SPP DISIS-2017-002 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 2017-002 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 twenty (20) 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Table 1: Withdrawn Study Cycle Requests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-2017-176	SWPS	300	ER/NR	Hybrid	Newhart 230kV Substation	05 SOUTHWEST
GEN-2017-199[1]	BEPC	202	ER/NR	Battery/Storage	Groton 345kV Substation	01 NORTH
GEN-2017-200[1]	BEPC	302	ER/NR	Wind	Groton 345kV Substation	01 NORTH
GEN-2017-213[1]	AEPW	300	ER	Hybrid	Clarksville 345kV Substation	04 SOUTHEAST
GEN-2017-112	KCPL	200	ER	Wind	Clinton - Stilwell 161 kV Line Tap	03 CENTRAL
GEN-2017-114	BEPC	450	ER	Wind	Chappelle Creek - Leland Olds 345kV	01 NORTH
GEN-2017-116	SWPS	192.5	ER	Solar	Oasis - Pleasant Hill 230kV	05 SOUTHWEST
GEN-2017-123	WERE	180	ER/NR	Wind	Stranger Creek 345kV	03 CENTRAL
GEN-2017-142	WERE	170	ER/NR	Wind	Swissvale 345kV Station	03 CENTRAL
GEN-2017-147	KCPL	252	ER/NR	Wind	Stilwell 345kV	03 CENTRAL
GEN-2017-153	OKGE	253	ER/NR	Wind	McClain 138kV	04 SOUTHEAST
GEN-2017-156	AEPW	234	ER/NR	Wind	Pittsburg 345kV Substation	04 SOUTHEAST
GEN-2017-157	AEPW	202	ER/NR	Wind	Pittsburg 345kV Substation	04 SOUTHEAST
GEN-2017-185	OKGE	200	ER/NR	Wind	Viola - Hunters 345kV	03 CENTRAL
GEN-2017-186	KCPL	100	ER	Solar	KC South-N. Raymore 161 kV	03 CENTRAL
GEN-2017-193	WERE	201.6	ER/NR	Solar	Tecumseh 230kV Substation	03 CENTRAL
GEN-2017-217	SWPS	300	ER/NR	Solar	Plant X 230kV Substation	05 SOUTHWEST
GEN-2017-218	SWPS	600	ER/NR	Solar	Tolk-Plant X 230kV Line	05 SOUTHWEST
GEN-2017-224	KCPL	302.4	ER/NR	Solar	Craig 345kV Substation	03 CENTRAL
GEN-2017-228	KCPL	302.4	ER/NR	Solar	Stilwell 345kV Substation	03 CENTRAL

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

[1] Listed GIR withdrew from SPP DISIS queue after the start of the analysis, however the impact of the withdrawal is captured in current restudy.

Table 2: Study Cycle Requests Evaluated

Project #	CA	Capacity (MW)	Service Type	Fuel Type	POI	Cluster Group
GEN-2017-108	KCPL	400.0	ER/NR	Solar	Stillwell - Clinton 161kV Line	03 CENTRAL
GEN-2017-111	KCPL	152.0	ER	Solar	Clinton - Stilwell 161 kV Line Tap	03 CENTRAL
GEN-2017-115	KCPL	244.0	ER	Wind	Holt County 345 kV	03 CENTRAL
GEN-2017-119	SUNC	180.0	ER	Wind	Elm Creek 345kV substation	03 CENTRAL
GEN-2017-120	WERE	260.0	ER	Wind	Abilene Energy Center-Northview 115kV	03 CENTRAL
GEN-2017-121	WERE	200.0	ER/NR	Wind	Sumner 138kV	03 CENTRAL
GEN-2017-125	WERE	252.0	ER/NR	Wind	Swissvale 345kV	03 CENTRAL
GEN-2017-128	WERE	202.0	ER/NR	Wind	Swissvale 345kV	03 CENTRAL
GEN-2017-132	OKGE	400.0	ER/NR	Wind	Arcadia 345kV	04 SOUTHEAST
GEN-2017-133	OKGE	200.0	ER/NR	Wind	Arcadia 345kV	04 SOUTHEAST
GEN-2017-134	OKGE	250.0	ER/NR	Wind	Arcadia 345kV	04 SOUTHEAST
GEN-2017-137	OKGE	295.0	ER/NR	Wind	Arcadia 345kV	04 SOUTHEAST
GEN-2017-140	AEPW	160.0	ER/NR	Solar	Clarksville 345kV Switching Station	04 SOUTHEAST
GEN-2017-141	AEPW	241.7	ER/NR	Solar	Clarksville 345kV Switching Station	04 SOUTHEAST
GEN-2017-144	WAPA	200.0	ER	Wind	Holt County 345kV	02 NEBRASKA
GEN-2017-146	SWPS	151.8	ER	Wind	Deaf Smith-Plant X 230kV	05 SOUTHWEST
GEN-2017-148	EMDE	202.0	ER/NR	Wind	Joplin 161kV sub	03 CENTRAL
GEN-2017-149	OKGE	258.0	ER/NR	Wind	Johnson County 345kV Substation	04 SOUTHEAST
GEN-2017-150	OKGE	250.0	ER/NR	Solar	Minco 345kV	04 SOUTHEAST
GEN-2017-151	SWPS	300.0	ER	Wind	TUCO-Oklaunion 345kV	05 SOUTHWEST
GEN-2017-152	OKGE	252.0	ER/NR	Wind	McClain 138kV	04 SOUTHEAST
GEN-2017-154	OKGE	255.0	ER/NR	Wind	Johnson County 345kV Substation	04 SOUTHEAST
GEN-2017-155	OKGE	300.0	ER/NR	Wind	Muskogee 345kV Substation	04 SOUTHEAST
GEN-2017-158	SWPS	265.0	ER	Wind	Tolk 230kV Substation	05 SOUTHWEST
GEN-2017-164	OKGE	250.0	ER/NR	Solar	Woodring 345kV Substation	04 SOUTHEAST
GEN-2017-166	OKGE	250.0	ER/NR	Solar	Sunnyside 345kV	04 SOUTHEAST
GEN-2017-168	OKGE	250.0	ER/NR	Solar	McClain 138kV	04 SOUTHEAST
GEN-2017-171	AEPW	150.0	ER/NR	Solar	Lawton Eastside - Terry Road 345kV	04 SOUTHEAST
GEN-2017-175	WAPA	300.0	ER	Wind	Vfodnes-Utica Jct. 230kV	01 NORTH
GEN-2017-179	WERE	222.0	ER/NR	Wind	Gordon Evans 138kV Substation	03 CENTRAL
GEN-2017-181	NPPD	300.0	ER/NR	Wind	Tobias 345kV Substation	02 NEBRASKA
GEN-2017-182	NPPD	128.0	ER/NR	Wind	Tobias 345kV Substation	02 NEBRASKA
GEN-2017-183	KCPL	400.0	ER/NR	Wind	Nashua-St. Joe 345kV	03 CENTRAL
GEN-2017-184	KCPL	400.0	ER/NR	Solar	Nashua-St. Joe 345kV	03 CENTRAL
GEN-2017-187	SWPS	150.0	ER	Solar	Sulphur Springs 115kV Substation	05 SOUTHWEST
GEN-2017-188	EMDE	130.0	ER	Solar	Asbury 161 kV	03 CENTRAL
GEN-2017-191	WERE	201.6	ER/NR	Solar	Swissvale 345kV	03 CENTRAL
GEN-2017-195	KCPL	500.4	ER/NR	Solar	West Gardner 345kV	03 CENTRAL
GEN-2017-196	KCPL	128.0	ER/NR	Battery/Storage	West Gardner 345kV	03 CENTRAL
GEN-2017-201	NPPD	250.0	ER/NR	Wind	Hoskins 345kV Substation	02 NEBRASKA

Project #	CA	Capacity (MW)	Service Type	Fuel Type	POI	Cluster Group
GEN-2017-202	SWPA	200.0	ER/NR	Solar	New Madrid - Sikeston 161kV	03 CENTRAL
GEN-2017-203	OKGE	210.0	ER	Hybrid	Renfrow 345kV Substation	04 SOUTHEAST
GEN-2017-209	KCPL	300.0	ER	Hybrid	LaCygne - Neosho 345kV	03 CENTRAL
GEN-2017-210	NPPD	310.0	ER	Hybrid	McCool 345kV Substation	02 NEBRASKA
GEN-2017-220	WERE	201.6	ER/NR	Solar	Buffalo Flats 345kV Substation	03 CENTRAL
GEN-2017-221	WERE	152.0	ER/NR	Battery/Storage	Buffalo Flats 345kV Substation	03 CENTRAL
GEN-2017-222	WAPA	180.0	ER	Wind	Denison 230kV Substation	01 NORTH
GEN-2017-226	WERE	201.6	ER/NR	Solar	Gordon Evans 138kV Substation	03 CENTRAL
GEN-2017-227	WERE	201.6	ER/NR	Battery/Storage	Gordon Evans 138kV Substation	03 CENTRAL
GEN-2017-229	KCPL	76.0	ER/NR	Battery/Storage	Stilwell 345kV Substation	03 CENTRAL
GEN-2017-231	OKGE	72.5	ER/NR	Solar	Branch 161kV Substation	04 SOUTHEAST
GEN-2017-233	OKGE	215.0	ER/NR	Wind	Minco 345kV	04 SOUTHEAST
GEN-2017-234	NPPD	115.0	ER	Wind	Spalding to North Loup 115kV	02 NEBRASKA
GEN-2017-239	SWPS	300.0	ER	Solar	Mahoney 230kV Substation	05 SOUTHWEST
GEN-2017-240	OKGE	202.0	ER/NR	Solar	Bristow 138kV Substation	04 SOUTHEAST

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

The following key assumption was included in the Study:

- Evergy System Upgrade identified by SPP for GEN-2017-108 in the SPP DISIS-2017-002 Phase 2 Study:
    - Build a new 161 kV line from Archie to G17-108-Tap and place in service.

The listed network upgrade was included in the mitigation analysis to identify if the upgrade was able to resolve impacts seen on the AECI system in the area as a result of the Study Cycle. Should this upgrade no longer be tagged to the Study Cycle by SPP, AECI will 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 at the level of dispatch consistent with requirements of the service type requested as defined in AECI's GI Study Guidelines document. Modeling parameters in the SPP DISIS 2017-002 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 seven (7) constraints reported on the AECI transmission system, as shown in Table 3, which are attributed to the Study Cycle requests. Transmission upgrades were evaluated to mitigate the impacts reported from the analysis as a result of the Study Cycle requests. Simulations were performed on each of the scenarios with the identified network upgrade and contingent network upgrades included.

The upgrades shown in Table 8 were evaluated in order to mitigate the reported steady state constraints for the Study Cycle requests; results from the simulations found that the network upgrades were able to mitigate the reported overload conditions as shown in Table 3.

Table 3: Steady State Constraints for the Study Cycle Requests with Upgrades

Constraint ID	Event	Monitored Facility	Contingency	Season	Base Loading	Project Loading	Upgrade Loading
NU01	P1	300323 2CENTRV 69.000 300336 2HOLDEN 69.000 1	OPEN BRANCH FROM BUS 300110 [5PITTSV 161.00] TO BUS 300320 [5LEVASY 161.00] CKT 1	26H	84.7	100.3	68.2
				26S	91.0	107.8	72.9
				31S	89.9	106.8	72.6
NU02	P1	300382 2SFRKTP 69.000 300578 2SANTFE 69.000 1	OPEN BRANCH FROM BUS 345435 [7MAYWOOD 345.00] TO BUS 345992 [7SPENCER 345.00] CKT 1	26S	84.4	100.5	43.7
	P2EHV		OPEN BRANCH FROM BUS 345435 [7MAYWOOD 345.00] TO BUS 345992 [7SPENCER 345.00] CKT 1 OPEN BRANCH FROM BUS 40254 [J1025 POI 345.00] TO BUS 345435 [7MAYWOOD 345.00] CKT 1	26S	88.9	108.1	56.2
				31S	81.3	102.0	52.9
NU03	P1	300530 2GEOGT2 69.000 300541 2SEDALI 69.000 1	OPEN BRANCH FROM BUS 300117 [5SEDALA 161.00] TO BUS 541209 [SEDALIA5 161.00] CKT 1	26H	94.7	150.2	96.8
				26S	97.0	141.4	93.3
				26W	75.5	123.7	66.8
				31S	96.8	145.0	96.7
				31W	77.3	123.5	66.3

Constraint ID	Event	Monitored Facility	Contingency	Season	Base Loading	Project Loading	Upgrade Loading
NU04	P1	300772 2COFMAN 69.000 300780 2KNOBBY 69.000 1	OPEN BRANCH FROM BUS 300034 [5EDMONS 161.00] TO BUS 301402 [5LOSTVALY 161.00] CKT 1	26H	57.2	106.3	50.4
			OPEN BRANCH FROM BUS 300563 [5SUNRIS 161.00] TO BUS 300574 [5GRAVOIB2 161.00] CKT 1	26W	83.5	103.8	52.9
				31W	83.7	103.9	52.0
			OPEN BRANCH FROM BUS 300086 [5GRNVTP 161.00] TO BUS 300563 [5SUNRIS 161.00] CKT 1 OPEN BRANCH FROM BUS 300086 [5GRNVTP 161.00] TO BUS 301062 [5LAKEVW 161.00] CKT 1 OPEN BRANCH FROM BUS 300086 [5GRNVTP 161.00] TO BUS 301367 [5HURCNDECKTP161.00] CKT 1	26S	68.3	109.8	45.6
				31S	67.5	107.6	44.5
NU05	P1	300773 2ELKTON 69.000 300817 2OSCEOLA 69.000 1	OPEN LINE FROM BUS 300798 [2HYDERHL 69.000] TO BUS 300799 [2ARNICA 69.000] CKT 1	26S	77.6	105.9	29.8
				31S	78.4	106.5	30.3
NU06	P1	300780 2KNOBBY 69.000 301401 2TURKEYCRK 69.000 1	OPEN BRANCH FROM BUS 300034 [5EDMONS 161.00] TO BUS 301402 [5LOSTVALY 161.00] CKT 1	26H	69.8	116.7	56.1
			OPEN BRANCH FROM BUS 300563 [5SUNRIS 161.00] TO BUS 300574 [5GRAVOIB2 161.00] CKT 1	26W	95.3	115.4	60.3
				31W	96.1	116.0	59.5
			OPEN BRANCH FROM BUS 300086 [5GRNVTP 161.00] TO BUS 300563 [5SUNRIS 161.00] CKT 1 OPEN BRANCH FROM BUS 300086 [5GRNVTP 161.00] TO BUS 301062 [5LAKEVW 161.00] CKT 1 OPEN BRANCH FROM BUS 300086 [5GRNVTP 161.00] TO BUS 301367 [5HURCNDECKTP161.00] CKT 1	26S	85.3	122.2	53.0
				31S	85.3	120.7	52.2
NU07	P1	300651 2LAMR 69.000 300794 5LAMAR 161.00 1	OPEN LINE FROM BUS 300045 [7MORGAN 345.00] TO BUS 709500 [GI-95_POI 345.00] CKT 1	26S	94.9	103.4	75.7
				31S	96.1	104.4	77.8
	P2EHV		OPEN BRANCH FROM BUS 300042 [7HUBEN 345.00] TO BUS 300045 [7MORGAN 345.00] CKT 1 OPEN BRANCH FROM BUS 300045 [7MORGAN 345.00] TO BUS 709500 [GI-95_POI 345.00] CKT 1	26S	98.9	107.5	64.0
				26W	93.3	101.0	63.2
				31S	101.1	109.3	64.5

Table 3 shows stressed modeling conditions in which the Base Loading represents models built with higher queue generation requests in service, but without network upgrades tagged to those higher queue requests. Multiple iterations of solutions, which can include applicable higher queued network upgrades, were tested to alleviate both the Base Loading and the additional loading contributed by the Study Cycle (Project Loading).

Table 3 lists facilities in which Project Loading cannot be mitigated by higher queue upgrades and in which a negative impact due to the Study Cycle was still present.

CONTINGENT FACILITY RESULTS

Thirty-six (36) facilities were reported as Contingent Facilities with the addition of the Study Cycle requests, as shown in Table 4. 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.

The transmission upgrades for the Contingent Facilities were evaluated in order to confirm that the planned system adjustments were sufficient to mitigate the overload seen for the addition of the Study Cycle requests. Simulations were performed on each of the scenarios with the identified network upgrade and contingent network upgrades included. The upgrades shown in Table 6 were evaluated in order to mitigate the reported constraints as listed in Table 4 below.

Table 4: Steady State Contingent Constraints for the Study Cycle Requests with Upgrades

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
CF01	P2EHV	300069 5CHOTEAU1 161.00 512648 MAID 5 161.00 1	26H	98.2	107.3	86.9	DISIS-2017-001
			26L	102.5	106.6	90.5	
			26S	99.5	106.5	85.6	
			31S	100.0	106.8	86.5	
CF02	P1	300050 7PALMYR_AI 345.00 300694 5PALMYR_AI 161.00 1	26S	93.6	108.6	48.9	MISO DPP 2018 APR
CF03	P1	300184 2NORTHB 69.000 301662 2HAMBRGB2 69.000 1	26S	101.5	107.4	68.2	DISIS-2016-002
			31S	98.3	104.7	66.5	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
CF04	P2EHV	300061 5BOONE 161.00 300519 5MLRSBGB1 161.00 1	26S	110.3	117.7	95.3	MISO DPP 2019
CF05	P1	300115 5STFRANB2 161.00 338202 5JIM HILL% 161.00 1	26S	102.2	107.4	71.8	MISO DPP 2019
	P2EHV		26S	101.1	107.4	71.8	
			31W	96.9	100.9	66.7	
CF06	P1	300124 5HOLDENB2 161.00 300336 2HOLDEN 69.000 1	26H	102.4	122.7	60.1	MISO DPP 2019
			26S	111.3	134.3	65.5	
			26W	95.8	115.1	57.1	
			31S	111.5	134.5	66.0	
			31W	96.0	115.4	57.3	
CF07	P1	300327 2ELM 69.000 300336 2HOLDEN 69.000 1	26H	95.7	117.7	85.7	MISO DPP 2019
			26S	103.7	129.6	93.7	
			31S	105.0	131.2	95.5	
CF08	P0	300387 2BEVIER 69.000 301623 2BEVIERTP 69.000 1	26S	112.0	118.0	64.4	SPP DISIS-2016-002/ MISO DPP 2019
			31S	111.2	117.8	64.2	
	P1		26H	105.3	110.7	66.0	
			26S	147.7	154.0	88.0	
			26W	96.4	105.0	77.0	
			31S	146.2	155.5	87.9	
			31W	92.2	100.9	74.6	
	P2EHV		26H	103.8	109.0	66.0	
			26S	145.6	153.8	94.1	
			26W	95.1	103.7	82.3	
			31S	145.1	154.2	94.1	
CF09	P0	300388 2AXTELL 69.000 300400 2MACNLK 69.000 1	26H	95.2	101.0	37.4	SPP DISIS-2016-002/ MISO DPP 2019
			26S	127.1	134.9	49.0	
			31S	126.0	134.6	48.9	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
	P1		26H	122.8	129.9	52.1	
			26L	96.8	102.0	39.0	
			26S	173.5	181.2	69.7	
			26W	110.8	121.7	50.2	
			31S	171.5	183.4	69.6	
			31W	104.8	116.0	48.3	
	P2EHV		26H	120.8	127.6	52.1	
			26S	170.7	181.3	74.9	
			26W	109.1	120.0	54.0	
			31S	170.0	181.8	75.0	
			31W	103.4	114.5	52.2	
CF10	P0	300388 2AXTELL 69.000 300401 2MACNTP 69.000 1	26S	120.5	128.2	46.3	SPP DISIS-2016-002/ MISO DPP 2019
			31S	119.5	128.0	46.2	
	P1		26H	117.7	124.9	49.9	
			26L	95.2	100.4	38.3	
			26S	166.8	174.2	67.0	
			26W	104.1	115.0	47.5	
			31S	164.7	176.7	66.9	
			31W	98.2	109.3	45.5	
	P2EHV		26H	115.7	122.5	49.9	
			26S	164.0	174.5	72.2	
			26W	102.5	113.2	51.3	
			31S	163.3	175.0	72.2	
			31W	96.7	107.8	49.5	
CF11	P2EHV	300398 2LOVELK 69.000 300401 2MACNTP 69.000 1	26S	87.9	101.6	72.6	MISO DPP 2019
			31S	88.6	103.3	73.7	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
CF12	P0	300400 2MACNLK 69.000 301623 2BEVIERTP 69.000 1	26H	105.4	111.1	41.5	SPP DISIS-2016-002/ MISO DPP 2019
			26S	140.2	148.1	54.2	
			26W	94.6	103.4	39.6	
			31S	139.1	147.8	54.0	
	P1		26H	132.9	139.9	56.1	
			26L	100.2	105.4	40.3	
			26S	186.7	194.9	74.9	
			26W	118.3	129.3	53.2	
			31S	184.8	196.8	74.8	
			31W	112.8	124.0	51.5	
	P2EHV		26H	130.9	137.7	56.1	
			26S	184.0	194.6	80.2	
			26W	116.7	127.5	57.0	
			31S	183.3	195.1	80.2	
			31W	111.4	122.5	55.5	
CF13	P1	300172 2TMHILLB1 69.000 300387 2BEVIER 69.000 1	26S	123.2	129.9	NB[2]	GI-083
			31S	121.7	129.0	NB[1]	
	P2EHV		26S	118.3	124.6	NB[1]	
			31S	117.4	124.5	NB[1]	
CF14	P1	300099 5MONTCT 161.00 300575 2MONTGY 69.000 2	26S	107.4	112.1	98.9	GI-083
	P2EHV		26S	108.5	112.5	89.9	
			31S	110.5	114.4	90.7	
CF15	P1	300512 2AUXVAS 69.000 300517 2KINGDM 69.000 1	26S	102.4	110.6	NB[1]	GI-083
			26W	93.1	103.3	NB[1]	
			31S	104.3	112.8	NB[1]	

[2] Monitored Facility no longer exists due to upgrade necessary for mitigating overload, as such no loading reported for this scenario.

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
			31W	93.7	103.6	NB[1]	
	P2EHV		31S	94.4	100.9	NB[1]	
CF16	P1	300517 2KINGDM 69.000 301497 5KINGDMB2 161.00 2	26H	111.6	116.3	NB[1]	GI-083
			26L	98.1	103.8	NB[1]	
	P2EHV		26H	103.2	108.4	NB[1]	
			26S	126.7	130.6	NB[1]	
			26W	115.6	119.7	NB[1]	
			31W	118.4	122.4	NB[1]	
CF17	P1	300517 2KINGDM 69.000 301497 5KINGDMB2 161.00 3	26H	111.5	116.2	59.3	GI-083
			26L	98.0	103.7	54.3	
	P2EHV		26H	103.1	108.3	59.8	
			26S	126.6	130.4	72.3	
			26W	115.5	119.6	69.2	
			31W	118.3	122.2	71.2	
CF18	P2EHV	300519 5MLRSBGB1 161.00 301498 5MLRSBGB2 161.00 Z1	26S	112.4	119.7	74.3	GI-083
CF19	P0	300133 5THMHLB3 161.00 344004 5ADAIR1 161.00 1	26S	98.8	106.1	49.5	MISO Tranche 1
			31S	98.3	106.4	49.6	
	P1		26S	123.7	131.4	87.3	
			26W	90.5	101.8	70.5	
			31S	123.5	131.9	87.6	
	P2EHV		26S	120.0	127.5	87.3	
			31S	119.4	127.8	87.6	
CF20	P1	300087 5HICKCK 161.00 300094 5LOCUST 161.00 1	26H	94.8	111.1	77.0	MISO Tranche 1
			26S	110.1	127.1	75.7	
			26W	98.0	120.7	83.1	
			31S	104.6	123.4	71.4	
			31W	86.8	109.7	74.4	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
	P2EHV		26H	91.5	108.2	77.0	
			26S	104.4	121.6	75.7	
			26W	96.0	118.5	83.1	
			31S	98.5	117.3	71.4	
			31W	84.8	107.6	74.4	
CF21	P1	300172 2TMHILLB1 69.000 301318 2THMINTP 69.000 1	26S	101.8	108.0	81.3	MISO Tranche 1
			31S	100.2	106.9	80.4	
CF22	P1	300185 2PHELPS 69.000 300186 2ROCKPT 69.000 1	26S	93.3	100.3	98.7	MISO Tranche 1
CF23	P1	300390 2CAIRO 69.000 300394 2HUNTSV 69.000 1	26S	100.5	106.7	80.1	MISO Tranche 1
			31S	99.0	105.6	79.1	
CF24	P1	300394 2HUNTSV 69.000 301318 2THMINTP 69.000 1	26S	101.8	108.0	81.3	MISO Tranche 1
			31S	100.2	106.9	80.4	
CF25	P1	300549 5ENONB2 161.00 301649 5ETHLYNB2 161.00 1	26H	96.6	100.1	90.6	MISO Tranche 1
CF26	P1	300590 5AUBURNTP 161.00 300595 5CYRENE 161.00 1	26S	100.3	104.8	80.7	MISO Tranche 1
	P2EHV		26S	104.9	109.2	98.4	
CF27	P2EHV	300525 5WRIGHTB2 161.00 300600 5NEWMELB1 161.00 1	31S	102.7	106.0	97.3	MISO Tranche 1
CF28	P2EHV	300525 5WRIGHTB2 161.00 300608 5WRIGHTB1 161.00 Z1	31S	102.5	105.7	97.3	MISO Tranche 1
CF29	P1	300323 2CENTRV 69.000 300334 2ROSEHL 69.000 1	26S	82.5	101.1	92.6	SPP DISIS-2017-002 Network Upgrades
CF30	P1	300618 2BARNET 69.000 300633 2MTPLSTC 69.000 1	31W	91.7	100.3	95.8	SPP DISIS-2017-002 Network Upgrades
CF31	P1	300688 2AUSTIN 69.000 300696 2CREIGH 69.000 1	26H	73.6	108.4	83.3	SPP DISIS-2017-002 Network Upgrades
			26S	81.6	119.8	91.3	
			31S	77.4	115.9	88.9	
CF32	P1	300688 2AUSTIN 69.000 300699 2ELYNTP 69.000 1	26S	70.0	108.3	79.8	SPP DISIS-2017-002 Network Upgrades
			31S	64.9	103.7	76.7	
CF33	P1	300772 2COFMAN 69.000 300779 2J&7 69.000 1	26H	51.2	100.7	94.2	SPP DISIS-2017-002 Network Upgrades
			26S	59.1	103.1	82.5	
			31S	56.7	100.5	79.9	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
CF34	P2EHV	300110 5PITTSV 161.00 300320 5LEVASY 161.00 1	26S	82.5	103.2	92.3	SPP DISIS-2017-002 Network Upgrades
			31S	84.0	104.7	94.4	
CF35	P2EHV	300110 5PITTSV 161.00 301561 5HOLDENB1 161.00 1	26S	82.9	102.3	90.5	SPP DISIS-2017-002 Network Upgrades
			31S	84.4	103.8	92.7	
CF36	P2EHV	300320 5LEVASY 161.00 548808 ECKLES-161 161.00 1	26S	80.5	101.2	90.3	SPP DISIS-2017-002 Network Upgrades
			31S	82.0	102.6	92.3	

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 will need to be coordinated with the appropriate transmission owner.

Five (5) facilities were reported on the AECI ties with the addition of the Study Cycle requests. The most severe constraints are shown in Table 5.

Table 5: Steady State Neighboring System Constraints for the Study Cycle Requests

Constraint ID	Event	Monitored Facility	Area	Season	Base Loading	Project Loading
AFS01	P1	300097 5MARYVB2 161.00 652560 CRESTON5 161.00 1	AECI/WAPA	26H	109.9	114.7
				26S	143.5	152.4
				31S	145.6	156.1
	P2EHV			26S	95.5	105.1
				31S	98.8	108.6
AFS02	P1	300694 5PALMYR_AI 161.00 347516 5MARBLE N 161.00 1	AECI/AMIL	26H	94.5	104.1
AFS03	P0	300071 5CLINTN 161.00 761278 G17-108-TAP 161.00 1	AECI/KCPL	26H	NB[3]	119.8

[3] Monitored Facility does not exist in base case, as such no loading reported for this scenario.

Constraint ID	Event	Monitored Facility	Area	Season	Base Loading	Project Loading
				26S	0.0[3]	114.0
				26W	0.0[3]	125.1
				31S	0.0[3]	115.4
				31W	0.0[3]	125.0
	P1			26H	0.0[3]	164.0
				26S	0.0[3]	164.9
				26W	0.0[3]	164.4
				31S	0.0[3]	165.2
				31W	0.0[3]	164.5
	P2EHV			26H	0.0[3]	116.3
				26S	0.0[3]	110.3
				26W	0.0[3]	122.5
				31S	0.0[3]	111.5
				31W	0.0[3]	122.1
AFS04	P1	42684 J1268 POI 161.00 300590 5AUBURNTP 161.00 1	AECI/AMMO	26S	103.1	107.7
	P2EHV			26S	107.7	112.2
AFS05	P0	300179 2HAMBRGB1 69.000 635055 PERCIVAL 8 69.000 1	AECI/MEC	26S	95.3	104.9
				31S	90.1	100.7
	P1			26H	116.2	121.5
				26L	111.1	115.4
				26S	141.4	151.5
				26W	103.0	121.8
				31S	136.9	147.8
				31W	103.1	122.2
	P2EHV			26S	96.6	104.4
				31S	92.4	100.8

NETWORK UPGRADES

The upgrades shown in Table 6 were evaluated in order to mitigate the reported steady state contingent constraints for the Study Cycle requests as listed in Table 4.

Table 6: Network Upgrades for the Study Cycle Contingent Constraints

Constraint ID	Monitored Facility	Network Upgrade
CF01	300069 5CHOTEAU1 161.00 512648 MAID 5 161.00 1	**Contingent on DISIS-2017-001** Construct a new 161 kV terminal at Sportsman. (KAMO) Reroute Kerr - 412 161 kV line to run between Sportsman and 412. (GRDA) Rebuild existing 161 kV double circuit from Maid-Kerr. (GRDA)
CF02	300050 7PALMYR_AI 345.00 300694 5PALMYR_AI 161.00 1	**Contingent on MISO DPP 2018 APR** Add a second 345/161 kV 500 MVA transformer at Palmyra.
CF03	300184 2NORTHB 69.000 301662 2HAMBRGB2 69.000 1	**Contingent on DISIS-2016-002** Rebuild 18.00 mile-long Hamburg - Northboro 69 kV line to 336 ACSR at 100C.
CF04	300061 5BOONE 161.00 300519 5MLRSBGB1 161.00 1	**Contingent on MISO DPP 2019** Reconductor 9.4 mile long Boone-Millersburg 161 kV line with 795 ACSS at 250C. Replace jumpers on both side of line with 795 ACSS High Temp.
CF05	300115 5STFRANB2 161.00 338202 5JIM HILL% 161.00 1	**Contingent on MISO DPP 2019** Rebuild 9.90 mile-long St. Francis - Jim Hill 161 kV line to 1192 ACSR at 100C. Replace jumpers at St. Francis with 1192 ACSR at 100C. Replace disconnect switches at St. Francis 161 kV bus on Jim hill line with 2000A switches.
CF06	300124 5HOLDENB2 161.00 300336 2HOLDEN 69.000 1	**Contingent on MISO DPP 2019** Add a second 161/69 kV transformer at Holden with rating of 84 MVA Summer/95 MVA Winter.
CF07	300327 2ELM 69.000 300336 2HOLDEN 69.000 1	**Contingent on MISO DPP 2019** Rebuild 3.10 mile-long Elm - Holden 69 kV line to 556 ACSR at 100C.
CF08	300387 2BEVIER 69.000 301623 2BEVIERTP 69.000 1	**Contingent on SPP DISIS-2016-002/MISO DPP 2019** Rebuild 0.10 mile-long Bevier - Bevier Tap 69 kV line to 795 ACSR at 100C.
CF09	300388 2AXTELL 69.000 300400 2MACNLK 69.000 1	**Contingent on SPP DISIS-2016-002/MISO DPP 2019** Rebuild 1.15 mile-long Axtell - Macon Lake 69 kV line to 795 ACSR.
CF10	300388 2AXTELL 69.000 300401 2MACNTP 69.000 1	**Contingent on SPP DISIS-2016-002/MISO DPP 2019** Rebuild 1.05 mile-long Axtell - Macon Tap 69 kV line to 795 ACSR.
CF11	300398 2LOVELK 69.000 300401 2MACNTP 69.000 1	**Contingent on MISO DPP 2019** Rebuild 12.20 mile-long Love Lake - Macon Tap 69 kV line to 336 ACSR at 100C. Upgrade bushing CTs on CB 33 at Love Lake to 600 A minimum base rating.
CF12	300400 2MACNLK 69.000 301623 2BEVIERTP 69.000 1	**Contingent on SPP DISIS-2016-002/MISO DPP 2019** Rebuild 4.25 mile-long Macon Lake - Bevier Tap 69 kV line to 795 ACSR at 100C.
CF13	300172 2TMHILLB1 69.000 300387 2BEVIER 69.000 1	**Contingent on GI-083** Thomas Hill - Bevier Area Upgrades: - Move Thomas Hill - Moberly 161 kV line to Thomas Hill Bus #2 - Move Thomas Hill - Meadville 161 kV line to Thomas Hill Bus #3 - Move Thomas Hill - Salisbury 161 kV line to Thomas Hill Bus #4 - Add Thomas Hill Bus #1 - Bevier 161 kV line. - Add Bevier 161/69 transformer rated for 112 Summer/127 Winter MVA - Remove Thomas Hill - Bevier 69 kV line

Constraint ID	Monitored Facility	Network Upgrade
CF14	300099 5MONTCT 161.00 300575 2MONTGY 69.000 2	**Contingent on GI-083** Kingdom City/Auxvasse/Salt River Upgrades: Rebuild 8 mile-long Kingdom City - Auxvasse 69 kV line to 161 kV - Utilize 795 ACSR at 100C. - Re-terminate the line on the 161 kV Bus #2 at Kingdom City. Rebuild 9 mile Auxvasse - Salt River Tap 69 kV line to 161 kV - Utilize 795 ACSR at 100C. - Re-terminate the line on the 161 kV bus at Salt River. Rebuild 1 mile-long Salt River Tap - Salt River line to 161/69 kV D.C. - 161 kV will be 795 ACSR at 100C. - 69 kV will be 336 ACSR at 100C. Modify the Salt River 69 kV station to include a 161/69 kV 84 MVA Summer/96 MVA Winter transformer and 2 161 kV terminal positions. Construct new 69 kV section between Salt River and Vandiver. Convert Auxvasse 69 kV station to 161 kV.
CF15	300512 2AUXVAS 69.000 300517 2KINGDM 69.000 1	
CF16	300517 2KINGDM 69.000 301497 5KINGDMB2 161.00 2	**Contingent on GI-083** Remove Kingdom City 161/69 kV transformer #2 from service.
CF17	300517 2KINGDM 69.000 301497 5KINGDMB2 161.00 3	**Contingent on GI-083** Upgrade Kingdom City 161/69 kV transformer #3 to an 84 MVA Summer/96 MVA Winter unit.
CF18	300519 5MLRSBGB1 161.00 301498 5MLRSBGB2 161.00 Z1	**Contingent on GI-083** Upgrade Millersburg 161 kV bus tie jumpers. Utilize 1590 ACSR conductor to be designed for 100ºC.
CF19	300133 5THMHLB3 161.00 344004 5ADAIR1 161.00 1	**Contingent on MISO Tranche 1** Build new 345 kV line from Thomas Hill 345 kV substation (AECI) to Zachary 345 kV substation (Ameren).
CF20	300087 5HICKCK 161.00 300094 5LOCUST 161.00 1	
CF21	300172 2TMHILLB1 69.000 301318 2THMINTP 69.000 1	
CF22	300185 2PHELPS 69.000 300186 2ROCKPT 69.000 1	
CF23	300390 2CAIRO 69.000 300394 2HUNTSV 69.000 1	
CF24	300394 2HUNTSV 69.000 301318 2THMINTP 69.000 1	
CF25	300549 5ENONB2 161.00 301649 5ETHLYNB2 161.00 1	
CF26	300590 5AUBURNTP 161.00 300595 5CYRENE 161.00 1	
CF27	300525 5WRIGHTB2 161.00 300600 5NEWMELB1 161.00 1	
CF28	300525 5WRIGHTB2 161.00 300608 5WRIGHTB1 161.00 Z1	
CF29	300323 2CENTRV 69.000 300334 2ROSEHL 69.000 1	**Contingent on SPP DISIS-2017-002 Network Upgrades** Build new 161 kV line from Archie to G17-108-Tap and place in service.
CF30	300618 2BARNET 69.000 300633 2MTPLSTC 69.000 1	
CF31	300688 2AUSTIN 69.000 300696 2CREIGH 69.000 1	
CF32	300688 2AUSTIN 69.000 300699 2ELYNTP 69.000 1	
CF33	300772 2COFMAN 69.000 300779 2J&7 69.000 1	
CF34	300110 5PITTSV 161.00 300320 5LEVASY 161.00 1	
CF35	300110 5PITTSV 161.00 301561 5HOLDENB1 161.00 1	
CF36	300320 5LEVASY 161.00 548808 ECKLES-161 161.00 1	

No upgrades were evaluated for the neighboring system constraints listed in Table 5. The upgrades for these impacts may need to be resolved through coordination with the transmission owner as listed in Table 7 below.

Table 7: Neighboring System Constraints

Constraint ID	Monitored Facility	Network Upgrade
AFS01	300097 5MARYVB2 161.00 652560 CRESTON5 161.00 1	WAPA owned; no upgrade evaluated.
AFS02	300694 5PALMYR_AI 161.00 347516 5MARBLE N 161.00 1	AMMO owned; no upgrade evaluated.
AFS03	300071 5CLINTN 161.00 761278 G17-108-TAP 161.00 1	KCPL owned; no upgrade evaluated.
AFS04	42684 J1268 POI 161.00 300590 5AUBURNTP 161.00 1	AMMO owned; no upgrade evaluated.
AFS05	300179 2HAMBRGB1 69.000 635055 PERCIVAL 8 69.000 1	MEC owned; no upgrade evaluated.

AECI developed non-binding, good faith estimates of the timing and cost estimates for upgrades needed as a result of the addition of the Study Cycle requests as shown in Table 8.

Table 8: Network Upgrade Costs

ID	Option / Description	Estimated Cost	Estimated Lead Time[4]
NU01	Uprate 6.51 mile-long Centerview - Holden 69 kV line to 336 ACSR at 100C.	$ 4,500,000	42 months
NU02	Rebuild 7.09 mile-long Santa Fe - South Fork Tap 69 kV line to 336 ACSR rated at 100C.	$ 6,390,000	36 months
NU03	Upgrade bushing CTs, breaker switchers on Georgetown - Sedalia 69 kV line (at Sedalia) to 1200 amp rating.	$ 125,000	24 months
NU04	Rebuild 4.70 mile-long Coffman Bend - Knobby 69 kV line to 795 ACSR rated at 100C.	$ 4,400,000	42 months
NU05	Rebuild 17.80 mile-long Elkton - Osceola 69 kV line to 795 ACSR rated at 100C.	$ 14,200,000	36 months
NU06	Rebuild 12.10 mile-long Knobby Creek - Turkey Creek 69 kV line to 795 ASCR rated at 100C.	$ 10,890,000	36 months
NU07	Install a second Lamar 161/69 kV transformer rated at 84 MVA Summer, 95 MVA Winter unit.	$ 6,129,000	40 months
	Total Cost:	$ 46,634,000	

Cost allocations for each of the impacted facilities are discussed in the Cost Allocation section below.

[4] Estimated Lead Time is the estimated time to place a network upgrade in service once AECI has received Provisions of Security equal to the estimated cost of the network upgrade.

COST ALLOCATION

Network upgrade costs are allocated to each of the Study Cycle projects based on the worst MW impact[5] 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:

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

The associated cost allocation of the network upgrades to each of the Study Cycle projects is shown below in Table 9. Further breakdown of costs is provided in Appendix B.

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

Table 9: Network Upgrade Cost Allocation

Project	Cluster Group	POI	MW	Total Cost
GEN-2017-108	03 CENTRAL	Stillwell - Clinton 161kV Line	400.0	**$22,504,473**
GEN-2017-111	03 CENTRAL	Clinton - Stilwell 161 kV Line Tap	152.0	**$6,899,478**
GEN-2017-115	03 CENTRAL	Holt County 345 kV	244.0	**$0**
GEN-2017-119	03 CENTRAL	Elm Creek 345kV substation	180.0	**$0**
GEN-2017-120	03 CENTRAL	Abilene Energy Center-Northview 115kV	260.0	**$373,867**
GEN-2017-121	03 CENTRAL	Sumner 138kV	200.0	**$392,117**
GEN-2017-125	03 CENTRAL	Swissvale 345kV	252.0	**$1,001,827**
GEN-2017-128	03 CENTRAL	Swissvale 345kV	202.0	**$304,704**
GEN-2017-132	04 SOUTHEAST	Arcadia 345kV	400.0	**$464,718**
GEN-2017-133	04 SOUTHEAST	Arcadia 345kV	200.0	**$0**
GEN-2017-134	04 SOUTHEAST	Arcadia 345kV	250.0	**$0**
GEN-2017-137	04 SOUTHEAST	Arcadia 345kV	295.0	**$0**
GEN-2017-140	04 SOUTHEAST	Clarksville 345kV Switching Station	160.0	**$0**
GEN-2017-141	04 SOUTHEAST	Clarksville 345kV Switching Station	241.7	**$0**
GEN-2017-144	02 NEBRASKA	Holt County 345kV	200.0	**$0**
GEN-2017-146	05 SOUTHWEST	Deaf Smith-Plant X 230kV	151.8	**$0**
GEN-2017-148	03 CENTRAL	Joplin 161kV sub	202.0	**$0**
GEN-2017-149	04 SOUTHEAST	Johnson County 345kV Substation	258.0	**$0**
GEN-2017-233	04 SOUTHEAST	Minco 345kV	215.0	**$0**
GEN-2017-150	04 SOUTHEAST	Minco 345kV	250.0	**$0**
GEN-2017-151	05 SOUTHWEST	TUCO-Oklaunion 345kV	300.0	**$0**
GEN-2017-152	04 SOUTHEAST	McClain 138kV	252.0	**$0**
GEN-2017-154	04 SOUTHEAST	Johnson County 345kV Substation	255.0	**$0**
GEN-2017-155	04 SOUTHEAST	Muskogee 345kV Substation	300.0	**$0**
GEN-2017-158	05 SOUTHWEST	Tolk 230kV Substation	265.0	**$0**
GEN-2017-164	04 SOUTHEAST	Woodring 345kV Substation	250.0	**$0**
GEN-2017-166	04 SOUTHEAST	Sunnyside 345kV	250.0	**$0**
GEN-2017-168	04 SOUTHEAST	McClain 138kV	250.0	**$0**
GEN-2017-171	04 SOUTHEAST	Lawton Eastside - Terry Road 345kV	150.0	**$0**
GEN-2017-175	01 NORTH	Vfodnes-Utica Jct. 230kV	300.0	**$0**
GEN-2017-179	03 CENTRAL	Gordon Evans 138kV Substation	222.0	**$440,456**
GEN-2017-181	02 NEBRASKA	Tobias 345kV Substation	300.0	**$0**
GEN-2017-182	02 NEBRASKA	Tobias 345kV Substation	128.0	**$0**
GEN-2017-183	03 CENTRAL	Nashua-St. Joe 345kV	400.0	**$3,122,580**
GEN-2017-184	03 CENTRAL	Nashua-St. Joe 345kV	400.0	**$3,122,580**
GEN-2017-187	05 SOUTHWEST	Sulphur Springs 115kV Substation	150.0	**$0**
GEN-2017-188	03 CENTRAL	Asbury 161 kV	130.0	**$0**

Project	Cluster Group	POI	MW	Total Cost
GEN-2017-191	03 CENTRAL	Swissvale 345kV	201.6	**$304,101**
GEN-2017-195	03 CENTRAL	West Gardner 345kV	500.4	**$4,502,367**
GEN-2017-196	03 CENTRAL	West Gardner 345kV	128.0	**$0**
GEN-2017-201	02 NEBRASKA	Hoskins 345kV Substation	250.0	**$0**
GEN-2017-202	03 CENTRAL	New Madrid - Sikeston 161kV	200.0	**$0**
GEN-2017-203	04 SOUTHEAST	Renfrow 345kV Substation	210.0	**$284,660**
GEN-2017-209	03 CENTRAL	LaCygne - Neosho 345kV	300.0	**$1,475,919**
GEN-2017-210	02 NEBRASKA	McCool 345kV Substation	310.0	**$0**
GEN-2017-220	03 CENTRAL	Buffalo Flats 345kV Substation	201.6	**$364,995**
GEN-2017-221	03 CENTRAL	Buffalo Flats 345kV Substation	152.0	**$275,195**
GEN-2017-222	01 NORTH	Denison 230kV Substation	180.0	**$0**
GEN-2017-226	03 CENTRAL	Gordon Evans 138kV Substation	201.6	**$399,982**
GEN-2017-227	03 CENTRAL	Gordon Evans 138kV Substation	201.6	**$399,982**
GEN-2017-229	03 CENTRAL	Stilwell 345kV Substation	76.0	**$0**
GEN-2017-231	04 SOUTHEAST	Branch 161kV Substation	72.5	**$0**
GEN-2017-234	02 NEBRASKA	Spalding to North Loup 115kV	115.0	**$0**
GEN-2017-239	05 SOUTHWEST	Mahoney 230kV Substation	300.0	**$0**
GEN-2017-240	04 SOUTHEAST	Bristow 138kV Substation	202.0	**$0**
			Total Cost	**$46,634,000**

VERSION HISTORY

Version Number and Date	Author	Change Description
V0 – 11/18/2022	AECI	Initial release
V1 – 07/06/2023	AECI	Withdrawal of twenty (20) SPP requests from Study Cycle Withdrawal of MISO, SPP, and AECI higher queued requests