SPP DISIS-2018-002 & 2019-001 AFS STUDY REPORT

INTRODUCTION

Associated Electric Cooperative Inc. (AECI), through coordination with the Southwest Power Pool (SPP), has updated the analysis for generator interconnection requests (GIRs) within the DISIS 2018-002 & 2019-001 Study Cycle (the "Study Cycle") for an Affected System Study (AFS) evaluation on the AECI transmission system (the "Study"). The restudy has been conducted to include the withdrawal of the six (6) SPP Study Cycle requests as listed in Table 1 below.

Table 1: Withdrawn Study Cycle Requests

Project #	CA	Capacity (MW)	Service Type	Fuel Type	POI	Cluster Group
GEN-2018-063	EDE	57	ER	Solar	Sedalia Marshfield - Springfield Nichols Street 69kV Line	03 CENTRAL
GEN-2018-068	NPPD	302.4	ER/NR	Wind	Antelope - Hoskins 345kV Substation	02 NEBRASKA
GEN-2018-088	AEP	130	ER	Solar	Lydia 345kV Substation	04 SOUTHEAST
GEN-2018-116	SUNC	150	ER/NR	Solar	Frey Street 115kV Substation	03 CENTRAL
GEN-2019-014	SUNC	125	ER/NR	Solar	Holcomb 115 kV Substation	03 CENTRAL
GEN-2019-035	EDE	80	ER/NR	Solar	Reeds Spring - Aurora 161kV Line	03 CENTRAL

The full list of Study Cycle requests included in the Study are listed in Table 2.

Table 2: Study Cycle Requests Evaluated

Project #	CA	Capacity (MW)	Service Type	Fuel Type	POI	Cluster Group
GEN-2018-064	GRDA	80	ER/NR	Solar	Tonnece 69kV Substation	04 SOUTHEAST
GEN-2018-071	OGE	151	ER/NR	Battery/Storage	Ranch Road 345kV Substation	04 SOUTHEAST
GEN-2018-072	OGE	151	ER/NR	Battery/Storage	Ranch Road 345kV Substation	04 SOUTHEAST
GEN-2018-074	WAPA	72	ER	Wind	Denison 230kV Substation	01 NORTH
GEN-2018-079	AEP	148	ER	Solar	Farmland - Delaware 138kV Line	04 SOUTHEAST
GEN-2018-082	AEP	215	ER	Wind	Pittsburg 345kV Substation	04 SOUTHEAST
GEN-2018-083	NPPD	250	ER	Wind	Shell Creek - Hoskins 345kV Line	02 NEBRASKA
GEN-2018-089	SPS	196	ER	Wind	Newhart 230kV Substation	05 SOUTHWEST
GEN-2018-099	SPS	300	ER	Wind	Tolk 230kV Substation	05 SOUTHWEST
GEN-2018-106	AEP	165	ER	Solar	Longwood 345kV Substation	04 SOUTHEAST
GEN-2018-108	ITCGP	95	ER	Battery/Storage	Thistle 345kV Substation	03 CENTRAL
GEN-2018-115	AEP	250	ER/NR	Hybrid	Lawton East Side 345kV/138kv Substation	04 SOUTHEAST
GEN-2018-125	NPPD	231	ER/NR	Wind	Gentleman - Sweetwater 345kV line	02 NEBRASKA
GEN-2018-128	WERE	200.22	ER/NR	Wind	Renfrow - Viola 345 kV Line	03 CENTRAL
GEN-2018-131	NPPD	221.4	ER/NR	Solar	Antelope - Hoskins 345kV Line	02 NEBRASKA
GEN-2018-132	NPPD	201.6	ER/NR	Solar	Antelope - Hoskins 345kV Line	02 NEBRASKA
GEN-2019-002	GRDA	100	ER	Battery/Storage	Maid 161kV Substation	04 SOUTHEAST
GEN-2019-003	SPS	150	ER/NR	Solar	Roosevelt 230kV Substation	05 SOUTHWEST

Project #	CA	Capacity (MW)	Service Type	Fuel Type	POI	Cluster Group
GEN-2019-009	OPPD	100	ER	Solar	S1263 Brock 161kV Substation	02 NEBRASKA
GEN-2019-011	SPS	207	ER/NR	Battery/Storage	Yoakum 345kV Substation	05 SOUTHWEST
GEN-2019-012	OGE	200	ER/NR	Battery/Storage	Woodward 345kV Substation	04 SOUTHEAST
GEN-2019-016	EDE	200	ER	Solar	Dadeville 161kV Substation	03 CENTRAL
GEN-2019-030	ITCGP	252	ER/NR	Wind	Spearville - Clark County 345kV line	03 CENTRAL
GEN-2019-039	NPPD	174.5	ER/NR	Solar	Columbus Southeast-Rising City 115kV Line	02 NEBRASKA
GEN-2019-044	SUNC	100	ER	Solar	North Fort Dodge 115kV Substation	03 CENTRAL
GEN-2019-045	OGE	155	ER	Solar	DeGrasse 138kV Substation	04 SOUTHEAST
GEN-2019-054	SUNC	150	ER/NR	Solar	Great Bend - Circle 230kV Line	03 CENTRAL
GEN-2019-055	SUNC	150	ER/NR	Solar	Great Bend - Spearville 230kV Line	03 CENTRAL
GEN-2019-058	ITCGP	150	ER/NR	Solar	Clark County 345kV Substation	03 CENTRAL

Further details of higher queued assumptions and changes can be found in Appendix A.

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

- AECI Expansion Plan
- Network Upgrades from AECI GI-083 request
- Network Upgrades from AECI GI-101/102 request
- Network Upgrades from AECI GI-103 request
- Network Upgrades from AECI GI-104 request
- Network Upgrades from AECI's AFS of MISO DPP-2019-Cycle requests

The listed network upgrades were included in the mitigation analysis to identify if the upgrades were able to resolve impacts seen on the AECI system in the area as a result of the Study Cycle. Should these upgrades no longer be tagged to the higher queue studies AECI may have to restudy the Study Cycle.

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). Each of the power flow models for the steady state analysis was modified to include appropriate higher-queued generation interconnection requests. Modeling parameters in the SPP DISIS 2018-002 & 2019-001 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.

STEADY STATE ANALYSIS RESULTS

Steady state analysis results showed no new constraints reported on the AECI transmission system which would have been attributed to the Study Cycle requests. As a result, no new transmission upgrades were evaluated to mitigate impacts reported from the analysis as a result of the Study Cycle requests.

CONTINGENT FACILITY RESULTS

No facilities were reported as Contingent Facilities with the addition of the Study Cycle requests. 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 would otherwise be the responsibility of the Study Cycle requests as necessary to interconnect to the 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 ties with the addition of the Study Cycle requests. The most severe constraint is shown in Table 3.

Table 3: Steady State Neighboring System Constraint 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	101.5	108.6
				27W	104.0	108.0
				32S	97.5	104.2
				32W	107.3	111.0

NETWORK UPGRADES

No upgrades were reported for steady state contingent constraints for the Study Cycle requests.

No upgrades were evaluated for the neighboring system constraints listed in Table 3. The upgrades for these impacts may need to be resolved through coordination with the transmission owner as listed in Table 4 below.

Table 4: Neighboring System Constraints

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

Since no upgrades were required as a result of the addition of the Study Cycle requests, AECI did not develop any cost estimates for the SPP DISIS-2018-002/2019-001 Study Cycle.

VERSION HISTORY

Version Number and Date	Author	Change Description
V0 – 10/20/2023	AECI	Initial release
V1 – 07/15/2025	AECI	Withdrawal of six (6) SPP requests from Study Cycle Withdrawal of MISO, SPP, and AECI higher queued requests