW	Ameren (400 MW) & Entergy (400 MW)	477	Dyess – East Rogers 161 kV (SWEPCO); Jumpers	Flint Creek – Gentry 161kV (SWEPCO)

For all constraints limiting the transfer capability below 800 MW, see the attached TLTG outputs.

System Improvements

In order to accommodate the two requested transfers of a total of 800 MW the following improvements must be made on the CSW system. These improvements and estimated costs correspond with the base case scenario of sending 400 MW to Entergy and 400 MW to Ameren.

SYSTEM IMPROVEMENT	ESTIMATED COST (1999 DOLLARS)
Changeout three(3) 138kV 600A disconnect switches at Tulsa Power Station (CB 1333A) with new 2000A switches (TPS to Carson Tap overload)	$55,000
Changeout three(3) 138kV 600A disconnect switches at Tulsa Power Station (CB 1329A) with new 2000A switches (TPS to Oaks overload)	$55,000
Changeout three(3) 138kV 600A disconnect switches at Tulsa Power Station (CB 1313A) with new 2000A switches (TPS to Riverside overload)	$55,000
Changeout 500 CU jumpers at Dyess substation with 750 Cu jumpers (Dyess to East Rogers overload)	$10,000
Reconductor & Rebuild Riverside -Beeline (OG&E) 138kV line 81-523. Reconductor 1.9 miles owned by PSO & rebuild 2.81 miles of OG&E owned line.	$600,000
TOTAL	$775,000

The estimated time frames for engineering and construction of the projects listed above are:

Switch changeouts: 6 Months
Jumper changeout: 1 Month
81-523 reconductor: 12 Months

Times are for each individual project. No consideration was given to possible outage conflicts during construction, conflicts with construction during the summer peak, engineering and construction manpower constraints, etc. Time frame is based on engineering starting when approval is received to start on the project.

. 1-99 SOUTHWEST POWER POOL BASE CASE POWER FLOW MODEL

. 2000 SUMMER PEAK - O1SP PECO

. *** TLTG EXPORT LIMIT OUTPUT FOR SUBSYSTEM PECO ***

SOLUTION OF7498 SYSTEM CONDITIONS ATTEMPTED 0 INSOLUBLE SYSTEM CONDITIONS

INCR. TRANS CAPAB	LIMITING ELEMENT FROM	LIMITING ELEMENT TO	CKT	DISTR. FACTOR	PRE-SHIFT MW	RATING BAS/CNT A/B	CONTINGENCY DESCRIPTION
45.1	3750 CARSN-T4 138	3800 T.P.S.-4 138	1	-0.03738	-140.6	142.3 OPEN	3800 [T.P.S.-4 138] TO 3862 [OAKS--W4 138] CKT 1
104.5	3750 CARSN-T4 138	3800 T.P.S.-4 138	1	-0.03032	-139.2	142.3 OPEN	3795 [R.S.S.-4 138] TO 5148 [EXGLN4 138] CKT 1
168.0	3750 CARSN-T4 138	3800 T.P.S.-4 138	1	-0.03032	-137.2	142.3 OPEN	5147 [BEE 4 138] TO 5148 [EXGLN4 138] CKT 1
273.0	3800 T.P.S.-4 138	3862 OAKS--W4 138	1	0.03690	132.4	142.5 OPEN	3750 [CARSN-T4 138] TO 3800 [T.P.S.-4 138] CKT 1
285.7	3131 DYESS 5 161	3135 EROGERS5 161	1	0.03462	211.1	221.0 OPEN	3139 [FLINTCR5 161] TO 3187 [GENTRYR5 161] CKT 1
395.6	3750 CARSN-T4 138	3800 T.P.S.-4 138	1	-0.03738	-127.5	142.3 OPEN	3827 [S.S.---4 138] TO 3862 [OAKS--W4 138] CKT 1
416.9 *	3750 CARSN-T4 138	3800 T.P.S.-4 138	1	-0.03730	-126.8	142.3 OPEN	3800 [T.P.S.-4 138] TO 3862 [OAKS--W4 138] CKT 1
						OPEN	3862 [OAKS--W4 138] TO 3827 [S.S.---4 138] CKT 1
						OPEN	3827 [S.S.---4 138] TO 3759 [DENVR-W4 138] CKT 1
498.6	3795 R.S.S.-4 138	5148 EXGLN4 138	1	0.11385	177.6	234.4 OPEN	3794 [R.S.S.-7 345] TO 4808 [ARCAD7 345] CKT 1
						OPEN	3794 [R.S.S.-7 345] TO 3819 [ONETA--7 345] CKT 1
						OPEN	3794 [R.S.S.-7 345] TO 5124 [MSKGE7 345] CKT 1

```
                                                                            OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  528.0   3131 DYESS  5 161  3135 EROGERS5 161 1   0.03462   202.7  221.0 OPEN  3133 [ECNTRTN5 161] TO  3187 [GENTRYR5 161]
CKT 1
  533.3   3800 T.P.S.-4 138  3862 OAKS--W4 138 1   0.03702   122.8  142.5 OPEN  3800 [T.P.S.-4 138] TO  3750 [CARSN-T4 138]
CKT 1
                                                                            OPEN  3750 [CARSN-T4 138] TO  3751 [UNIONAV4 138]
CKT 1
                                                                            OPEN  3751 [UNIONAV4 138] TO  3760 [CARSN-C4 138]
CKT 1
                                                                            OPEN  3750 [CARSN-T4 138] TO  3827 [S.S.---4 138]
CKT 1
  565.1   3795 R.S.S.-4 138  5148   EXGLN4 138 1   0.10336   176.0  234.4 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
  620.4   3794 R.S.S.-7 345  3795 R.S.S.-4 138 1   1.00000    -4.6  615.8 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                            OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  620.4   3794 R.S.S.-7 345  3795 R.S.S.-4 138 1   1.00000    -4.6  615.8 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
  669.9   3800 T.P.S.-4 138  3812 36LEWIS4 138 1   0.14818   187.7  286.9 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                            OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  679.5   3795 R.S.S.-4 138  3068 WELEETK4 138 1   0.07490    64.3  115.2 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                            OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                            OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
```

```
  712.8   3795 R.S.S.-4 138  3800 T.P.S.-4 138 1   0.12347    54.9  142.9 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                                OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                                OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                                OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  741.6   3800 T.P.S.-4 138  3862 OAKS--W4 138 1   0.03688   115.2  142.5 OPEN  3750 [CARSN-T4 138] TO  3827 [S.S.---4 138]
CKT 1
  743.0   3795 R.S.S.-4 138  3068 WELEETK4 138 1   0.06962    63.5  115.2 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                                OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                                OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
```

1-99 SOUTHWEST POWER POOL BASE CASE POWER FLOW MODEL

2000 SUMMER PEAK - O1SP PECO

*** TLTG EXPORT LIMIT OUTPUT FOR SUBSYSTEM PECO ***

INCR. TRANS CAPAB	LIMITING ELEMENT FROM	LIMITING ELEMENT TO	CKT	DISTR. FACTOR	PRE-SHIFT MW	RATING BAS/CNT A/B	CONTINGENCY DESCRIPTION
758.5	3800 T.P.S.-4 138	3862 OAKS--W4 138	1	0.08571	77.5	142.5	OPEN 3794 [R.S.S.-7 345] TO 4808 [ARCAD7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 3819 [ONETA--7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 5124 [MSKGE7 345] CKT 1
							OPEN 3795 [R.S.S.-4 138] TO 3859 [KIMCLRK4 138] CKT 1
837.8 *	3800 T.P.S.-4 138	3862 OAKS--W4 138	1	0.07888	76.4	142.5	OPEN 3794 [R.S.S.-7 345] TO 4808 [ARCAD7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 3819 [ONETA--7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 5124 [MSKGE7 345] CKT 1
851.4	3795 R.S.S.-4 138	3800 T.P.S.-4 138	1	0.10649	52.2	142.9	OPEN 3794 [R.S.S.-7 345] TO 4808 [ARCAD7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 3819 [ONETA--7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 5124 [MSKGE7 345] CKT 1
885.5	3800 T.P.S.-4 138	3812 36LEWIS4 138	1	0.11751	182.9	286.9	OPEN 3794 [R.S.S.-7 345] TO 4808 [ARCAD7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 3819 [ONETA--7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 5124 [MSKGE7 345] CKT 1

```
  888.0  17853 5BULLSH* 161 17875 5MIDWAY# 161 1   0.03852   127.2  161.4 OPEN  2924 [NORFORK5 161] TO  2936 [BULL SH5 161]
CKT 1
  900.0    113 126HAR7  345  3794 R.S.S.-7 345 1   1.00000     0.0  900.0 BASE CASE
  934.4   3827 S.S.---4 138  3862 OAKS--W4 138 1  -0.03690  -108.3  142.8 OPEN  3750 [CARSN-T4 138] TO  3800 [T.P.S.-4 138]
CKT 1
  969.2   4023 OKMULGE4 138  4049 EC.HEN-4 138 1   0.06807    39.0  105.0 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                          OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  975.6   3750 CARSN-T4 138  3827 S.S.---4 138 1   0.03688   106.7  142.7 OPEN  3800 [T.P.S.-4 138] TO  3862 [OAKS--W4 138]
CKT 1
  976.1   3750 CARSN-T4 138  3827 S.S.---4 138 1   0.08559    59.1  142.7 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                          OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  977.4   3972 SCOFVLE4 138  6682 DEARING4 138 1   0.05420    90.0  143.0 OPEN  3929 [COFTAP 7 345] TO  6606 [NEOSHO 7 345]
CKT 1
  985.6   4935   BRSTO4 138  5142   BLUBL4 138 1  -0.07944   -63.7  142.0 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                          OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  999.3   5134   PECAN5 161  5135   PECAN7 345 1  -0.08623  -277.6  363.8 OPEN  5124 [  MSKGE7 345] TO  5202 [  FTSMI7 345]
CKT 1
 1012.6   3823 T.S.E.-4 138  3847 S.HUD.-4 138 1  -0.16558   -19.3  187.0 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                          OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
 1026.7   4028 WELETK4  138  4049 EC.HEN-4 138 1  -0.06807   -35.1  105.0 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
```

```
                                                                                      OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                                      OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
 1027.3   3788 52DELTP4 138  3812 36LEWIS4 138 1  -0.14818  -134.6  286.8 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                                      OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                                      OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                                      OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
 1030.4   5147   BEE  4 138  5148   EXGLN4 138 1  -0.11385  -169.5  286.8 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                                      OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                                      OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                                      OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
```

1-99 SOUTHWEST POWER POOL BASE CASE POWER FLOW MODEL

2000/01 WINTER PEAK - 01WP PECO

*** TLTG EXPORT LIMIT OUTPUT FOR SUBSYSTEM PECO ***

SOLUTION OF7500 SYSTEM CONDITIONS ATTEMPTED 0 INSOLUBLE SYSTEM CONDITIONS

INCR. TRANS CAPAB	LIMITING ELEMENT FROM	LIMITING ELEMENT TO	CKT	DISTR. FACTOR	PRE-SHIFT MW	RATING BAS/CNT A/B	CONTINGENCY DESCRIPTION
476.9	3131 DYESS 5 161	3135 EROGERS5 161	1	0.03461	203.8	220.3	OPEN 3139 [FLINTCR5 161] TO 3187 [GENTRYR5 161] CKT 1
624.8	3794 R.S.S.-7 345	3795 R.S.S.-4 138	1	1.00000	-8.9	615.9	OPEN 3794 [R.S.S.-7 345] TO 4808 [ARCAD7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 3819 [ONETA--7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 5124 [MSKGE7 345] CKT 1
624.8	3794 R.S.S.-7 345	3795 R.S.S.-4 138	1	1.00000	-8.9	615.9	OPEN 3794 [R.S.S.-7 345] TO 4808 [ARCAD7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 3819 [ONETA--7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 5124 [MSKGE7 345] CKT 1
							OPEN 3795 [R.S.S.-4 138] TO 3859 [KIMCLRK4 138] CKT 1
688.7	3131 DYESS 5 161	3135 EROGERS5 161	1	0.03461	196.4	220.3	OPEN 3133 [ECNTRTN5 161] TO 3187 [GENTRYR5 161] CKT 1
689.7	3795 R.S.S.-4 138	3800 T.P.S.-4 138	1	0.12347	57.8	142.9	OPEN 3794 [R.S.S.-7 345] TO 4808 [ARCAD7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 3819 [ONETA--7 345] CKT 1
							OPEN 3794 [R.S.S.-7 345] TO 5124 [MSKGE7 345] CKT 1

```
                                                                          OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  786.1   3795 R.S.S.-4 138  3800 T.P.S.-4 138 1   0.10649    59.2  142.9 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
  808.2   4023 OKMULGE4 138  4049 EC.HEN-4 138 1   0.06807    49.8  104.8 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                          OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  810.5   4935   BRSTO4 138  5142   BLUBL4 138 1  -0.07945   -77.5  141.9 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                          OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  840.6   4028 WELETK4  138  4049 EC.HEN-4 138 1  -0.06807   -47.5  104.8 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                          OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
  860.4   4935   BRSTO4 138  5142   BLUBL4 138 1  -0.07433   -78.0  141.9 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                          OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
  862.1   3795 R.S.S.-4 138  3800 T.P.S.-4 138 1   0.03241   115.0  142.9 OPEN  3795 [R.S.S.-4 138] TO  3771 [JENKS--4 138]
CKT 1
                                                                          OPEN  3771 [JENKS--4 138] TO  3826 [S.HIL-W4 138]
CKT 1
                                                                          OPEN  3826 [S.HIL-W4 138] TO  3800 [T.P.S.-4 138]
CKT 1
                                                                          OPEN  3826 [S.HIL-W4 138] TO  3871 [52DEL-W4 138]
CKT 1
                                                                          OPEN  3800 [T.P.S.-4 138] TO  3864 [OAKS-E4  138]
CKT 1
```

```
                                                                                OPEN  3864 [OAKS-E4  138] TO  3795 [R.S.S.-4 138]
CKT 1
  862.7   4023 OKMULGE4 138  4049 EC.HEN-4 138 1   0.06330    50.2  104.8 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                                OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                                OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
  890.2   3795 R.S.S.-4 138  3068 WELEETK4 138 1   0.07490    64.6  131.3 OPEN  3794 [R.S.S.-7 345] TO  4808 [  ARCAD7 345]
CKT 1
                                                                                OPEN  3794 [R.S.S.-7 345] TO  3819 [ONETA--7 345]
CKT 1
                                                                                OPEN  3794 [R.S.S.-7 345] TO  5124 [  MSKGE7 345]
CKT 1
                                                                                OPEN  3795 [R.S.S.-4 138] TO  3859 [KIMCLRK4 138]
CKT 1
```