SPP DISIS-2018-001 AFS STUDY REPORT

INTRODUCTION

Associated Electric Cooperative Inc. (AECI), through coordination with the Southwest Power Pool (SPP), has updated the Study Analysis to account for the withdraw of GEN-2018-032. These assumptions were updated for the generator interconnection requests (GIRs) within the DISIS-2018-001 Study Cycle (the "Study Cycle") for an Affected System Study (AFS) evaluation on the AECI transmission system (the "Study"). The full list of Study Cycle requests included in the Study is listed in Table 1.

Table 1: Study Cycle Requests Evaluated

Project #	TO	Capacity (MW)	Service Type	Fuel Type	POI	Cluster Group
GEN-2018-015	SPS	252	ER/NR	Solar	Tuco-Oklaunion 345kV Line	05 SOUTHWEST
GEN-2018-025	OPPD	200	ER	Battery/Storage	Fort Calhoun 345kV Substation	02 NEBRASKA
GEN-2018-026	OGE	100	ER	Battery/Storage	Mustang 138kV Substation	04 SOUTHEAST
GEN-2018-027	AEP	100	ER	Battery/Storage	Tulsa Power Station 38kV Substation	04 SOUTHEAST
GEN-2018-028	AEP	200	ER	Battery/Storage	Tulsa North 138kV Substation	04 SOUTHEAST
GEN-2018-029	OGE	100	ER	Battery/Storage	Horseshoe Lake 138kV Substation	04 SOUTHEAST
GEN-2018-031	INDN	50	ER	Battery/Storage	Blue Valley 161kV Substation	03 CENTRAL
GEN-2018-033	OPPD	200	ER	Battery/Storage	Cass County 345kV Substation	02 NEBRASKA
GEN-2018-037	OPPD	100	ER	Battery/Storage	Looping in OPPD (S1211) (S1220) (S1211) (S1299) 161kV	02 NEBRASKA
GEN-2018-043	OPPD	500	ER	Solar	Ft. Calhoun - Raun 345 kV Line Break	02 NEBRASKA
GEN-2018-048	OGE	300	ER	Solar	Pecan Creek 345kV Substation	04 SOUTHEAST
GEN-2018-050	AEP	200	ER	Solar	Longwood 345kV Substation	04 SOUTHEAST
GEN-2018-055	AEP	252	ER/NR	Solar	Terry Road 345kV station (shared with Rush Springs Windfarm on a common gen-tie)	04 SOUTHEAST
GEN-2018-057	WERE	203.4	ER/NR	Solar	Gordon Evans 138kV	03 CENTRAL
ASGI-2018-003	KCPL	20	ER	Solar	Appleton 69kV Substation	03 CENTRAL
ASGI-2018-006	KCPL	20	ER	Solar	Metz 69kV Substation	03 CENTRAL
ASGI-2018-007	KCPL	20	ER	Solar	Salisbury 161kV Substation	03 CENTRAL

Network upgrades from the following studies were added to models prior to the addition of the Study Cycle requests to help alleviate loadings:

- Network Upgrades from AECI GI-101/102 requests.

The Network Upgrades included from these requests are detailed in Appendix A.

INPUTS AND ASSUMPTIONS

Each of the SERC member transmission planners is responsible for submitting system modeling data to SERC for development of the power flow models. Power flow analysis utilized the latest Long-Term Working Group (LTWG) models as developed by SERC Reliability Corporation (SERC).

Modeling parameters in the SPP DISIS 2018-001 steady state models were referenced for each of the Study Cycle requests.

Full details of the inputs and assumptions are provided in Appendix A.

METHODOLOGY

Steady state analysis was performed to confirm the reliability impacts on the AECI system under a variety of system conditions and outages. AECI's transmission system must be capable of operating within the applicable normal ratings, emergency ratings, and voltage limits of AECI planning criteria. AECI is a member of SERC, one of eight Electric Reliability Organizations under the North American Electric Reliability Corporation (NERC). As a member of SERC, AECI develops its planning criteria consistent with NERC Reliability Planning Standards and the SERC planning criteria. The NERC TPL-001-5 Planning Standard Table 1 requires that, for normal and contingency conditions, line and equipment loading shall be within applicable thermal limits, voltage levels shall be maintained within applicable limits, all customer demands shall be supplied (except as noted), and stability of the network shall be maintained.

In evaluating the impacts of the Study Cycle requests, the following thermal and voltage limits were applied to the analysis for P0 or normal system conditions:

- Thermal Limits within Applicable Rating – Applicable Rating shall be defined as the Normal Rating. The thermal limit shall be 100% of Rating A.
- Voltage Limits within Applicable Rating – Applicable Rating shall have the meaning of Nominal Voltage. Voltage limits shall be set at plus or minus five percent (+/- 5%), 0.95 p.u. - 1.05 p.u. for systems operating at 60 kV or above on load serving buses.

The following thermal and voltage limits were applied to the analysis for contingency conditions under P1 and P2EHV planning events:

- Thermal Limits within Applicable Rating – Applicable Rating shall be defined as the Emergency Rating. The thermal limit shall be 100% of Rating B.
- Voltage Limits within Applicable Rating – Applicable Rating shall have the meaning of Nominal Voltage. Voltage limits shall be set at plus five percent to minus ten percent (+5%/-10%), 0.90 p.u. – 1.05 p.u. for systems operating at 60 kV or above on load serving buses.

In order for the Study Cycle requests to have a negative impact (i.e. criteria violation) on the system, the Study Cycle must cause a three percent (3%) or greater increase in flow on an overloaded facility based upon the rating of the facility. In order for the Project to have a negative voltage impact on the system, the Project must cause a voltage violation and have a two percent (2%) or greater change in the voltage.

System upgrades are required for constraints resulting from the addition of the Study Cycle requests under P0, P1, P2.1, P2.2 (EHV only), and P2.3 (EHV only) system conditions. For the purpose of this study, P2.1 events are included as part of the P1 contingency file. As such, these events will be denoted as a P1 event in the results. All improvements were developed and studied in coordination with AECI.

AECI will perform an annual limited operations study which will indicate seasonal operating limits for SPP/MISO/AECI generation interconnection requests that will reach commercial operation in the 12-month horizon but whose AECI network upgrades have not yet been energized.

STEADY STATE ANALYSIS RESULTS

Steady state analysis showed no constraints reported on the AECI transmission system.

CONTINGENT FACILITY RESULTS

Contingent Facilities are those facilities identified that are the responsibility of higher-queued generators or are included in the Transmission Provider's transmission expansion plan and that if not included in the Study may otherwise be the responsibility of the Study Cycle requests as necessary to interconnect to the transmission system.

Steady state analysis results showed no Contingent Facilities reported on the AECI transmission system.

NEIGHBORING SYSTEM RESULTS

The Study has identified impacts from the Study Cycle requests on the AECI ties with neighboring systems. The most limiting component of the AECI owned portion of the facility was evaluated and if found inadequate, a network upgrade for the AECI equipment was determined. Network upgrades for transmission facilities limited by non-AECI equipment are not captured and may need to be coordinated with the appropriate transmission owner.

One (1) facility was reported on the AECI tie with the addition of the Study Cycle requests. The most severe constraints are shown in Table 2.

Table 2: Steady State Neighboring System Constraints for the Study Cycle Requests

Constraint ID	Event	Monitored Facility	Area	Season	Base Loading	Project Loading
AFS01	P1	300098 5MOCITYB2 161.00 541248 LBRTYST5 161.00 1	AECI/KCPL	27S	103.1	109.4
				27W	102.9	106.9
				32S	99.5	105.6
				32W	105.5	109.2

NETWORK UPGRADES

No upgrades were evaluated for the neighboring system constraints listed in Table 2. The upgrades for these impacts may need to be resolved through coordination with the transmission owner as listed in Table 3 below.

Table 3: Neighboring System Constraints

Constraint ID	Monitored Facility	Network Upgrade
AFS01	300098 5MOCITYB2 161.00 541248 LBRTYST5 161.00 1	KCPL owned; no upgrade evaluated.

Cost allocation calculation methodology is shown for reference in the Cost Allocation section, however there are no costs assigned to the Study Cycle.

COST ALLOCATION

Network upgrade costs are allocated to each of the Study Cycle projects based on the worst MW impact[1] each project had on the constraint and as described in the steps below:

1. Determine the MW impact each Study Cycle project had on each constraint using the size of each request:

$$Project\ X\ MW\ Impact\ on\ Constraint\ 1 = DFAX\ (X) * MW\ (X) = X1$$

$$Project\ Y\ MW\ Impact\ on\ Constraint\ 1 = DFAX\ (Y) * MW\ (Y) = Y1$$

$$Project\ Z\ MW\ Impact\ on\ Constraint\ 1 = DFAX\ (Z) * MW\ (Z) = Z1$$

2. Determine the maximum MW% impact each generator has as a percentage of the total Study Cycle impact on a given constraint.

$$X2\ =\ Project\ X\ MW\ impact\ \%\ = \frac{X1}{Total\ MW\ Impact\ of\ Study\ Cycle\ on\ Constraint}$$

$$Y2\ =\ Project\ Y\ MW\ impact\ \%\ = \frac{Y1}{Total\ MW\ Impact\ of\ Study\ Cycle\ on\ Constraint}$$

$$Z2\ =\ Project\ Z\ MW\ impact\ \%\ = \frac{Z1}{Total\ MW\ Impact\ of\ Study\ Cycle\ on\ Constraint}$$

3. Apply three percent (3%) MW impact De Minimis Threshold: If a Study Cycle project MW% impact is less than 3% for a particular constraint then the project MW% impact is adjusted to 0 for that constraint and the Study Cycle project will not be allocated cost for that particular constraint.

4. Determine the cost allocated to each remaining Study Cycle project for each upgrade using the total cost of a given upgrade:

$$Project\ X\ Upgrade\ 1\ Cost\ Allocation\ (\$) = \frac{Network\ Upgrade\ 1\ Cost\ (\$) * X2}{X2 + Y2 + Z2}$$

[1] All negative MW impacts (helpers) were set to 0 MW impact.

VERSION HISTORY

Version Number and Date	Author	Change Description
V0 – 07/11/2023	AECI	Initial release
V1 – 06/19/2024	AECI	Withdrawal of seven (7) SPP requests from Study Cycle Withdrawal of MISO, SPP, and AECI higher queued requests
V2 – 02/06/2025	AECI	Withdrawal of MISO, SPP, and AECI higher queued requests
V3 – 11/25/2025	AECI	Withdrawal of SPP GEN-2018-032.