SPP DISIS-2018-001 AFS STUDY REPORT

INTRODUCTION

Associated Electric Cooperative Inc. (AECI), through coordination with the Southwest Power Pool (SPP), has identified 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-2018-008	BEPC	252	ER/NR	Wind	Groton-Leland Olds 345kV Line	01 NORTH
GEN-2018-015	SPS	252	ER/NR	Solar	Tuco-Oklaunion 345kV Line	05 SOUTHWEST
GEN-2018-022	GMO	300	ER/NR	Solar	Mullen Creek 345kV Substation	03 CENTRAL
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-2018-032	WERE	310	ER	Wind	Neosho 345kV 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-2018-044[1]	OPPD	500	ER	Solar	Fort Calhoun 345kV Substation	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-2018-054	GMO	120	ER	Solar	KC South - N. Raymore 161kV Line	03 CENTRAL
GEN-2018-055	AEP	252	ER/NR	Solar	Terry Road 345kV station (shared with Rush Springs Windfarm on a common gen-tie)	04 SOUTHEAST

[1] GIR withdrew from SPP DISIS queue after the start of the analysis, the impact of the withdrawal will be captured in a future restudy. Any costs assigned to these studies have been removed and re-distributed to remaining active GIRs.

Project #	TO	Capacity (MW)	Service Type	Fuel Type	POI	Cluster Group
GEN-2018-057	WERE	203.4	ER/NR	Solar	Gordon Evans 138kV	03 CENTRAL
GEN-2018-058[1]	WERE	252	ER/NR	Solar	Stranger Creek 345kV	03 CENTRAL
GEN-2018-059[1]	WERE	252	ER/NR	Solar	Stranger Creek 345kV	03 CENTRAL
GEN-2018-062	KACY	75.6	ER/NR	Solar	Nearman 161kV substation	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

The following key assumptions were included in the Study:

- Ameren/AECI Tranche 1 Project identified by MISO as part of the MTEP process:
    - Build a new 345 kV line from Ameren's Zachary Substation to AECI's Thomas Hill substation.

The listed facilities were included in the mitigation analysis to identify if these upgrades were able to resolve impacts seen on the AECI system in this area as a result of the Study Cycle. Should this new facility no longer be part of MISO's MTEP, 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 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.

STEADY STATE ANALYSIS RESULTS

Steady state analysis results showed nine (9) constraints reported on the AECI transmission system, as shown in Table 2, 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 7 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 2.

Table 2: 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	300173 2GOBKNOB 69.000 301230 2FAIRDLG 69.000 1	OPEN BRANCH FROM BUS 300084 [5GRNFRT 161.00] TO BUS 505440 [DONIPHN5 161.00] CKT 1	27S	101.6	109.5	60.4
				32S	101.4	109.2	60.2
	P2EHV		OPEN BRANCH FROM BUS 300040 [7FLETCH 345.00] TO BUS 300054 [7GOBKNOB 345.00] CKT 1 OPEN BRANCH FROM BUS 300048 [7STFRAN 345.00] TO BUS 300054 [7GOBKNOB 345.00] CKT 1	32S	243.0	246.2	38.2
NU02	P1	301217 2OXLEY 69.000 301230 2FAIRDLG 69.000 1	OPEN BRANCH FROM BUS 300084 [5GRNFRT 161.00] TO BUS 505440 [DONIPHN5 161.00] CKT 1	27S	94.4	102.3	32.3
				32S	94.3	102.1	32.2
	P2EHV		OPEN BRANCH FROM BUS 300040 [7FLETCH 345.00] TO BUS 300054 [7GOBKNOB 345.00] CKT 1 OPEN BRANCH FROM BUS 300048 [7STFRAN 345.00] TO BUS 300054 [7GOBKNOB 345.00] CKT 1	32S	236.0	239.4	19.7
NU03	P1	301217 2OXLEY 69.000 301227 2RIPLEY 69.000 1	OPEN BRANCH FROM BUS 300084 [5GRNFRT 161.00] TO BUS 505440 [DONIPHN5 161.00] CKT 1	27S	87.2	101.2	52.1
				32S	87.0	100.8	51.9
	P2EHV		OPEN BRANCH FROM BUS 300040 [7FLETCH 345.00] TO BUS 300054 [7GOBKNOB 345.00] CKT 1 OPEN BRANCH FROM BUS 300048 [7STFRAN 345.00] TO BUS 300054 [7GOBKNOB 345.00] CKT 1	27S	230.1	233.1	29.7
				32S	229.1	232.7	30.4
NU04	P1	301201 2DONIPH 69.000 301227 2RIPLEY 69.000 1	OPEN BRANCH FROM BUS 300084 [5GRNFRT 161.00] TO BUS 505440 [DONIPHN5 161.00] CKT 1	27S	87.1	101.1	52.0
				32S	86.9	100.7	51.8
	P2EHV		OPEN BRANCH FROM BUS 300040 [7FLETCH 345.00] TO BUS 300054 [7GOBKNOB 345.00] CKT 1	27S	229.9	232.9	29.6
				32S	228.9	232.5	30.4

Constraint ID	Event	Monitored Facility	Contingency	Season	Base Loading	Project Loading	Upgrade Loading
			OPEN BRANCH FROM BUS 300048 [7STFRAN 345.00] TO BUS 300054 [7GOBKNOB 345.00] CKT 1				
NU05	P1	300107 5OSBORN 161.00 300290 2OSBORN 69.000 1	OPEN LINE FROM BUS 300036 [5ELATHRP 161.00] TO BUS 301310 [5REX 161.00] CKT 1	27H	156.8	165.9	53.0
				27L	138.1	143.5	41.9
				27S	175.1	184.7	60.6
				27W	177.1	184.1	57.7
				32S	174.1	183.8	61.2
				32W	181.0	187.4	58.9
NU06	P1	300293 2CAMRNJ 69.000 300312 2TURNEY 69.000 1	OPEN LINE FROM BUS 300036 [5ELATHRP 161.00] TO BUS 301310 [5REX 161.00] CKT 1	27H	137.4	154.6	42.3
				27L	133.3	143.3	40.6
				27S	166.2	184.5	53.7
				27W	152.4	162.8	57.1
				32S	162.2	180.5	52.3
				32W	157.9	167.6	59.4
NU07	P1	301050 2CONWY 69.000 301071 2PBURG 69.000 1	OPEN BRANCH FROM BUS 300088 [5HUBEN 161.00] TO BUS 300102 [5MRSHFL 161.00] CKT 1	27S	91.9	105.8	53.2
				32S	90.4	104.5	52.4
NU08	P1	301201 2DONIPH 69.000 505440 DONIPHN5 161.00 1	OPEN LINE FROM BUS 301201 [2DONIPH 69.000] TO BUS 505440 [DONIPHN5 161.00] CKT 2	27S	116.4	119.7	93.4[2]
				32S	121.4	124.7	94.3[2]
NU09	P2EHV	300106 5NOVELY_SW 161.00 300364 2NOVLTY_SW 69.000 1	OPEN BRANCH FROM BUS 344000 [7ZACHARY 345.00] TO BUS 344011 [7HUGHES 345.00] CKT 1 OPEN BRANCH FROM BUS 344000 [7ZACHARY 345.00] TO BUS 345438 [7FABIUS 345.00] CKT 1	27S	82.8	104.2	89.1[2]
				32S	64.3	100.0	87.8[2]

Table 2 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).

[2] Upgrade loading reflects adjustment of transformer taps as mitigation.

Table 2 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.

There were six (6) facilities in which the network upgrade assigned to higher queued generators were no longer sufficient to mitigate loadings observed with the addition of the Study Cycle. As a result, the below facilities are also included as Project impacts:

- Gobbler Knob - Fairdealing 69 kV line
- Fairdealing - Oxley 69 kV line
- Oxley - Ripley 69 kV line
- Ripley - Doniphan 69 kV line
- Cameron Junction – Turney 69 kV line
- Osborne 161/69 kV transformer

CONTINGENT FACILITY RESULTS

Forty-eight (48) facilities were reported as Contingent Facilities with the addition of the Study Cycle requests, as shown in Table 3. 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 5 were evaluated in order to mitigate the reported constraints as listed in Table 3 below.

Overloads seen on six (6) facilities were unable to be mitigated with the planned contingent upgrade; as a result, additional network upgrades have been assigned to the Study Cycle and are discussed in the Steady State Analysis Results section above. Results from the simulations found that the remaining planned contingent upgrades were able to mitigate the reported constraints as shown in Table 3.

Table 3: 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	P1	300387 2BEVIER 69.000 301623 2BEVIERTP 69.000 1	27S	133.1	144.2	65.7	SPP DISIS 2016-002/ MISO DPP-2019
	P2EHV		27W	97.3	104.4	66.3	
CF02	P1	300388 2AXTELL 69.000 300400 2MACNLK 69.000 1	27S	154.0	168.4	50.1	SPP DISIS 2016-002/ MISO DPP-2019
	P2EHV		27W	110.5	119.7	42.0	
CF03	P1	300388 2AXTELL 69.000 300401 2MACNTP 69.000 1	27S	147.7	162.0	47.6	SPP DISIS 2016-002/ MISO DPP-2019
	P2EHV		27W	103.2	112.3	39.1	
CF04	P1	300400 2MACNLK 69.000 301623 2BEVIERTP 69.000 1	27S	167.7	182.2	55.3	SPP DISIS 2016-002/ MISO DPP-2019
	P2EHV		27W	118.8	128.0	45.3	
CF05	P1	300050 7PALMYR_AI 345.00 300694 5PALMYR_AI 161.00 1	27S	86.4	102.7	46.9	MISO 2018 APR
	P1		27W	91.0	102.5	46.8	
CF06	P2EHV	300090 5KINGDMB1 161.00 301498 5MLRSBGB2 161.00 1	27S	99.3	112.9	95.8	GI-083
			32S	99.9	113.6	96.4	
CF07	P2EHV	300519 5MLRSBGB1 161.00 301498 5MLRSBGB2 161.00 Z1	27S	98.0	111.5	72.6	GI-083
			32S	98.5	112.2	73.0	
CF08	P2EHV	300061 5BOONE 161.00 300519 5MLRSBGB1 161.00 1	27S	96.0	109.6	93.1	MISO DPP 2019
			32S	96.5	110.1	93.5	
CF09	P0	300115 5STFRANB2 161.00 338202 5JIM HILL% 161.00 1	27S	111.5	114.5	40.7	MISO DPP 2019/ GI-107
	P1		27S	168.1	171.6	58.4	
			32S	164.6	168.0	57.2	
	P2EHV		27S	168.1	171.6	58.4	
			32S	164.6	168.0	57.2	
CF10	P2EHV	300740 7SPORTSMAN 345.00 300741 5SPORTSMAN 161.00 1	27L	98.4	101.4	85.3	SPP DISIS-2017-001

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
CF11	P2EHV	300740 7SPORTSMAN 345.00 300741 5SPORTSMAN 161.00 2	27L	98.4	101.4	85.3	SPP DISIS-2017-001
CF12	P2EHV	300069 5CHOTEAU1 161.00 512648 MAID 5 161.00 1	27L	98.6	106.0	88.7	SPP DISIS-2017-001
			27S	98.7	104.6	82.2	
			32S	97.9	103.8	80.3	
CF13	P1	300694 5PALMYR_AI 161.00 347516 5MARBLE N 161.00 1	32W	92.0	100.2	94.6	GI-093
CF14	P1	300651 2LAMR 69.000 300794 5LAMAR 161.00 1	27S	95.7	101.8	76.3	SPP DISIS-2017-002
			27W	94.3	100.4	67.8	
			32S	95.8	101.6	75.3	
	P2EHV		27S	100.3	107.2	66.1	
			27W	95.7	102.6	69.0	
			32S	99.9	106.6	65.3	
			32W	95.1	102.4	67.3	
CF15	P1	300780 2KNOBBY 69.000 301401 2TURKEYCRK 69.000 1	27S	100.2	108.3	33.2	SPP DISIS-2017-002
			27W	103.1	111.3	34.4	
			32S	101.5	109.5	33.7	
			32W	106.4	114.5	35.9	
CF16	P1	300772 2COFMAN 69.000 300780 2KNOBBY 69.000 1	32W	42.0	102.4	55.0	SPP DISIS-2017-002
CF17	P1	301207 2GRNFOR 69.000 301224 2TWNSHP 69.000 1	27S	95.9	100.4	25.4	MISO 2018 APR/ GI-099
			32S	96.8	101.1	25.5	
CF18	P2EHV	300040 7FLETCH 345.00 3WNDTR 330:7_5_FLETCH.. WND 2 1	27S	96.9	100.1	75.1	GI-099
CF19	P2EHV	300077 5FLETCH 161.00 300093 5LEEPER 161.00 1	27L	109.0	112.0	81.8	GI-099
CF20	P2EHV	300077 5FLETCH 161.00 301532 5FLETCHXF1 161.00 1	27W	117.6	120.9	85.6	GI-099
			32W	120.4	123.9	88.1	
CF21	P2EHV	301532 5FLETCHXF1 161.00 3WNDTR 330:7_5_FLETCH.. WND 1 1	27W	102.6	105.6	74.8	GI-099
CF22	P0	300036 5ELATHRP 161.00 300091 5LATHRP 161.00 1	27H	112.3	121.1	49.9	GI-101
			27L	117.0	122.2	49.5	
			27S	121.3	130.8	54.1	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
			27W	120.0	126.1	51.3	
			32S	119.7	129.0	53.5	
			32W	122.9	128.6	52.4	
	P1		27H	174.9	206.9	75.7	
	P2EHV		27H	119.8	131.0	53.4	
			27L	135.6	139.2	53.8	
			27S	163.5	171.0	66.8	
			27W	151.3	155.9	60.1	
			32S	160.7	168.0	65.8	
			32W	154.2	158.4	61.1	
CF23	P0	300036 5ELATHRP 161.00 301310 5REX 161.00 1	27H	119.9	128.7	0.0[3]	GI-101
			27L	118.9	124.1	0.0[3]	
			27S	131.5	140.9	0.0[3]	
			27W	126.9	133.0	0.0[3]	
			32S	129.6	138.9	0.0[3]	
			32W	129.8	135.6	0.0[3]	
	P1		27H	182.6	214.6	0.0[3]	
	P2EHV		27H	127.4	138.6	0.0[3]	
			27L	137.5	141.1	0.0[3]	
			27S	173.7	181.1	0.0[3]	
			27W	158.3	162.8	0.0[3]	
			32S	170.6	178.0	0.0[3]	
			32W	161.1	165.3	0.0[3]	
CF24	P0	300091 5LATHRP 161.00 301563 5MOCITYB1 161.00 1	27L	96.6	101.6	39.1	GI-101
			27S	94.8	104.1	39.7	
			27W	97.6	103.6	39.7	

[3] 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)
			32S	92.9	102.1	38.8	
			32W	100.4	106.0	40.6	
	P1		27H	142.5	160.8	59.1	
	P2EHV		27H	96.2	107.2	41.0	
			27L	114.7	118.1	43.7	
			27S	135.2	142.5	52.4	
			27W	127.6	132.0	48.6	
			32S	132.3	139.4	51.2	
			32W	130.2	134.3	49.4	
CF25	P1	300192 2RCKWOLT 69.000 300292 2CAMERN 69.000 1	27H	99.8	111.6	64.2	GI-101
			27L	93.5	100.4	53.6	
			27S	121.0	133.5	81.5	
			27W	107.4	114.6	71.4	
			32S	118.6	131.2	79.9	
			32W	111.3	117.9	74.3	
CF26	P1	300192 2RCKWOLT 69.000 300293 2CAMRNJ 69.000 1	27H	94.4	106.2	58.1	GI-101
			27S	114.2	126.7	73.8	
			27W	103.7	110.9	67.5	
			32S	111.4	124.0	71.8	
			32W	107.5	114.1	70.2	
CF27	P0	300297 2HOLT 69.000 300302 2LATHRP 69.000 1	27H	95.1	103.7	47.7	GI-101
			27S	112.3	121.4	57.1	
			27W	95.6	101.0	53.6	
			32S	112.1	121.1	57.3	
			32W	98.2	103.5	54.4	
	P1		27H	192.7	210.3	68.1	
			27L	189.3	199.9	58.7	
			27S	216.5	235.3	79.2	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
			27W	189.5	199.7	75.7	
			32S	214.3	232.8	78.8	
			32W	193.8	204.1	77.3	
	P2EHV		27H	99.8	109.9	50.4	
			27L	98.6	102.3	42.2	
			27S	149.5	156.9	68.8	
			27W	119.7	123.9	61.7	
			32S	148.5	155.6	68.5	
			32W	122.4	126.2	62.5	
CF28	P0	300297 2HOLT 69.000 300311 2SMRSET 69.000 1	27S	96.5	106.1	49.0	GI-101
			32S	95.8	105.2	48.9	
	P1		27H	181.2	198.8	61.6	
			27L	185.3	195.9	56.5	
			27S	201.4	220.2	70.8	
			27W	177.9	188.0	68.4	
			32S	198.7	217.3	70.2	
			32W	181.8	192.0	69.9	
	P2EHV		27S	134.5	142.0	60.6	
			27W	108.1	112.3	54.6	
			32S	132.9	140.2	60.1	
			32W	110.7	114.5	55.1	
CF29	P1	300301 2KEARNY 69.000 300311 2SMRSET 69.000 1	27S	90.9	100.6	29.5	GI-101
CF30	P1	300302 2LATHRP 69.000 300313 2WESTBR 69.000 1	27H	128.9	135.8	80.5	GI-101
			27L	139.2	142.4	78.7	
			27S	138.0	145.1	90.6	
			27W	115.3	118.6	68.6	
			32S	135.9	143.0	90.5	
			32W	116.9	120.7	69.4	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
CF31	P1	300302 2LATHRP 69.000 301627 2LATHRPLD 69.000 1	27H	124.9	142.2	37.6	GI-101
			27L	128.5	138.7	43.1	
			27S	151.4	169.8	44.5	
			27W	140.4	150.9	48.8	
			32S	146.9	165.4	42.8	
			32W	145.8	155.8	51.1	
CF32	P1	300312 2TURNEY 69.000 300316 2LATHRPEMG 69.000 1	27H	133.1	150.3	39.9	GI-101
			27L	131.5	141.6	41.4	
			27S	161.0	179.3	50.7	
			27W	148.2	158.6	54.3	
			32S	156.8	175.1	49.1	
			32W	153.7	163.6	56.7	
CF33	P1	300316 2LATHRPEMG 69.000 301627 2LATHRPLD 69.000 1	27H	132.9	150.1	39.8	GI-101
			27L	131.4	141.5	41.5	
			27S	160.8	179.1	50.6	
			27W	148.1	158.5	54.3	
			32S	156.6	174.9	49.0	
			32W	153.6	163.5	56.6	
CF34	P1	300292 2CAMERN 69.000 301629 2OSBORNTPS 69.000 1	27S	97.2	106.3	69.3	GI-102
			27W	97.0	103.1	67.0	
			32S	95.7	104.9	68.7	
			32W	100.4	106.0	69.4	
CF35	P1	300290 2OSBORN 69.000 301629 2OSBORNTPS 69.000 1	27S	97.3	106.4	69.3	GI-102
			27W	97.0	103.1	67.0	
			32S	95.8	104.9	68.7	
			32W	100.4	106.0	69.4	
CF36	P1	300091 5LATHRP 161.00 300302 2LATHRP 69.000 1	27H	217.9	229.2	75.8	GI-101
			27L	218.6	225.1	75.3	

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
			27S	232.7	244.2	78.0	
			27W	237.5	244.9	73.6	
			32S	231.0	242.6	78.2	
			32W	240.5	248.1	74.2	
CF37	P0	300137 4BRISTOW 138.00 300889 2BRIISTOW 69.000 2	27L	121.0	125.1	35.4	GI-103
	P1		27H	272.8	276.4	66.8	
			27L	238.1	242.6	60.3	
			27S	290.0	293.2	70.9	
	P2EHV		27L	125.7	129.5	36.0	
CF38	P1	300141 4STILWTR 138.00 300844 4RAMSEY 138.00 1	27H	117.2	122.2	85.1	GI-104
			27L	106.0	113.4	79.9	
			27S	125.9	130.6	90.9	
			32S	129.9	134.4	93.4	
CF39	P1	300889 2BRIISTOW 69.000 300898 2GYPSY 69.000 1	27S	100.4	104.7	0.0[3]	AECI[4]
			32S	108.0	111.9	0.0[3]	
CF40	P1	300196 2WOODY 69.000 300906 2NUYAKA 69.000 1	27L	96.7	107.6	58.4	AECI[4]/GI-105
CF41	P1	300906 2NUYAKA 69.000 513092 BEGGS 2 69.000 1	27L	98.1	109.0	59.1	AECI[4]/GI-105
CF42	P1	300133 5THMHLB3 161.00 344004 5ADAIR1 161.00 1	27S	108.5	123.2	83.5	MISO Tranche 1
CF43	P1	300517 2KINGDM 69.000 301497 5KINGDMB2 161.00 2	27L	101.9	107.2	89.3	MISO Tranche 1
CF44	P1	300517 2KINGDM 69.000 301497 5KINGDMB2 161.00 3	27L	101.8	107.1	89.2	MISO Tranche 1
CF45	P1	300373 2CENTER 69.000 300374 2CNTRSW 69.000 1	27S	81.6	100.0	65.2	MISO Tranche 1
CF46	P1	300505 2STURGN 69.000 300508 5STURGN 161.00 3	27S	97.6	100.6	92.1	MISO Tranche 1
			32S	99.4	102.7	93.5	
CF47	P1	300505 2STURGN 69.000 300508 5STURGN 161.00 4	27S	98.1	101.2	92.6	MISO Tranche 1
			32S	99.8	103.2	94.0	

[4] Thermal overload on listed facilities will be mitigated by network upgrade currently included in AECI's transmission expansion plan

Constraint ID	Event	Monitored Facility	Season	Base Loading	Project Loading	Upgrade Loading	Contingent Generator(s)
CF48	P0	300087 5HICKCK 161.00 300094 5LOCUST 161.00 1	27W	100.6	103.6	67.3	MISO Tranche 1
	P1		27S	111.0	117.2	71.7	

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.

Four (4) facilities were reported on the AECI ties with the addition of the Study Cycle requests. The most severe constraints are shown in Table 4.

Table 4: 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	32S	140.3	159
AFS02	P1	300141 4STILWTR 138.00 512731 NORTHTP4 138.00 1	AECI/GRDA	27H	120.5	125.8
				27L	111.6	119.1
				27S	129.5	134.4
				27W	123.7	128.2
				32S	132.5	137.4
				32W	120.6	125.2
	P2EHV			27S	100.4	104.1
				32S	100.9	104.8
AFS03	P1	300098 5MOCITYB2 161.00 541248 LBRTYST5 161.00 1	AECI/KCPL	27L	94.1	110.5
				27S	81.9	103.3
				27W	80.3	101.5
				32W	82.1	104.3

Constraint ID	Event	Monitored Facility	Area	Season	Base Loading	Project Loading
AFS04	P1	300889 2BRIISTOW 69.000 513092 BEGGS 2 69.000 1	AECI/GRDA	27H	128.1	144.1
				27L	134.8	148.2
				27S	133.9	151.5
				27W	131.8	148.9
				32S	129.6	146.6
				32W	134.4	152.3

NETWORK UPGRADES

The upgrades shown in Table 5 were evaluated in order to mitigate the reported steady state contingent constraints for the Study Cycle requests as listed in Table 3.

Table 5: Network Upgrades for the Study Cycle Contingent Constraints

Constraint ID	Monitored Facility	Upgrade Description
CF01	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.
CF02	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.
CF03	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.
CF04	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.
CF05	300050 7PALMYR_AI 345.00 300694 5PALMYR_AI 161.00 1	**Contingent on MISO 2018 APR** Add a second 345/161 kV 500 MVA transformer at Palmyra.
CF06	300090 5KINGDMB1 161.00 301498 5MLRSBGB2 161.00 1	**Contingent on GI-083** Reconductor 8.07 mile Kingdom City-Millersburg 161 kV line to 795 ACSS High Temp at 250C.
CF07	300519 5MLRSBGB1 161.00 301498 5MLRSBGB2 161.00 Z1	**Contingent on GI-083** Reconductor Millersburg bus tie to 1590 ACSR to be designed for 100ºC.
CF08	300061 5BOONE 161.00 300519 5MLRSBGB1 161.00 1	**Contingent on MISO DPP 2019** Reconductor 9.40 mile-long Boone - Millersburg 161 kV line to 795 ACSS at 250C. Replace jumpers at Boone and Millersburg 161 kV buses to 795 ACSS at 250C.
CF09	300115 5STFRANB2 161.00 338202 5JIM HILL% 161.00 1	**Contingent on MISO DPP 2019/GI-107** Rebuild 9.90 mile-long St. Francis - Jim Hill 161 kV line to 1192 ACSS at 250C. Replace jumpers at St. Francis with 1192 ACSS at 250C. Replace disconnect switches at St. Francis 161 kV bus on Jim hill line with 2000A switches.
CF10	300740 7SPORTSMAN 345.00 300741 5SPORTSMAN 161.00 1	**Contingent on SPP 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)
CF11	300740 7SPORTSMAN 345.00 300741 5SPORTSMAN 161.00 2	
CF12	300069 5CHOTEAU1 161.00 512648 MAID 5 161.00 1	
CF13	300694 5PALMYR_AI 161.00 347516 5MARBLE N 161.00 1	**Contingent on GI-093** Upgrade jumpers on Palmyra-North Marblehead 161 kV line (at Palmyra) to 1192 ACSR
CF14	300651 2LAMR 69.000 300794 5LAMAR 161.00 1	**Contingent on SPP DISIS-2017-002** Install a second Lamar 161/69 kV transformer rated at 84 MVA Summer, 95 MVA Winter unit.

Constraint ID	Monitored Facility	Upgrade Description
CF15	300780 2KNOBBY 69.000 301401 2TURKEYCRK 69.000 1	**Contingent on SPP DISIS-2017-002** Rebuild 12.10 mile-long Knobby Creek - Turkey Creek 69 kV line to 795 ACSR rated at 100C.
CF16	300772 2COFMAN 69.000 300780 2KNOBBY 69.000 1	**Contingent on SPP DISIS-2017-002** Rebuild 4.70 mile-long Coffman Bend - Knobby 69 kV line to 795 ACSR rated at 100C.
CF17	301207 2GRNFOR 69.000 301224 2TWNSHP 69.000 1	**Contingent on GI-099** Rebuild existing 69 kV line from Gobbler-PB South-Harviell-Poplar Bluff-Township-Green Forest to double circuit 161 and 69 kV. The 69 kV circuit will be constructed to 795 ACSR and terminate at stations as it currently does. The 161 kV circuit will be constructed to 795 ACSS High Temp at 200C and terminate only at Gobbler Knob and Green Forest. Add terminals and associated equipment as needed at Gobbler and Green Forest stations. The individual line segments are: · Rebuild 4.4-mile-long Gobbler Knob to Poplar Bluff South 69 kV Line with 795 ACSR at 100C. · Rebuild 2.5-mile-long Green Forest to Township 69kV Line with 795 ACSR at 100C. · Rebuild 4.5-mile-long Harviell to Poplar Bluff South 69 kV Line with 795 ACSR at 100C. · Rebuild 6.3-mile-long Harviell to Poplar Bluff 69 kV Line with 795 ACSR at 100C. · Rebuild 2.7-mile-long Poplar Bluff to Township 69 kV Line with 795 ACSR at 100C. · Construct a new 161 kV circuit from Gobbler Knob to Green Forest along the existing 69 kV path between these stations. Use 795 ACSS High Temp at 200C.
CF18	300040 7FLETCH 345.00 3WNDTR 330:7_5_FLETCH.. WND 2 1	
CF19	300077 5FLETCH 161.00 300093 5LEEPER 161.00 1	
CF20	300077 5FLETCH 161.00 301532 5FLETCHXF1 161.00 1	
CF21	301532 5FLETCHXF1 161.00 3WNDTR 330:7_5_FLETCH.. WND 1 1	
CF22	300036 5ELATHRP 161.00 300091 5LATHRP 161.00 1	**Contingent on GI-101** Rebuild 2.2 mile long Lathrop-Lathrop East 161 kV line to 1192 ACSR at 100C. Upgrade jumpers at Lathrop East and Lathrop on line to 1192 ACSR. Upgrade disconnect switches at Lathrop on line to 2,000 amp switches
CF23	300036 5ELATHRP 161.00 301310 5REX 161.00 1	**Contingent on GI-101** Rebuild 5.2 mile long Shoal Creek-Lathrop East 161 kV line to 1192 ACSR at 100C. Upgrade jumpers at Lathrop East on line to 1192 ACSR.
CF24	300091 5LATHRP 161.00 301563 5MOCITYB1 161.00 1	**Contingent on GI-101** Rebuild 23.2 mile long Missouri City-Lathrop 161 kV line to 1192 ACSR at 100C. Upgrade jumpers at Lathrop and Missouri City on line to 1192 ACSR. Upgrade disconnect switches at Lathrop on line to 2,000 amp switches. Upgrade relay limits at Missouri City to 372 MVA Summer, 456 MVA Winter
CF25	300192 2RCKWOLT 69.000 300292 2CAMERN 69.000 1	**Contingent on GI-101** Build a new 27.8 mile long 161 kV circuit between Shoal Creek and Missouri City utilizing 1192 ACSR at 100C. Line will be overbuilt on the 69 kV line from Turney-Lathrop Load-Lathrop-Holt-Summerset-Kearney-Missouri City. The 69 kV lines will be replaced with 336 ACSR at 100C. Add a new 161 kV terminal and reconfigure Missouri City 161 kV bus to accommodate the new 161 kV line between Missouri City and Shoal Creek. Construct a new 161 kV switchyard called Shoal Creek ~0.5 miles east of Rockies Express. Cut existing REX-Osborn 161 kV line in/out of new switchyard. Cut existing REX-Lathrop 161 kV line in/out of new switchyard.
CF26	300192 2RCKWOLT 69.000 300293 2CAMRNJ 69.000 1	
CF27	300297 2HOLT 69.000 300302 2LATHRP 69.000 1	
CF28	300297 2HOLT 69.000 300311 2SMRSET 69.000 1	
CF28	300297 2HOLT 69.000 300311 2SMRSET 69.000 1	
CF29	300301 2KEARNY 69.000 300311 2SMRSET 69.000 1	

Constraint ID	Monitored Facility	Upgrade Description
CF30	300302 2LATHRP 69.000 300313 2WESTBR 69.000 1	
CF31	300302 2LATHRP 69.000 301627 2LATHRPLD 69.000 1	
CF32	300312 2TURNEY 69.000 300316 2LATHRPEMG 69.000 1	
CF33	300316 2LATHRPEMG 69.000 301627 2LATHRPLD 69.000 1	
CF34	300292 2CAMERN 69.000 301629 2OSBORNTPS 69.000 1	
CF35	300290 2OSBORN 69.000 301629 2OSBORNTPS 69.000 1	
CF36	300091 5LATHRP 161.00 300302 2LATHRP 69.000 1	**Contingent on GI-101** Upgrade existing Lathrop 161/69 kV transformer to 112 MVA Summer, 127 MVA Winter unit.
CF37	300137 4BRISTOW 138.00 300889 2BRIISTOW 69.000 2	**Contingent on GI-103** Upgrade existing Bristow 138/69 kV transformer to a 112 MVA Summer/127 MVA Winter rated unit. Add a second 138/69 kV transformer at Bristow with rating of 112 MVA Summer/127 MVA Winter.
CF38	300141 4STILWTR 138.00 300844 4RAMSEY 138.00 1	**Contingent on GI-104** Uprate 13.0-milelong Stillwater-Ramsey 138 kV 795 ACSR line from 75C to 100C
CF39	300889 2BRIISTOW 69.000 300898 2GYPSY 69.000 1	**Contingent on AECI** Rebuild and convert 0.09-mile-long section of Gypsy to Stroud 69 kV line to 138 kV 1192.5 ACSR at 100C - Build additional 138kV bay at Stroud - Convert Gypsy substation to 138 kV - Install a GOAB near Gypsy station to create a 3 terminal 138 kV line between Stroud, Gypsy, and Bristow. - Re-terminate Gypsy-Stroud line to land on 138 kV bay at Stroud. Rebuild and convert 9.50-mile-long section of Bristow to Gypsy 69 kV line to 138 kV 1192.5 ACSR at 100C - Build additional 138kV bay at Bristow - Re-terminate Gypsy – Bristow 138 kV line land on a 138 kV bay at Bristow.
CF40	300196 2WOODY 69.000 300906 2NUYAKA 69.000 1	**Contingent on AECI/GI-105** CF39 above captures AECI upgrade Rebuild 9.40 mile Woody - Nuyaka 69 kV line to 336 ACSR at 100C.
CF41	300906 2NUYAKA 69.000 513092 BEGGS 2 69.000 1	**Contingent on AECI/GI-105** CF39 above captures AECI upgrade Rebuild 9.20 mile Beggs - Nuyaka 69 kV line to 336 ACSR at 100C.
CF42	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).
CF43	300517 2KINGDM 69.000 301497 5KINGDMB2 161.00 2	
CF44	300517 2KINGDM 69.000 301497 5KINGDMB2 161.00 3	
CF45	300373 2CENTER 69.000 300374 2CNTRSW 69.000 1	
CF46	300505 2STURGN 69.000 300508 5STURGN 161.00 3	

Constraint ID	Monitored Facility	Upgrade Description
CF47	300505 2STURGN 69.000 300508 5STURGN 161.00 4	
CF48	300087 5HICKCK 161.00 300094 5LOCUST 161.00 1	

No upgrades were evaluated for the neighboring system constraints listed in Table 4. The upgrades for these impacts may need to be resolved through coordination with the transmission owner as listed in Table 6 below.

Table 6: 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	300141 4STILWTR 138.00 512731 NORTHTP4 138.00 1	GRDA owned; no upgrade evaluated
AFS03	300098 5MOCITYB2 161.00 541248 LBRTYST5 161.00 1	KCPL owned; no upgrade evaluated
AFS04	300889 2BRIISTOW 69.000 513092 BEGGS 2 69.000 1	GRDA 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 7.

Table 7: Network Upgrade Costs

ID	Option / Description	Estimated Cost (2023$)	Estimated Lead Time[5]
NU01	Rebuild 2.5-mile-long 4/0 section of Gobbler Knob - Fairdealing 69 kV line to 795 ACSR at 100C.	$3,750,000	30 months
NU02	Rebuild 5.9-mile-long 4/0 section of Oxly - Fairdealing 69 kV line to 795 ACSR at 100C.	$8,850,000	30 months
NU03	Rebuild 3.8-mile-long line from Ripley - Oxly 69 kV line to 336 ACSR rated at 100C.	$5,320,000	30 months
NU04	Rebuild 1.3-mile-long line from Doniphan - Ripley 69 kV line to 336 ACSR rated at 100C .	$1,820,000	30 months
NU05	Upgrade existing Osborn 161/69 kV xfmer to 112 MVA Summer, 127 MVA Winter unit.	$4,200,000	48 months
NU06	Rebuild 7.7-mile-long Cameron Junction - Turney 69 kV line to 336 ACSR at 100C.	$3,264,800	30 months
NU07	Tap Huben - Marshfield 161 kV line and tie into Conway with 1 mile of double circuit 161 kV line. Install 161 kV distribution transformer at Conway. De-energize existing Phillipsburg - Conway - Marshfield 69 kV line .	$4,418,000	40 months
NU08	Tap adjustments able to mitigate overload; no upgrade evaluated.	$0	-
NU09	Tap adjustments able to mitigate overload; no upgrade evaluated.	$0	-
	Total Cost:	$31,622,800	

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

[5] 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[6] 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 8. Further breakdown of costs is provided in Appendix B.

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

Table 8: Network Upgrade Cost Allocation

Project	Cluster Group	POI	MW	Total Cost
ASGI-2018-003	03 CENTRAL	Appleton 69kV Substation	20	**$0**
ASGI-2018-006	03 CENTRAL	Metz 69kV Substation	20	**$0**
ASGI-2018-007	03 CENTRAL	Salisbury 161kV Substation	20	**$0**
GEN-2018-015	05 SOUTHWEST	Tuco-Oklaunion 345kV Line	252	**$0**
GEN-2018-008	01 NORTH	Groton-Leland Olds 345kV Line	252	**$5,282,718**
GEN-2018-022	03 CENTRAL	Mullen Creek 345kV Substation	300	**$4,222,523**
GEN-2018-025	02 NEBRASKA	Fort Calhoun 345kV Substation	200	**$4,194,170**
GEN-2018-026	04 SOUTHEAST	Mustang 138kV Substation	100	**$0**
GEN-2018-027	04 SOUTHEAST	Tulsa Power Station 38kV Substation	100	**$0**
GEN-2018-028	04 SOUTHEAST	Tulsa North 138kV Substation	200	**$0**
GEN-2018-029	04 SOUTHEAST	Horseshoe Lake 138kV Substation	100	**$0**
GEN-2018-031	03 CENTRAL	Blue Valley 161kV Substation	50	**$0**
GEN-2018-032	03 CENTRAL	Neosho 345kV Substation	310	**$0**
GEN-2018-033	02 NEBRASKA	Cass County 345kV Substation	200	**$4,116,940**
GEN-2018-037	02 NEBRASKA	Looping in OPPD (S1211) (S1220) (S1211) (S1299) 161kV	100	**$2,113,931**
GEN-2018-043	02 NEBRASKA	Ft. Calhoun - Raun 345 kV Line Break	500	**$10,516,097**
GEN-2018-044	02 NEBRASKA	Fort Calhoun 345kV Substation	500	**$0**
GEN-2018-048	04 SOUTHEAST	Pecan Creek 345kV Substation	300	**$0**
GEN-2018-050	04 SOUTHEAST	Longwood 345kV Substation	200	**$0**
GEN-2018-054	03 CENTRAL	KC South - N. Raymore 161kV Line	120	**$1,176,421**
GEN-2018-055	04 SOUTHEAST	Terry Road 345kV station (shared with Rush Springs Wind farm on a common gen-tie)	252	**$0**
GEN-2018-057	03 CENTRAL	Gordon Evans 138kV	203.4	**$0**
GEN-2018-058	03 CENTRAL	Stranger Creek 345kV	252	**$0**
GEN-2018-059	03 CENTRAL	Stranger Creek 345kV	252	**$0**
GEN-2018-062	03 CENTRAL	Nearman 161kV substation	75.6	**$0**

VERSION HISTORY

Version Number and Date	Author	Change Description
V0 – 07/11/2023	AECI	Initial release