



**SPP**

*Southwest  
Power Pool*

*System Impact Study for  
Transmission Service Request from  
Southwestern Public Service Co. to  
Oklahoma Gas & Electric Co.*

*SPP Transmission Planning*

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## **Executive Summary**

Southwestern Public Service Co. has requested a system impact study for long-term Firm Point-to-Point transmission service from Southwestern Public Service Co. to Oklahoma Gas & Electric Co. The transaction period is from 1/1/01 to 1/1/02. The request is for three reservations (142429; 142431; 142519), totaling 112 MW.

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the additional 112 MW transfer while maintaining system reliability. The analysis in this document shows that to accommodate an additional 112 MW transfer, upgrades will be required on the SPP transmission systems. A summary of the overloads and suggested upgrades can be found in Table No. 1.

SPP has existing long-term firm service customers with a reservation priority for this requested transmission service as described in section 2.2 of the SPP Open Access Transmission Service Tariff. SPP will extend full priority rights to existing customers prior to contracting with new eligible customers.

The SPP and effected member companies shall use due diligence to coordinate the addition of necessary facilities or transmission system upgrades to provide the requested transmission service. Southwestern Public Service Co. is to compensate SPP 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 Southwestern Public Service Co. 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 effected member companies receives the appropriate authorization to proceed from the SPP after they receive authorization from the transmission customer.

## **Introduction**

Southwestern Public Service Co. has requested an impact study for transmission service from SPS control area with a sink of OKGE.

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 112 MW. This study includes steady-state contingency analysis (PSS/E function ACCC) and Available Transfer Capability (ATC Linear) analysis.

The steady-state analysis considers the impact of a 112 MW transfer on transmission line loading and transmission bus voltages for outages of single transmission lines and autotransformers on the SPP system.

ATC analyses shows the amount of First Contingency Incremental Transfer Capabilities (FCITC) between the given study systems and what the limitations are, if any, for transferring up to 112 MW.

## **Study Methodology**

SPP has used methodologies consistent with SPP and NERC requirements.

This study was done in two different parts. The first part was to study the steady-state analysis impacts caused on the SPP system from the 112 MW transfer identified and the second part was to study Available Transfer Capability (ATC). The SPP base case models were modified to reflect the most current modeling information.

The steady-state analysis part was done to ensure current SPP Criteria and NERC Planning Standards requirements are fulfilled.

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

- 1) More probable contingency testing .... shall 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.

The NERC Planning Standards, Table 1, provides the strictest requirements related to thermal overloads with a contingency. It requires that all facilities are within emergency ratings after a contingency.

The ATC study portion was done using the requirements specified in the current SPP Criteria related to determination of ATC. The linear analysis was first performed using the PSSE TLTG activity. The results were AC verified and validated.

When facilities were identified as being overloaded the facility owners were asked to review and confirm the validity of the limit. During this review the transmission providers would use available mitigation plans.

SPP built six models for each season representative of the system with and without the requested transfer. Cases for year 2000 Winter Peak, 2001 Spring Peak, 2001 April,

2001 Summer Peak, 2001 Fall Peak, and 2001 Winter Peak were included. These cases were modified to reflect future firm transfers not already included in the January 2000 base case series.

Using the created models and the ACCC function of PSS\E, single and select double contingency outages were analyzed. Then full AC solution was to obtain the most accurate results possible. Any facility, which overloaded using MVA ratings in the transfer case and was not overloaded in the base case, was flagged.

Shown in Table No. 1 are the outages that caused overloads and the upgrades needed to solve the overloading problems in the appropriate year cases.

#### 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 automatically
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 - 1.0
2. Contingency case rating - Rate B
3. Percent of rating - 100
4. Output code - Summary
5. Min flow change in overload report - 1mw
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

Table No. 1: SPS TO OKGE Transmission Service Study – 112 MW

Study Year	Load flow case description (opened branch(es))	Overloaded lines	% load	Solutions
00 WP	All Studied Contingencies	NONE	-----	
01 AP	TUCO 345/230 KV XFMR 51533[TUCO 6] TO 51534[TUCO 7] CKT 1	ELK CITY to MOREWOOD SOUTHWEST 138kV 54121 ELKCTY-4 TO 56001 MORWODS4	131.6	NEW
01 AP	TUCO 345 KV to OKLAUNION 345 KV 51534[TUCO 7] TO 54119[O.K.U.-7] CKT 1	GRAMEVN to ELK CITY 230 KV 50827 GRAPEVN6 TO 54153 ELKCITY6 ELK CITY to MOREWOOD SOUTHWEST 138 kV 54121 ELKCTY-4 TO 56001 MORWODS4	104.4 135.9	NEW NEW
01 AP	TUCO 345 KV to OKLAUNION 345 KV 51534[TUCO 7] TO 54119[O.K.U.-7] CKT 1 TUCO 345/230 KV XFMR 51533[TUCO 6] TO 51534[TUCO 7] CKT 1	ELK CITY to MOREWOOD SOUTHWEST 138 KV 54121 ELKCTY-4 TO 56001 MORWODS4	131.5	NEW
01 AP	TUCO TO OKLAUNION 345 KV 51534[TUCO 7] TO 54119[O.K.U.-7] CKT 1 TUCO 345/230 KV XFMR 51533[TUCO 6] TO 51534[TUCO 7] CKT 1 OKLAUNION TO LAWTON EASTSIDE 345 KV 54119[O.K.U.-7] TO 54131[L.E.S.-7] CKT 1 OKLAUNION TO OKLAUNION 345 KV 54119[O.K.U.-7] TO 59991[OKLAUN 7] CKT 1	ELK CITY to MOREWOOD SOUTHWEST 138 KV 54121 ELKCTY-4 TO 56001 MORWODS4	130.6	NEW
01 AP	OKLAUNION TO LAWTON EASTSIDE 345 KV 54119[O.K.U.-7] TO 54131[L.E.S.-7] CKT 1	ELK CITY 230/138 XFMR 54121 ELKCTY-4 TO 54153 ELKCIT6 ELK CITY to MOREWOOD SOUTHWEST 138 KV Y6 54121 ELKCTY-4 TO 56001 MORWODS4	137.8 114.3	ADDRESSED IN PREVIOUS STUDY NEW
01 SR	OKLAUNION TO LAWTON EASTSIDE 345 KV 54119[O.K.U.-7] TO 54131[L.E.S.-7] CKT 1	ELK CITY 230/138 XFMR 54121 ELKCTY-4 TO 54153 ELKCITY6 ELK CITY to MOREWOOD SOUTHWEST 138 KV 54121 ELKCTY-4 TO 56001 MORWODS4	149.9 103.5	ADDRESSED IN PREVIOUS STUDY NEW
01 SR	ORCHARD TO UNITED NO. 7 ROSE 69 KV 57218[ORCHARD2] TO 57224[UN7ROSE2] CKT 1	LEHIGH TAP TO OWL CREEK 69KV 57213 LEHIGTP2 TO 57217 OWL CRK2	100.1	NEW
01 SP	GRAPEVN TO NICHOLS 230 KV 50827[GRAPEVN6] TO 50915[NICHOL 6] CKT 1	GRAY CO 115/69 KV XFMR 50781 GRAY CO2 TO 50782 GRAY CO3	107.0	NEW
01 SP	TUCO 345/230 KV XFMR 51533[TUCO 6] TO 51534[TUCO 7] CKT 1	ELK CITY 230/138 XFMR 54121 ELKCTY-4 TO 54153 ELKCITY6	139.1	ADDRESSED IN PREVIOUS STUDY

Table No. 1 continued: SPS TO OKGE Transmission Service Study – 112 MW

Study Year	Load flow case description (opened branch(es))	Overloaded lines	% load	Solutions
01 SP	TUCO TO OKLAUNION 345 KV 51534[TUCO 7] TO 54119[O.K.U.-7] CKT 1	ELK CITY 230/138 XFMR 54121 ELKCTY-4 TO 54153 ELKCITY6	138.9	ADDRESSED IN PREVIOUS STUDY
01 SP	OKLAUNION TO LAWTON EASTSIDE 345 KV 54119[O.K.U.-7] TO 54131[L.E.S.-7] CKT 1	ELK CITY 230/138 XFMR 54121 ELKCTY-4 TO 54153 ELKCITY6	122.8	ADDRESSED IN PREVIOUS STUDY
01 SP	BEE LINE TO EXPLORER GLENPOOL 55247[ BEE 4] TO 55248[ EXGLN4] CKT 1	PRATTVILLE TO BLUEBELL 138 KV 53770 PRATTV-4 TO 55242 BLUBL 4	101.0	NEW
01 SP	TUCO TO OKLAUNION 345 KV 51534[TUCO 7] TO 54119[O.K.U.-7] CKT 1 TUCO 345/230 KV XFMR 51533[TUCO 6] TO 51534[TUCO 7] CKT 1	ELK CITY 230/138 XFMR 54121 ELKCTY-4 TO 54153 ELKCITY6	138.9	ADDRESSED IN PREVIOUS STUDY
01 SP	TUCO TO OKLAUNION 345 KV 51534[TUCO 7] TO 54119[O.K.U.-7] CKT 1 TUCO 345/230 KV XFMR 51533[TUCO 6] TO 51534[TUCO 7] CKT 1 OKLAUNION TO LAWTON EASTSIDE 345 KV 54119[O.K.U.-7] TO 54131[L.E.S.-7] CKT 1 OKLAUNION TO OKLAUNION 345 KV 54119[O.K.U.-7] TO 59991[OKLAUN 7] CKT 1	ELK CITY 230/138 XFMR 54121 ELKCTY-4 TO 54153 ELKCITY6	139.0	ADDRESSED IN PREVIOUS STUDY
01 FA	All Studied Contingencies	NONE	-----	
01 WP	All Studied Contingencies	NONE	-----	



## **Available Transfer Capability Existing System**

ATC studies were run. The purpose of these studies was to ensure that the desired power transfer (112 MW) could be accomplished while maintaining system reliability.

The results for the studies have shown no additional problems.