AFFECTED SYSTEM STUDY

TSR 90918528

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By SPP Engineering, Transmission Services

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
07/02/2020	SPP	Original	

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EXECUTIVE SUMMARY

Associated Electric Cooperative, Inc (AECI) received a 1,000 MW TSR request from AECI to MISO.S. In accordance with the JOA they notified SPP of this TSR so that SPP could study the request to determine if there were any impacts on the SPP system. The period of the service requested is from 1/1/2025 to 1/1/2030.

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the TSR request while maintaining system reliability. SPP studied this request using the base reliability scenarios of the 2020 ITP model series.

The service caused one SPP branch to overload and several first-tier entity facilities to overload.

INTRODUCTION

This study includes steady-state contingency analysis (Power System Simulator for Engineering (PSS/E) function ACCC). The steady-state analysis 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 and third party systems.

SPP studied the request by using modified Base Reliability models to reflect the current modeling information. Base Reliability includes projected usage of transmission included in the SPP 2020 ITP Cases.

STUDY METHODOLOGY

DESCRIPTION

SPP conducted the facility study analysis to determine the steady-state impact of the requested service on the SPP and first-tier non-SPP control area systems. SPP performed the steady-state analysis that was consistent with current SPP Criteria and North American Electric Reliability Corporation (NERC) Reliability Standards requirements. SPP conforms to NERC Reliability Standards, which provide strict requirements related to voltage violations and thermal overloads during normal conditions and during a contingency. NERC Standards require all facilities to 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 Integrated Transmission Planning (ITP) 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%.

The contingency set includes all SPP control area branches and ties 69 kV and above; first-tier non-SPP control area branches and ties 115 kV and above; any defined contingencies for these control areas; and generation unit outages for the control areas with SPP reserve share program redispatch. The monitored 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 115 kV and above. SPP performs voltage monitoring for SPP control area buses 69 kV and above.

SPP applied the appropriate TDF cutoffs (SPP and third party) to determine the impacted facilities.

MODEL DEVELOPMENT

SPP used the following 2020 ITP models, used in the 2020 ITP Assessment, to study the impact of the requested service on the transmission system:

- 2025 Light Load, Summer, and Winter
- 2030 Light Load, Summer, and Winter

The Summer Peak models apply to June through September and the Winter Peak models apply to December through March. The Light Load models apply to April through May.

The chosen base case models were modified to reflect the current modeling information, including confirmed transactions from previous studies. Base Reliability scenarios include projected usage of transmission included in the SPP 2020 ITP Cases.

TRANSMISSION REQUEST MODELING

SPP modeled the request as a generation-to-generation transfer. TDFs were computed based on generation-to-generation and generation-to-load configurations.

TRANSFER ANALYSIS

SPP compared the results (with and without the requested transfer modeled) by using the PSS/E Activity ACCC to determine the facility overloads caused by the transfer. In addition, SPP applied the appropriate TDF cutoffs (SPP and third party) to determine the impacted facilities. Appendix A lists the PSS/E options chosen to conduct the analysis.

STUDY RESULTS

SPP STUDY ANALYSIS RESULTS

Table 1 lists SPP thermal transfer limitations caused by the transfer.

Table 1: SPP Thermal Violations

Season	Area	Monitored Branch	Base Case Loading (%)	Transfer Case Loading (%)	Contingency
25SP	KCPL	**SALSBRY5-NORTON 5 161kV**	64.2	101.2	P12:345:AMMO::MONTGOMERY:OVERTON:5
25SP	KCPL	**SALSBRY5-NORTON 5 161kV**	63.9	101.0	P23:345:AMMO::MONTGOMERY:V43
30SP	KCPL	**SALSBRY5-NORTON 5 161kV**	68.8	105.8	P12:345:AMMO::MONTGOMERY:OVERTON:5
30SP	KCPL	**SALSBRY5-NORTON 5 161kV**	68.6	105.6	P23:345:AMMO::MONTGOMERY:V43

Table 2 details the SPP-assigned network upgrades required to implement the 1,000 MW transmission service request.

Table 2: SPP Assigned Network Upgrade

Upgrade Description	Cost Estimate	Est. In-Service
Salisbury – Norton 161kV terminal upgrades	$125,000	January, 2023

THIRD PARTY STUDY ANALYSIS RESULTS

Table 3 lists third party thermal transfer limitations caused by the transfer.

Table 3: Third Party Thermal Violations

Season	Area	Monitored Branch	Base Case Loading (%)	Transfer Case Loading (%)	Contingency
25SP	AECI	**MLRSBGB1-5BOONE 161kV**	49.2	136.4	P12:345:AMMO::MONTGOMERY:OVERTON:5
25SP	AECI	**MLRSBGB1-5BOONE 161kV**	48.9	136.1	P23:345:AMMO::MONTGOMERY:V43
25WP	AECI	**MLRSBGB1-5BOONE 161kV**	41.9	123.8	P12:345:AMMO::MONTGOMERY:OVERTON:5
25WP	AECI	**MLRSBGB1-5BOONE 161kV**	41.5	123.5	P23:345:AMMO::MONTGOMERY:V43
30SP	AECI	**MLRSBGB1-5BOONE 161kV**	52.5	139.7	P12:345:AMMO::MONTGOMERY:OVERTON:5
30SP	AECI	**MLRSBGB1-5BOONE 161kV**	52.1	139.3	P23:345:AMMO::MONTGOMERY:V43
30WP	AECI	**MLRSBGB1-5BOONE 161kV**	42.2	124.3	P12:345:AMMO::MONTGOMERY:OVERTON:5
30WP	AECI	**MLRSBGB1-5BOONE 161kV**	41.8	123.8	P23:345:AMMO::MONTGOMERY:V43
25SP	AECI	**5KINGDMB1-5MLRSBGB2 161kV**	52.8	140.0	P12:345:AMMO::MONTGOMERY:OVERTON:5
25SP	AECI	**5KINGDMB1-5MLRSBGB2 161kV**	52.4	139.7	P23:345:AMMO::MONTGOMERY:V43

Season	Area	Monitored Branch	Base Case Loading (%)	Transfer Case Loading (%)	Contingency
25WP	AECI	**5KINGDMB1-5MLRSBGB2 161kV**	39.8	111.0	P12:345:AMMO::MONTGOMERY:OVERTON:5
25WP	AECI	**5KINGDMB1-5MLRSBGB2 161kV**	39.4	110.7	P23:345:AMMO::MONTGOMERY:V43
30SP	AECI	**5KINGDMB1-5MLRSBGB2 161kV**	56.3	143.6	P12:345:AMMO::MONTGOMERY:OVERTON:5
30SP	AECI	**5KINGDMB1-5MLRSBGB2 161kV**	55.9	143.2	P23:345:AMMO::MONTGOMERY:V43
30WP	AECI	**5KINGDMB1-5MLRSBGB2 161kV**	40.2	111.6	P12:345:AMMO::MONTGOMERY:OVERTON:5
30WP	AECI	**5KINGDMB1-5MLRSBGB2 161kV**	39.8	111.1	P23:345:AMMO::MONTGOMERY:V43
25SP	AECI	**5THMHILB1-5MOBTAP 161kV**	65.9	102.0	P12:345:AMMO::MONTGOMERY:OVERTON:5
25SP	AECI	**5THMHILB1-5MOBTAP 161kV**	65.7	101.9	P23:345:AMMO::MONTGOMERY:V43
25WP	AECI	**5THMHILB1-5MOBTAP 161kV**	68.5	105.6	P12:345:AMMO::MONTGOMERY:OVERTON:5
25WP	AECI	**5THMHILB1-5MOBTAP 161kV**	68.3	105.4	P23:345:AMMO::MONTGOMERY:V43
30SP	AECI	**5THMHILB1-5MOBTAP 161kV**	69.1	105.4	P12:345:AMMO::MONTGOMERY:OVERTON:5
30SP	AECI	**5THMHILB1-5MOBTAP 161kV**	69.0	105.3	P23:345:AMMO::MONTGOMERY:V43
30WP	AECI	**5THMHILB1-5MOBTAP 161kV**	69.0	106.0	P12:345:AMMO::MONTGOMERY:OVERTON:5
30WP	AECI	**5THMHILB1-5MOBTAP 161kV**	68.8	105.7	P23:345:AMMO::MONTGOMERY:V43
25SP	AECI	**5THOMHLXF3-5THMHLB3 161kV**	83.5	103.2	7THOMHL - 5THOMHLXF4 - 4
25SP	AECI	**5THOMHLXF3-5THMHLB3 161kV**	83.5	103.0	5THMHLB4 - 5THOMHLXF4 - 1
25SP	AECI	**5THOMHLXF3-5THMHLB3 161kV**	49.4	102.5	P12:345:AMMO::MONTGOMERY:OVERTON:5
30SP	AECI	**5THOMHLXF3-5THMHLB3 161kV**	83.1	102.4	5THMHLB4 - 5THOMHLXF4 - 1
30SP	AECI	**5THOMHLXF3-5THMHLB3 161kV**	49.1	102.3	P12:345:AMMO::MONTGOMERY:OVERTON:5
25SP	AECI	**7KINGDM-5KINGDMB1 345/161kV**	36.8	127.9	P23:345:AMMO::MONTGOMERY:V43
25WP	AECI	**7KINGDM-5KINGDMB1 345/161kV**	42.8	122.0	P23:345:AMMO::MONTGOMERY:V43
30LP	AECI	**7KINGDM-5KINGDMB1 345/161kV**	13.5	100.2	P12:345:AMMO::MONTGOMERY:OVERTON:5
30LP	AECI	**7KINGDM-5KINGDMB1 345/161kV**	13.5	100.1	P23:345:AMMO::MONTGOMERY:V43
30SP	AECI	**7KINGDM-5KINGDMB1 345/161kV**	37.6	128.7	P12:345:AMMO::MONTGOMERY:OVERTON:5
30WP	AECI	**7KINGDM-5KINGDMB1 345/161kV**	42.4	121.6	P12:345:AMMO::MONTGOMERY:OVERTON:5
30WP	AECI	**7KINGDM-5KINGDMB1 345/161kV**	42.4	121.5	P23:345:AMMO::MONTGOMERY:V43
25SP	AECI	**7THOMHL-5THOMHLXF4 345/161kV**	91.0	112.2	7THOMHL - 5THOMHLXF3 - 3
30SP	AECI	**7THOMHL-5THOMHLXF4 345/161kV**	90.6	111.5	7THOMHL - 5THOMHLXF3 - 3
25LP	AMMO	**4JOACHIM 2-4BOYD BR 138kV**	91.1	104.4	P23:345:AMMO::STFRANCOIS:V15
30LP	AMMO	**4JOACHIM 2-4BOYD BR 138kV**	87.8	101.0	P23:345:AMMO::STFRANCOIS:V15
25SP	EES	**6ADMSCRK%-6BOGALUS% 230kV**	96.7	100.9	6ADMSCRK% - 6BOGALUS% - 2
25SP	EES	**6ADMSCRK%-6BOGALUS% 230kV**	96.7	100.9	6ADMSCRK% - 6BOGALUS% - 1

CONCLUSION

Associated Electric Cooperative, Inc (AECI) received a 1,000 MW TSR request from AECI to MISO.S. In accordance with the JOA they notified SPP of this TSR so that SPP could study the request to determine if there were any impacts on the SPP system. The period of the service requested is from 1/1/2025 to 1/1/2030.

SPP has conducted an affected system study to determine if there are any impacts to the SPP system based on this request. The analysis has determined that an SPP assigned network upgrade will be required as listed in Table 2.

APPENDIX A

PSS/E OPTIONS IN RUNNING LOAD FLOW PROGRAM AND ACCC

BASE CASE SETTINGS:

- 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 CASE SETTINGS:

- Solutions: AC contingency checking (ACCC)
- MW mismatch tolerance: 0.5
- System intact rating: Rate A
- 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: No
- Perform voltage limit check: Yes
- Elements in available capacity table: 60,000
- Cutoff threshold for available capacity table: 99,999
- Minimum contingency case voltage change for report: 0.02
- Sorted output: None
- Newton Solution:
- Tap adjustment: Stepping
- Area Interchange Control: Tie lines and loads (Disabled for generator outages)
- VAR limits: Apply immediately
- Solution options:
  - X Phase shift adjustment
  - _ Flat start
  - _ Lock DC taps
  - _ Lock switched shunts