Southwest Power Pool

Affected System Study
SPP-ASA-2009-003
For the PID 224
Requested By
<OMITTED TEXT>(Customer)

For a Reserved Amount of 100 MW

SPP Engineering, SPP Tariff Studies

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1. Executive Summary

<OMITTED TEXT>(Customer) has requested an affected system study to determine the impacts on SPP facilities with the addition of a 100 MW resource connected to the Entergy Electric System (EES) network through a tap on the Green Forest South – Harrison West 161 kV line. The service type requested for this generation interconnection request is Network Resource Interconnection Service (NRIS).

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the deliverability of the 100 MW NRIS request while maintaining system reliability. The PID 224 to EES.Network 100 MW request was studied using five System Scenarios. The service was modeled by a transfer from the new resource in the EES Control Area to the EES Network. The five scenarios were studied to capture worst case system limitations dependent on the bias of the transmission system. Analysis was conducted on the planning horizon from 12/1/2009 to 10/1/2018.

The service was modeled from the PID 224 to EES.Network. The new source location causes new facility overloads on the SPP transmission system. Tables 1 and 2 summarize the results of the system impact analyses for the new source location for the scenarios listed in the table. ~~Table 1 lists SPP thermal transfer limitations identified.~~ No SPP thermal transfer limitations were identified. No SPP voltage transfer limitations were identified. Table 1 shows no results.

~~The results of the Affected System Study show that one limiting constraint exists in SWPA within the SPP regional transmission system for the deliverability of 100 MW from PID 224 to EES.Network. This facility limits the ATC to 79 MW after the requested start date. These results are based on the inclusion of PID 223 in the analysis. This inclusion is due to the prior queue position of PID 223 and assuming PID 223 continues with NRIS. In the event that NRIS is no longer the service type for PID 223, the study impacts will be determined for PID 224 without modeling PID 223. Execution of an Affected System Facility Study Agreement is now required. The final upgrade solutions and cost assignments will be determined upon the completion of the facility study.~~

Per further review, the limitation given in Table 1 was determined invalid for the single outage of Inependence – Moorefield 161kV Ckt 1. The Independence – Moorefield 161kV Ckt 1 line is an invalid outage taken by itself. The appropriate breaker-to-breaker outage is Independence – Sage, which showed no limitations per criteria on the SPP system. To verify no additional limitations occurred, an additional analysis was performed using appropriate Multi-terminal line outages. The results of this additional analysis showed no limitations per criteria on the SPP system.

2. Introduction

<OMITTED TEXT>(Customer) has requested a system impact study to determine the impacts on SPP facilities with the addition of a 100 MW resource connected to the EES network through a tap on the Green Forest South – Harrison West 161 kV line. The principal objective of this study is to identify the restraints on the SPP Regional Tariff System that may limit the NRIS request and determine the least cost solutions required to alleviate the limiting facilities.

This study includes steady-state contingency analyses (PSS/E function ACCC). The steady-state analyses considers the impact of the request on transmission line and transformer loadings, and bus voltages for outages of single transmission lines, transformers, and generating units, and selected multiple transmission lines and transformers on the SPP system.

The PID 224 to EES.Network 100 MW request was studied using five System Scenarios. The service was modeled by a transfer from the new resource in the EES Control Area to the EES Network. The five scenarios were studied to capture worst case system limitations dependent on the bias of the transmission system.

3. Study Methodology

A. Description

The system impact analysis was conducted to determine the steady-state impact of the requested service on the 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 upper bound and lower bound of the normal voltage range monitored is 105% and 95%. The upper bound and lower bound of the emergency voltage range monitored is 105% and 90%. Transmission Owner voltage monitoring criteria is used if more restrictive. The SPS Tuco 230 kV bus voltage is monitored at 92.5% due to pre-determined system stability limitations. The WERE Wolf Creek 345 kV bus voltage is monitored at 98.5% due to transmission operating procedure

The contingency set includes all SPP control area branches and ties 69kV and above, any defined contingencies for these control areas, and generation unit outages for the control areas with SPP reserve share program redispatch. The monitor elements include all SPP control area branches, ties, and buses 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 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 six seasonal models to study the PID 224 to EES.Network 100 MW request for the requested service period. The SPP 2008 Series Quarter 4 STEP/TSR Cases—2009 Winter Peak (09WP), 2010 Summer Peak (10SP), 2010/11 Winter Peak (10WP), 2013 Summer Peak (13SP), 2013/14 Winter Peak (13WP), and 2018 Summer Peak (18SP)—were used to study the impact of the 100 MW transfer on the system during the planning horizon from 12/1/2009 to 10/1/2018. Also included in these models is PID 223 due to the prior queue position. The Summer Peak models apply to June through September and the Winter Peak models apply to December through March.

The chosen base case models were modified to reflect the current modeling information, including an EES modified dispatch order of EES system generation using the economic dispatch activity (ECDI) in PSSE. This activity utilizes (.ecd) files provided by the SPP ICT department. From the six seasonal models, five system scenarios were developed. Scenario 1 includes SWPP OASIS transmission requests not already included in the SPP 2008 Series Cases flowing in a West to East direction with ERCOTN HVDC Tie South to North, ERCOTE HVDC Tie East to West, SPS exporting, and SPS importing from the Lamar HVDC Tie. Scenario 2 includes transmission requests not already included in the SPP 2008 Series Cases flowing in an East to West direction with ERCOTN HVDC tie North to South, ERCOTE HVDC tie East to West, SPS importing, and SPS exporting to the Lamar HVDC Tie. Scenario 3 includes transmission requests not already included in the SPP 2008 Series Cases flowing in a South to

North direction with ERCOTN HVDC tie South to North, ERCOTE HVDC tie East to West, SPS exporting, and SPS exporting to the Lamar HVDC Tie. Scenario 4 includes transmission requests not already included in the SPP 2008 Series Cases flowing in a North to South direction with ERCOTN HVDC tie North to South, ERCOTE HVDC tie East to West, SPS importing, and SPS importing from the Lamar HVDC tie. Scenario 5 includes all transmission not already included in the SPP 2008 Cases with ERCOTN North to South, ERCOTE East to West, SPS importing and SPS exporting to the Lamar HVDC tie. The system scenarios were developed to minimize counter flows from previously confirmed, higher priority requests not included in the MDWG Base Case.

C. Transfer Analysis

Using the selected cases both with and without the requested transfer modeled, the PSS/E Activity ACCC was run on the cases and compared to determine the facility overloads caused or impacted by the transfer. Transfer distribution factor cutoffs (3% for SPP facilities) and voltage threshold (0.02 change) were applied to determine the impacted facilities. The PSS/E options chosen to conduct the analysis can be found in Appendix A.

4. Study Results

A. Study Analysis Results

Tables 1 and 2 contain the initial steady-state analysis results of the System Impact Study. The Tables are in the attached workbook SPP-ASA-2009-003 Tables. The tables identify the seasonal case in which the event occurred, the transfer amount studied, the facility control area location, applicable ratings of the thermal transfer limitations and SPP voltage transfer limitations, and the loading percentage and voltage violation.

~~Table 1 lists the SPP thermal transfer limitations caused by the 100 MW transfer for applicable scenarios. Solutions with engineering and construction costs are provided in the tables.~~

No SPP thermal transfer limitations were identified.

No SPP voltage transfer limitations were identified.

5. Conclusion

~~The results of the Affected System Study show that one limiting constraint exists in SWPA within the SPP regional transmission system for the deliverability of 100 MW from PID 224 to EES.Network. This facility limits the ATC to 79 MW after the requested start date. These results are based on the inclusion of PID 223 in the analysis. This inclusion is due to the prior queue position of PID 223 and assuming PID 223 continues with NRIS. In the event that NRIS is no longer the service type for PID 223, the study impacts will be determined for PID 224 without modeling PID 223. Execution of an Affected System Facility Study Agreement is now required. The final upgrade solutions and cost assignments will be determined upon the completion of the facility study.~~

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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 and loads
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. Minimum flow change in overload report – 3 MW
6. Exclude cases w/ no overloads from report – YES
7. Exclude interfaces from report – YES
8. Perform voltage limit check – YES
9. Elements in available capacity table – 60000
10. Cutoff threshold for available capacity table – 99999.0
11. Minimum contingency case Voltage change for report – 0.02
12. Sorted output – None

Newton Solution:

1. Tap adjustment – Stepping
2. Area interchange control – Tie lines and loads
3. VAR limits - Apply automatically
4. Solution options - X Phase shift adjustment
   _ Flat start
   _ Lock DC taps
   _ Lock switched shunts

Study Case	Scenario	From Area	To Area	Monitored Branch Over 100% Rate B	Rate (MVA)	Pre-transfer % Loading	Post-transfer % Loading	TDF (%)	Outaged Branch Causing Overload	ATC (MW)	Solution	Estimated Cost
~~18SP~~	~~1~~	~~SWPA~~	~~EES~~	~~BULL SHOALS - MIDWAY (YVEPA) 161KV CKT 1~~	~~162~~	~~100.2~~	~~103.9~~	~~5.9~~	~~INDEPENDENCE - MOOREFIELD 161KV CKT 1~~	~~79~~	~~Entergy owned transmission line; SWPA wavetrap and CTs limit this line to 167MVA, required Rate B 168.3~~	~~Indeterminate~~
				None								