SPP Southwest Power Pool

System Impact Study SPP-2004-007-1 For Network Service Requested By Southwestern Public Service Company

From SPS To SPS

For a Reserved Amount Of 20 MW From 7/1/2004 To 7/1/2019

SPP Engineering, Tariff Studies

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1. Executive Summary

Southwestern Public Service Company has requested a system impact study for Network Integration Transmission Service from SPS to SPS for 20 MW. The period of the service requested is from 7/1/2004 to 7/1/2019. The OASIS reservation number is 636886.

The principal objective of this study is to identify system constraints and potential system modifications necessary to grant the requested Network Service while maintaining system reliability. Due to higher priority requests, analysis was conducted to evaluate only the first year of service.

The requested service was studied using two System Scenarios with SPS exporting and importing, respectively. The service was modeled by transfers from SPS generation to the Network Load. Tables 1.1 and 1.2 list the SPS facility overloads caused or impacted by the transfers modeled using Scenario 1 and 2, respectively. Tables 2.1 and 2.2 list the SPS voltage violations caused or impacted by the transfers modeled using Scenario 1 and 2, respectively. No facilities outside of SPS were identified as being impacted with application of established transfer distribution factor cutoffs.

The SPS to SPS 20 MW request, evaluated for the first year only, does not create any new violations or impacts on facilities requiring upgrades. Therefore, the service will be accepted for the first year. The reservation queue priority of the remaining years of requested service will remain the same. SPP requests that a facility study agreement be executed. Upon execution of a facility study agreement, SPP will evaluate the remaining years of requested service and determine necessary transmission upgrades.

2. Introduction

Southwestern Public Service Company has requested a system impact study for Network Integration Transmission Service from SPS to SPS for 20 MW. The principal objective of this study is to identify the restraints on the SPP Regional Tariff System that may limit the requested service and determine the least cost solutions required to alleviate the limiting facilities. Due to higher priority requests, analysis was conducted to evaluate only the first year of service.

The 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 request on transmission line and transformer loadings, and bus voltages for outages of single transmission lines and transformers, and selected multiple transmission lines and transformers on the SPP system and first tier Non - SPP systems. Generation unit outages were performed for the SPS control area.

The requested service was studied using two System Scenarios with SPS exporting and importing, respectively. The two scenarios were studied to capture worst case system limitations dependent on the bias of the transmission system. The service was modeled by transfers from SPS generation to the Network Load.

3. Study Methodology

A. Description

The system impact analysis was conducted to determine the steady-state impact of the requested service on the SPP and first tier Non - SPP control area systems. The steady-state analysis was done to ensure current SPP Criteria and NERC Planning Standards requirements are fulfilled. The Southwest Power Pool conforms to the NERC Planning Standards, which provide the strictest requirements, related to voltage violations and thermal overloads during normal conditions and during a contingency. It requires that all facilities be within normal operating ratings for normal system conditions and within emergency ratings after a contingency. Normal operating ratings and emergency operating ratings monitored are Rate A and B in the SPP MDWG models, respectively. The lower bound of the normal voltage range monitored is 95%. The lower bound of the emergency voltage range monitored is 90%. The Tuco 230 kV bus voltage is monitored at 92.5% due to pre-determined system stability limitations.

The contingency set includes all SPP control area branches and ties 69kV and above, first tier Non - SPP control area branches and ties 115 kV and above, and any defined contingencies for these control areas. Generation unit outages for the SPS control area with SPP reserve share program redispatch were included in the contingency set. The monitor elements include all SPP control area branches, ties, and buses 69 kV and above, and all first tier Non – SPP control area branches and ties 69 kV and above. Voltage monitoring was performed for SPP control area buses 69 kV and above.

A 3 % transfer distribution factor (TDF) cutoff was applied to all SPP control area facilities. For first tier Non – SPP control area facilities, a 3 % TDF cutoff was applied to AECI, AMRN, and ENTR and a 2 % TDF cutoff was applied to MEC, NPPD, and OPPD. For voltage monitoring, a 0.02 per unit change in voltage must occur due to the transfer to be considered a valid limit to the transfer.

B. Model Updates

SPP used eight seasonal models to study the requested service for the first year of service. The SPP 2004 Series Cases Update 2 2004 Summer Peak (04SP), 2004 Summer Shoulder (04SH), 2004 Fall Peak (04FA), 2004/2005 Winter Peak (04WP), 2005 April Minimum (05AP), 2005 Spring Peak (05G), 2005 Summer Peak (05SP), and 2005 Summer Shoulder (05SH) were used to study the impact of the requested service on the transmission system during the first year of service from 7/1/2004 to 7/1/2005. The Spring Peak models apply to April and May, the Summer Peak models apply to June through September, the Fall Peak models apply to October and November, and the Winter Peak models apply to December through March.

The chosen base case models were modified to reflect the most current modeling information. From the eight seasonal models, two system scenarios were developed. Scenario 1 includes SWPP OASIS transmission requests not already included in the SPP 2004 Series Cases flowing in a West to East direction with ERCOT exporting and the SPS Control Area exporting to outside control areas and exporting to the planned Lamar HVDC Tie. Scenario 2 includes transmission requests not already included in the SPP 2004 Series Cases flowing in an East to West direction with ERCOT net importing and SPS importing from an outside control area and importing from the planned Lamar HVDC Tie. The system scenarios were developed to minimize counter flows to the transfers studied. The Lamar HVDC Tie is modeled starting in the 2004 Fall Peak.

The Network load for the 2004 Summer Peak was forecasted to be a maximum of 20 MW. Summer peaks were forecasted to increase 2.7% annually. The Network load amounts modeled for the spring peaks, fall peaks and winter peaks was 65% of the summer peaks. The Network load amount modeled in the summer shoulder is 85% of the summer peaks. The Network load amount for 2005 April minimum is 47% of the summer peaks. Future Summer Peak and Non-Summer Peak loads were determined by scaling the 2004 summer peak values while maintaining constant real power and reactive power ratios. Table 3 documents the total Network load modeled and the transfer amounts modeled in each seasonal case.

SPS currently has 7 MW of long-term firm point-to-point service to the Network Load. The existing reserved service was modeled in the cases before any transfer analysis was performed.

C. Transfer Analysis

The service was modeled by transfers from SPS generation to the Network Load. Using the selected cases both with and without the transfers modeled, the PSS/E Activity ACCC was run on the cases and compared to determine the facility thermal overloads and voltage violations caused or impacted by the transfer. The PSS/E options chosen to conduct the analysis can be found in Appendix A.

E. Upgrade Analysis

This system impact study does not include analysis of upgrades.

4. Study Results

A. Study Analysis Results

Tables 1.1, 2.1, 1.2, and 2.2 contain the steady-state analysis results of the System Impact Study. The Tables are in the attached workbook *SPP-2004-007-1 Tables*. The tables identify the seasonal case in which the event occurred, the transfer amount studied which does not include the existing 7 MW of firm service, the facility control area location, applicable ratings of the overloaded facility, the loading percentage or voltage with and without the studied transfer, the percent transfer distribution factor (TDF) if applicable, and the estimated ATC value using interpolation if calculated. Comments are provided in the tables to document any SPP or Non - SPP identification or assignment of the event, existing mitigations plans or criteria to disregard the event as a limiting constraint, upgrades and costs to mitigate a limiting constraint, or any specific study procedures associated with modeling an event.

Tables 1.1 and 1.2 list the SPP Facility Overloads caused or impacted by the transfers modeled from SPS generation to the Network Load using Scenario 1 and 2, respectively. Tables 2.1 and 2.2 list the SPP facility voltage violations caused or impacted by the transfers modeled from SPS generation to the Network Load using Scenario 1 and 2, respectively. No facilities outside of SPS were identified as being impacted with application of established transfer distribution factor cutoffs. All SPS limitations identified were mitigated by implementing and verifying SPS Operating Guides.

Tables 1.1a and 1.2a documents the modeling representation of the events identified in Tables 1.1 and 1.2 to include bus numbers and bus names.

5. Conclusion

The SPS to SPS 20 MW request, evaluated for the first year only, does not create any new violations or impacts on facilities requiring upgrades. Therefore, the service will be accepted for the first year. The reservation queue priority of the remaining years of requested service will remain the same. SPP requests that a facility study agreement be executed. Upon execution of a facility study agreement, SPP will evaluate the remaining years of requested service and determine necessary transmission upgrades.

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 - X 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 – 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 – 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 - X Phase shift adjustment
   _ Flat start
   _ Lock DC taps
   _ Lock switched shunts

Study Case	Transfer Amount (MW)	From Area	To Area	Monitored Branch Overload	Rate <MVA>	BC % Loading	TC % Loading	%TDF	Outaged Branch Causing Overload	ATC (MW)	Solution	Estimated Cost
04SP	13	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	114.4	149.7	108.9	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	13	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909) and b. Close Normally Open line between ZAVALLA2 (51723) and SLAUGHT2 (51725) and/or c. Close Normally Open line between ELEVEL2 (51607) and SLAUGT2 (51727).	
04SP	13	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	114.4	149.8	109.0	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	13	"	
04SH	10	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	99.9	129.4	118.1	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	10	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
04SH	10	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	99.9	129.5	118.2	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	10	"	
04FA	6			NONE IDENTIFIED						6		
04WP	6			NONE IDENTIFIED						6		
05AP	2.4			NONE IDENTIFIED						2.4		
05G	6.4	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	83.4	106.5	144.6	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	6.4	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
05G	6.4	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	83.4	106.5	144.6	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	6.4	"	
05SP	13.5	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	116.3	153.3	109.8	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	13.5	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909) and b. Close Normally Open line between ZAVALLA2 (51723) and SLAUGHT2 (51725) and/or c. Close Normally Open line between ELEVEL2 (51607) and SLAUGT2 (51727).	
05SP	13.5	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	116.3	153.4	109.9	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	13.5	"	
05SH	10.5	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	98.6	129.3	116.9	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	10.5	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
05SH	10.5	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	98.6	129.3	116.9	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	10.5	"	
											Total Estimated Cost	$0

Study Case	Transfer Amount (MW)	AREA	Monitored Bus with Violation	BC Voltage (PU)	TC Voltage (PU)	Outaged Branch Causing Voltage Violation	ATC (MW)	Solution	Estimated Cost
04SP	13		NONE IDENTIFIED				13		
04SH	10		NONE IDENTIFIED				10		
04FA	6		NONE IDENTIFIED				6		
04WP	6		NONE IDENTIFIED				6		
05AP	2.4		NONE IDENTIFIED				2.4		
05G	6.4		NONE IDENTIFIED				6.4		
05SP	13.5		NONE IDENTIFIED				13.5		
05SH	10.5		NONE IDENTIFIED				10.5		
								Total Estimated Cost	$0

Study Case	Transfer Amount (MW)	AREA	Monitored Bus with Violation	BC Voltage (PU)	TC Voltage (PU)	Outaged Branch Causing Voltage Violation	ATC (MW)	Solution	Estimated Cost
04SP	13		NONE IDENTIFIED				13		
04SH	10		NONE IDENTIFIED				10		
04FA	6		NONE IDENTIFIED				6		
04WP	6		NONE IDENTIFIED				6		
05AP	2.4		NONE IDENTIFIED				2.4		
05G	6.4		NONE IDENTIFIED				6.4		
05SP	13.5		NONE IDENTIFIED				13.5		
05SH	10.5		NONE IDENTIFIED				10.5		
								Total Estimated Cost	$0

Study Case	Transfer Amount (MW)	From Area	To Area	Monitored Branch Overload	Rate <MVA>	BC % Loading	TC % Loading	%TDF	Outaged Branch Causing Overload	ATC (MW)	Solution	Estimated Cost
04SP	13	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	114.4	149.8	108.9	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	13	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909) and b. Close Normally Open line between ZAVALLA2 (51723) and SLAUGHT2 (51725) and/or c. Close Normally Open line between ELEVEL2 (51607) and SLAUGT2 (51727).	
04SP	13	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	114.4	149.8	109.0	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	13	"	
04SH	10	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	99.9	129.4	118.1	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	10	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
04SH	10	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	99.9	129.5	118.2	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	10	"	
04FA	6			NONE IDENTIFIED						6		
04WP	6			NONE IDENTIFIED						6		
05AP	2.4			NONE IDENTIFIED						2.4		
05G	6.4	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	83.4	106.5	144.6	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	6.4	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
05G	6.4	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	83.4	106.5	144.6	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	6.4	"	
05SP	13.5	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	116.3	153.3	109.6	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	0	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909) and b. Close Normally Open line between ZAVALLA2 (51723) and SLAUGHT2 (51725) and/or c. Close Normally Open line between ELEVEL2 (51607) and SLAUGT2 (51727).	
05SP	13.5	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	116.4	153.4	109.7	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	0	"	
05SH	10.5	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	40	98.6	129.2	116.3	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	10.5	Relieved by SPS Operating Procedure to Close line between Wellman Sub (51911) and LG-Jess Smith (51909).	
05SH	10.5	SPS	SPS	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	40	98.7	129.2	116.3	TERRY COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 2	10.5	"	
											Total Estimated Cost	$0

Study Case	Transfer Amount (MW)	AREA	Monitored Bus with Violation	BC Voltage (PU)	TC Voltage (PU)	Outaged Branch Causing Voltage Violation	ATC (MW)	Solution	Estimated Cost
04SP	13		NONE IDENTIFIED				13		
04SH	10		NONE IDENTIFIED				10		
04FA	6		NONE IDENTIFIED				6		
04WP	6		NONE IDENTIFIED				6		
05AP	2.4		NONE IDENTIFIED				2.4		
05G	6.4		NONE IDENTIFIED				6.4		
05SP	13.5		NONE IDENTIFIED				13.5		
05SH	10.5		NONE IDENTIFIED				10.5		
								Total Estimated Cost	$0

Study Case	Network Load (MW)	Network Load (MVAR)	Transfer Amount (MW)	Existing Service Modeled to Network Load (MW)
04SP	20	1.8	13	7
04SH	17	1.5	10	7
04FA	13	1.2	6	7
04WP	13	1.2	6	7
05AP	9.4	0.8	2.4	7
05G	13.4	1.2	6.4	7
05SP	20.5	1.8	13.5	7
05SH	17.5	1.6	10.5	7

Study Case	Transfer Amount (MW)	From Area	To Area	Monitored Branch Overload	Rate <MVA>	BC % Loading	TC % Loading	%TDF	Outaged Branch Causing Overload	ATC (MW)	Solution	Estimated Cost
04SP	13	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	40	114.4	149.7	108.9	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	13	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909) and b. Close Normally Open line between ZAVALLA2 (51723) and SLAUGHT2 (51725) and/or c. Close Normally Open line between ELEVEL2 (51607) and SLAUGT2 (51727).	
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04SH	10	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	40	99.9	129.4	118.1	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	10	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
04SH	10	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	40	99.9	129.5	118.2	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	10	"	
04FA	6									6		
04WP	6									6		
05AP	2.4									2.4		
05G	6.4	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	40	83.4	106.5	144.6	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	6.4	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
05G	6.4	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	40	83.4	106.5	144.6	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	6.4	"	
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04SH	10	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	40	99.9	129.4	118.1	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	10	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
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05G	6.4	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	40	83.4	106.5	144.6	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	6.4	Relieved by SPS Operating Procedure to a. Close Normally Open line between WELLMAN2 (51911) and LG-JSM2 (51909)	
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05SH	10.5	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	40	98.6	129.2	116.3	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	10.5	Relieved by SPS Operating Procedure to Close line between Wellman Sub (51911) and LG-Jess Smith (51909).	
05SH	10.5	SPS	SPS	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 1	40	98.7	129.2	116.3	51829 TERRYC2 69 to 51830 TERRYC3 115 CKT 2	10.5	"	
											Total Estimated Cost	$0