SPP Southwest Power Pool

System Impact Study for Transmission Service Request from Southwestern Public Service to Northern States Power

SPP Transmission Planning
(#SPP-1999-010)

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Executive Summary

Southwestern Public Service (SPS) has requested a system impact study for long-term firm point to point transmission service from SPS to Ameren for the years 2001 through 2010. These requests wheel through Ameren and are sunk in the Northern States Power (NSP) control area. Four separate requests were made for 50 MW each.

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the four 50 MW transfers while maintaining system reliability. For the purposes of this study the four 50 MW transfers were studied together.

The analysis in this document shows that to accommodate a 200 MW transfer, upgrades will be required on the SPP transmission systems. These upgrades include reconductoring of a 138kV transmission line, changing out transformers, changing out disconnect switches and jumpers. CSW is the owner of all facilities requiring improvements. 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 CSW shall use due diligence to coordinate the addition of necessary facilities or transmission system upgrades to provide the requested transmission service. SPS 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 SPS per section 19.8 of the SPP Open Access Transmission Service Tariff.

The new 345 kV transmission facilities proposed by SPS from Potter to Holcomb and Potter to Northwest are a significant factor in evaluating this request. This service is contingent upon completion of those proposed facilities in the currently proposed schedule. Delays in completion of one of both of those facilities will alter the results of this study.

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 CSW receives the appropriate authorization to proceed from the SPP after they receive authorization from the transmission customer.

Introduction

SPS has requested an impact study for transmission service from SPS control area with a sink of NSP. No specific generation was identified as being built to accommodate this transfer so it will be studied as a system dispatch from SPS to NSP.

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 200 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 200 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 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 200 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 200 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 two models for each season representative of the system with and without the requested transfer. Base Southwest Power Pool Cases for 2001 summer and winter peaks were not available at the time of this study. Cases for year 2000 were used and they included the summer peak case, April minimum, fall peak, and winter peak cases. These cases were modified to reflect expected changes due to be in service by 2001 that were not included in the base cases. Additional summer and winter peak cases were used for the 2003, 2005 and 2008 time frames. Cases include anticipated additions and system improvements submitted by SPP members.

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. This extensive list contained facilities owned by seven different SPP companies under the Regional Tariff. The overloaded facilities list was sent to the companies for review of mitigation plans and validity. The facilities identified in the Impact Study are only those which were considered valid and had no mitigation plan.

Shown in table 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 - X Phase shift adjustment
   _ Flat start
   _ Lock DC taps
   _ Lock switched shunts

ACCC CASES:
Solutions – AC contingency checking (ACCC)
1. MW mismatch tolerance – 0.50
2. Contingency case rating – Rate B
3. Percent of rating – 100
4. Output code – Summary
5. Min flow change in overload report – 1mw
6. Excld 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 – 6000
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 - X Phase shift adjustment
_ Flat start
_ Lock DC taps
_ Lock switched shunts

Table No. 1: SPS to NSP Transmission Service Study – 200 MW

Study Year	Load flow case description	Overloaded lines/ Buses with low voltage	Solutions
2001 Summer Peak	Duncan 138/69 kV out	Walters – Comanche 69 kV - 100.0% of emergency	Replace Wave Trap
2001 Summer Peak	Pine Ridge – Washita 69 kV out	Elk City 138/69 kV - 102.3% of emergency	Change out transformer
2003 Summer Peak	Riverside – Oral Roberts E. 138 kV out or, Riverside – Oral Roberts W. 138 kV out	Tulsa Power Station (TPS) – Lewis 138kV – 100.1% and 100.1% of emergency	Rebuild 2 miles of line.
2003 Summer Peak	Dyess – South Springdale 161 kV out	Chamber Springs – Farmington 161 kV – 100.1% of emergency	Replace jumpers
2003 Summer Peak	Mountain View – Pine Ridge 69 kV out	Elk City 138/69 kV – 100.3% of emergency	Change out transformer
2005 Summer Peak	Oral Roberts E. – Warn Tap 138 kV out or, Spring Hill E. – Oral Roberts W. 138 kV out	Tulsa Power Station (TPS) – Lewis 138kV – 100.7% and 100.1% of emergency	Rebuild 2 miles of line.
2008 Summer Peak	Dyess – E. Rogers 161 kV out	East Centerton – Gentry 161 kV – 100.2% of emergency	Change out breaker and switches
2008 Summer Peak	Warren Medical – 81st & Yale N 138 kV out	Tulsa Power Station (TPS) – Lewis 138kV – 100.5%	Rebuild 2 miles of line.
2008 Summer Peak	Pine Ridge – Washita 69 kV out	Elk City 138/69 kV – 100.2% of emergency	Change out transformer

Using ACCC function of PSS\E

Available Transfer Capability Existing System

ATC studies were run using default participation points for both Southwestern Public Service and Northern States Power. To accomplish this, the generation was scaled among all available on-line generators at both companies. The purpose of these studies was to ensure that the desired power transfer (200 MW) could be accomplished while maintaining system reliability.

Results for the studies are shown in Table 2. As shown in the tables the amount of First Contingency Incremental Transfer Capability available is less than 200 MW in the two seasons studied. The results were AC verified and validated.

TABLE 2: AVAILABLE TRANSFER CAPABILITIES

Study Year	Load flow case description	Overloaded lines/ Buses with low voltage	Solutions
2003 Summer Peak	Oklaunion – Lawton 345 kV out	Elk City 230/138 kV	Replace Transformer
2005/2006 Winter Peak	Coffeyville Tap – Neosho 345 kV out	S. Coffeyville – Dearing 138 kV	Change out Switch

TABLE 3: AVAILABLE TRANSFER CAPABILITIES (TLTG Results)

2001 April Minimum				
SPS Exports to SPP	SPS to EMDE	0		
	Lamar DC Tie schedule	NA		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	Elk City 230/138 kV	CSW	308	Oklaunion - Tuco 345 kV
2001 Summer Peak				
SPS Exports to SPP	SPS to EMDE	45		
	Lamar DC Tie schedule	NA		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	Elk City 230/138 kV	CSW	213	Oklaunion - Lawton 345 kV
2001 Fall Peak				
SPS Exports to SPP	SPS to EMDE	45		
	Lamar DC Tie schedule	NA		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	Elk City 230/138 kV	CSW	229	Oklaunion - Lawton 345 kV
2001/2002 Winter Peak				
SPS Exports to SPP	SPS to EMDE	45		
	Lamar DC Tie schedule	NA		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	Elk City 230/138 kV	CSW	215	Oklaunion - Lawton 345 kV
2003 Summer Peak				
SPS Exports to SPP	SPS to EMDE	0		
	Lamar DC Tie schedule	210		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	Elk City 230/138 kV	CSW	66	Oklaunion - Lawton 345 kV

2003/2004 Winter Peak

SPS Exports to SPP	SPS to EMDE	0		
	Lamar DC Tie schedule	210		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	Elk City 230/138 kV	CSW	215	Oklaunion - Lawton 345 kV

2005 Summer Peak

Potter - Northwest 345 kV in-service

SPS Exports to SPP	SPS to EMDE	0		
	Lamar DC Tie schedule	210		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	Elk City 230/138 kV	CSW	433	Oklaunion - Lawton 345 kV

2005/2006 Winter Peak

SPS Exports to SPP	SPS to EMDE	0		
	Lamar DC Tie schedule	210		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	S. Coffyville - Dearing 138 kV	CSW	83	Coffyville Tap - Neosho 345 kV

2008 Summer Peak

SPS Exports to SPP	SPS to EMDE	0		
	Lamar DC Tie schedule	210		
	Limits	**Company**	**MW**	**Outage**
TLTG Results	Elk City 230/138 kV	CSW	486	Oklaunion - Lawton 345 kV