Southwest Power Pool

Affected System Study
SPP-ASA-2009-004
From AECI to TVA
Requested By
Associated Electric Cooperative, Inc.

For a Reserved Amount of 201 MW
From 7/1/2011
To 7/1/2016

SPP Engineering, SPP Tariff Studies

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1. Executive Summary

Associated Electric Cooperative, Inc. (AECI) has requested an affected system study to determine the impacts on SPP facilities due to the transfer of 201 MW from AECI to TVA. The period of the service requested is from 7/1/2011 to 7/1/2016.

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the additional 201 MW request while maintaining system reliability. The AECI to TVA 201 MW request was studied using five System Scenarios. The service was modeled by a transfer from the AECI Control Area to the TVA 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 6/1/2011 to 10/1/2019.

The service was modeled from the AECI to TVA. The transfer causes new facility overloads on the SPP transmission system. Tables 1 and 2 summarize the results of the system impact analyses for the transfer for the scenarios listed in the table. Table 1 lists SPP thermal transfer limitations identified. Table 2 lists SPP voltage violations identified. No SPP voltage transfer limitations were identified; therefore, Table 2 is empty and is not included in this report.

2. Introduction

AECI has requested a system impact study to determine the impacts on SPP facilities due to the transfer of 201 MW from AECI to TVA. The principal objective of this study is to identify the restraints on the SPP Regional Tariff System that may limit the Transmission Service Request (TSR).

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 AECI to TVA 201 MW request was studied using five System Scenarios. The service was modeled by a transfer from the AECI Control Area to the TVA 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 103.5% and 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 five seasonal models to study the AECI to TVA 201 MW request for the requested service period. The SPP STEP 2009 Build 3 Cases—2011 Summer Peak (11SP), 2011/12 Winter Peak (11WP), 2014 Summer Peak (13SP), 2014/15 Winter Peak (14WP), and 2019 Summer

Peak (19SP)—were used to study the impact of the 201 MW transfer on the system during the planning horizon from 6/1/2011 to 10/1/2019. Also included in these models:

- Wind generation at Atchison, Clyde, Gentry, and Lost Creek dispatched to full capacity
- AECI's 2009 Long Range Plan (LRP) system upgrades provided.

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 the latest AECI dispatch order of the AECI system generation on file. From the five seasonal models, five system scenarios were developed. Scenario 1 includes SWPP OASIS transmission requests not already included in the SPP 2009 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 2009 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 2009 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 2009 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 2009 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-2009-004 Tables. The tables identify the seasonal case in which the event occurred, the facility control area location, applicable ratings of the overloaded facility, the loading percentage or voltage with and without the transfer, the percent transfer distribution factor (TDF) if applicable, and the estimated ATC value.

The results of the Affected System Study show that three limiting constraints exist in the KCPL/KCPL-GMO (MIPU) areas within the SPP regional transmission system for the transfer of 201 MW from AECI to TVA. The facilities limit the ATC to 40 MW after the requested start date.

Table 1 lists the SPP thermal transfer limitations caused by the 201 MW transfer for applicable scenarios. Solutions with engineering and construction costs are currently indeterminate and will be determined upon the completion of the facility study.

Table 2 lists SPP voltage violations caused by the 201 MW transfer for applicable scenarios. No SPP voltage transfer limitations were identified; therefore, Table 2 is empty and is not included in this report.

5. Conclusion

The results of the Affected System Study show that the transfer of the full 201 MW from AECI to TVA causes steady-state violations on the SPP regional transmission system. The worst case constraint limits the ATC to 40 MW after the requested start date. AECI Generation Interconnection stability analysis has not been reviewed by SPP for the source associated with this TSR. The results of this review will determine the validity of these findings indentified in this report. Execution of an Affected System Facility Study Agreement is now required. The upgrade solutions and cost assignments are currently indeterminate and will be determined upon the completion of the facility study.

Appendix A

PSS/E CHOICES IN RUNNING LOAD FLOW PROGRAM AND ACCC

BASE CASES:
Solutions - Fixed slope decoupled Newton-Raphson solution (FDNS)

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

ACCC CASES:
Solutions – AC contingency checking (ACCC)

- MW mismatch tolerance – 0.5
- Contingency case rating – Rate B
- Percent of rating – 100
- Output code – Summary
- Minimum flow change in overload report – 3 MW
- Exclude cases w/ no overloads from report – YES
- Exclude interfaces from report – YES
- Perform voltage limit check – YES
- Elements in available capacity table – 60000
- Cutoff threshold for available capacity table – 99999.0
- Minimum contingency case Voltage change for report – 0.02
- Sorted output – None

Newton Solution:

- Tap adjustment – Stepping
- Area interchange control – Tie lines and loads
- VAR limits - Apply automatically
- 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)	Transmission Provider Comments	Solution	Estimated Cost
11SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	83.6	143.3	67.9	FAIRPORT - HARVIEL E 161KV CKT 1	55.2		Indeterminate	Indeterminate
11SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	82.6	142.2	67.8	FAIRPORT - HARVIEL E 161KV CKT 1	58.6		Indeterminate	Indeterminate
11SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	83.3	132.9	56.5	CRESTON - MARYVILLE 161KV CKT 1	67.7		Indeterminate	Indeterminate
11SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	83.3	132.9	56.5	CRESTON - MARYVILLE 161KV CKT 1	67.8		Indeterminate	Indeterminate
11SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	68.1	126.5	66.5	HARVIEL E - NODAWAY 161KV CKT 1	109.7		Indeterminate	Indeterminate
11SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	67.2	125.5	66.4	HARVIEL E - NODAWAY 161KV CKT 1	113.2		Indeterminate	Indeterminate
11SP	4	KACP	MIPU	IATAN (IATAN 11) 345/161/13.8KV TRANSFORMER CKT 11	715	102.6	105.3	9.6	IATAN - STRANGER CREEK 345KV CKT 1	141.4	The ATC provided is calculated based on the implementation of an Operating Directive that brings BC % to 98.1 and TC % to 100.8	Indeterminate	Indeterminate
14SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	85.9	135.9	57.0	CRESTON - MARYVILLE 161KV CKT 1	56.7		Indeterminate	Indeterminate
14SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	85.5	135.4	56.9	CRESTON - MARYVILLE 161KV CKT 1	58.4		Indeterminate	Indeterminate
14SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	80.1	139.8	68.0	FAIRPORT - HARVIEL E 161KV CKT 1	67.0		Indeterminate	Indeterminate
14SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	79.2	138.8	67.9	FAIRPORT - HARVIEL E 161KV CKT 1	70.1		Indeterminate	Indeterminate
14SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	64.7	123.0	66.4	HARVIEL E - NODAWAY 161KV CKT 1	121.6		Indeterminate	Indeterminate
14SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	63.9	122.1	66.3	HARVIEL E - NODAWAY 161KV CKT 1	124.8		Indeterminate	Indeterminate
19SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	90.1	139.8	56.7	CRESTON - MARYVILLE 161KV CKT 1	40.1		Indeterminate	Indeterminate
19SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	89.5	139.3	56.7	CRESTON - MARYVILLE 161KV CKT 1	42.2		Indeterminate	Indeterminate
19SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	79.9	138.6	66.9	FAIRPORT - HARVIEL E 161KV CKT 1	68.8		Indeterminate	Indeterminate
19SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	79.1	137.7	66.7	FAIRPORT - HARVIEL E 161KV CKT 1	71.7		Indeterminate	Indeterminate
19SP	2	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	64.9	122.1	65.2	HARVIEL E - NODAWAY 161KV CKT 1	123.4		Indeterminate	Indeterminate
19SP	3	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	64.2	121.2	64.9	HARVIEL E - NODAWAY 161KV CKT 1	126.3		Indeterminate	Indeterminate
19SP	3	MIPU	MEC	CLARINDA - MARYVILLE 161KV CKT 1	168	73.6	103.8	25.2	CRESTON - MARYVILLE 161KV CKT 1	175.7		Indeterminate	Indeterminate
19SP	2	MIPU	MEC	CLARINDA - MARYVILLE 161KV CKT 1	168	72.7	102.8	25.1	CRESTON - MARYVILLE 161KV CKT 1	182.6		Indeterminate	Indeterminate
19SP	5	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	50.8	102.4	58.8	CRESTON - MARYVILLE 161KV CKT 1	191.7		Indeterminate	Indeterminate
19SP	1	AECI	MIPU	MARYVILLE - MARYVILLE 161KV CKT 1	229	48.5	100.1	58.7	CRESTON - MARYVILLE 161KV CKT 1	200.7		Indeterminate	Indeterminate