SPP Southwest Power Pool

System Impact Study SPP-2004-009-3 For Network Service Requested By Xcel Energy Marketing

From SPS To SPS

For a Reserved Amount Of 9 MW From 7/8/2005 To 7/1/2019

SPP Engineering, Tariff Studies

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1. Executive Summary

Xcel Energy Marketing has requested a system impact study for Network Integration Transmission Service from SPS to SPS for 9 MW. The period of the service requested is from 7/8/2005 to 7/1/2019. The OASIS reservation number is 730042.

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. The service was modeled from SPS generation to the requested Network Load. The requested service was studied using two System Scenarios with SPS exporting and importing, respectively.

The study was revised to account for status changes of two higher priority requests. A SECI to SPS 300 MW request and a SPS to EDDY 200 MW request have both withdrawn. The ATC and upgrades required may vary from these results due to the status of one higher priority request. The higher priority request is a SECI to SPS 150 MW request. Additional analysis was performed with the higher priority request and assigned upgrades included in the models.

Tables 1.1 and 1.2 list the SPP 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 Non-SPP violations were identified for this transfer. Selected solutions with known engineering and construction costs are provided for the SPP Facility Overloads and Voltage violations found in the Tables.

Without the higher priority request included in the models, the total estimated engineering and construction cost required is $3,745,950. The total estimated engineering and construction cost required is $1,395,950 with the higher priority request and assigned upgrades included in the study. This study does not include the analysis of Oasis Reservation 705270 studied in SPP-2004-006. SPP-2004-006 has not yet been resolved with respect to the assigned upgrades that would be associated with the requested service. The SPS to SPS service studied in impact studies SPP-2004-007 and SPP-2004-008 is included in this analysis. The required network upgrades associated with the higher priority requests will have an impact on the upgrades required to accommodate the additional SPS to SPS service.

2. Introduction

Xcel Energy Marketing has requested a system impact study for Network Integration Transmission Service from SPS to SPS for 9 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.

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. Additional analysis was performed with the higher priority requests and assigned upgrades included in the 2010 Summer Peak and 2010/11 Winter Peak.

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 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 4 2005 Summer Peak (05SP), 2005 Summer Shoulder (05SH), 2005 Fall Peak (05FA), 2005/2006 Winter Peak (05WP), 2007 Summer Peak (07SP), 2007/2008 Winter Peak (07WP), 2010 Summer Peak (10SP) and 2010/2011 Winter Peak (10WP) were used to study the impact of the requested service on the transmission system during the requested service period from 7/8/2005 to 7/1/2019. 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 Network load for the 2004 Summer Peak was forecasted to be a maximum of 9 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 3 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 1.2, 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-2004-009-3 Tables*. The tables identify the seasonal case in which the event occurred, the transfer amount studied which does not include the existing 3 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.

Table 3 documents the total Network load modeled and the transfer amounts modeled in each seasonal case.

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

Without the higher priority request included in the models, the total estimated engineering and construction cost required is $3,745,950. The total estimated engineering and construction cost required is $1,395,950 with the higher priority request and assigned upgrades included in the study. This study does not include the analysis of Oasis Reservation 705270 studied in SPP-2004-006. SPP-2004-006 has not yet been resolved with respect to the assigned upgrades that would be associated with the requested service. The SPS to SPS service studied in impact studies SPP-2004-007 and SPP-2004-008 is included in this analysis. The required network upgrades associated with the higher priority requests will have an impact on the upgrades required to accommodate the additional SPS to SPS service.

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	From Area	To Area	Monitored Branch Over 100% Rate B	Rate <MVA>	BC % Loading	TC % Loading	Outaged Branch Causing Overload	ATC (MW)	Solution	Estimated Cost
05SH	SPS	SPS	EAST PLANT INTERCHANGE 115/69KV TRANSFORMER CKT 1	46	105.2	106.1	EAST PLANT INTERCHANGE 115/69KV TRANSFORMER CKT 2	4.9	Relieved by SPS Operating Procedure to open line between Hastings (50949) and Van Buren Tap (50961).	
05SP	SPS	SPS	LUBBOCK EAST INTERCHANGE 230/115KV TRANSFORMER	172.5	101.0	101.2	LUBBOCK SOUTH INTERCHANGE 230/115KV TRANSFORMER	6.2	Relieved by Updating Models with LH-AIKN2 (51367) to AIKENT2 (51365) Normally Closed and LH-AIKN2 (51367) to IRICK2 (51513) Normally Open	
05FA			None Identified					3.1		
05WP			None Identified					3.1		
07SP	SPS	SPS	LUBBOCK EAST INTERCHANGE 230/115KV TRANSFORMER	172.5	109.5	109.6	LUBBOCK SOUTH INTERCHANGE 230/115KV TRANSFORMER	0.0	Replace 230/115 kV auto with larger unit - 258 MVA max	$1,395,950
07WP			None Identified					3.4		
10SP	SPS	SPS	LUBBOCK EAST INTERCHANGE 230/115KV TRANSFORMER	172.5	119.9	120.2	LUBBOCK SOUTH INTERCHANGE 230/115KV TRANSFORMER	0.0	See Previous Upgrade Specified for Facility	
10WP			None Identified					3.9		
									Total Estimated Cost Without Higher Priority Request	$1,395,950
10SP*	SPS	SPS	LUBBOCK EAST INTERCHANGE 230/115KV TRANSFORMER	172.5	110.7	111.3	LUBBOCK SOUTH INTERCHANGE 230/115KV TRANSFORMER	0.0	Replace 230/115 kV auto with larger unit - 258 MVA max	$1,395,950
10WP*			None Identified					3.9		
									Total Estimated Cost With Higher Priority Request	$1,395,950

* Study Cases include higher priority service (SUNC to SPS 150 MW) with required network upgrades.

Study Case	Area	Monitored Bus with Violation	BC Voltage (PU)	TC Voltage (PU)	Outaged Branch Causing Voltage Violation	ATC (MW)	Solution	Estimated Cost
05SH		None			None	6.2		
05SP		None			None	4.9		
05FA		None			None	3.1		
05WP		None			None	3.1		
07SP		None			None	6.7		
07WP		None			None	3.4		
10SP		None			None	7.6		
10WP		None			None	3.9		
							Total Estimated Cost	$0

Study Case	From Area	To Area	Monitored Branch Over 100% Rate B	Rate <MVA>	BC % Loading	TC % Loading	Outaged Branch Causing Overload	ATC (MW)	Solution	Estimated Cost
05SH	SPS	SPS	EAST PLANT INTERCHANGE 115/69KV TRANSFORMER CKT 1	46	106.0	106.9	EAST PLANT INTERCHANGE 115/69KV TRANSFORMER CKT 2	4.9	Relieved by SPS Operating Procedure to open line between Hastings (50949) and Van Buren Tap (50961).	
05SP			None Identified					6.2		
05FA			None Identified					3.1		
05WP			None Identified					3.1		
07SP			None Identified					6.7		
07WP			None Identified					3.4		
10SP	SPS	SPS	LUBBOCK EAST INTERCHANGE 230/115KV TRANSFORMER	172.5	102.0	102.2	LUBBOCK SOUTH INTERCHANGE 230/115KV TRANSFORMER	0.0	Replace 230/115 kV auto with larger unit - 258 MVA max	$ 1,395,950
10SP	SPS	SPS	TUCO INTERCHANGE 230/115KV TRANSFORMER	252	100.8	100.9	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV	7.6	Add 2nd 252 MVA 230/115 kV transformer	$ 2,350,000
10WP			None Identified					3.9		
									Total Estimated Cost Without Higher Priority Request	$ 3,745,950
10SP*			None Identified					3.9		
10WP*			None Identified					3.9		
									Total Estimated Cost With Higher Priority Request	$0

* Study Cases include higher priority service (SUNC to SPS 150 MW) with required network upgrades.

Study Case	Area	Monitored Bus with Violation	BC Voltage (PU)	TC Voltage (PU)	Outaged Branch Causing Voltage Violation	ATC (MW)	Solution	Estimated Cost
05SH		None			None	6.2		
05SP		None			None	4.9		
05FA		None			None	3.1		
05WP		None			None	3.1		
07SP		None			None	6.7		
07WP		None			None	3.4		
10SP		None			None	7.6		
10WP		None			None	3.9		
							Total Estimated Cost	$0

Study Case	Network Load (MW)	Network Load (MVAR)	Transfer Amount (MW)	Existing Service Modeled to Network Load (MW)
05SP	9.2	3.6	6.2	3
05SH	7.9	3.1	4.9	3
05FA	6.1	2.4	3.1	3
05WP	6.1	2.4	3.1	3
07SP	9.7	3.8	6.7	3
07WP	6.4	2.5	3.4	3
10SP	10.6	4.1	7.6	3
10WP	6.9	2.7	3.9	3

Study Case	From Area	To Area	Monitored Branch Over 100% Rate B	Rate <MVA>	BC % Loading	TC % Loading	Outaged Branch Causing Overload	ATC (MW)	Solution	Estimated Cost
05SH	SPS	SPS	50955 EASTPL2 69 to 50956 EASTPL3 115 CKT 1	46	105.2	106.1	50955 EASTPL2 69 to 50956 EASTPL3 115 CKT 2	4.9	Relieved by SPS Operating Procedure to open line between Hastings (50949) and Van Buren Tap (50961).	
05SP	SPS	SPS	51688 LUBE3 115 to 51689 LUBE6 230 CKT 1	172.5	101.0	101.2	51680 LUBS3 115 to 51681 LUBS6 230 CKT 1	6.2	Relieved by Updating Models with LH-AIKN2 (51367) to AIKENT2 (51365) Normally Closed and LH-AIKN2 (51367) to IRICK2 (51513) Normally Open	
05FA			None Identified					3.1		
05WP			None Identified					3.1		
07SP	SPS	SPS	51688 LUBE3 115 to 51689 LUBE6 230 CKT 1	172.5	109.5	109.6	51680 LUBS3 115 to 51681 LUBS6 230 CKT 1	0.0	Replace 230/115 kV auto with larger unit - 258 MVA max	$1,395,950
07WP			None Identified					3.4		
10SP	SPS	SPS	51688 LUBE3 115 to 51689 LUBE6 230 CKT 1	172.5	119.9	120.2	51680 LUBS3 115 to 51681 LUBS6 230 CKT 1	0.0	See Previous Upgrade Specified for Facility	
10WP			None Identified					3.9		
									Total Estimated Cost Without Higher Priority Request	$1,395,950
10SP*	SPS	SPS	51688 LUBE3 115 to 51689 LUBE6 230 CKT 1	172.5	110.7	111.3	51680 LUBS3 115 to 51681 LUBS6 230 CKT 1	0.0	Replace 230/115 kV auto with larger unit - 258 MVA max	$1,395,950
10WP*			None Identified					3.9		
* Study Cases include higher priority service (SUNC to SPS 150 MW) with required network upgrades.									Total Estimated Cost With Higher Priority Request	$1,395,950

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07SP			None Identified					6.7		
07WP			None Identified					3.4		
10SP	SPS	SPS	51688 LUBE3 115 to 51689 LUBE6 230 CKT 1	172.5	102.0	102.2	51680 LUBS3 115 to 51681 LUBS6 230 CKT 1	0.0	Replace 230/115 kV auto with larger unit - 258 MVA max	$ 1,395,950
10SP	SPS	SPS	51532 TUCO3 115 to 51533 TUCO6 230 CKT 1	252	100.8	100.9	51533 TUCO6 230 to 51647 CARLISL6 230 CKT 1	7.6	Add 2nd 252 MVA 230/115 kV transformer	$ 2,350,000
10WP			None Identified					3.9		
									Total Estimated Cost Without Higher Priority Request	$ 3,745,950
10SP*			None Identified					3.9		
10WP*			None Identified					3.9		
									Total Estimated Cost With Higher Priority Request	$0

* Study Cases include higher priority service (SUNC to SPS 150 MW) with required network upgrades.