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MISO Affected System Study on SPP DISIS 2023-001 Phase 2 Projects

Prepared for

MISO

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Contents

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Executive Summary

This report presents the results of an Affected System Impact Study (AFSIS) on MISO transmission system performed for Phase 2 generator interconnection requests in the Southwest Power Pool (SPP) queue 2023-001 cycle (Study Projects). The AFSIS results are summarized below.

1.1 Project List

Because of a wide geographical region of the DISIS 2023-001 Phase 2 Study Projects, the MISO AFSIS was divided into two groups to identify the impacts on the MISO West and MISO South regions.

1.1.1 Phase 2 Study Projects in MISO South

The DISIS 2023-001 Phase 2 Study Projects in MISO South region (Study Projects in MISO South) have 64 generation projects with combined energy of 14697 MW, which are listed in Table ES-1.

Table ES-1: DISIS 2023-001 Phase 2 Study Projects in MISO South

Project #	Fuel type	Town / County	State	Point of Interconnection	MW request	SH (MW)	SPK (MW)
GEN-2023-001	Solar	Lea	NM	T14 115 kV	230	0	230
GEN-2023-005	Solar	Lamb	TX	Plant X 230kV	256	0 0	128 128
GEN-2023-009	BESS	Sawyer	OK	Hugo 138 kV	250	126.92 123.08	126.92 123.08
GEN-2023-010	Wind	Sherman	TX	Moore Co 230 kV	280	140 140	21.84 21.84
GEN-2023-022	Wind	McIntosh	OK	Canadian River 345 kV	250	250	39
GEN-2023-027	Hybrid (Solar / BESS)	Mayes	OK	Bird Hollow-Pryor Junction 138 kV	150	0 (PV) 79.8 (BT)	150 (PV) 0 (BT)
GEN-2023-028	Hybrid (Solar / BESS)	Mayes	OK	Dry Gulch-Pensacola 161 kV	230	0 (PV) 127.68 (BT)	230 (PV) 0 (BT)
GEN-2023-030	Solar	DeSoto Parish	LA	SW Shreveport-Dolet Hills 345 kV	25	0	25
GEN-2023-035	Solar	Grady	OK	Cleveland-Amber Tap 138 kV	200	0	200
GEN-2023-038	Solar	Coal	OK	Lula 138 kV	200	0	200
GEN-2023-049	Hybrid (Solar / BESS)	Mayes	OK	Dry Gulch-Pensacola 161 kV	150	0 (PV) 75 (ST)	150 (PV) 0 (ST)
GEN-2023-055	BESS	Mayes	OK	Kerr Grove 161 kV	100	100	100
GEN-2023-056	BESS	Van Buren	AR	Van Buren 161 kV	150	150	150

Project #	Fuel type	Town / County	State	Point of Interconnection	MW request	SH (MW)	SPK (MW)
GEN-2023-057	BESS	Pawnee	OK	Pawnee Switch 138 kV	150	150	150
GEN-2023-059	Hybrid (Solar / RECIP Gas)	Harrison / Panola	TX	Rockhill-South Shreveport 138 kV	200	0	100 (PV) 50 (CT) 50 (CT)
GEN-2023-060	Solar	Lamb	TX	Plant X 230kV	256	0	128 128
GEN-2023-063	Hybrid (Solar / BESS)	Rogers	OK	Catoosa-Owasso 88th 138 kV	135	0 (PV) 135 (BT)	135 (PV) 0 (BT)
GEN-2023-064	Hybrid (Solar / BESS)	LeFlore	OK	RS Kerr-Stigler 161 kV	200	0 (PV) 200 (BT)	200 (PV) 0 (BT)
GEN-2023-069	Hybrid (Solar / BESS)	Atoka	OK	Tupelo-Atoka 138 kV	100	0 (PV) 52.25 (ST)	100 (PV) 0 (ST)
GEN-2023-075	Wind	Nowata / Craig	OK	Delaware-Neosho 345 kV	200	100 100	15.6 15.6
GEN-2023-076	Wind	Nowata / Craig	OK	Delaware-Neosho 345 kV	100	100	15.6
GEN-2023-081	Hybrid (Solar / BESS)	Lea	NM	Crossroads-Hobbs 345 kV	625	0 (PV) 58.37 (ST) 0 (PV) 58.37 (ST) 0 (PV) 58.37 (ST)	200 (PV) 0 (ST) 200 (PV) 0 (ST) 225 (PV) 0 (ST)
GEN-2023-086	Hybrid (Solar / BESS)	Randall	TX	Potter-Newhart 230 kV	300	0 (PV) 300 (ST)	300 (PV) 0 (ST)
GEN-2023-088	Wind	Okfuskee / Okmulgee	OK	Pharaoh 138 kV	117	117	18.25
GEN-2023-092	Hybrid (Solar / BESS)	Choctaw	OK	Unger-Frogville 138 kV	125	0 (PV) 61.75 (BT)	125 (PV) 0 (BT)
GEN-2023-100	Hybrid (Solar / BESS)	Woods	OK	Degrasse 345 kV	300	0 (PV) 71.25 (BT) 0 (PV) 71.25 (BT)	150 (PV) 0 (BT) 150 (PV) 0 (BT)
GEN-2023-102	Hybrid (Solar / BESS)	Woods	OK	Degrasse 345 kV	475	0 (PV) 47.5 (BT) 0 (PV) 47.5 (BT) 0 (PV) 47.5 (BT) 0 (PV) 47.5 (BT)	119 (PV) 0 (BT) 119 (PV) 0 (BT) 119 (PV) 0 (BT) 119 (PV) 0 (BT)

Project #	Fuel type	Town / County	State	Point of Interconnection	MW request	SH (MW)	SPK (MW)
GEN-2023-110	Solar	Hall	TX	Border-Tuco 345 kV	250	0	126.87 123.13
GEN-2023-123	Wind	Ochiltree / Handsford	TX	Pringle Interchange 230 kV	285	142.5 142.5	22.23 22.23
GEN-2023-132	Solar	Craighead	AR	Jonesboro-Independence 161 kV	150	0	150
GEN-2023-134	Wind	Hughes / Okfuskee	OK	Fixico Tap-Weleetka 138 kV	252	252	39.31
GEN-2023-135	Solar	Bowie	TX	Lydia 345kV	52	0	52
GEN-2023-138	Wind	Deleware	OK	GRDA1-Tonece7 345 kV	250	125 125	18.5 18.5
GEN-2023-142	Solar	Lamb	TX	Plant X 230 kV	275	0 0	141.32 133.68
GEN-2023-151	Hybrid (Solar / BESS)	Hempstead	AR	South Nashville-South Murfreesboro 138kV	100	0 (PV) 0 (PV) 38.47 (BT)	50 (PV) 50 (PV) 0 (BT)
GEN-2023-158	Solar	Bailey / Lamb	TX	Needmore-Yoakum 230 kV	335	0	169.52 165.48
GEN-2023-164	BESS	Caddo	OK	Gracemont 345 kV	210	210	210
GEN-2023-165	BESS	Caddo	OK	Gracemont 345 kV	210	210	210
GEN-2023-167	BESS	Oklahoma	OK	Washington Park 138 kV	250	250	250
GEN-2023-168	BESS	Oklahoma	OK	Classen 138 kV	175	175	175
GEN-2023-174	BESS	Garvin	OK	Paoli West 138 kV	150	150	150
GEN-2023-176	Wind	Lamb	TX	Plant X 230 kV	300	151.4 148.6	23.618 23.182
GEN-2023-177	Solar	Garvin	OK	Paoli-Seminole 138 kV	200	0	101.96 98.04
GEN-2023-180	Solar	Sebastian	AR	Hackett-N Huntington 161 kV	150	0	150
GEN-2023-183	CTG	Hale	TX	Tuco 345kV	217	0	217
GEN-2023-188	Hybrid (Solar / BESS)	Cotton	OK	Oklaunion-Lawton 345 kV	160	0 (PV) 87.78 (BT)	87.78 (PV) 73 (BT)
GEN-2023-193	Hybrid (Solar / BESS)	Harrison	TX	Pirkey-Whitney 138 kV	175	0 (PV) 175 (BT)	175 (PV) 0 (BT)
GEN-2023-195	Solar	Bailey	TX	Roosevelt-Tolk 230 kV	250	0 0	132.81 117.19
GEN-2023-201	Hybrid (Solar / BESS)	Lea	NM	Crossroads-Hobbs 345 kV	300	0 (PV) 101.89 (BT)	150 (PV) 0 (BT)

Project #	Fuel type	Town / County	State	Point of Interconnection	MW request	SH (MW)	SPK (MW)
						0 (PV) 101.89 (BT)	150 (PV) 0 (BT)
GEN-2023-203	Hybrid (Solar / BESS)	Lea	NM	Hobbs-Ink Basin 230 kV	300	0 (PV) 101.89 (BT) 0 (PV) 101.89 (BT)	150 (PV) 0 (BT) 150 (PV) 0 (BT)
GEN-2023-204	CTG	Morris	TX	Welsh-Lydia 345kV	953	0 0	476.5 476.5
GEN-2023-205	Solar	Hughes	OK	McAlester City-Weleetka 138 kV	180	0	180
GEN-2023-206	BESS	Sebastian	AR	Battlefield BESS 161 kV	50	50	50
GEN-2023-210	Solar	Lincoln	OK	Prague-Chernicky 138 kV	191	0	191
GEN-2023-211	Hybrid (Solar / BESS)	Kay	OK	Ranch Road 345 kV	250	171.19 (W) 0 (PV) 78.81 (BT)	26.71 (W) 108.68 (PV) 115 (BT)
GEN-2023-212	Hybrid (Solar / BESS)	Bowie	TX/OK	Northwest Texarkana-Valliant 345 kV	400	0 (PV) 117.04 (BT)	400 (PV) 0 (BT)
GEN-2023-213	BESS	Benton	AR	Chamber Springs 161 kV	100	100	100
GEN-2023-227	BESS	Titus	TX	Petty-Chapel 138 kV	200	200	200
GEN-2023-228	BESS	Cottle	TX	Tuco-Okalunion 345 kV	250	125 125	125 125
GEN-2023-229	Wind	Caddo	OK	Southwestern Power Station 138 kV (SWS4)	230	127.78 102.22	19.93 15.95
GEN-2023-230	Hybrid (Solar / BESS)	Bossier	LA	Red Pointe 138 kV	150	0 (PV) 52.668 (BT)	104.5 (PV) 46 (BT)
GEN-2023-236	Solar	Lea	NM	Hobbs-Yoakum 345 kV	400	0	113.21 90.57 113.21 83.02
GEN-2023-237	Wind	Hale	TX	Crawfish Draw 345 kV	500	125 125 125 125	19.5 19.5 19.5 19.5
GEN-2023-241	Solar	Franklin / Wood	TX	Winnsboro 138 kV	93	0	93

1.1.2 Phase 2 Study Projects in MISO West

The DISIS 2023-001 Phase 2 Study Projects in MISO West region (Study Projects in MISO West) have 48 generation projects with combined energy of 11202.6 MW, which are listed in Table ES-2.

Table ES-2: DISIS 2023-001 Phase 2 Study Projects in MISO West

Project #	Fuel type	Town / County	State	Point of Interconnection	MW request	SH (MW)	SPK (MW)
GEN-2023-006	Wind	Barton / Vernon	MO	Wolf Creek-Blackberry 345 Kv	202	101 101	15.756 15.756
GEN-2023-011	Wind	Jefferson	NE	Harbine 115 kV	190	190	29.64
GEN-2023-012	Wind	Lake Preston	SD	Kingsbury County 115kV	98.6	51 47.6	7.956 7.426
GEN-2023-015	Solar	Finney	KS	Finney-Carpenter 345 kV	330	0	330
GEN-2023-023	BESS	Wyandotte	KS	Center City 161 kV	200	100 100	100 100
GEN-2023-032	Solar	Lafayette	MO	Odessa-Lexington 161 kV	200	0	200
GEN-2023-033	BESS	Clay	MO	Liberty South 161 kV	200	100 100	100 100
GEN-2023-036	BESS	Jackson	MO	Eckles Road 161 kV	165	165	165
GEN-2023-037	BESS	Wyandotte	KS	Nearman 161 kV	200	100 100	100 100
GEN-2023-050	Hybrid (Solar / BESS)	Labette	KS	Neosho 345 kV	400	0 (PV) 100 (ST) 0 (PV) 100 (ST)	200 (PV) 0 (ST) 200 (PV) 0 (ST)
GEN-2023-061	BESS	Jasper	MO	Carthage 161 kV	100	100	100
GEN-2023-062	Steam	Williams	ND	REN 115 kV	98	49 49	49 49
GEN-2023-065	BESS	Harvey	KS	Halstead 69 kV	140	140	140
GEN-2023-073	BESS	Butler	KS	Rose Hill 345 kV	250	125 125	125 125
GEN-2023-077	CTG	Cass	NE	Substation 3740 345 kV	255	0	255
GEN-2023-078	CTG	Cass	NE	Substation 3740 345 kV	255	0	255
GEN-2023-079	CTG	Cass	NE	Substation 3740 345 kV	303	0	303
GEN-2023-082	BESS	Brookings	SD	White 115 kV	175	175	175
GEN-2023-085	Wind	Douglas / Wright	MO	Mansfield-Logan 161 kV	150	150	23.4
GEN-2023-087	Solar	Cass	MO	Archie 161 kV	200	0	200
GEN-2023-097	BESS	Williams	ND	Judson 345 kV	250	125 125	125 125

Project #	Fuel type	Town / County	State	Point of Interconnection	MW request	SH (MW)	SPK (MW)
GEN-2023-099	Solar	Jackson	KS	Jeffery Energy Center 345 kV	300	0	150 150
GEN-2023-105	Wind	Hyde	SD	Chappelle Creek 345 kV	249	124.5 124.5	19.42 19.42
GEN-2023-107	Wind	Finney / Kearny	KS	Setab 345 kV	300	150 150	23.4 23.4
GEN-2023-116	Wind	Keith / Deuel / Garden	NE	Keystone 345 kV	500	168.54 165.73 165.73	26.29 25.85 25.85
GEN-2023-117	Wind	Keith / Deuel / Garden	NE	Keystone 345 kV	300	151.4 148.6	23.62 23.18
GEN-2023-133	Wind	Custer	NE	Sweetwater 345 kV	250	125 125	19.5 19.5
GEN-2023-149	BESS	Lin	KS	LaCygne-Stilwell 345 kV	300	150 150	150 150
GEN-2023-153	Hybrid (Solar / BESS)	Perkins	NE	Grant 115 kV	120	0 (PV) 120 (BT)	120 (PV) 0 (BT)
GEN-2023-154	Solar	Hand	SD	Fort Thompson-Huron 230 kV	175	0	175
GEN-2023-169	BESS	Clay	MO	Missouri City-Liberty South 161 kV	125	125	125
GEN-2023-170	BESS	Chariton	MO	Salisbury 161 kV	150	150	150
GEN-2023-171	BESS	Jackson	MO	Sub M 161 kV	150	150	150
GEN-2023-172	Wind	Kearny	KS	Holcomb 345 kV	200	100 100	15.6 15.6
GEN-2023-182	Wind	Logan / McIntosh	ND	Groton-Leland Olds 345 kV	300	150 150	23.4 23.4
GEN-2023-194	Solar	Cherokee	KS	Riverton-Neosho 161 kV	225	0	225
GEN-2023-199	Hybrid (Solar / BESS)	Dakota	NE	Twin Church 230 kV	250	0 (PV) 250 (BT)	250 (PV) 0 (BT)
GEN-2023-216	Wind	Knox / Cedar	NE	Turtle Creek 345 kV	200	200	31.2
GEN-2023-217	Wind	Knox / Cedar	NE	Turtle Creek 345 kV	200	200	31.2
GEN-2023-218	Wind	Knox / Cedar	NE	Turtle Creek 345 kV	200	200	31.2
GEN-2023-219	Solar	Osage	KS	Reading-Osage Jct 115 kV	125	0	125
GEN-2023-220	Solar	Osage	KS	Emporia Energy Center-Swissvale 345 kV	250	0	250
GEN-2023-221	Solar	Osage	KS	Emporia Energy Center-Swissvale 345 kV	250	0	250

Project #	Fuel type	Town / County	State	Point of Interconnection	MW request	SH (MW)	SPK (MW)
GEN-2023-222	CTG	Gage	NE	New Beatrice Power Station 345 kV	478	0	239 239
GEN-2023-223	CTG	Gage	NE	New Beatrice Power Station 345 kV	239	0	239
GEN-2023-224	CTG	Lancaster	NE	Olive Creek 345 kV	478	0	239 239
GEN-2023-225	RICE	Lancaster	NE	Olive Creek 345 kV	217	0	108.5 108.5
GEN-2023-231	Hybrid (Wind / BESS)	Crawford	KS	Neosho-LaCynge 345 kV	310	155 (WIND) 155 (WIND) 0 (BT) 0 (BT)	25.6 (WIND) 25.6 (WIND) 131.17 (BT) 127.63 (BT)

1.2 MISO AFSIS Study Summary

1.2.1 Study Summary for Study Projects in MISO South

Summer peak and summer shoulder steady state models and stability packages used for MISO AFSIS on SPP DISIS 2023-001 Study Projects in MISO South were developed from the Phase 2 models used in MISO South AFSIS on SPP DISIS-2022-001 Cycle, which were originally developed from the MISO DPP 2021 South Phase 2 models and stability packages.

Steady state thermal and voltage analysis was performed to identify any thermal and voltage violations in the MISO South region. MISO AFSIS Thermal Network Upgrades are listed in Table ES-3, MISO AFSIS voltage Network Upgrades are listed in Table ES-4, and MISO AFSIS interconnection facilities upgrades are listed in Table ES-5.

Table ES-3: AFSIS Thermal Network Upgrades Identified for SPP Study Projects in MISO South

Constraint	Owner	Mitigation	Cost ($)	Construction Time
Rocky Creek 345-230 kV xfmr	EES	Upgrade to 550MVA rating	$32,000,000	42 mo
Couch-Lewisville 115 kV	EES-EAI	Rebuild 9.1 miles of the line, post upgrade rating 299 MVA	$14,380,000	32 mo
Murfreesboro - G23-151 Tap 138 kV	EES-EAI AEPW	Entergy: Only Entergy upgrade would be a line bay riser at Murfreesboro South. $270,000 AEPW: Rebuild approximatly 8.6 miles of 138 kV line between G23-151 Tap 138 kV and AEP's connection with Entergy at Murfreesboro. $19.78M	$20,050,000	Entergy: 18 mo AEPW: 36 mo
Murfreesboro 138-115-13.8 kV xfmr	EES-EAI	Upgrade to 200 MVA rating	$15,000,000	42 mo

Constraint	Owner	Mitigation	Cost ($)	Construction Time
Amity-Murfreesboro E. 138 kV	EES-EAI	Rebuild 14.3 miles of the line, post upgrade rating 176MVA, $26,050,000. DISIS-2022-001 Phase 2 AFS NUs	$0	36 mo
Sans Souci-Driver 500 kV	EES-EAI	New Substation (tapping in Driver - Sandy Bayou and Dell - Sancy Souci) with New Line to Sandy Bayou, $50M. DPP-2021 Upgrade	$0	pending DPP-2021 NUFS
Driver-Sandy Bayou 500 kV	EES-EAI	New Substation (tapping in Driver - Sandy Bayou and Dell - Sancy Souci) with New Line to Sandy Bayou, $50M. DPP-2021 Upgrade	$0	pending DPP-2021 NUFS
Lewisville-Patmos 115 kV	EES-EAI AECC	EES: Rebuild 10.4 miles of the line, post upgrade rating 320MVA. $15,060,000 AECC: Bus upgrade at Patmos - $500,000 (~400MVA post-mitigation rating).	$15,560,000	Entergy:34 mo AECC: 12 mo
Patmos-Fulton 115 kV	EES-EAI AEPW AECC	Entergy: Upgrade 4.3 miles of the line to 319MVA rating. $5,560,000 AEPW: Rebuild 7.1 miles of 115 kV line between AEP's connection with AECC and AEP's connection with Entergy. $16,330,000 AECC: Bus upgrade at Patmos, station upgrades at Fulton, rebuild the 3.61 mile AECC owned section of the 115kV line from Patmos to Fulton - $11.5M total for all upgrades (~400MVA post-mitigation rating for all AECC facilities).	$33,390,000	Entergy:30 mo AEPW: 36 mo AECC: 36 mo

Table ES-4: AFSIS Voltage Network Upgrades Identified for SPP Study Projects in MISO South

Constraints	Network Upgrades	Owner	Cost ($)	Construction Time
Low voltages at Grimes, Frontier, Rock Creek 345 kV buses	300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	42 mo

Table ES-5: AFSIS Interconnection Facility Upgrades Identified for SPP Study Projects in MISO South

Network Upgrades	Owner	Cost ($)	Construction Time
Protection Upgrades at Entergy S. Murfreesboro 138 kV station, driven by GEN-2023-151	EES	TBD	TBD

Transient stability analysis was performed to identify any transient stability violations caused by the SPP Study Projects in MISO South.

Based on the MISO South 2026 summer peak transient stability analysis, no MISO Affected System stability constraints were identified in the summer peak scenario. No MISO AFSIS stability NUs are required in summer peak stability study.

Based on the MISO South 2026 summer shoulder transient stability analysis, no MISO Affected System stability constraints were identified in the summer shoulder scenario. Active power oscillations at GEN-2023-086 battery portion were caused by GEN-2023-086 battery portion itself. The GEN-2023-086 generation project is responsible for fixing this issue. No MISO AFSIS stability NUs are required in summer shoulder stability study.

A short circuit screening analysis was conducted by comparing three phase fault currents in the benchmark and study cases for the SPP Study Projects in MISO South. Based on the screening results, MISO Transmission Owners do not plan to conduct additional studies.

Contingent facilities were identified for the SPP Study Projects in MISO South. Details are in Section 4.1.

Based on Entergy's feedback, an Affected System Facilities Study for protection system upgrades at the Entergy South Murfreesboro 138 kV station will be needed if GEN-2023-151 proceeds to the next phase.

It should be noted that a restudy may be required if significant changes to the study assumptions occur, including but not limited to, interconnection request withdrawals and/or changes to higher-queued Network Upgrades included in the Base Case.

For the study projects that are required to mitigate thermal violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit is provided to the project through MISO Annual ERIS process.

For projects that are required to mitigate voltage or stability violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit is provided to the project through MISO Annual ERIS process.

1.2.2 Study Summary for Study Projects in MISO West

Summer peak and summer shoulder steady state models and stability packages used for MISO AFSIS on SPP DISIS 2023-001 Study Projects in MISO West were developed from the Phase 2 models used in MISO West AFSIS on SPP DISIS-2022-001 Cycle, which were originally developed from the MISO DPP 2021 West Phase 2 models and stability packages.

Steady state thermal and voltage analysis was performed to identify any thermal and voltage violations in MISO West region. Due to voltage collapse in Jamestown and Alexandria areas in summer shoulder scenario, MISO LRTP projects listed in Table ES-6 are required Network Upgrades in summer shoulder scenario.

Table ES-6: LRTP Projects Required in MISO West Summer Shoulder Scenario

Project	Description
LRTP-1	Jamestown - Ellendale
LRTP-2	Big Stone South - Alexandria - Cassie's Crossing

Additional MISO AFSIS Thermal and voltage Network Upgrades for steady state analysis are listed in Table ES-7 and Table ES-8.

Table ES-7: AFSIS Thermal Network Upgrades Identified for SPP Study Projects in MISO West

Constraint	Owner	Mitigation	Cost ($)	Construction Time
J976 POI-Enon Tap 345 kV	Ameren	upgraded by internal projects: SN/SE: 1836 / 2091MVA	$0	
J976 POI-Montgomery 345 kV	Ameren	DPP19 Central Upgrade: Upgrade 0.02 mi 345 kV line conductor from MTGY to Str 326 on MTGY-BELU-6 to be 3000 A, upgrade the Mongomery line position to be 3000A, $600,000. No Cost to DISIS-2023-001	$0	
MPC4300 New Sub-Buffalo 345 kV	OTP	OTP: Replace wavetrap with rating > 1042.0 MVA Upgrade on MPC facilities not required in this study	$100,000	54 mo
Harrison East-Summit 161 kV	EES-EAI	upgrade the line to 216/216 MVA rating	$29,730,000	48 mo
Bison-Buffalo 345 kV	XEL OTP MPC	OTP: limited by MPC equipment, upgrade on MPC equipment not required from this study. $0 XEL: The line from Bison to Buffalo terminates in the Minnkota side of the sub. All XEL facilities at Bison are rated at 3000A. No XEL upgrade needed	$0	
Sheyenne-Lake Park 230 kV	XEL OTP	XEL:the Xcel portion of the Sheyenne – Lake Park 230kV line and sub is rated to 460.54/506.6 MVA, no upgrade needed. $0 OTP:DPP-2021 West Phase 2 Upgrade: Reconductor/rebuild to 796.7/876.4MVA rating, $35M	$0	
Audubon-Lake Park 230 kV	OTP	OTP:DPP-2021 West Phase 2 Upgrade: Reconductor/rebuild to 796.7/876.4MVA rating $10M	$0	
Raun - Gen-2018-043 POI 345 kV	MEC OPPD	MEC: No MEC mitigation required. Existing MEC only rating is 1195 MVA. OPPD equipment is the limit. OPPD:Structure replacements on the line. $3,720,909, currently assigned to DISIS-2018-002/2019-001 cluster in MISO AFS for DISIS-2018-002/2019-001 Phase 3	$0	OPPD: 36 mo

Constraint	Owner	Mitigation	Cost ($)	Construction Time
Glenham-Campbell 230 kV	MDU WAPA	MDU: no upgrade on MDU facilities needed, MDU limiting element is 319MVA/351MVA,Normal/Emergency WAPA:Rebuild the existing CAMPBELL 4 to GLENHAM4 230 kV line (14 miles) to a standard rating of 796 MVA, $12,369,126. currently assigned to DPP21 from SPP AFS	$0	WAPA:36 mo

Table ES-8: AFSIS Voltage Network Upgrades Identified for SPP Study Projects in MISO West

Constraints	Network Upgrades	Owner	Cost ($)	Construction Time
Low voltage at Mt Ida 115 kV bus	Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	30 mo
Low voltage at Camden 161 kV bus	DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	Ameren	$0	TBD
Low voltages in area of Pilot Knob 161 kV	27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	TBD
Low voltages in area of Blue Lake, McLeod	4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	MRES	$0	3-4 years
Low voltages in area of Mapleton 115 kV	1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	54 mo
Low voltages in area of Big Stone 345 kV	3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	54 mo
Low voltages in area of Alexandria 345 kV	2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	4-5 years
Low voltages in areas of Oaks, Forman, Hankinson, Wahpeton, Fergus Falls 230 kV	3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	54 mo
Low voltages in areas of Audubon, Erie Jct 230 kV	3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	54 mo
Low voltages in areas of Buffalo, Maple River 345 kV	1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	54 mo

Transient stability analysis was performed to identify any transient stability violations caused by the SPP Study Projects in MISO West.

Based on the MISO West 2026 summer peak transient stability analysis, no MISO Affected System stability constraints were identified in the summer peak scenario. GEN-2023-222 and GEN-2023-223 projects are responsible for mitigating the generator tripping due to their

transient instability. GEN-2023-087 project is responsible for mitigating the transient low voltage recovery issue in areas of Adrian (541240) and Butler (301342).

Based on the MISO West 2026 summer shoulder transient stability analysis, transient stability violations were identified in the summer shoulder scenario. All these identified stability violations can be mitigated by MTEP Appendix A project or prior queued Network Upgrades listed in Table ES-9, which are required in DPP 2021 West Phase 2 study. The study projects in DISIS-2023-001 West group are not responsible for costs of these Network Upgrades. The transient low voltage recovery issue in areas of Adrian (541240) and Butler (301342) should be mitigated by GEN-2023-087 project.

Table ES-9: Prior Queued Network Upgrades Required for Stability Constraints in Summer Shoulder Scenario

Network Upgrade	Study Cycle	Construction Time
Add LRTP 1.3 (Iron Range - Benton County (615318) - Cassie's Crossing (604999))	MTEP Appendix A	6/1/2030
Add 3 x 100 MVAr MSC at Monticello 345 kV (601010)	DPP 2021 West Phase 2 study	TBD
Add 100 MVAr STATCOM at Alexandria 345 kV (658047)	DPP 2021 West Phase 2 study	TBD
Add 150 MVAr STATCOM at Wahpeton 230 kV (620329)	DPP 2021 West Phase 2 study	TBD
Add ±50 MVAr STATCOM at Audubon 230 (620336)	DPP 2021 West Phase 2 study	TBD
Add 150 MVAr STATCOM at Winger 230 kV (657758)	DPP 2021 West Phase 2 study	TBD
Add 250 MVAr STATCOM at Coon Creek 345 kV (601019)	DPP 2021 West Phase 2 study	TBD
Add 150 MVAr STATCOM at Cassies Crossing 345 kV (604999)	DPP 2021 West Phase 2 study	TBD
Add 200 MVAr STATCOM at Kohlman Lake 345 kV (601021)	DPP 2021 West Phase 2 study	TBD

A short circuit screening analysis was conducted by comparing three phase fault currents in the benchmark and study cases for the SPP Study Projects in MISO West. Based on the screening results, MISO Transmission Owners do not plan to conduct additional studies.

Contingent MTEP facilities and Network Upgrades were identified for the SPP Study Projects in MISO West. Details are in Section 4.2.

It should be noted that a restudy may be required if significant changes to the study assumptions occur, including but not limited to, interconnection request withdrawals and/or changes to higher-queued Network Upgrades included in the Base Case.

For the study projects that are required to mitigate thermal violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit is provided to the project through MISO Annual ERIS process.

For projects that are required to mitigate voltage or stability violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit is provided to the project through MISO Annual ERIS process.

1.3 Total MISO AFSIS Network Upgrades

1.3.1 Total MISO AFSIS Network Upgrades for Study Projects in MISO South

The total cost of MISO AFSIS Network Upgrades required for the Study Projects in MISO South is listed in Table ES-10. The costs for Network Upgrades are planning level estimates and subject to be revised in the facility studies.

Table ES-10: Total Cost of MISO AFSIS Network Upgrades for SPP DISIS 2023-001 Study Projects in MISO South

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-001	$439,655	$0	$0	$439,655
GEN-2023-005	$571,552	$0	$0	$571,552
GEN-2023-009	$1,626,724	$0	$0	$1,626,724
GEN-2023-010	$131,897	$0	$0	$131,897
GEN-2023-022	$175,862	$0	$0	$175,862
GEN-2023-027	$395,690	$0	$0	$395,690
GEN-2023-028	$615,517	$0	$0	$615,517
GEN-2023-030	$131,897	$0	$0	$131,897
GEN-2023-035	$703,448	$0	$0	$703,448
GEN-2023-038	$879,310	$0	$0	$879,310
GEN-2023-049	$395,690	$0	$0	$395,690
GEN-2023-055	$263,793	$0	$0	$263,793
GEN-2023-056	$263,793	$0	$0	$263,793
GEN-2023-057	$483,621	$0	$0	$483,621
GEN-2023-059	$1,934,483	$0	$0	$1,934,483
GEN-2023-060	$571,552	$0	$0	$571,552
GEN-2023-063	$395,690	$0	$0	$395,690
GEN-2023-064	$395,690	$0	$0	$395,690
GEN-2023-069	$483,621	$0	$0	$483,621
GEN-2023-075	$87,931	$0	$0	$87,931
GEN-2023-076	$43,966	$0	$0	$43,966

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-081	$1,318,966	$0	$0	$1,318,966
GEN-2023-086	$879,310	$0	$0	$879,310
GEN-2023-088	$43,966	$0	$0	$43,966
GEN-2023-092	$791,379	$0	$0	$791,379
GEN-2023-100	$923,276	$0	$0	$923,276
GEN-2023-102	$1,406,897	$0	$0	$1,406,897
GEN-2023-110	$659,483	$0	$0	$659,483
GEN-2023-123	$131,897	$0	$0	$131,897
GEN-2023-132	$43,966	$0	$0	$43,966
GEN-2023-134	$131,897	$0	$0	$131,897
GEN-2023-135	$2,413,798	$0	$0	$2,413,798
GEN-2023-138	$87,931	$0	$0	$87,931
GEN-2023-142	$615,517	$0	$0	$615,517
GEN-2023-151	$32,358,361	$0	$0	$32,358,361
GEN-2023-158	$703,448	$0	$0	$703,448
GEN-2023-164	$747,414	$0	$0	$747,414
GEN-2023-165	$747,414	$0	$0	$747,414
GEN-2023-167	$923,276	$0	$0	$923,276
GEN-2023-168	$659,483	$0	$0	$659,483
GEN-2023-174	$615,517	$0	$0	$615,517
GEN-2023-176	$87,931	$0	$0	$87,931
GEN-2023-177	$791,379	$0	$0	$791,379
GEN-2023-180	$263,793	$0	$0	$263,793
GEN-2023-183	$527,586	$0	$0	$527,586
GEN-2023-188	$571,552	$0	$0	$571,552
GEN-2023-193	$2,550,000	$0	$0	$2,550,000
GEN-2023-195	$527,586	$0	$0	$527,586
GEN-2023-201	$615,517	$0	$0	$615,517
GEN-2023-203	$615,517	$0	$0	$615,517
GEN-2023-204	$86,410,784	$0	$0	$86,410,784
GEN-2023-205	$659,483	$0	$0	$659,483

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-206	$87,931	$0	$0	$87,931
GEN-2023-210	$659,483	$0	$0	$659,483
GEN-2023-211	$747,414	$0	$0	$747,414
GEN-2023-212	$22,166,885	$0	$0	$22,166,885
GEN-2023-213	$263,793	$0	$0	$263,793
GEN-2023-227	$2,286,207	$0	$0	$2,286,207
GEN-2023-228	$703,448	$0	$0	$703,448
GEN-2023-229	$131,897	$0	$0	$131,897
GEN-2023-230	$1,362,931	$0	$0	$1,362,931
GEN-2023-236	$835,345	$0	$0	$835,345
GEN-2023-237	$175,862	$0	$0	$175,862
GEN-2023-241	$1,143,103	$0	$0	$1,143,103
Total ($)	**$181,380,000**	**$0**	**$0**	**$181,380,000**

1.3.2 Total MISO AFSIS Network Upgrades for Study Projects in MISO West

The total cost of MISO AFSIS Network Upgrades required for the Study Projects in MISO West is listed in Table ES-11. The costs for Network Upgrades are planning level estimates and subject to be revised in the facility studies.

Table ES-11: Total Cost of MISO AFSIS Network Upgrades for SPP DISIS 2023-001 Study Projects in MISO West

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-006	$568,621	$0	$0	$568,621
GEN-2023-011	$1,378,772	$0	$0	$1,378,772
GEN-2023-012	$1,632,051	$0	$0	$1,632,051
GEN-2023-015	$0	$0	$0	$0
GEN-2023-023	$682,715	$0	$0	$682,715
GEN-2023-032	$62,222	$0	$0	$62,222
GEN-2023-033	$690,492	$0	$0	$690,492
GEN-2023-036	$567,927	$0	$0	$567,927
GEN-2023-037	$689,719	$0	$0	$689,719

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-050	$567,618	$0	$0	$567,618
GEN-2023-061	$259,313	$0	$0	$259,313
GEN-2023-062	$2,908,455	$0	$0	$2,908,455
GEN-2023-065	$457,974	$0	$0	$457,974
GEN-2023-073	$765,018	$0	$0	$765,018
GEN-2023-077	$73,889	$0	$0	$73,889
GEN-2023-078	$73,889	$0	$0	$73,889
GEN-2023-079	$77,778	$0	$0	$77,778
GEN-2023-082	$2,926,092	$0	$0	$2,926,092
GEN-2023-085	$30,009,008	$0	$0	$30,009,008
GEN-2023-087	$42,778	$0	$0	$42,778
GEN-2023-097	$6,722,451	$0	$0	$6,722,451
GEN-2023-099	$19,444	$0	$0	$19,444
GEN-2023-105	$4,502,835	$0	$0	$4,502,835
GEN-2023-107	$1,345,090	$0	$0	$1,345,090
GEN-2023-116	$4,362,099	$0	$0	$4,362,099
GEN-2023-117	$2,936,188	$0	$0	$2,936,188
GEN-2023-133	$2,089,213	$0	$0	$2,089,213
GEN-2023-149	$901,765	$0	$0	$901,765
GEN-2023-153	$1,350,524	$0	$0	$1,350,524
GEN-2023-154	$355,139	$0	$0	$355,139
GEN-2023-169	$438,184	$0	$0	$438,184
GEN-2023-170	$374,203	$0	$0	$374,203
GEN-2023-171	$515,904	$0	$0	$515,904
GEN-2023-172	$866,474	$0	$0	$866,474
GEN-2023-182	$7,085,035	$0	$0	$7,085,035
GEN-2023-194	$0	$0	$0	$0
GEN-2023-199	$1,787,902	$0	$0	$1,787,902
GEN-2023-216	$1,601,889	$0	$0	$1,601,889
GEN-2023-217	$1,601,889	$0	$0	$1,601,889
GEN-2023-218	$1,601,889	$0	$0	$1,601,889

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-219	$38,889	$0	$0	$38,889
GEN-2023-220	$11,667	$0	$0	$11,667
GEN-2023-221	$11,667	$0	$0	$11,667
GEN-2023-222	$62,222	$0	$0	$62,222
GEN-2023-223	$70,000	$0	$0	$70,000
GEN-2023-224	$62,222	$0	$0	$62,222
GEN-2023-225	$70,000	$0	$0	$70,000
GEN-2023-231	$860,884	$0	$0	$860,884
Total ($)	**$86,080,000**	**$0**	**$0**	**$86,080,000**

1.4 Per Project Summary

This section provides estimated cost of MISO AFSIS Network Upgrades on a per project basis for the Study Projects in SPP DISIS 2023-001 cycle.

It should be noted that a restudy may be required should significant changes to the study assumptions occur, including but not limited to, interconnection request withdrawals and/or changes to higher-queued Network Upgrades included in the Base Case.

1.4.1 Per Project Summary for Study Projects in MISO South

MISO AFSIS Network Upgrade costs are allocated to the below projects in MISO South:

1.4.1.1 GEN-2023-001 Summary

Network Upgrade	Owner	Cost	GEN-2023-001	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$439,655	SPK Volt
Total Cost Per Project			**$439,655**	

1.4.1.2 GEN-2023-005 Summary

Network Upgrade	Owner	Cost	GEN-2023-005	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$571,552	SPK Volt
Total Cost Per Project			**$571,552**	

1.4.1.3 GEN-2023-009 Summary

Network Upgrade	Owner	Cost	GEN-2023-009	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$1,626,724	SPK Volt
Total Cost Per Project			**$1,626,724**	

1.4.1.4 GEN-2023-010 Summary

Network Upgrade	Owner	Cost	GEN-2023-010	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$131,897	SPK Volt
Total Cost Per Project			**$131,897**	

1.4.1.5 GEN-2023-022 Summary

Network Upgrade	Owner	Cost	GEN-2023-022	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$175,862	SPK Volt
Total Cost Per Project			**$175,862**	

1.4.1.6 GEN-2023-027 Summary

Network Upgrade	Owner	Cost	GEN-2023-027	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$395,690	SPK Volt
Total Cost Per Project			**$395,690**	

1.4.1.7 GEN-2023-028 Summary

Network Upgrade	Owner	Cost	GEN-2023-028	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$615,517	SPK Volt
Total Cost Per Project			**$615,517**	

1.4.1.8 GEN-2023-030 Summary

Network Upgrade	Owner	Cost	GEN-2023-030	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$131,897	SPK Volt
Total Cost Per Project			**$131,897**	

1.4.1.9 GEN-2023-035 Summary

Network Upgrade	Owner	Cost	GEN-2023-035	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$703,448	SPK Volt
Protection Upgrades at Entergy South Murfreesboro 138 kV station,	EES	TBD	TBD	Interconnection Facility
Total Cost Per Project			**$703,448**	

1.4.1.10 GEN-2023-038 Summary

Network Upgrade	Owner	Cost	GEN-2023-038	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$879,310	SPK Volt
Total Cost Per Project			**$879,310**	

1.4.1.11 GEN-2023-049 Summary

Network Upgrade	Owner	Cost	GEN-2023-049	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$395,690	SPK Volt
Total Cost Per Project			**$395,690**	

1.4.1.12 GEN-2023-055 Summary

Network Upgrade	Owner	Cost	GEN-2023-055	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$263,793	SPK Volt
Total Cost Per Project			**$263,793**	

1.4.1.13 GEN-2023-056 Summary

Network Upgrade	Owner	Cost	GEN-2023-056	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$263,793	SPK Volt
Total Cost Per Project			**$263,793**	

1.4.1.14 GEN-2023-057 Summary

Network Upgrade	Owner	Cost	GEN-2023-057	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$483,621	SPK Volt
Total Cost Per Project			**$483,621**	

1.4.1.15 GEN-2023-059 Summary

Network Upgrade	Owner	Cost	GEN-2023-059	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$1,934,483	SPK Volt
Total Cost Per Project			**$1,934,483**	

1.4.1.16 GEN-2023-060 Summary

Network Upgrade	Owner	Cost	GEN-2023-060	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$571,552	SPK Volt
Total Cost Per Project			**$571,552**	

1.4.1.17 GEN-2023-063 Summary

Network Upgrade	Owner	Cost	GEN-2023-063	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$395,690	SPK Volt
Total Cost Per Project			**$395,690**	

1.4.1.18 GEN-2023-064 Summary

Network Upgrade	Owner	Cost	GEN-2023-064	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$395,690	SPK Volt
Total Cost Per Project			**$395,690**	

1.4.1.19 GEN-2023-069 Summary

Network Upgrade	Owner	Cost	GEN-2023-069	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$483,621	SPK Volt
Total Cost Per Project			**$483,621**	

1.4.1.20 GEN-2023-075 Summary

Network Upgrade	Owner	Cost	GEN-2023-075	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$87,931	SPK Volt
Total Cost Per Project			**$87,931**	

1.4.1.21 GEN-2023-076 Summary

Network Upgrade	Owner	Cost	GEN-2023-076	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$43,966	SPK Volt
Total Cost Per Project			**$43,966**	

1.4.1.22 GEN-2023-081 Summary

Network Upgrade	Owner	Cost	GEN-2023-081	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$1,318,966	SPK Volt
Total Cost Per Project			**$1,318,966**	

1.4.1.23 GEN-2023-086 Summary

Network Upgrade	Owner	Cost	GEN-2023-086	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$879,310	SPK Volt
Total Cost Per Project			**$879,310**	

1.4.1.24 GEN-2023-088 Summary

Network Upgrade	Owner	Cost	GEN-2023-088	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$43,966	SPK Volt
Total Cost Per Project			**$43,966**	

1.4.1.25 GEN-2023-092 Summary

Network Upgrade	Owner	Cost	GEN-2023-092	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$791,379	SPK Volt
Total Cost Per Project			**$791,379**	

1.4.1.26 GEN-2023-100 Summary

Network Upgrade	Owner	Cost	GEN-2023-100	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$923,276	SPK Volt
Total Cost Per Project			**$923,276**	

1.4.1.27 GEN-2023-102 Summary

Network Upgrade	Owner	Cost	GEN-2023-102	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$1,406,897	SPK Volt
Total Cost Per Project			**$1,406,897**	

1.4.1.28 GEN-2023-110 Summary

Network Upgrade	Owner	Cost	GEN-2023-110	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$659,483	SPK Volt
Total Cost Per Project			**$659,483**	

1.4.1.29 GEN-2023-123 Summary

Network Upgrade	Owner	Cost	GEN-2023-123	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$131,897	SPK Volt
Total Cost Per Project			**$131,897**	

1.4.1.30 GEN-2023-132 Summary

Network Upgrade	Owner	Cost	GEN-2023-132	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$43,966	SPK Volt
Total Cost Per Project			**$43,966**	

1.4.1.31 GEN-2023-134 Summary

Network Upgrade	Owner	Cost	GEN-2023-134	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$131,897	SPK Volt
Total Cost Per Project			**$131,897**	

1.4.1.32 GEN-2023-135 Summary

Network Upgrade	Owner	Cost	GEN-2023-135	NUs Type
Couch-Lewisville 115 kV	EES-EAI	$14,380,000	$438,275	SPK Thermal
Lewisville-Patmos 115 kV	EES-EAI AECC	$15,560,000	$474,239	SPK Thermal

Network Upgrade	Owner	Cost	GEN-2023-135	NUs Type
Patmos-Fulton 115 kV	EES-EAI AEPW AECC	$33,390,000	$1,017,663	SPK Thermal
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$483,621	SPK Volt
Total Cost Per Project			**$2,413,798**	

1.4.1.33 GEN-2023-138 Summary

Network Upgrade	Owner	Cost	GEN-2023-138	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$87,931	SPK Volt
Total Cost Per Project			**$87,931**	

1.4.1.34 GEN-2023-142 Summary

Network Upgrade	Owner	Cost	GEN-2023-142	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$615,517	SPK Volt
Total Cost Per Project			**$615,517**	

1.4.1.35 GEN-2023-151 Summary

Network Upgrade	Owner	Cost	GEN-2023-151	NUs Type
Couch-Lewisville 115 kV	EES-EAI	$14,380,000	$1,217,775	SPK Thermal
Murfreesboro - G23-151 Tap 138 kV	EES-EAI AEPW	$20,050,000	$11,423,690	SPK Thermal
Murfreesboro 138-115-13.8 kV xfmr	EES-EAI	$15,000,000	$15,000,000	SPK Thermal
Lewisville-Patmos 115 kV	EES-EAI AECC	$15,560,000	$1,317,703	SPK Thermal
Patmos-Fulton 115 kV	EES-EAI AEPW AECC	$33,390,000	$2,827,642	SPK Thermal
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$571,552	SPK Volt
Protection Upgrades at Entergy South Murfreesboro 138 kV station	EES	TBD	TBD	Interconnection Facility
Total Cost Per Project			**$32,358,361**	

1.4.1.36 GEN-2023-158 Summary

Network Upgrade	Owner	Cost	GEN-2023-158	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$703,448	SPK Volt
Total Cost Per Project			**$703,448**	

1.4.1.37 GEN-2023-164 Summary

Network Upgrade	Owner	Cost	GEN-2023-164	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$747,414	SPK Volt
Total Cost Per Project			**$747,414**	

1.4.1.38 GEN-2023-165 Summary

Network Upgrade	Owner	Cost	GEN-2023-165	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$747,414	SPK Volt
Total Cost Per Project			**$747,414**	

1.4.1.39 GEN-2023-167 Summary

Network Upgrade	Owner	Cost	GEN-2023-167	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$923,276	SPK Volt
Total Cost Per Project			**$923,276**	

1.4.1.40 GEN-2023-168 Summary

Network Upgrade	Owner	Cost	GEN-2023-168	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$659,483	SPK Volt
Total Cost Per Project			**$659,483**	

1.4.1.41 GEN-2023-174 Summary

Network Upgrade	Owner	Cost	GEN-2023-174	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$615,517	SPK Volt
Total Cost Per Project			**$615,517**	

1.4.1.42 GEN-2023-176 Summary

Network Upgrade	Owner	Cost	GEN-2023-176	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$87,931	SPK Volt
Total Cost Per Project			**$87,931**	

1.4.1.43 GEN-2023-177 Summary

Network Upgrade	Owner	Cost	GEN-2023-177	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$791,379	SPK Volt
Total Cost Per Project			**$791,379**	

1.4.1.44 GEN-2023-180 Summary

Network Upgrade	Owner	Cost	GEN-2023-180	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$263,793	SPK Volt
Total Cost Per Project			**$263,793**	

1.4.1.45 GEN-2023-183 Summary

Network Upgrade	Owner	Cost	GEN-2023-183	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$527,586	SPK Volt
Total Cost Per Project			**$527,586**	

1.4.1.46 GEN-2023-188 Summary

Network Upgrade	Owner	Cost	GEN-2023-188	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$571,552	SPK Volt
Total Cost Per Project			**$571,552**	

1.4.1.47 GEN-2023-193 Summary

Network Upgrade	Owner	Cost	GEN-2023-193	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$2,550,000	SPK Volt
Total Cost Per Project			**$2,550,000**	

1.4.1.48 GEN-2023-195 Summary

Network Upgrade	Owner	Cost	GEN-2023-195	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$527,586	SPK Volt
Total Cost Per Project			**$527,586**	

1.4.1.49 GEN-2023-201 Summary

Network Upgrade	Owner	Cost	GEN-2023-201	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$615,517	SPK Volt
Total Cost Per Project			**$615,517**	

1.4.1.50 GEN-2023-203 Summary

Network Upgrade	Owner	Cost	GEN-2023-203	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$615,517	SPK Volt
Total Cost Per Project			**$615,517**	

1.4.1.51 GEN-2023-204 Summary

Network Upgrade	Owner	Cost	GEN-2023-204	NUs Type
Rocky Creek 345-230 kV xfmr	EES	$32,000,000	$32,000,000	SPK Thermal
Couch-Lewisville 115 kV	EES-EAI	$14,380,000	$8,449,345	SPK Thermal
Murfreesboro - G23-151 Tap 138 kV	EES-EAI AEPW	$20,050,000	$8,626,310	SPK Thermal
Lewisville-Patmos 115 kV	EES-EAI AECC	$15,560,000	$9,142,685	SPK Thermal
Patmos-Fulton 115 kV	EES-EAI AEPW AECC	$33,390,000	$19,619,168	SPK Thermal
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$8,573,276	SPK Volt
Total Cost Per Project			**$86,410,784**	

1.4.1.52 GEN-2023-205 Summary

Network Upgrade	Owner	Cost	GEN-2023-205	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$659,483	SPK Volt
Total Cost Per Project			**$659,483**	

1.4.1.53 GEN-2023-206 Summary

Network Upgrade	Owner	Cost	GEN-2023-206	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$87,931	SPK Volt
Total Cost Per Project			**$87,931**	

1.4.1.54 GEN-2023-210 Summary

Network Upgrade	Owner	Cost	GEN-2023-210	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$659,483	SPK Volt
Total Cost Per Project			**$659,483**	

1.4.1.55 GEN-2023-211 Summary

Network Upgrade	Owner	Cost	GEN-2023-211	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$747,414	SPK Volt
Total Cost Per Project			**$747,414**	

1.4.1.56 GEN-2023-212 Summary

Network Upgrade	Owner	Cost	GEN-2023-212	NUs Type
Couch-Lewisville 115 kV	EES-EAI	$14,380,000	$4,274,606	SPK Thermal
Lewisville-Patmos 115 kV	EES-EAI AECC	$15,560,000	$4,625,373	SPK Thermal
Patmos-Fulton 115 kV	EES-EAI AEPW AECC	$33,390,000	$9,925,527	SPK Thermal
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$3,341,379	SPK Volt
Total Cost Per Project			**$22,166,885**	

1.4.1.57 GEN-2023-213 Summary

Network Upgrade	Owner	Cost	GEN-2023-213	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$263,793	SPK Volt
Total Cost Per Project			**$263,793**	

1.4.1.58 GEN-2023-227 Summary

Network Upgrade	Owner	Cost	GEN-2023-227	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$2,286,207	SPK Volt
Total Cost Per Project			**$2,286,207**	

1.4.1.59 GEN-2023-228 Summary

Network Upgrade	Owner	Cost	GEN-2023-228	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$703,448	SPK Volt
Total Cost Per Project			**$703,448**	

1.4.1.60 GEN-2023-229 Summary

Network Upgrade	Owner	Cost	GEN-2023-229	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$131,897	SPK Volt
Total Cost Per Project			**$131,897**	

1.4.1.61 GEN-2023-230 Summary

Network Upgrade	Owner	Cost	GEN-2023-230	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$1,362,931	SPK Volt
Total Cost Per Project			**$1,362,931**	

1.4.1.62 GEN-2023-236 Summary

Network Upgrade	Owner	Cost	GEN-2023-236	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$835,345	SPK Volt
Total Cost Per Project			**$835,345**	

1.4.1.63 GEN-2023-237 Summary

Network Upgrade	Owner	Cost	GEN-2023-237	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$175,862	SPK Volt
Total Cost Per Project			**$175,862**	

1.4.1.64 GEN-2023-241 Summary

Network Upgrade	Owner	Cost	GEN-2023-241	NUs Type
300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$1,143,103	SPK Volt
Total Cost Per Project			**$1,143,103**	

1.4.2 Per Project Summary for Study Projects in MISO West

The following projects in MISO West do not have MISO AFSIS Network Upgrade cost allocated to the projects:

- GEN-2023-015, GEN-2023-194

MISO AFSIS Network Upgrade costs are allocated to the below projects in MISO West:

1.4.2.1 GEN-2023-006 Summary

Network Upgrade	Owner	Cost	GEN-2023-006	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$7,778	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$22,976	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$128,316	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$147,087	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$99,274	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$115,169	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$48,023	SH Volt
Total Cost Per Project			**$568,621**	

1.4.2.2 GEN-2023-011 Summary

Network Upgrade	Owner	Cost	GEN-2023-011	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$46,667	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$42,123	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$242,374	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$273,161	SH Volt

Network Upgrade	Owner	Cost	GEN-2023-011	NUs Type
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$184,367	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$216,788	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$92,043	SH Volt
Total Cost Per Project			**$1,378,772**	

1.4.2.3 GEN-2023-012 Summary

Network Upgrade	Owner	Cost	GEN-2023-012	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$38,889	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$51,696	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$470,491	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$483,284	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$156,003	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$311,633	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$120,056	SH Volt
Total Cost Per Project			**$1,632,051**	

1.4.2.4 GEN-2023-023 Summary

Network Upgrade	Owner	Cost	GEN-2023-023	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$54,444	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$26,805	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$142,573	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$168,099	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$99,274	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$135,492	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$56,026	SH Volt
Total Cost Per Project			**$682,715**	

1.4.2.5 GEN-2023-032 Summary

Network Upgrade	Owner	Cost	GEN-2023-032	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$62,222	SPK Volt
Total Cost Per Project			**$62,222**	

1.4.2.6 GEN-2023-033 Summary

Network Upgrade	Owner	Cost	GEN-2023-033	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$62,222	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$26,805	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$142,573	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$168,099	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$99,274	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$135,492	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$56,026	SH Volt
Total Cost Per Project			**$690,492**	

1.4.2.7 GEN-2023-036 Summary

Network Upgrade	Owner	Cost	GEN-2023-036	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$62,222	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$21,061	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$114,058	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$133,078	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$85,092	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$108,394	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$44,021	SH Volt
Total Cost Per Project			**$567,927**	

1.4.2.8 GEN-2023-037 Summary

Network Upgrade	Owner	Cost	GEN-2023-037	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$54,444	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$26,805	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$142,573	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$175,103	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$99,274	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$135,492	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$56,026	SH Volt
Total Cost Per Project			**$689,719**	

1.4.2.9 GEN-2023-050 Summary

Network Upgrade	Owner	Cost	GEN-2023-050	NUs Type
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$22,976	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$128,316	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$147,087	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$99,274	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$121,943	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$48,023	SH Volt
Total Cost Per Project			**$567,618**	

1.4.2.10 GEN-2023-061 Summary

Network Upgrade	Owner	Cost	GEN-2023-061	NUs Type
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$11,488	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$57,029	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$70,041	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$42,546	SH Volt

Network Upgrade	Owner	Cost	GEN-2023-061	NUs Type
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$54,197	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$24,011	SH Volt
Total Cost Per Project			**$259,313**	

1.4.2.11 GEN-2023-062 Summary

Network Upgrade	Owner	Cost	GEN-2023-062	NUs Type
MPC4300 New Sub-Buffalo 345 kV	OTP	$100,000	$11,040	SH
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$58,333	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$101,477	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$427,719	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$469,276	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$808,377	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$514,871	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$236,111	SH Volt
Total Cost Per Project			**$2,908,455**	

1.4.2.12 GEN-2023-065 Summary

Network Upgrade	Owner	Cost	GEN-2023-065	NUs Type
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$19,147	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$99,801	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$119,070	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$85,092	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$94,845	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$40,019	SH Volt
Total Cost Per Project			**$457,974**	

1.4.2.13 GEN-2023-073 Summary

Network Upgrade	Owner	Cost	GEN-2023-073	NUs Type
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$32,549	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$171,088	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$203,119	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$127,639	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$162,591	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$68,032	SH Volt
Total Cost Per Project			**$765,018**	

1.4.2.14 GEN-2023-077 Summary

Network Upgrade	Owner	Cost	GEN-2023-077	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$73,889	SPK Volt
Total Cost Per Project			**$73,889**	

1.4.2.15 GEN-2023-078 Summary

Network Upgrade	Owner	Cost	GEN-2023-078	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$73,889	SPK Volt
Total Cost Per Project			**$73,889**	

1.4.2.16 GEN-2023-079 Summary

Network Upgrade	Owner	Cost	GEN-2023-079	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$77,778	SPK Volt
Total Cost Per Project			**$77,778**	

1.4.2.17 GEN-2023-082 Summary

Network Upgrade	Owner	Cost	GEN-2023-082	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$73,889	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$70,842	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$826,923	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$875,515	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$141,821	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$487,773	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$168,079	SH Volt
Total Cost Per Project			**$2,926,092**	

1.4.2.18 GEN-2023-085 Summary

Network Upgrade	Owner	Cost	GEN-2023-085	NUs Type
Harrison East-Summit 161 kV	EES-EAI	$29,730,000	$29,730,000	SPK
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$13,403	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$57,029	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$77,045	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$42,546	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$60,972	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$28,013	SH Volt
Total Cost Per Project			**$30,009,008**	

1.4.2.19 GEN-2023-087 Summary

Network Upgrade	Owner	Cost	GEN-2023-087	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$42,778	SPK Volt
Total Cost Per Project			**$42,778**	

1.4.2.20 GEN-2023-097 Summary

Network Upgrade	Owner	Cost	GEN-2023-097	NUs Type
MPC4300 New Sub-Buffalo 345 kV	OTP	$100,000	$28,052	SH
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$81,667	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$195,295	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$1,069,297	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$1,155,680	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$2,042,216	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$1,300,727	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$568,267	SH Volt
Total Cost Per Project			**$6,722,451**	

1.4.2.21 GEN-2023-099 Summary

Network Upgrade	Owner	Cost	GEN-2023-099	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$19,444	SPK Volt
Total Cost Per Project			**$19,444**	

1.4.2.22 GEN-2023-105 Summary

Network Upgrade	Owner	Cost	GEN-2023-105	NUs Type
MPC4300 New Sub-Buffalo 345 kV	OTP	$100,000	$27,280	SH
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$46,667	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$130,197	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$855,438	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$917,540	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$1,049,472	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$846,827	SH Volt

Network Upgrade	Owner	Cost	GEN-2023-105	NUs Type
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$348,164	SH Volt
Total Cost Per Project			**$4,502,835**	

1.4.2.23 GEN-2023-107 Summary

Network Upgrade	Owner	Cost	GEN-2023-107	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$27,222	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$57,440	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$285,146	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$322,190	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$255,277	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$277,759	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$120,056	SH Volt
Total Cost Per Project			**$1,345,090**	

1.4.2.24 GEN-2023-116 Summary

Network Upgrade	Owner	Cost	GEN-2023-116	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$562,500	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$58,333	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$114,880	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$812,666	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$896,527	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$836,741	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$772,307	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$308,145	SH Volt
Total Cost Per Project			**$4,362,099**	

1.4.2.25 GEN-2023-117 Summary

Network Upgrade	Owner	Cost	GEN-2023-117	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$562,500	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$50,556	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$86,160	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$499,005	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$546,321	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$510,554	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$480,998	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$200,094	SH Volt
Total Cost Per Project			**$2,936,188**	

1.4.2.26 GEN-2023-133 Summary

Network Upgrade	Owner	Cost	GEN-2023-133	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$50,556	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$72,757	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$384,947	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$427,251	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$354,551	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$365,829	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$152,072	SH Volt
Total Cost Per Project			**$2,089,213**	

1.4.2.27 GEN-2023-149 Summary

Network Upgrade	Owner	Cost	GEN-2023-149	NUs Type
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$38,293	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$199,602	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$238,140	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$156,003	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$189,689	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$80,038	SH Volt
Total Cost Per Project			**$901,765**	

1.4.2.28 GEN-2023-153 Summary

Network Upgrade	Owner	Cost	GEN-2023-153	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$62,222	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$44,037	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$213,859	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$245,144	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$212,731	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$203,239	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$88,041	SH Volt
Total Cost Per Project			**$1,350,524**	

1.4.2.29 GEN-2023-154 Summary

Network Upgrade	Owner	Cost	GEN-2023-154	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$73,889	SPK Volt
Total Cost Per Project			**$355,139**	

1.4.2.30 GEN-2023-169 Summary

Network Upgrade	Owner	Cost	GEN-2023-169	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$62,222	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$15,317	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$85,544	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$105,062	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$56,728	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$81,295	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$32,015	SH Volt
Total Cost Per Project			**$438,184**	

1.4.2.31 GEN-2023-170 Summary

Network Upgrade	Owner	Cost	GEN-2023-170	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$101,111	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$11,488	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$57,029	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$77,045	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$42,546	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$60,972	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$24,011	SH Volt
Total Cost Per Project			**$374,203**	

1.4.2.32 GEN-2023-171 Summary

Network Upgrade	Owner	Cost	GEN-2023-171	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$58,333	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$19,147	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$99,801	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$126,074	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$70,910	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$101,619	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$40,019	SH Volt
Total Cost Per Project			**$515,904**	

1.4.2.33 GEN-2023-172 Summary

Network Upgrade	Owner	Cost	GEN-2023-172	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$19,444	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$36,379	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$185,345	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$217,128	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$156,003	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$176,140	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$76,036	SH Volt
Total Cost Per Project			**$866,474**	

1.4.2.34 GEN-2023-182 Summary

Network Upgrade	Owner	Cost	GEN-2023-182	NUs Type
MPC4300 New Sub-Buffalo 345 kV	OTP	$100,000	$33,628	SH
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$50,556	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$187,637	SH Volt

Network Upgrade	Owner	Cost	GEN-2023-182	NUs Type
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$1,340,186	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$1,393,820	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$1,843,668	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$1,382,022	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$572,269	SH Volt
Total Cost Per Project			**$7,085,035**	

1.4.2.35 GEN-2023-199 Summary

Network Upgrade	Owner	Cost	GEN-2023-199	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$81,667	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$65,098	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$413,462	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$469,276	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$255,277	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$359,055	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$144,068	SH Volt
Total Cost Per Project			**$1,787,902**	

1.4.2.36 GEN-2023-216 Summary

Network Upgrade	Owner	Cost	GEN-2023-216	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$46,667	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$49,781	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$299,403	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$343,202	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$198,549	SH Volt

Network Upgrade	Owner	Cost	GEN-2023-216	NUs Type
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$270,985	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$112,053	SH Volt
Total Cost Per Project			**$1,601,889**	

1.4.2.37 GEN-2023-217 Summary

Network Upgrade	Owner	Cost	GEN-2023-217	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$46,667	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$49,781	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$299,403	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$343,202	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$198,549	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$270,985	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$112,053	SH Volt
Total Cost Per Project			**$1,601,889**	

1.4.2.38 GEN-2023-218 Summary

Network Upgrade	Owner	Cost	GEN-2023-218	NUs Type
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$281,250	SPK Volt
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$46,667	SPK Volt
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$49,781	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$299,403	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$343,202	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$198,549	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$270,985	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$112,053	SH Volt

Network Upgrade	Owner	Cost	GEN-2023-218	NUs Type
Total Cost Per Project			**$1,601,889**	

1.4.2.39 GEN-2023-219 Summary

Network Upgrade	Owner	Cost	GEN-2023-219	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$38,889	SPK Volt
Total Cost Per Project			**$38,889**	

1.4.2.40 GEN-2023-220 Summary

Network Upgrade	Owner	Cost	GEN-2023-220	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$11,667	SPK Volt
Total Cost Per Project			**$11,667**	

1.4.2.41 GEN-2023-221 Summary

Network Upgrade	Owner	Cost	GEN-2023-221	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$11,667	SPK Volt
Total Cost Per Project			**$11,667**	

1.4.2.42 GEN-2023-222 Summary

Network Upgrade	Owner	Cost	GEN-2023-222	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$62,222	SPK Volt
Total Cost Per Project			**$62,222**	

1.4.2.43 GEN-2023-223 Summary

Network Upgrade	Owner	Cost	GEN-2023-223	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$70,000	SPK Volt
Total Cost Per Project			**$70,000**	

1.4.2.44 GEN-2023-224 Summary

Network Upgrade	Owner	Cost	GEN-2023-224	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$62,222	SPK Volt
Total Cost Per Project			**$62,222**	

1.4.2.45 GEN-2023-225 Summary

Network Upgrade	Owner	Cost	GEN-2023-225	NUs Type
27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$70,000	SPK Volt
Total Cost Per Project			**$70,000**	

1.4.2.46 GEN-2023-231 Summary

Network Upgrade	Owner	Cost	GEN-2023-231	NUs Type
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$36,379	SH Volt
3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$199,602	SH Volt
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$224,132	SH Volt
3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$141,821	SH Volt
3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$182,915	SH Volt
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$76,036	SH Volt
Total Cost Per Project			**$860,884**	

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Section

1

Model Development and Study Criteria

1.1 MISO South Model Development and Study Criteria

1.1.1 MISO South Region AFSIS Model Development

Summer peak and summer shoulder steady state models and stability packages used for MISO AFSIS on SPP DISIS 2023-001 Study Projects in MISO South were developed from the Phase 2 models used in MISO South AFSIS on SPP DISIS-2022-001 Cycle, which were originally developed from the MISO DPP 2021 South Phase 2 models and stability packages.

The starting models used for developing MISO South AFSIS models on DISIS 2023-001 Study are listed below:

- 2026 summer peak model: DISIS-2022-001_AFSIS-South-2026SUM-Ph2-Study_241007.sav
- 2026 summer shoulder model: DISIS-2022-001_AFSIS-South-2026SSH-Ph2-Study_241007.sav

1.1.1.1 MISO South AFSIS Benchmark Cases

The benchmark cases for the MISO South AFSIS study were created as follows:

- Removed recently withdrawn MISO South prior queued generation projects (Table A-1). Power mismatch was balanced by scaling generation in the MISO South (Table A-12).
- Removed recently withdrawn MISO Classic prior queued generation projects (Table A-2). Power mismatch was balanced by scaling generation in the MISO North (Table A-11).
- Removed recently withdrawn SPP prior queued generation projects (Table A-3). Corrected generation dispatch for several SPP prior queued projects. Power mismatch was balanced by scaling generation in SPP market (Table A-13) based on the load-ratio share of the Transmission Owner (TO) power flow modeling areas.
- Removed several withdrawn generation projects in DISIS 2022-001 cycle (Table A-4). Power mismatch was balanced by scaling generation in SPP market (Table A-13) based on the load-ratio share of the Transmission Owner (TO) power flow modeling area.
- SPP prior queued generation projects (Table A-5) were modeled. SPP DISIS 2022-001 generation projects in MISO South (Table A-7) were updated and dispatched.
- Removed several SPP Network Upgrades associated with SPP prior queued withdrawn projects. Added SPP R PLAN "BUILD GENTLEMAN - CHERRY COUNTY - HOLT 345kV". Power mismatch was balanced by scaling generation in SPP market (Table A-13) based on the load-ratio share of the TO power flow modeling areas.

- Removed withdrawn AECI prior queued generation projects GIA-99, GIA-100, GIA-105, GIA-106, GIA-107. AECI prior queued generation projects (Table A-7) were modeled. Power mismatch was balanced by scaling generation in AECI (Table A-14).
- Several prior queued Network Upgrades were added (Table A-8)
- Removed recently retired MISO generation in MISO South area. These recently retired MISO South generation are listed in Table A-9. Power mismatch was balanced by scaling generation in the MISO South (Table A-12).
- Removed recently retired MISO generation in MISO Central area. These recently retired generation projects in MISO Central are listed in Table A-10. Power mismatch was balanced by scaling generation in the MISO North (Table A-11).
- Turned off MISO generation projects in DPP 2021 Central area due to their lower queue positions. Power mismatch was balanced by scaling generation in the MISO North (Table A-11).
- Added the SPP Study Projects with offline status in DISIS 2023-001 cycles close to MISO South. The SPP Study Projects in MISO South are listed in Table ES-1.

1.1.1.2 MISO South AFSIS Study Cases

Summer peak (SPK) study case was created by dispatching the Study Projects in MISO South at the specified summer peak level from the benchmark case.

Summer shoulder (SH) study case was created by dispatching the Study Projects in MISO South at the specified summer shoulder level from the benchmark case.

Generation in the SPP market was used for power balance, where SPP generation was scaled based on the load-ratio share of the TO power flow modeling areas.

Both study and benchmark power flow cases were solved with transformer tap adjustment enabled, area interchange disabled, phase shifter adjustment enabled and switched shunt adjustment enabled.

1.1.1.3 Fictitious Shunt Capacitors and SVCs in SPP System

Due to low voltages in SPP system, several fictitious SVCs (Table 1-1) were added in summer peak study case only. The summer shoulder study case does not have these fictitious SVCs.

Table 1-1: Fictitious SVCs in SPP System Modeled in SPK Study Case Only

Bus	MISO South AFS on DISIS 2023-001 Peak Model
G23-086-TAP (773700)	±200 MVAR (study only)
WWRDEHV7 (515375)	±1000 MVAR (study only)
IRONWOOD WF (539815)	±500 MVAR (study only)
G23-110-TAP (774180)	±500 MVAR (study only)
CLARKCOUNTY7 (539800)	±500 MVAR (study only)
S.OTTWA5 (543066)	±150 MVAR (study only)
POTTER_CO 6 (523959)	±900 MVAR (study only)

1.1.2 MISO South Region AFSIS Contingency Criteria

The following contingencies were considered in the MISO South AFSIS analysis:

- NERC Category P0 (system intact - no contingencies)
- NERC Category P1 contingencies
  - Single element outages, at buses with a nominal voltage of 60 kV and above.
  - Multiple-element NERC Category P1 contingencies.
  - NERC Category P2, P4, P5, P7 contingencies.

The detailed list of contingency files is in Appendix A.10

For all contingency and post-disturbance analyses, cases were solved with transformer tap adjustment enabled, area interchange adjustment disabled, phase shifter adjustment disabled (fixed) and switched shunt adjustment enabled.

1.1.3 MISO South Region AFSIS Monitored Elements

The MISO South AFSIS study area is defined in Table 1-2. Facilities in the study area were monitored for system intact and contingency conditions. Under NERC category P0 conditions (system intact), branches were monitored for loading above the normal (PSS®E rate A) rating, and bus voltages were monitored based on normal voltage limits associated with each bus in power flow case. Under NERC category P1-P7 conditions, branches were monitored for loading as shown in the column labeled "Post-Disturbance Thermal Limits", and bus voltages were monitored based on emergency voltage limits associated with each bus in power flow case.

Table 1-2: MISO South AFSIS Monitored Elements

Owner / Area	Thermal Limits [1]	
	Pre-Disturbance	Post-Disturbance
EES	100% of Rate A	100% of Rate B
CLECO	100% of Rate A	100% of Rate B
SMEPA	100% of Rate A	100% of Rate B
LAFA	100% of Rate A	100% of Rate B
LAGN	100% of Rate A	100% of Rate B
LEPA	100% of Rate A	100% of Rate B

Notes

1: PSS®E Rate A, Rate B or Rate C

1.2 MISO West Model Development and Study Criteria

1.2.1 MISO West Region AFSIS Model Development

Summer peak and summer shoulder steady state models and stability packages used for MISO AFSIS on SPP DISIS 2023-001 Study Projects in MISO West were developed from the Phase 2 models used in MISO West AFSIS on SPP DISIS-2022-001 Cycle, which were originally developed from the MISO DPP 2021 West Phase 2 models and stability packages.

The starting models used for developing MISO West AFSIS models on DISIS 2023-001 Study are listed below:

- 2026 summer peak model: DISIS-2022-001_AFSIS-West-2026SUM-Ph2-Study_250130.sav
- 2026 summer shoulder model: DISIS-2022-001_AFSIS-West-2026SHHW-Ph2-Study_250130.sav

1.2.1.1 MISO West AFSIS Benchmark Cases

The benchmark cases for the MISO West AFSIS study were created as follows:

- Removed recently withdrawn MISO West and Central prior queued generation projects (Table B-1). Power mismatch was balanced by scaling generation in the MISO North (Table A-11).
- Removed recently withdrawn SPP prior queued generation projects (Table B-2). Power mismatch was balanced by scaling generation in SPP market (Table A-13) based on the load-ratio share of the TO power flow modeling areas.
- SPP prior queued generation projects (Table B-3) were modeled. SPP DISIS 2022-001 generation projects in MISO West (Table B-4) were updated and dispatched.
- Removed several SPP Network Upgrades associated with SPP prior queued withdrawn projects. Added SPP R PLAN "BUILD GENTLEMAN - CHERRY COUNTY - HOLT 345kV". Power mismatch was balanced by scaling generation in SPP market (Table A-13) based on the load-ratio share of the TO power flow modeling areas
- Network Upgrades for prior queued projects and MTEP Appendix A projects were added into the models (Table B-5). Partial of Network Upgrades for MPC04300 were also added into the models, with most of them only added in the summer shoulder cases (Table B-6).
- MPC prior queued generation projects (Table B-7) were modeled. Power mismatch was balanced by scaling generation in the MISO North (Table A-11) except generation in Dakotas.
- Removed withdrawn AECI prior queued generation projects GIA-99, GIA-100, GIA-105, GIA-106, GIA-107. AECI prior queued generation projects (Table B-8) were modeled. Power mismatch was balanced by scaling generation in AECI (Table A-14).
- Removed recently retired MISO generation in MISO West and Central areas. These recently retired MISO West and Central generation are listed in Table B-9. Power mismatch was balanced by scaling generation in the MISO North (Table A-11).
- Turned off MISO generation projects in DPP 2021 Central area due to their lower queue positions. Power mismatch was balanced by scaling generation in the MISO North (Table A-11).

- Added the SPP Study Projects with offline status in DISIS 2023-001 cycles close to MISO West. The SPP Study Projects in MISO West are listed in Table ES-2.

1.2.1.2 MISO West AFSIS Study Cases

Summer peak (SPK) study case was created by dispatching the Study Projects in MISO West at the specified summer peak level from the benchmark case.

Summer shoulder (SH) study case was created by dispatching the Study Projects in MISO West at the specified summer shoulder level from the benchmark case.

Generation in the SPP market was used for power balance, where SPP generation was scaled based on the load-ratio share of the TO power flow modeling areas.

Due to potential voltage collapse in SPP system, several fictitious SVCs in SPP were added to the models. Several 345 kV line reactors were also switched off. These changes are listed in Table B-10.

Both study and benchmark power flow cases were solved with transformer tap adjustment enabled, area interchange disabled, phase shifter adjustment enabled and switched shunt adjustment enabled.

1.2.2 MISO West Region AFSIS Contingency Criteria

The following contingencies were considered in the MISO West AFSIS analysis:

- NERC Category P0 (system intact - no contingencies)
- NERC Category P1 contingencies
  - Single element outages, at buses with a nominal voltage of 60 kV and above.
  - Multiple-element NERC Category P1 contingencies.
  - NERC Category P2, P4, P5, P7 contingencies.

The detailed list of contingency files is in Appendix B.8.

For all contingency and post-disturbance analyses, cases were solved with transformer tap adjustment enabled, area interchange adjustment disabled, phase shifter adjustment disabled (fixed) and switched shunt adjustment enabled.

1.2.3 MISO West Region AFSIS Monitored Elements

The MISO West AFSIS study area is defined in Table 1-3. Facilities in the study area were monitored for system intact and contingency conditions. Under NERC category P0 conditions (system intact), branches were monitored for loading above the normal (PSS®E rate A) rating, and bus voltages were monitored based on normal voltage limits associated with each bus in power flow case. Under NERC category P1-P7 conditions, branches were monitored for loading as shown in the column labeled "Post-Disturbance Thermal Limits", and bus voltages were monitored based on emergency voltage limits associated with each bus in power flow case.

Table 1-3: MISO West AFSIS Monitored Elements

Owner / Area	Thermal Limits [1]	
	Pre-Disturbance	Post-Disturbance
AMIL	100% of Rate A	100% of Rate B
AMMO	100% of Rate A	100% of Rate B
BEPC-MISO	100% of Rate A	100% of Rate B
CMMPA	100% of Rate A	100% of Rate B
CWLD	100% of Rate A	100% of Rate B
CWLP	100% of Rate A	100% of Rate B
DPC	100% of Rate A	100% of Rate B
GLH	100% of Rate A	100% of Rate B
GRE	100% of Rate A	100% of Rate B
ITCM	100% of Rate A	100% of Rate B
MDU	100% of Rate A	100% of Rate B
MEC	100% of Rate A	100% of Rate B
MMPA	100% of Rate A	100% of Rate B
MP	100% of Rate A	100% of Rate B
MPW	100% of Rate A	100% of Rate B
MRES	100% of Rate A	100% of Rate B
OTP	100% of Rate A	100% of Rate B
PPI	100% of Rate A	100% of Rate B
RPU	100% of Rate A	100% of Rate B
SIPC	100% of Rate A	100% of Rate B
SMMPA	100% of Rate A	100% of Rate B
WPPI	100% of Rate A	100% of Rate B
XEL	100% of Rate A	100% of Rate B

Notes

1: PSS®E Rate A, Rate B or Rate C

1.3 MISO Steady State Performance Criteria

A branch is considered as a thermal injection constraint if the branch is loaded above its applicable normal or emergency rating for the post-change case, and any of the following conditions are met:

1) the generator (NR/ER) has a larger than 20% DF on the overloaded facility under post contingent condition or 5% DF under system intact condition, or

2) the megawatt impact due to the generator is greater than or equal to 20% of the applicable rating (normal or emergency) of the overloaded facility, or
3) the overloaded facility or the overload-causing contingency is at generator's outlet, or
4) for any other constrained facility, where none of the study generators meet one of the above criteria in 1), 2), or 3), however, the cumulative megawatt impact of the group of study generators (NR/ER) is greater than 20% of the applicable rating, then only those study generators whose individual MW impact is greater than 5% of the applicable rating and has DF greater than 5% (OTDF or PTDF) will be responsible for mitigating the cumulative MW impact constraint.

A bus is considered a voltage constraint if both of the following conditions are met. All voltage constraints must be resolved before a project can receive interconnection service.

1) the bus voltage is outside of applicable normal or emergency limits for the post-change case, and
2) the change in bus voltage is greater than 0.01 per unit.

All Study Projects must mitigate thermal injection constraints and voltage constraints in order to obtain unconditional Interconnection Service.

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Section

2

MISO South Affected System Study

Steady state thermal and voltage analysis and transient stability analysis were performed in the MISO South AFSIS study.

2.1 MISO South AFSIS Thermal and Voltage Analysis

Nonlinear (AC) contingency analysis was performed on the benchmark and study cases, and the incremental impact of the SPP DISIS 2023-001 Study Projects in MISO South were evaluated by comparing the steady-state performance of the transmission system in the benchmark and study cases. Network upgrades were identified to mitigate any steady state thermal and voltage constraints.

Steady-state analysis was performed in summer peak and summer shoulder discharging scenarios. PSS®E version 34.9.3 and PSS®MUST version 12.4.0 were used in the study.

2.1.1 MISO Contingency Analysis for 2026 Summer Peak Condition

Steady state AC contingency analysis was performed on the MISO South AFSIS summer peak (SPK) study and benchmark cases developed in Section 1.1.1. The 2026 summer peak MISO thermal and voltage results are in Appendix C.1.

2.1.1.1 Summer Peak System Intact Conditions

For NERC category P0 (system intact) conditions, thermal constraints are listed in Table C-1, and voltage constraints are listed in Table C-2.

2.1.1.2 Summer Peak Post Contingency Conditions

The results in this Section are for analysis of conditions following NERC category P1-P7 contingencies.

For P1 contingencies, thermal constraints are listed in Table C-3, and voltage constraints are listed in Table C-4.

For P2-P7 contingencies, thermal constraints are listed in Table C-5, and voltage constraints are listed in Table C-6.

2.1.1.3 Summary of Summer Peak Results

In summer peak scenario, MISO South AFSIS worst thermal constraints are listed in Table 2-1, and MISO South AFSIS worst voltage constraints are listed in Table 2-2.

Table 2-1: Summer Peak MISO South AFSIS Thermal Constraints, Maximum Screened Loading

Generator	Constraint	Rating	Owner	Worst Loading		Contingency	Cont Type
				(MVA)	(%)		
GEN-2023-204	Rocky Creek 345-230 kV xfmr	500.0	EES	503.3	100.7	CEII Redacted	P1
GEN-2023-204	Rocky Creek 345-230 kV xfmr	500.0	EES	503.3	100.7	CEII Redacted	P2-P7
GEN-2023-135, GEN-2023-151, GEN-2023-204, GEN-2023-212	Couch-Lewisville 115 kV	159.0	EES-EAI	258.4	162.5	CEII Redacted	P1
GEN-2023-204, GEN-2023-212	Couch-Lewisville 115 kV	159.0	EES-EAI	266.8	167.8	CEII Redacted	P2-P7
GEN-2023-151	Murfreesboro - G23-151 Tap 138 kV	114.0	EES-EAI AEPW	151.4	132.8	CEII Redacted	P0
GEN-2023-151, GEN-2023-204	Murfreesboro - G23-151 Tap 138 kV	114.0	EES-EAI AEPW	175.7	154.1	CEII Redacted	P1
GEN-2023-151, GEN-2023-204	Murfreesboro - G23-151 Tap 138 kV	114.0	EES-EAI AEPW	180.5	158.3	CEII Redacted	P2-P7
GEN-2023-151	Murfreesboro 138-115-13.8 kV xfmr	150.0	EES-EAI	169.3	112.9	CEII Redacted	P1
GEN-2023-151	Murfreesboro 138-115-13.8 kV xfmr	150.0	EES-EAI	172.8	115.2	CEII Redacted	P2-P7

Generator	Constraint	Rating	Owner	Worst Loading		Contingency	Cont Type
				(MVA)	(%)		
GEN-2023-151	Amity-Murfreesboro E. 138 kV	98.0	EES-EAI	142.0	144.9	CEII Redacted	P0
GEN-2023-151, GEN-2023-204	Amity-Murfreesboro E. 138 kV	98.0	EES-EAI	165.6	169.0	CEII Redacted	P1
GEN-2023-151, GEN-2023-204	Amity-Murfreesboro E. 138 kV	98.0	EES-EAI	170.3	173.8	CEII Redacted	P2-P7
GEN-2023-132	Sans Souci-Driver 500 kV	2598.0	EES-EAI	2828.1	108.9	CEII Redacted	P1
GEN-2023-132	Sans Souci-Driver 500 kV	2598.0	EES-EAI	2899.8	111.6	CEII Redacted	P2-P7
GEN-2023-132	Driver-Sandy Bayou 500 kV	2575.0	EES-EAI	2626.6	102.0	CEII Redacted	P2-P7
GEN-2023-135, GEN-2023-151, GEN-2023-204, GEN-2023-212	Lewisville-Patmos 115 kV	159.0	EES-EAI AECC	283.8	178.5	CEII Redacted	P1
GEN-2023-204, GEN-2023-212	Lewisville-Patmos 115 kV	159.0	EES-EAI AECC	292.3	183.8	CEII Redacted	P2-P7

Generator	Constraint	Rating	Owner	Worst Loading		Contingency	Cont Type
				(MVA)	(%)		
GEN-2023-135, GEN-2023-151, GEN-2023-204, GEN-2023-212	Patmos-Fulton 115 kV	159.0	EES-EAI AEPW AECC	287.2	180.6	CEII Redacted	P1
GEN-2023-204, GEN-2023-212	Patmos-Fulton 115 kV	159.0	EES-EAI AEPW AECC	295.7	186.0	CEII Redacted	P2-P7

Table 2-2: Summer Peak MISO South AFSIS Voltage Constraints, Worst Voltages

Bus			Owner	Vlow	Vhi	Benchmark	StudyCase	Delta (> 0.01 p.u.)	Contingency Details	Cont Type
						VCONT	VCONT			
334028	7GRIMES%	345	EES	0.975	1.05	0.9889	0.9588	-0.0301	CEII Redacted	P0
334028	7GRIMES%	345	EES	0.95	1.05	0.9496	0.9034	-0.046	CEII Redacted	P1
334028	7GRIMES%	345	EES	0.95	1.05	0.9624	0.9172	-0.0452	CEII Redacted	P2-P7
334029	7FRONTR	345	EES	0.975	1.05	0.9889	0.9588	-0.0301	CEII Redacted	P0
334029	7FRONTR	345	EES	0.95	1.05	0.9496	0.9034	-0.046	CEII Redacted	P1

Bus			Owner	Vlow	Vhi	Benchmark	StudyCase	Delta (> 0.01 p.u.)	Contingency Details	Cont Type
						VCONT	VCONT			
334029	7FRONTR	345	EES	0.95	1.05	0.9624	0.9172	-0.0452	CEII Redacted	P2-P7
334197	7ROCKYCRK%	345	EES	0.975	1.05	0.9880	0.9556	-0.0324	CEII Redacted	P0
334197	7ROCKYCRK%	345	EES	0.95	1.05	0.9456	0.8943	-0.051	CEII Redacted	P1
334197	7ROCKYCRK%	345	EES	0.95	1.05	0.9595	0.9104	-0.0491	CEII Redacted	P2-P7

2.1.2 MISO Contingency Analysis for 2026 Summer Shoulder Condition

Steady state AC contingency analysis was performed on the MISO South AFSIS summer shoulder (SH) study and benchmark cases developed in Section 1.1.1. The 2026 summer shoulder MISO thermal and voltage results are in Appendix C.2.

2.1.2.1 Summer Shoulder System Intact Conditions

For NERC category P0 (system intact) conditions, no thermal constraints (Table C-7) or voltage constraints (Table C-8) were identified.

2.1.2.2 Summer Shoulder Post Contingency Conditions

The results in this Section are for analysis of conditions following NERC category P1-P7 contingencies.

For P1 contingencies, no thermal constraints (Table C-9) or voltage constraints (Table C-10) were identified.

For P2-P7 contingencies, no thermal constraints (Table C-11) or voltage constraints (Table C-12) were identified.

2.1.2.3 Summary of Summer Shoulder Results

In summer shoulder scenario, no thermal or voltage constraints were identified in the MISO South steady state analysis for the SPP Study Projects.

2.1.3 Summary of MISO South AFSIS Steady State Analysis

MISO South steady state analyses were performed on the MISO 2026 summer peak and summer shoulder scenarios. The steady state thermal constraints and required Network Upgrades are listed in Table 2-3, and the voltage constraints and required Network Upgrades are listed in

Table 2-3: MISO South AFSIS Thermal Constraints and Network Upgrades

Generator	Constraint	Owner	Mitigation	Cost ($)
GEN-2023-204	Rocky Creek 345-230 kV xfmr	EES	Upgrade to 550MVA rating	$32,000,000
GEN-2023-135, GEN-2023-151, GEN-2023-204, GEN-2023-212	Couch-Lewisville 115 kV	EES-EAI	Rebuild 9.1 miles of the line, post upgrade rating 299 MVA	$14,380,000
GEN-2023-151, GEN-2023-204	Murfreesboro - G23-151 Tap 138 kV	EES-EAI AEPW	Entergy: Only Entergy upgrade would be a line bay riser at Murfreesboro South. $270,000 AEPW: Rebuild approximatly 8.6 miles of 138 kV line between G23-151 Tap 138 kV and AEP's connection with Entergy at Murfreesboro. $19.78M	$20,050,000

Generator	Constraint	Owner	Mitigation	Cost ($)
GEN-2023-151	Murfreesboro 138-115-13.8 kV xfmr	EES-EAI	Upgrade to 200 MVA rating	$15,000,000
GEN-2023-151, GEN-2023-204	Amity-Murfreesboro E. 138 kV	EES-EAI	Rebuild 14.3 miles of the line, post upgrade rating 176MVA, $26,050,000. DISIS-2022-001 Phase 2 AFS NUs	$0
GEN-2023-132	Sans Souci-Driver 500 kV	EES-EAI	New Substation (tapping in Driver - Sandy Bayou and Dell - Sancy Souci) with New Line to Sandy Bayou, $50M. DPP-2021 Upgrade	$0
GEN-2023-132	Driver-Sandy Bayou 500 kV	EES-EAI	New Substation (tapping in Driver - Sandy Bayou and Dell - Sancy Souci) with New Line to Sandy Bayou, $50M. DPP-2021 Upgrade	$0
GEN-2023-135, GEN-2023-151, GEN-2023-204, GEN-2023-212	Lewisville-Patmos 115 kV	EES-EAI AECC	EES: Rebuild 10.4 miles of the line, post upgrade rating 320MVA. $15,060,000 AECC: Bus upgrade at Patmos - $500,000 (~400MVA post-mitigation rating).	$15,560,000
GEN-2023-135, GEN-2023-151, GEN-2023-204, GEN-2023-212	Patmos-Fulton 115 kV	EES-EAI AEPW AECC	Entergy: Upgrade 4.3 miles of the line to 319MVA rating. $5,560,000 AEPW: Rebuild 7.1 miles of 115 kV line between AEP's connection with AECC and AEP's connection with Entergy. $16,330,000 AECC: Bus upgrade at Patmos, station upgrades at Fulton, rebuild the 3.61 mile AECC owned section of the 115kV line from Patmos to Fulton - $11.5M total for all upgrades (~400MVA post-mitigation rating for all AECC facilities).	$33,390,000

Table 2-4: MISO South AFSIS Voltage Constraints and Network Upgrades

Constraints	Network Upgrades	Owner	Cost ($)
Low voltages at Grimes, Frontier, Rock Creek 345 kV buses	300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000

2.2 MISO South AFSIS Transient Stability Analysis

Stability analysis was performed to evaluate transient stability and impact on the MISO South region of the SPP Study Projects in MISO South.

2.2.1 Procedure

2.2.1.1 Computer Programs

Stability analysis was performed using TSAT revision 23.0.

2.2.1.2 Methodology

Stability package representing 2026 summer peak (SPK) and summer shoulder (SH) scenarios with SPP DISIS 2023-001 Study Projects in MISO South was created from stability package used in MISO South AFSIS on SPP DISIS-2022-001 Phase 2 Cycle. Power flow models are the same as steady state power flow models, which were developed in Section 1.1.1.

Disturbances were simulated to evaluate the transient stability and impact on the region of the SPP Study Projects in MISO South. MISO transient stability criteria and local TOs' planning criteria specified in MTEP21 were adopted for checking stability violations.

2.2.2 Model Development

Summer peak and summer shoulder stability power flow models are the same as the correspondent steady state models, which were developed as specified in Section 1.1.1. As mentioned in Section 1.1.1.3, several fictitious SVCs (Table 1-1) were added in SPP system in summer peak study case due to low voltages in SPP system. The summer shoulder study case does not have these fictitious SVCs.

Due to low voltages in other areas in SPP system and stringent voltage requirements in stability study, additional SVCs (Table 2-5) were further added to the summer peak stability case.

Table 2-5: Additional Fictitious SVCs in SPP System Modeled in SPK Stability Case Only

Bus	MISO South AFS on DISIS 2023-001 Peak Model
PECULR 7 (541198)	±900 MVAR (study only)
SEDEAST5 (541241)	±130 MVAR (study only)
PRINGLE 6 (523267)	±200 MVAR (study only)
DGRASSE7 (515852)	±600 MVAR (study only)
POSTROCK7 (530583)	±500 MVAR (study only)
NRIMWND7 (515818)	±400 MVAR (study only)
O.K.U.-7 (511456)	±150 MVAR (study only)

In summary, Table 2-6 lists all fictitious SVCs added in the summer peak study power flow case for stability study.

Table 2-6: All Fictitious SVCs in SPP System Modeled in SPK Stability Case Only

Bus	MISO South AFS on DISIS 2023-001 Peak Model
G23-086-TAP (773700)	±200 MVAR (study only)
WWRDEHV7 (515375)	±1000 MVAR (study only)
IRONWOOD WF (539815)	±500 MVAR (study only)
G23-110-TAP (774180)	±500 MVAR (study only)
CLARKCOUNTY7 (539800)	±500 MVAR (study only)
S.OTTWA5 (543066)	±150 MVAR (study only)
POTTER_CO 6 (523959)	±900 MVAR (study only)
PECULR 7 (541198)	±900 MVAR (study only)
SEDEAST5 (541241)	±130 MVAR (study only)
PRINGLE 6 (523267)	±200 MVAR (study only)
DGRASSE7 (515852)	±600 MVAR (study only)
POSTROCK7 (530583)	±500 MVAR (study only)
NRIMWND7 (515818)	±400 MVAR (study only)
O.K.U.-7 (511456)	±150 MVAR (study only)

Dynamic models of “SVSMO3U2” were added to all these fictitious SVCs (Table 2-6) in the summer peak stability package to mitigate voltage oscillations and increase power damping.

2.2.3 Disturbance Criteria

The stability simulations performed as part of this study considered all the regional and local contingencies listed in Table 2-7. Regional contingencies with pre-defined switching sequences were selected from the MISO MTEP21 study; switching sequences for local contingencies were developed based on the generic clearing times shown in Table 2-8. The admittance for local single line-to-ground (SLG) faults were estimated by assuming that the Thevenin impedance of the positive, negative and zero sequence networks at the fault point are equal.

Table 2-7: MISO South AFSIS Regional and Local Disturbance Descriptions

CEII Redacted

Table 2-8: Generic Clearing Time Assumption

Voltage Level (kV)	Primary Clearing Time (cycle)	Backup Clearing Time (cycle)
345 kV	4	11
230 kV	5	13
161/138 kV	6	18
115 kV	6	20
69 kV	8	24

2.2.4 Performance Criteria

MISO transient stability criteria and local TOs' planning criteria specified in MTEP21 were adopted. The Study Projects must mitigate the stability constraints to obtain any type of Interconnection Service.

2.2.5 Summer Peak Stability Analysis

The contingencies listed in Table 2-7 were simulated using the summer peak stability model. The summer peak stability model was developed from the summer peak steady state model. As mentioned in Section 2.2.2, multiple fictitious SVCs (Table 2-6) were added in SPP system in summer peak study case due to low voltages in SPP system. Their associated dynamic models of "SVSMO3U2" were also added in the summer peak stability package.

2.2.6 Summer Peak Stability Results

The contingencies listed in Table 2-7 were simulated using the summer peak stability model.

Appendix D.1.2 contains plots of generator rotor angles, generator power output, and bus voltages for each simulation. Simulations were performed with a 0.5 seconds steady-state run followed by the appropriate disturbance. Simulations were run for a 10-second duration.

MISO South AFSIS summer peak stability study results summary is in Appendix D.1.1, Table D-1.

Under all the simulated faults, all simulations are transiently stable, transient period voltage criteria are met, oscillations are damped. No stability constraints were identified.

2.2.6.1 Stability Network Upgrades Identified in Summer Peak

In summary, no MISO Affected System stability constraints were identified in the summer peak scenario. No MISO AFSIS stability NUs are required in summer peak stability study.

2.2.7 Summer Shoulder Stability Analysis

The contingencies listed in Table 2-7 were simulated using the summer shoulder stability model. The summer shoulder stability model was developed from the summer shoulder steady state model. No fictitious SVCs were added in the summer shoulder study case.

2.2.8 Summer Shoulder Stability Results

The contingencies listed in Table 2-7 were simulated using the summer shoulder stability model.

Appendix D.2.2 contains plots of generator rotor angles, generator power output, and bus voltages for each simulation. Simulations were performed with a 0.5 seconds steady-state run followed by the appropriate disturbance. Simulations were run for a 10-second duration.

MISO South AFSIS summer shoulder stability study results summary is in Appendix D.2.1, Table D-2.

The following stability related issues were identified in the summer shoulder stability study.

2.2.8.1 Generation Tripping Due to Low Voltages / Instability

Under two NERC Category P6 contingencies (Table 2-9), several local generators were tripped due to instability and/or low voltages. These local generators have more than 1200 MW power flowing through two or three step-down transformers after the fault. The same local generators were also tripped due to instability and/or low voltages under the same contingencies in the benchmark model. Therefore, the SPP Study Projects in MISO South are not responsible for the local generation tripping.

Table 2-9: Local Generation Tripping Due to Instability / Low Voltages

CEII Redacted

2.2.8.2 Active Power Oscillation of GEN-2023-086 (BESS portion)

Under contingencies listed in Table 2-10, active power oscillations at GEN-2023-086 battery portion were observed. The actual reason for the oscillation is unknown. The GEN-2023-086 generation project is responsible for fixing this issue. Since the oscillation is caused by the study project GEN-2023-086 battery portion, MISO AFSIS Network Upgrades are not required.

Table 2-10: Active Power Oscillation of GEN-2023-086 (BESS portion)

CEII Redacted

2.2.8.3 Stability Network Upgrades Identified in Summer Shoulder

In summary, no MISO Affected System stability constraints were identified in the summer shoulder scenario. Active power oscillations at GEN-2023-086 battery portion were caused by GEN-2023-086 battery portion itself. The GEN-2023-086 generation project is responsible

for fixing this issue. No MISO AFSIS stability NUs are required in summer shoulder stability study.

2.2.9 Summary of MISO South AFSIS Transient Stability Analysis

Based on the MISO South 2026 summer peak and summer shoulder transient stability analysis, no MISO South AFSIS stability NUs are required for the SPP Study Projects in MISO South.

Section

3

MISO West Affected System Study

Steady state thermal and voltage analysis and transient stability analysis were performed in the MISO West AFSIS study.

3.1 MISO West AFSIS Thermal and Voltage Analysis

Nonlinear (AC) contingency analysis was performed on the benchmark and study cases, and the incremental impact of the SPP DISIS 2023-001 Study Projects in MISO West were evaluated by comparing the steady-state performance of the transmission system in the benchmark and study cases. Network upgrades were identified to mitigate any steady state thermal and voltage constraints.

Steady-state analysis was performed in summer peak and summer shoulder discharging scenarios. PSS®E version 34.9.3 and PSS®MUST version 12.4.0 were used in the study.

3.1.1 MISO Contingency Analysis for 2026 Summer Peak Condition

Steady state AC contingency analysis was performed on the MISO West AFSIS summer peak (SPK) study and benchmark cases developed in Section 1.2.1. The 2026 summer peak MISO thermal and voltage results are in Appendix E.1.

3.1.1.1 Summer Peak System Intact Conditions

For NERC category P0 (system intact) conditions, no thermal constraints (Table E-1) were identified. Voltage constraints are listed in Table E-2.

3.1.1.2 Summer Peak Post Contingency Conditions

The results in this Section are for analysis of conditions following NERC category P1-P7 contingencies.

For P1 contingencies, thermal constraints are listed in Table E-3 and voltage constraints are listed in Table E-4.

For P2-P7 contingencies, no thermal constraints (Table E-5) were identified. Voltage constraints are listed in Table E-6.

3.1.1.3 Summer Peak Worst Constraints

In the 2026 summer peak scenario, MISO West AFSIS worst thermal constraints are listed in Table 3-1, and MISO West AFSIS worst voltage constraints are listed in Table 3-2.

Table 3-1: Summer Peak MISO West AFSIS Thermal Constraints, Maximum Screened Loading

Generator	Constraint	Rating	Owner	Worst Loading		Contingency	Cont Type
				(MVA)	(%)		
GEN-2023-085	Harrison East-Summit 161 kV	162.0	EES-EAI	168.9	104.2	CEII Redacted	P1

Table 3-2: Summer Peak MISO West AFSIS Voltage Constraints, Worst Voltages

Bus			Owner	Vlow	Vhi	Benchmark	StudyCase	Delta (> 0.01 p.u.)	Contingency Details	Cont Type
						VCONT	VCONT			
337677	3MT IDA	115	EES-EAI	0.95	1.05	0.9809	0.9477	-0.0332	CEII Redacted	P0
344257	5CAMDEN UE	161	Ameren	0.93	1.075	0.9759	0.9047	-0.0712	CEII Redacted	P1
344400	5GALENA	161	Ameren	0.95	1.075	0.9673	0.9425	-0.0248	CEII Redacted	P2-P7
345511	5PILTKBUE 1	161	Ameren	0.93	1.075	0.9456	0.9265	-0.0191	CEII Redacted	P1
345512	5PILTKBUE 2	161	Ameren	0.93	1.075	0.9456	0.9265	-0.0191	CEII Redacted	P1

3.1.1.4 Summary of Summer Peak Results

In the summer peak scenario, Table 3-3 lists MISO West AFSIS thermal constraints and Network Upgrades, and Table 3-4 lists MISO West AFSIS voltage constraints and Network Upgrades.

Table 3-3: MISO West AFSIS Thermal Constraints and Network Upgrades in Summer Peak Scenario

Generator	Constraint	Owner	Mitigation	Cost ($)
GEN-2023-085	Harrison East-Summit 161 kV	EES-EAI	upgrade the line to 216/216 MVA rating	$29,730,000

Table 3-4: MISO West AFSIS Thermal Constraints and Network Upgrades in Summer Peak Scenario

Constraints	Network Upgrades	Owner	Cost ($)
Low voltage at Mt Ida 115 kV bus	Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000
Low voltage at Camden 161 kV bus	DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	Ameren	$0
Low voltages in area of Pilot Knob 161 kV	27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000

3.1.2 MISO Contingency Analysis for 2026 Summer Shoulder Condition

3.1.2.1 Voltage Collapses under Multiple Contingencies

Under multiple contingencies listed in Table 3-5, voltage collapses were identified in the summer shoulder scenario. Mitigations are not required for contingencies not converged in both benchmark and study cases. For contingencies causing voltage collapses in the study case but not in the benchmark case, mitigations are required. Because voltage collapses were identified in Jamestown 345 kV and Alexandria 345 kV areas, MISO LRTP-1 project “Jamestown – Ellendale” and MISO LRTP-2 project “Big Stone South - Alexandria - Cassie's Crossing” are proposed as mitigation.

With MISO LRTP-1 and LRTP-2 projects, no voltage collapses or severe voltage violations were identified in both summer shoulder benchmark and study cases.

Table 3-5: Voltage collapses under Multiple Contingencies

CEII Redacted

3.1.2.2 Summer Shoulder AC Contingency Analysis

The summer shoulder benchmark and study cases were updated to include the LRTP-1 and LRTP-2 projects, which are listed in Table 3-6.

Table 3-6: LRTP Projects Required in Summer Shoulder Scenario

Project	Description
LRTP-1	Jamestown - Ellendale
LRTP-2	Big Stone South - Alexandria - Cassie's Crossing

Steady state AC contingency analysis was performed on the updated summer shoulder cases to determine if there are any additional constraints that require mitigation. The 2026 summer shoulder MISO thermal and voltage results are in Appendix E.2.

3.1.2.3 Summer Shoulder System Intact Conditions

For NERC category P0 (system intact) conditions, thermal constraints are listed in Table E-7. No voltage constraints were identified (Table E-8).

3.1.2.4 Summer Shoulder Post Contingency Conditions

The results in this Section are for analysis of conditions following NERC category P1-P7 contingencies.

For P1 contingencies, thermal constraints are listed in Table E-9, and voltage constraints are listed in Table E-10.

For P2-P7 contingencies, no thermal constraints were identified (Table E-11). Voltage constraints are listed in Table E-12.

3.1.2.5 Summer Shoulder Worst Constraints

In the 2026 summer shoulder scenario, MISO West AFSIS worst thermal constraints are listed in Table 3-7, and MISO West AFSIS worst voltage constraints are listed in Table E-13.

Table 3-7: 2026 Summer Shoulder MISO West AFSIS Thermal Constraints, Maximum Screened Loading

Generator	Constraint	Rating	Owner	Worst Loading		Contingency	Cont Type
				(MVA)	(%)		
GEN-2023-170	J976 POI-Enon Tap 345 kV	956.0	Ameren	1136.9	118.9	CEII Redacted	P0
GEN-2023-170	J976 POI-Montgomery 345 kV	956.0	Ameren	1136.9	118.9	CEII Redacted	P0
GEN-2023-062, GEN-2023-097, GEN-2023-182	MPC4300 New Sub-Buffalo 345 kV	956.0	OTP	1035.9	108.4	CEII Redacted	P0
GEN-2023-105, GEN-2023-182	MPC4300 New Sub-Buffalo 345 kV	1042.0	OTP	1082.2	103.9	CEII Redacted	P1
GEN-2023-062, GEN-2023-097	Bison-Buffalo 345 kV	1042.0	XEL OTP	1091.8	104.8	CEII Redacted	P0
GEN-2023-062, GEN-2023-097, GEN-2023-105, GEN-2023-182	Bison-Buffalo 345 kV	1042.0	XEL OTP	1137.4	109.2	CEII Redacted	P1
GEN-2023-062, GEN-2023-105, GEN-2023-182	Sheyenne-Lake Park 230 kV	300.8	XEL OTP	401.1	133.4	CEII Redacted	P1
GEN-2023-062, GEN-2023-105, GEN-2023-182	Audubon-Lake Park 230 kV	293.6	OTP	393.5	134.0	CEII Redacted	P1
GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218,	Raun - Gen-2018-043 POI 345 kV	956.0	MEC OPPD	1049.5	109.8	CEII Redacted	P1
GEN-2023-105, GEN-2023-182	Glenham-Campbell 230 kV	210.0	MDU WAPA	304.3	144.9	CEII Redacted	P1

3.1.2.6 Summary of Summer Shoulder Results

In the summer shoulder scenario with LRTP-1 and LRTP-2 projects included (Table 3-6), Table 3-8 lists MISO West AFSIS thermal constraints and Network Upgrades, and Table 3-9 lists MISO West AFSIS voltage constraints and Network Upgrades.

Table 3-8: MISO West AFSIS Thermal Constraints and Network Upgrades in Summer Shoulder Scenario

Generator	Constraint	Owner	Mitigation	Cost ($)
GEN-2023-170	J976 POI-Enon Tap 345 kV	Ameren	upgraded by internal projects: SN/SE: 1836 / 2091MVA	$0
GEN-2023-170	J976 POI-Montgomery 345 kV	Ameren	DPP19 Central Upgrade: Upgrade 0.02 mi 345 kV line conductor from MTGY to Str 326 on MTGY-BELU-6 to be 3000 A, upgrade the Mongomery line position to be 3000A, $600,000. No Cost to DISIS-2023-001	$0
GEN-2023-062, GEN-2023-097, GEN-2023-105, GEN-2023-182	MPC4300 New Sub-Buffalo 345 kV	OTP	OTP: Replace wavetrap with rating > 1042.0 MVA Upgrade on MPC facilities not required in this study	$100,000
GEN-2023-062, GEN-2023-097, GEN-2023-105, GEN-2023-182	Bison-Buffalo 345 kV	XEL OTP MPC	OTP: limited by MPC equipment, upgrade on MPC equipment not required from this study. $0 XEL: The line from Bison to Buffalo terminates in the Minnkota side of the sub. All XEL facilities at Bison are rated at 3000A. No XEL upgrade needed	$0
GEN-2023-062, GEN-2023-105, GEN-2023-182	Sheyenne-Lake Park 230 kV	XEL OTP	XEL:the Xcel portion of the Sheyenne – Lake Park 230kV line and sub is rated to 460.54/506.6 MVA, no upgrade needed. $0 OTP:DPP-2021 West Phase 2 Upgrade: Reconductor/rebuild to 796.7/876.4MVA rating, $35M	$0
GEN-2023-062, GEN-2023-105, GEN-2023-182	Audubon-Lake Park 230 kV	OTP	OTP:DPP-2021 West Phase 2 Upgrade: Reconductor/rebuild to 796.7/876.4MVA rating $10M	$0
GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218,	Raun - Gen-2018-043 POI 345 kV	MEC OPPD	MEC: No MEC mitigation required. Existing MEC only rating is 1195 MVA. OPPD equipment is the limit. OPPD:Structure replacements on the line. $3,720,909, currently assigned to DISIS-2018-002/2019-001 cluster in MISO AFS for DISIS-2018-002/2019-001 Phase 3	$0
GEN-2023-105, GEN-2023-182	Glenham-Campbell 230 kV	MDU WAPA	MDU: no upgrade on MDU facilities needed, MDU limiting element is 319MVA/351MVA,Normal/Emergency WAPA: Rebuild the existing CAMPBELL 4 to	$0

Generator	Constraint	Owner	Mitigation	Cost ($)
			GLENHAM4 230 kV line (14 miles) to a standard rating of 796 MVA, $12,369,126,currently assigned to DPP21 from SPP AFS	

Table 3-9: MISO West AFSIS Voltage Constraints and Network Upgrades in Summer Shoulder Scenario

Constraints	Network Upgrades	Owner	Cost ($)
Low voltages in area of Blue Lake, McLeod	4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	MRES	$0
Low voltages in area of Mapleton 115 kV	1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000
Low voltages in area of Big Stone 345 kV	3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000
Low voltages in area of Alexandria 345 kV	2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000
Low voltages in areas of Oaks, Forman, Hankinson, Wahpeton, Fergus Falls 230 kV	3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000
Low voltages in areas of Audubon, Erie Jct 230 kV	3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000
Low voltages in areas of Buffalo, Maple River 345 kV	1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000

3.1.3 Summary of MISO West AFSIS Steady State Analysis

MISO West steady state analyses were performed on the MISO 2026 summer peak and summer shoulder scenarios. Due to voltage collapse in Jamestown and Alexandria areas in summer shoulder scenario, MISO LRTP projects listed in Table 3-10 are required Network Upgrades in summer shoulder scenario. The additional steady state thermal constraints and required Network Upgrades are listed in Table 3-11, and additional voltage constraints and required Network Upgrades are listed in Table 3-12.

Table 3-10: LRTP Projects Required in MISO West Summer Shoulder Scenario

Project	Description
LRTP-1	Jamestown - Ellendale
LRTP-2	Big Stone South - Alexandria - Cassie's Crossing

Table 3-11: MISO West AFSIS Thermal Constraints and Network Upgrades

Constraint	Owner	Scenario	Mitigation	Cost ($)
J976 POI-Enon Tap 345 kV	Ameren	SH	upgraded by internal projects: SN/SE: 1836 / 2091MVA	$0
J976 POI-Montgomery 345 kV	Ameren	SH	DPP19 Central Upgrade: Upgrade 0.02 mi 345 kV line conductor from MTGY to Str 326 on MTGY-BELU-6 to be 3000 A, upgrade the Mongomery line position to be 3000A, $600,000. No Cost to DISIS-2023-001	$0
MPC4300 New Sub-Buffalo 345 kV	OTP	SH	OTP: Replace wavetrap with rating > 1042.0 MVA Upgrade on MPC facilities not required in this study	$100,000
Harrison East-Summit 161 kV	EES-EAI	SPK	upgrade the line to 216/216 MVA rating	$29,730,000
Bison-Buffalo 345 kV	XEL OTP MPC	SH	OTP: limited by MPC equipment, upgrade on MPC equipment not required from this study. $0 XEL: The line from Bison to Buffalo terminates in the Minnkota side of the sub. All XEL facilities at Bison are rated at 3000A. No XEL upgrade needed	$0
Sheyenne-Lake Park 230 kV	XEL OTP	SH	XEL:the Xcel portion of the Sheyenne – Lake Park 230kV line and sub is rated to 460.54/506.6 MVA, no upgrade needed. $0 OTP:DPP-2021 West Phase 2 Upgrade: Reconductor/rebuild to 796.7/876.4MVA rating, $35M	$0
Audubon-Lake Park 230 kV	OTP	SH	OTP:DPP-2021 West Phase 2 Upgrade: Reconductor/rebuild to 796.7/876.4MVA rating $10M	$0
Raun - Gen-2018-043 POI 345 kV	MEC OPPD	SH	MEC: No MEC mitigation required. Existing MEC only rating is 1195 MVA. OPPD equipment is the limit. OPPD:Structure replacements on the line. $3,720,909, currently assigned to DISIS-2018-002/2019-001 cluster in MISO AFS for DISIS-2018-002/2019-001 Phase 3	$0
Glenham-Campbell 230 kV	MDU WAPA	SH	MDU: no upgrade on MDU facilities needed, MDU limiting element is 319MVA/351MVA,Normal/Emergency WAPA: Rebuild the existing CAMPBELL 4 to GLENHAM4 230 kV line (14 miles) to a standard rating of 796 MVA, $12,369,126,currently assigned to DPP21 from SPP AFS	$0

Table 3-12: MISO West AFSIS Voltage Constraints and Network Upgrades

Constraints	Network Upgrades	Owner	Scenario	Cost ($)
Low voltage at Mt Ida 115 kV bus	Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	SPK	$4,500,000
Low voltage at Camden 161 kV bus	DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	Ameren	SPK	$0
Low voltages in area of Pilot Knob 161 kV	27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	SPK	$2,100,000
Low voltages in area of Blue Lake, McLeod	4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	MRES	SH	$0
Low voltages in area of Mapleton 115 kV	1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	SH	$1,750,000
Low voltages in area of Big Stone 345 kV	3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	SH	$10,750,000
Low voltages in area of Alexandria 345 kV	2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	SH	$11,900,000
Low voltages in areas of Oaks, Forman, Hankinson, Wahpeton, Fergus Falls 230 kV	3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	SH	$10,750,000
Low voltages in areas of Audubon, Erie Jct 230 kV	3x40MVAR MSC at Audubon 230 kV (620336)	OTP	SH	$10,250,000
Low voltages in areas of Buffalo, Maple River 345 kV	1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	SH	$4,250,000

3.2 MISO West AFSIS Transient Stability Analysis

Stability analysis was performed to evaluate transient stability and impact on the MISO West region of the SPP Study Projects in MISO West.

3.2.1 Procedure

3.2.1.1 Computer Programs

Stability analysis was performed using TSAT revision 24.0.

3.2.1.2 Methodology

Stability package representing 2026 summer peak (SPK) and summer shoulder (SH) scenarios with SPP DISIS 2023-001 Study Projects in MISO West was created from stability package used in MISO West AFSIS on SPP DISIS-2022-001 Phase 2 Cycle. Power flow models are the same as steady state power flow models, which were developed in Section

1.2.1. Summer shoulder power flow case includes the LRTP-1 and LRTP-2 projects, which are listed in Table 3-6.

Disturbances were simulated to evaluate the transient stability and impact on the region of the SPP Study Projects in MISO West. MISO transient stability criteria and local TOs' planning criteria specified in MTEP21 were adopted for checking stability violations.

3.2.2 Model Development

Summer peak and summer shoulder stability power flow models are the same as the correspondent steady state models, which were developed as specified in Section 1.2.1. As mentioned in Section 3.1.2.1, MISO LRTP-1 project "Jamestown – Ellendale" and MISO LRTP-2 project "Big Stone South - Alexandria - Cassie's Crossing" were added in the summer shoulder case.

Due to low voltages in other areas in SPP system and stringent voltage requirements in stability study, additional SVCs (Table 3-13) were further added to the summer shoulder stability case.

Table 3-13: Additional Fictitious SVCs in SPP System Modeled in SH Stability Case Only

Bus	MISO West AFS on DISIS 2023-001 Shoulder Model
AXTELL 3 (640065)	±500 MVAR
POSTROCK7 (530583)	±500 MVAR

3.2.3 Disturbance Criteria

The stability simulations performed as part of this study considered all the regional and local contingencies listed in Table 3-14. Regional contingencies with pre-defined switching sequences were selected from the MISO MTEP21 study; switching sequences for local contingencies were developed based on the generic clearing times shown in Table 2-8. The admittance for local single line-to-ground (SLG) faults were estimated by assuming that the Thevenin impedance of the positive, negative and zero sequence networks at the fault point are equal.

Table 3-14: MISO West AFSIS Regional and Local Disturbance Descriptions

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3.2.4 Performance Criteria

MISO transient stability criteria and local TOs' planning criteria specified in MTEP21 were adopted. The Study Projects must mitigate the stability constraints to obtain any type of Interconnection Service.

3.2.5 Summer Peak Stability Results

The contingencies listed in Table 3-14 were simulated using the summer peak stability model. The summer peak stability model was developed from the summer peak steady state model. As mentioned in Section 1.2.1.2, several fictitious SVCs were added and several 345 kV line reactors were also switched off (Table B-10) due to potential voltage collapse in SPP system.

Appendix F.1.2 contains plots of generator rotor angles, generator power output, and bus voltages for each simulation. Simulations were performed with a 0.5 seconds steady-state run followed by the appropriate disturbance. Simulations were run for a 10-second duration.

MISO West AFSIS summer peak stability study results summary is in Appendix F.1.1, Table F-1.

The following stability related issues were identified in the summer peak stability study.

3.2.5.1 Transient Instability of GEN-2023-222 and GEN-2023-223

Under one contingency listed in Table 3-15, GEN-2023-222 and GEN-2023-223 were tripped due to their transient instability. There was more than 700 MW from GEN-2023-222 and GEN-2023-223 flew into one 345-115-13.8 kV transformer. Generators of GEN-2023-222 and GEN-2023-223 lost synchronism after the fault was cleared. GEN-2023-222 and GEN-2023-223 are responsible for mitigating this instability issue. No MISO AFSIS NU is required.

Table 3-15: Transient Instability of GEN-2023-222 and GEN-2023-223

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3.2.5.2 Transient Low Voltage Recovery

Under two contingencies listed in Table 3-16, post contingency voltages in areas of Adrian (541240) and Butler (301342) are below 0.9 per unit. The post-fault low voltage recovery issue is not related to MISO system. GEN-2023-087 project is responsible for mitigating this transient low voltage recovery issue. No MISO AFSIS NU is required.

Table 3-16: Transient Low Voltage Recovery in Summer Peak

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3.2.6 Stability Network Upgrades Identified in Summer Peak

In summary, no MISO Affected System stability constraints were identified in the summer peak scenario. GEN-2023-222 and GEN-2023-223 projects are responsible for mitigating the generator tripping due to their transient instability. GEN-2023-087 project is responsible for mitigating the transient low voltage recovery issue in areas of Adrian (541240) and Butler (301342).

3.2.7 Summer Shoulder Stability Analysis

The contingencies listed in Table 3-14 were simulated using the summer shoulder stability model.

Due to voltage collapses identified in the stability study, summer shoulder stability study includes two stages. Stage-1 stability study is to identify all the voltage collapse issues and develop mitigation plan to resolve these voltage collapse issues. Stage-2 stability study is to identify additional stability issues after inclusion of the mitigation plan developed in Stage-1 study.

3.2.7.1 Stage-1 Stability Results for Summer Shoulder Stability Analysis

Under multiple contingencies listed in Table 3-17, voltage collapses were identified in the Stage-1 summer shoulder stability study.

Table 3-17: Voltage Collapse in Stage-1 Stability Study

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With numerous testing, it was identified that following Network Upgrades in Table 3-18 can completely mitigate the voltage collapse issues listed in Table 3-17. These Network Upgrades are either MTEP Appendix A project or prior queued Network Upgrades required in DPP 2021 West Phase 2 study.

Table 3-18: Prior Queued Network Upgrades Required for Mitigating Voltage Collapse

Network Upgrade	Study Cycle
Add LRTP 1.3 (Iron Range - Benton County (615318) - Cassie's Crossing (604999))	MTEP Appendix A
Add 3 x 100 MVAr MSC at Monticello 345 kV (601010)	DPP 2021 West Phase 2 study
Add 100 MVAr STATCOM at Alexandria 345 kV (658047)	DPP 2021 West Phase 2 study
Add 150 MVAr STATCOM at Wahpeton 230 kV (620329)	DPP 2021 West Phase 2 study
Add ±50 MVAr STATCOM at Audubon 230 (620336)	DPP 2021 West Phase 2 study
Add 150 MVAr STATCOM at Winger 230 kV (657758)	DPP 2021 West Phase 2 study
Add 250 MVAr STATCOM at Coon Creek 345 kV (601019)	DPP 2021 West Phase 2 study
Add 150 MVAr STATCOM at Cassies Crossing 345 kV (604999)	DPP 2021 West Phase 2 study
Add 200 MVAr STATCOM at Kohlman Lake 345 kV (601021)	DPP 2021 West Phase 2 study

3.2.7.2 Stage-2 Stability Results for Summer Shoulder Stability Analysis

Prior queued Network Upgrades identified in Stage-1 summer shoulder stability study are listed in Table 3-18. These prior queued Network Upgrades are added to the stability package to create Stage-2 summer shoulder stability package.

Stage-2 summer shoulder stability analysis was performed for all the contingencies listed in Table 3-14. Appendix F.2.2 contains plots of generator rotor angles, generator power output, and bus voltages for each simulation. Simulations were performed with a 0.5 seconds steady-state run followed by the appropriate disturbance. Simulations were run for a 10-second duration.

MISO West AFSIS summer shoulder Stage-2 stability study results summary is in Appendix F.2.1, Table F-2.

The following stability related issues were identified in the Stage-2 summer shoulder stability study.

Transient Low Voltage Recovery

Under two contingencies listed in Table 3-19, post contingency voltages in areas of Adrian (541240) and Butler (301342) are below 0.9 per unit. The post-fault low voltage recovery issue is not related to MISO system. GEN-2023-087 project is responsible for mitigating this transient low voltage recovery issue. No MISO AFSIS NU is required.

Table 3-19: Transient Low Voltage Recovery in Summer Shoulder

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3.2.7.3 Stability Network Upgrades Identified in Summer Shoulder

In summary, Network Upgrades in Table 3-18 are additional Network Upgrades for stability constraints identified in summer shoulder study case. All these Network Upgrades are either MTEP Appendix A project or prior queued Network Upgrades required in DPP 2021 West Phase 2 study. Study projects in DISIS-2023-001 West group are not responsible for costs of these Network Upgrades.

GEN-2023-087 project is responsible for mitigating the transient low voltage recovery issue in areas of Adrian (541240) and Butler (301342).

3.2.8 Summary of MISO West AFSIS Transient Stability Analysis

Based on the MISO West 2026 summer peak transient stability analysis, no MISO Affected System stability constraints were identified in the summer peak scenario. GEN-2023-222 and GEN-2023-223 projects are responsible for mitigating the generator tripping due to their transient instability. GEN-2023-087 project is responsible for mitigating the transient low voltage recovery issue in areas of Adrian (541240) and Butler (301342).

Based on the MISO West 2026 summer shoulder transient stability analysis, transient stability violations were identified in the summer shoulder scenario. All these identified stability violations can be mitigated by MTEP Appendix A project or prior queued Network Upgrades (Table 3-18) required in DPP 2021 West Phase 2 study. The study projects in DISIS-2023-001 West group are not responsible for costs of these Network Upgrades. The transient low voltage recovery issue in areas of Adrian (541240) and Butler (301342) should be mitigated by GEN-2023-087 project.

Section

4

Contingent Facilities

4.1 Contingent Facilities in MISO South

No contingent MTEP facilities were identified for the SPP Study Projects in MISO South. However, contingent prior queue upgrades are identified.

Table 4-1: Contingent Facility and Conditional Projects in MISO South

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
N/A	N/A	Rebuild 14.3 miles of the line, post upgrade rating 176MVA, $26,050,000.	DISIS-2022-001 Phase 2 AFS NUs	N/A	N/A	GEN-2023-151, GEN-2023-204
N/A	N/A	New Substation (tapping in Driver - Sandy Bayou and Dell - Sancy Souci) with New Line to Sandy Bayou, $50M.	DPP-2021 Upgrade	N/A	N/A	GEN-2023-132
N/A	N/A	New Substation (tapping in Driver - Sandy Bayou and Dell - Sancy Souci) with New Line to Sandy Bayou, $50M.	DPP-2021 Upgrade	N/A	N/A	GEN-2023-132

4.2 Contingent Facilities in MISO West

Table 4-2 describes transmission assumptions modeled in the studies that were deemed necessary to mitigate the thermal and voltage violations identified in the study.

For the study projects that are required to mitigate thermal violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit was provided to the project through MISO Annual ERIS process.

Table 4-2: Contingent Facility and Conditional Projects in MISO West

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
13621	MTEP18	Norfork - Southland 161kV: Rebuild line	Rebuild this line and upgrade all station equipment to a minimum of 1300 Amps.	M2 - Appendix A Approved	6/1/2026	GEN-2023-085
13622	MTEP18	Southland - Mt. Home 161kV: Rebuild line	Rebuild the line and upgrade all station equipment to a minimum of 1300 Amps.	M2 - Appendix A Approved	6/1/2026	GEN-2023-085
16490	MTEP21	Granville SS, Control House and Relay Replacement and Asset Renewal	345kV Project Scope • Replace 4 1970-vintage Westinghouse 3450-GW-25000 oil breakers • Replace 7 disconnect switches 138kV Project Scope • Replace 7 1969-vintage Westinghouse 1380-GM-15000 oil breakers • Replace 2 underground HPFF lines with overhead and retire pump house at Granville and East Granville Terminal General Project Scope • Reconfigure 345kV bus to 6-position ring (5 positions plus one future position) • Vacate existing control house, transfer ownership to We Energies, obtain new high-security control house • Replace all relays and SCADA with current standard • Address planning-identified need for redundant bus differential protection • Expand yard to accommodate ring bus	M3 - Under Construction	6/15/2026	GEN-2023-097
23368	MTEP21	LRTP-01: Jamestown – Ellendale 27040-Jamestown 345 kV-Ellendale 345	Construct new 345kV single circuit transmission line	M2 - Appendix A Approved	12/31/2028	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085,

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
						GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
23369	MTEP21	LRTP-02: Big Stone South – Alexandria – Big Oaks (Cassie's Crossing) 27044-Big Stone South 345 kV- 27045-Big Stone South 345 kV-Alexandria 345kV 27046-Alexandria 345kV- 27047-Alexandria 345kV-Outside Monticello Substation 27048-Outside Monticello Substation-Big Oaks (Cassie's Crossing) 27049-Big Oaks (Cassie's Crossing)- 27050-Big Oaks (Cassie's Crossing)-	Install single circuit 345kV transmission line from existing Big Stone South Substation, to the existing Alexandria Substation (constructed with double circuit capable 345kV structures), to the new Big Oaks Substation (Cassie's Crossing).	M2 - Appendix A Approved	6/1/2030	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
23370	MTEP21	LRTP-03: Iron Range - Benton County - Cassie's Crossing	Install double circuit 345kV transmission line from the existing Iron Range Substation, to the existing Benton Country Substation, to the new Big Oaks Substation (Cassie's Crossing)	M2 - Appendix A Approved	6/1/2030	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085,

Contingent Facilities

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
						GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Add 3 x 100 MVAr MSC at Monticello 345 kV (601010)	MISO DPP 2021 West Phase 2 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Add 100 MVAr STATCOM at Alexandria 345 kV (658047)	MISO DPP 2021 West Phase 2 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105,

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
						GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Add 150 MVAr STATCOM at Wahpeton 230 kV (620329)	MISO DPP 2021 West Phase 2 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Add ±50 MVAr STATCOM at Audubon 230 (620336)	MISO DPP 2021 West Phase 2 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105,

Contingent Facilities

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
						GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Add 150 MVAr STATCOM at Winger 230 kV (657758)	MISO DPP 2021 West Phase 2 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Add 250 MVAr STATCOM at Coon Creek 345 kV (601019)	MISO DPP 2021 West Phase 2 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116,

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
						GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Add 150 MVAr STATCOM at Cassies Crossing 345 kV (604999)	MISO DPP 2021 West Phase 2 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Add 200 MVAr STATCOM at Kohlman Lake 345 kV (601021)	MISO DPP 2021 West Phase 2 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116,

Contingent Facilities

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
						GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153, GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231
NA	NA	Upgrade 0.02 mi 345 kV line conductor from MTGY to Str 326 on MTGY-BELU-6 to be 3000 A, upgrade the Mongomery line position to be 3000A, $600,000. No Cost to DISIS-2023-001	DPP19 Central Upgrade	NA	NA	GEN-2023-170
NA	NA	Reconductor/rebuild Audubon-Lake Park 230 kV to 796.7/876.4MVA rating	OTP: DPP-2021 West Phase 2 Upgrade:	NA	NA	GEN-2023-062, GEN-2023-105, GEN-2023-182
NA	NA	Raun - Gen-2018-043 POI 345 kV OPPD structure replacement	MISO AFS DISIS-2018-002/2019-001 Phase 3 upgrade	NA	NA	GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218,
NA	NA	Rebuild the existing CAMPBELL 4 toGLENHAM4 230 kV line (14 miles) to a standard rating of 796 MVA,	Assigned to DPP21 Phase 2 from SPP AFS	NA	NA	GEN-2023-105, GEN-2023-182
NA	NA	4x40 MVAr MSC at McLeod 230 (658276).	MISO AFS DISIS-2018-002/2019-001 Phase 3 upgrade	NA	NA	GEN-2023-006, GEN-2023-011, GEN-2023-012, GEN-2023-023, GEN-2023-033, GEN-2023-036, GEN-2023-037, GEN-2023-050, GEN-2023-061, GEN-2023-062, GEN-2023-065, GEN-2023-073, GEN-2023-082, GEN-2023-085, GEN-2023-097, GEN-2023-105, GEN-2023-107, GEN-2023-116, GEN-2023-117, GEN-2023-133, GEN-2023-149, GEN-2023-153,

MTEP ID	MTEP Cycle	Project Name	Description	Status	Expected ISD	Conditional Projects
						GEN-2023-169, GEN-2023-170, GEN-2023-171, GEN-2023-172, GEN-2023-182, GEN-2023-199, GEN-2023-216, GEN-2023-217, GEN-2023-218, GEN-2023-231

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Section

5

Network Upgrades and Cost Allocation

5.1 Cost Assumptions for Network Upgrades

The cost estimate for each network upgrade was provided by the corresponding transmission owning company.

5.2 Cost Allocation Methodology

Costs of AFSIS Network Upgrades are allocated based on MISO Network Upgrade cost allocation methodology, which is detailed in the MISO Generation Interconnection Business Practices Manual BPM-015.

5.3 MISO South AFSIS Network Upgrades Required for the SPP Study Projects in MISO South

5.3.1 MISO South AFSIS Network Upgrades

Based on the MISO South 2026 summer peak and summer shoulder steady state analysis, thermal constraints and voltage constraints were identified in MISO system for the SPP Study Projects in MISO South.

Based on the MISO South 2026 summer peak transient stability analysis, no MISO Affected System stability constraints were identified in the summer peak scenario. No MISO AFSIS stability NUs are required in summer peak stability study

Based on the MISO South 2026 summer shoulder transient stability analysis, no MISO Affected System stability constraints were identified in the summer shoulder scenario. Active power oscillations at GEN-2023-086 battery portion were caused by GEN-2023-086 battery portion itself. The GEN-2023-086 generation project is responsible for fixing this issue. No MISO AFSIS stability NUs are required in summer shoulder stability study.

A short circuit screening analysis was conducted by comparing three phase fault currents in the benchmark and study cases for the SPP Study Projects in MISO South. Based on the screening results, MISO Transmission Owners do not plan to conduct additional studies.

Based on Entergy's feedback, an Affected System Facilities Study for protection system upgrades at the Entergy South Murfreesboro 138 kV station will be needed if GEN-2023-151 proceeds to the next phase.

Contingent facilities were identified for the SPP Study Projects in MISO South, as listed in Section 4.1.

The total costs of MISO South AFSIS Network Upgrades for SPP Study Projects in MISO South are summarized in Table 5-1.

It should be noted that a restudy may be required if significant changes to the study assumptions occur, including but not limited to, interconnection request withdrawals and/or changes to higher-queued Network Upgrades included in the Base Case.

For the study projects that are required to mitigate thermal violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit is provided to the project through MISO Annual ERIS process.

For projects that are required to mitigate voltage violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit is provided to the project through MISO Annual ERIS process.

Table 5-1: Summary of MISO South AFSIS Network Upgrades

Category of Network Upgrades	Cost ($)
Thermal Network Upgrades Identified in MISO Steady-State Analysis	$130,380,000
Voltage Network Upgrades Identified in MISO Steady-State Analysis	$51,000,000
Network Upgrades Identified in Stability Analysis	$0
Network Upgrades Identified in Short Circuit Analysis	$0
Total	**$181,380,000**

MISO South AFSIS Network Upgrades for SPP Study Projects in MISO South are listed below.

Table 5-2: MISO South Thermal NUs and Cost

Constraint	Owner	Mitigation	Cost ($)
Rocky Creek 345-230 kV xfmr	EES	Upgrade to 550MVA rating	$32,000,000
Couch-Lewisville 115 kV	EES-EAI	Rebuild 9.1 miles of the line, post upgrade rating 299 MVA	$14,380,000
Murfreesboro - G23-151 Tap 138 kV	EES-EAI AEPW	Entergy: Only Entergy upgrade would be a line bay riser at Murfreesboro South. $270,000 AEPW: Rebuild approximatly 8.6 miles of 138 kV line between G23-151 Tap 138 kV and AEP's connection with Entergy at Murfreesboro. $19.78M	$20,050,000
Murfreesboro 138-115-13.8 kV xfmr	EES-EAI	Upgrade to 200 MVA rating	$15,000,000
Amity-Murfreesboro E. 138 kV	EES-EAI	Rebuild 14.3 miles of the line, post upgrade rating 176MVA, $26,050,000. DISIS-2022-001 Phase 2 AFS NUs	$0

Constraint	Owner	Mitigation	Cost ($)
Sans Souci-Driver 500 kV	EES-EAI	New Substation (tapping in Driver - Sandy Bayou and Dell - Sancy Souci) with New Line to Sandy Bayou, $50M. DPP-2021 Upgrade	$0
Driver-Sandy Bayou 500 kV	EES-EAI	New Substation (tapping in Driver - Sandy Bayou and Dell - Sancy Souci) with New Line to Sandy Bayou, $50M. DPP-2021 Upgrade	$0
Lewisville-Patmos 115 kV	EES-EAI AECC	EES: Rebuild 10.4 miles of the line, post upgrade rating 320MVA. $15,060,000 AECC: Bus upgrade at Patmos - $500,000 (~400MVA post-mitigation rating).	$15,560,000
Patmos-Fulton 115 kV	EES-EAI AEPW AECC	Entergy: Upgrade 4.3 miles of the line to 319MVA rating. $5,560,000 AEPW: Rebuild 7.1 miles of 115 kV line between AEP's connection with AECC and AEP's connection with Entergy. $16,330,000 AECC: Bus upgrade at Patmos, station upgrades at Fulton, rebuild the 3.61 mile AECC owned section of the 115kV line from Patmos to Fulton - $11.5M total for all upgrades (~400MVA post-mitigation rating for all AECC facilities).	$33,390,000

Table 5-3: MISO South Steady-State Voltage NUs and Cost

Constraints	Network Upgrades	Owner	Cost ($)
Low voltages at Grimes, Frontier, Rock Creek 345 kV buses	300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000

Table 5-4: MISO South Transient Stability NUs and Cost

Network Upgrades	Owner	Cost ($)
No MISO AFS stability NUs		$0

Table 5-5: MISO South Short Circuit Network Upgrades

NUs	Cost ($)
No short circuit NUs	$0

Table 5-6: MISO South Interconnection Facility Upgrades

Network Upgrades	Owner	Cost ($)
Protection Upgrades at Entergy S. Murfreesboro 138 kV station, driven by GEN-2023-151	EES	TBD

5.3.2 MISO South AFSIS NU Cost Allocation

The calculated Distribution Factor (DF) results, voltage impact, and MW contribution on each MISO South Affected System constraint are in Appendix G.1.1. The cost allocation for each NU is calculated based on the contribution of each generating facility, as detailed in Appendix G.1.2.

Assuming all generation projects in the SPP Study Projects in MISO South advance, a summary of the costs for total MISO South AFSIS NUs allocated to each generation project is listed in Table 5-7.

Table 5-7: Summary of MISO South AFSIS NU Costs Allocated to the SPP South Study Projects

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-001	$439,655	$0	$0	$439,655
GEN-2023-005	$571,552	$0	$0	$571,552
GEN-2023-009	$1,626,724	$0	$0	$1,626,724
GEN-2023-010	$131,897	$0	$0	$131,897
GEN-2023-022	$175,862	$0	$0	$175,862
GEN-2023-027	$395,690	$0	$0	$395,690
GEN-2023-028	$615,517	$0	$0	$615,517
GEN-2023-030	$131,897	$0	$0	$131,897
GEN-2023-035	$703,448	$0	$0	$703,448
GEN-2023-038	$879,310	$0	$0	$879,310
GEN-2023-049	$395,690	$0	$0	$395,690
GEN-2023-055	$263,793	$0	$0	$263,793
GEN-2023-056	$263,793	$0	$0	$263,793
GEN-2023-057	$483,621	$0	$0	$483,621
GEN-2023-059	$1,934,483	$0	$0	$1,934,483
GEN-2023-060	$571,552	$0	$0	$571,552
GEN-2023-063	$395,690	$0	$0	$395,690
GEN-2023-064	$395,690	$0	$0	$395,690

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-069	$483,621	$0	$0	$483,621
GEN-2023-075	$87,931	$0	$0	$87,931
GEN-2023-076	$43,966	$0	$0	$43,966
GEN-2023-081	$1,318,966	$0	$0	$1,318,966
GEN-2023-086	$879,310	$0	$0	$879,310
GEN-2023-088	$43,966	$0	$0	$43,966
GEN-2023-092	$791,379	$0	$0	$791,379
GEN-2023-100	$923,276	$0	$0	$923,276
GEN-2023-102	$1,406,897	$0	$0	$1,406,897
GEN-2023-110	$659,483	$0	$0	$659,483
GEN-2023-123	$131,897	$0	$0	$131,897
GEN-2023-132	$43,966	$0	$0	$43,966
GEN-2023-134	$131,897	$0	$0	$131,897
GEN-2023-135	$2,413,798	$0	$0	$2,413,798
GEN-2023-138	$87,931	$0	$0	$87,931
GEN-2023-142	$615,517	$0	$0	$615,517
GEN-2023-151	$32,358,361	$0	$0	$32,358,361
GEN-2023-158	$703,448	$0	$0	$703,448
GEN-2023-164	$747,414	$0	$0	$747,414
GEN-2023-165	$747,414	$0	$0	$747,414
GEN-2023-167	$923,276	$0	$0	$923,276
GEN-2023-168	$659,483	$0	$0	$659,483
GEN-2023-174	$615,517	$0	$0	$615,517
GEN-2023-176	$87,931	$0	$0	$87,931
GEN-2023-177	$791,379	$0	$0	$791,379
GEN-2023-180	$263,793	$0	$0	$263,793
GEN-2023-183	$527,586	$0	$0	$527,586
GEN-2023-188	$571,552	$0	$0	$571,552
GEN-2023-193	$2,550,000	$0	$0	$2,550,000
GEN-2023-195	$527,586	$0	$0	$527,586
GEN-2023-201	$615,517	$0	$0	$615,517

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-203	$615,517	$0	$0	$615,517
GEN-2023-204	$86,410,784	$0	$0	$86,410,784
GEN-2023-205	$659,483	$0	$0	$659,483
GEN-2023-206	$87,931	$0	$0	$87,931
GEN-2023-210	$659,483	$0	$0	$659,483
GEN-2023-211	$747,414	$0	$0	$747,414
GEN-2023-212	$22,166,885	$0	$0	$22,166,885
GEN-2023-213	$263,793	$0	$0	$263,793
GEN-2023-227	$2,286,207	$0	$0	$2,286,207
GEN-2023-228	$703,448	$0	$0	$703,448
GEN-2023-229	$131,897	$0	$0	$131,897
GEN-2023-230	$1,362,931	$0	$0	$1,362,931
GEN-2023-236	$835,345	$0	$0	$835,345
GEN-2023-237	$175,862	$0	$0	$175,862
GEN-2023-241	$1,143,103	$0	$0	$1,143,103
Total ($)	**$181,380,000**	**$0**	**$0**	**$181,380,000**

5.4 MISO West AFSIS Network Upgrades Required for the SPP Study Projects in MISO West

5.4.1 MISO West AFSIS Network Upgrades

Based on the MISO West 2026 summer peak and summer shoulder steady state analysis, thermal and voltage constraints were identified in MISO system for the SPP Study Projects in MISO West.

Based on the MISO West 2026 summer peak transient stability analysis, no MISO Affected System stability constraints were identified in the summer peak scenario. GEN-2023-222 and GEN-2023-223 projects are responsible for mitigating the generator tripping due to their transient instability. GEN-2023-087 project is responsible for mitigating the transient low voltage recovery issue in areas of Adrian (541240) and Butler (301342).

Based on the MISO West 2026 summer shoulder transient stability analysis, transient stability violations were identified in the summer shoulder scenario. All these identified stability violations can be mitigated by MTEP Appendix A project or prior queued Network Upgrades required in DPP 2021 West Phase 2 study. The study projects in DISIS-2023-001 West group are not responsible for costs of these Network Upgrades. The transient low

voltage recovery issue in areas of Adrian (541240) and Butler (301342) should be mitigated by GEN-2023-087 project.

A short circuit screening analysis was conducted by comparing three phase fault currents in the benchmark and study cases for the SPP Study Projects in MISO West. Based on the screening results, MISO Transmission Owners do not plan to conduct additional studies.

Contingent MTEP facilities and Network Upgrades were identified for the SPP Study Projects in MISO West, as listed in Section 4.2.

The total costs of MISO West AFSIS Network Upgrades for SPP Study Projects in MISO West are summarized in Table 5-8.

Table 5-8: Summary of MISO West AFSIS Network Upgrades

Category of Network Upgrades	Cost ($)
Thermal Network Upgrades Identified in MISO Steady-State Analysis	$29,830,000
Voltage Network Upgrades Identified in MISO Steady-State Analysis	$56,250,000
Network Upgrades Identified in Stability Analysis	$0
Network Upgrades Identified in Short Circuit Analysis	$0
Total	**$86,080,000**

MISO West AFSIS Network Upgrades for SPP Study Projects in MISO West are listed below.

It should be noted that a restudy may be required if significant changes to the study assumptions occur, including but not limited to, interconnection request withdrawals and/or changes to higher-queued Network Upgrades included in the Base Case.

For the study projects that are required to mitigate thermal violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit is provided to the project through MISO Annual ERIS process.

For projects that are required to mitigate voltage or stability violations, the projects should not be allowed to come into service before the required Network Upgrades are in service, unless a MISO restudy removes the mitigation requirement from the project, or an interim limit is provided to the project through MISO Annual ERIS process.

Table 5-9: LRTP Projects Required in MISO West Summer Shoulder Scenario

Project	Description
LRTP-1	Jamestown - Ellendale
LRTP-2	Big Stone South - Alexandria - Cassie's Crossing

Table 5-10: MISO West Thermal NUs and Cost

Constraint	Owner	Mitigation	Cost ($)
J976 POI-Enon Tap 345 kV	Ameren	upgraded by internal projects: SN/SE: 1836 / 2091MVA	$0
J976 POI-Montgomery 345 kV	Ameren	DPP19 Central Upgrade: Upgrade 0.02 mi 345 kV line conductor from MTGY to Str 326 on MTGY-BELU-6 to be 3000 A, upgrade the Mongomery line position to be 3000A, $600,000. No Cost to DISIS-2023-001	$0
MPC4300 New Sub-Buffalo 345 kV	OTP	OTP: Replace wavetrap with rating > 1042.0 MVA Upgrade on MPC facilities not required in this study	$100,000
Harrison East-Summit 161 kV	EES-EAI	upgrade the line to 216/216 MVA rating	$29,730,000
Bison-Buffalo 345 kV	XEL OTP MPC	OTP: limited by MPC equipment, upgrade on MPC equipment not required from this study. $0 XEL: The line from Bison to Buffalo terminates in the Minnkota side of the sub. All XEL facilities at Bison are rated at 3000A. No XEL upgrade needed	$0
Sheyenne-Lake Park 230 kV	XEL OTP	XEL:the Xcel portion of the Sheyenne – Lake Park 230kV line and sub is rated to 460.54/506.6 MVA, no upgrade needed. $0 OTP:DPP-2021 West Phase 2 Upgrade: Reconductor/rebuild to 796.7/876.4MVA rating, $35M	$0
Audubon-Lake Park 230 kV	OTP	OTP:DPP-2021 West Phase 2 Upgrade: Reconductor/rebuild to 796.7/876.4MVA rating $10M	$0
Raun - Gen-2018-043 POI 345 kV	MEC OPPD	MEC: No MEC mitigation required. Existing MEC only rating is 1195 MVA. OPPD equipment is the limit. OPPD:Structure replacements on the line. $3,720,909, currently assigned to DISIS-2018-002/2019-001 cluster in MISO AFS for DISIS-2018-002/2019-001 Phase 3	$0
Glenham-Campbell 230 kV	MDU WAPA	MDU: no upgrade on MDU facilities needed, MDU limiting element is 319MVA/351MVA,Normal/Emergency WAPA:Rebuild the existing CAMPBELL 4 to GLENHAM4 230 kV line (14 miles) to a standard rating of 796 MVA, $12,369,126. currently assigned to DPP21 from SPP AFS	$0

Table 5-11: MISO West Steady-State Voltage NUs and Cost

Constraints	Network Upgrades	Owner	Cost ($)
Low voltage at Mt Ida 115 kV bus	Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000
Low voltage at Camden 161 kV bus	DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	Ameren	$0
Low voltages in area of Pilot Knob 161 kV	27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000
Low voltages in area of Blue Lake, McLeod	4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	MRES	$0
Low voltages in area of Mapleton 115 kV	1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000
Low voltages in area of Big Stone 345 kV	3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000
Low voltages in area of Alexandria 345 kV	2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000
Low voltages in areas of Oaks, Forman, Hankinson, Wahpeton, Fergus Falls 230 kV	3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000
Low voltages in areas of Audubon, Erie Jct 230 kV	3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000
Low voltages in areas of Buffalo, Maple River 345 kV	1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000

Table 5-12: MISO West Transient Stability NUs and Cost

Network Upgrade [1]	Study Cycle	Cost ($) [1]
Add LRTP 1.3 (Iron Range - Benton County (615318) - Cassie's Crossing (604999))	MTEP Appendix A	$0
Add 3 x 100 MVAr MSC at Monticello 345 kV (601010)	DPP 2021 West Phase 2 study	$0
Add 100 MVAr STATCOM at Alexandria 345 kV (658047)	DPP 2021 West Phase 2 study	$0
Add 150 MVAr STATCOM at Wahpeton 230 kV (620329)	DPP 2021 West Phase 2 study	$0
Add ±50 MVAr STATCOM at Audubon 230 (620336)	DPP 2021 West Phase 2 study	$0
Add 150 MVAr STATCOM at Winger 230 kV (657758)	DPP 2021 West Phase 2 study	$0
Add 250 MVAr STATCOM at Coon Creek 345 kV (601019)	DPP 2021 West Phase 2 study	$0
Add 150 MVAr STATCOM at Cassies Crossing 345 kV (604999)	DPP 2021 West Phase 2 study	$0
Add 200 MVAr STATCOM at Kohlman Lake 345 kV (601021)	DPP 2021 West Phase 2 study	$0

Note 1: Network Upgrades' costs are not assigned to DISIS-2023-001 projects

Table 5-13: MISO West Short Circuit Network Upgrades

NUs	Cost ($)
No short circuit NUs	$0

5.4.2 MISO West AFSIS NU Cost Allocation

The calculated Distribution Factor (DF) results, voltage impact, and MW contribution on each MISO West Affected System constraint are in Appendix G.2.1. The cost allocation for each NU is calculated based on the contribution of each generating facility, as detailed in Appendix G.2.2.

Assuming all generation projects in the SPP Study Projects in MISO West advance, a summary of the costs for total MISO West AFSIS NUs allocated to each generation project is listed in Table 5-14.

Table 5-14: Summary of MISO West AFSIS NU Costs Allocated to the SPP West Study Projects

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-006	$568,621	$0	$0	$568,621
GEN-2023-011	$1,378,772	$0	$0	$1,378,772
GEN-2023-012	$1,632,051	$0	$0	$1,632,051
GEN-2023-015	$0	$0	$0	$0
GEN-2023-023	$682,715	$0	$0	$682,715
GEN-2023-032	$62,222	$0	$0	$62,222
GEN-2023-033	$690,492	$0	$0	$690,492
GEN-2023-036	$567,927	$0	$0	$567,927
GEN-2023-037	$689,719	$0	$0	$689,719
GEN-2023-050	$567,618	$0	$0	$567,618
GEN-2023-061	$259,313	$0	$0	$259,313
GEN-2023-062	$2,908,455	$0	$0	$2,908,455
GEN-2023-065	$457,974	$0	$0	$457,974
GEN-2023-073	$765,018	$0	$0	$765,018
GEN-2023-077	$73,889	$0	$0	$73,889
GEN-2023-078	$73,889	$0	$0	$73,889
GEN-2023-079	$77,778	$0	$0	$77,778

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2023-082	$2,926,092	$0	$0	$2,926,092
GEN-2023-085	$30,009,008	$0	$0	$30,009,008
GEN-2023-087	$42,778	$0	$0	$42,778
GEN-2023-097	$6,722,451	$0	$0	$6,722,451
GEN-2023-099	$19,444	$0	$0	$19,444
GEN-2023-105	$4,502,835	$0	$0	$4,502,835
GEN-2023-107	$1,345,090	$0	$0	$1,345,090
GEN-2023-116	$4,362,099	$0	$0	$4,362,099
GEN-2023-117	$2,936,188	$0	$0	$2,936,188
GEN-2023-133	$2,089,213	$0	$0	$2,089,213
GEN-2023-149	$901,765	$0	$0	$901,765
GEN-2023-153	$1,350,524	$0	$0	$1,350,524
GEN-2023-154	$355,139	$0	$0	$355,139
GEN-2023-169	$438,184	$0	$0	$438,184
GEN-2023-170	$374,203	$0	$0	$374,203
GEN-2023-171	$515,904	$0	$0	$515,904
GEN-2023-172	$866,474	$0	$0	$866,474
GEN-2023-182	$7,085,035	$0	$0	$7,085,035
GEN-2023-194	$0	$0	$0	$0
GEN-2023-199	$1,787,902	$0	$0	$1,787,902
GEN-2023-216	$1,601,889	$0	$0	$1,601,889
GEN-2023-217	$1,601,889	$0	$0	$1,601,889
GEN-2023-218	$1,601,889	$0	$0	$1,601,889
GEN-2023-219	$38,889	$0	$0	$38,889
GEN-2023-220	$11,667	$0	$0	$11,667
GEN-2023-221	$11,667	$0	$0	$11,667
GEN-2023-222	$62,222	$0	$0	$62,222
GEN-2023-223	$70,000	$0	$0	$70,000
GEN-2023-224	$62,222	$0	$0	$62,222
GEN-2023-225	$70,000	$0	$0	$70,000
GEN-2023-231	$860,884	$0	$0	$860,884

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
Total ($)	$86,080,000	$0	$0	$86,080,000

Appendix

A

MISO South AFSIS Model Development for Steady-State Analysis

A.1 Recently Withdrawn Prior Queued Projects

Table A-1: Recently Withdrawn MISO South Prior Queued Project

Prj #	Bus Number	Bus Name	Id	Status
J1709	47090	J1709 GEN 0.3850	1	Withdrawn
J1850	48500	J1850 GEN 0.6300	1	Withdrawn
J1857	48570	J1857 GEN1 0.6600	1	Withdrawn
J1857	48571	J1857 GEN2 0.6600	1	Withdrawn
J1871	48710	J1871 GEN 0.6900	1	Withdrawn
J1874	48740	J1874 GEN 0.6900	1	Withdrawn
J1875	48750	J1875 GEN 0.6900	1	Withdrawn
J1906	49060	J1906 GEN 0.8000	1	Withdrawn
J1907	49070	J1907 GEN 0.8000	1	Withdrawn
J1908	49080	J1908 GEN 0.8000	1	Withdrawn
J1991	49910	J1991 GEN 0.6300	1	Withdrawn
J1995	49950	J1995 GEN 0.6600	1	Withdrawn
J1997	49970	J1997 GEN 0.6300	1	Withdrawn
J1999	49990	J1999 GEN 0.6300	1	Withdrawn
J2028	50280	J2028 GEN1 0.6600	1	Withdrawn
J2028	50281	J2028 GEN2 0.6600	1	Withdrawn
J2041	50410	J2041 PV 0.6600	1	Withdrawn
J2041	50411	J2041 BESS 0.6600	1	Withdrawn
J2042	50420	J2042 GEN 0.6500	1	Withdrawn
J2072	50720	J2072 GEN1 0.6300	1	Withdrawn
J2072	50721	J2072 GEN2 0.6000	1	Withdrawn
J2082	50820	J2082 GEN 0.6300	1	Withdrawn

Prj #	Bus Number	Bus Name	Id	Status
J2093	50930	J2093 GEN 0.6300	1	Withdrawn
J2112	51120	J2112 GEN1 0.6300	1	Withdrawn
J2114	51140	J2114 GEN1 0.6300	1	Withdrawn
J2135	51350	J2135 GEN 0.6300	1	Withdrawn
J2138	51380	J2138 GEN 0.6900	1	Withdrawn
J2154	51540	J2154 GEN1 0.6300	1	Withdrawn
J2154	51541	J2154 GEN2 0.6300	1	Withdrawn
J2162	51620	J2162 GEN 0.6300	1	Withdrawn
J2163	51630	J2163 GEN 0.6300	1	Withdrawn
J2169	51690	J2169 GEN 0.6500	1	Withdrawn
J2184	51840	J2184 GEN1 0.6600	1	Withdrawn
J2184	51841	J2184 GEN2 0.6900	1	Withdrawn
J2214	52140	J2214 GEN 0.6300	1	Withdrawn
J2220	52200	J2220 GEN 0.6300	1	Withdrawn
J2231	52310	J2231 GEN 0.6300	1	Withdrawn
J2235	52350	J2235 GEN 0.8000	1	Withdrawn
J2240	52400	J2240 GEN 0.6300	1	Withdrawn
J2242	52420	J2242 GEN1 0.6300	1	Withdrawn
J2242	52421	J2242 GEN2 0.6000	1	Withdrawn
J2244	52440	J2244 GEN 0.6000	1	Withdrawn
J2248	52480	J2248 GEN 0.6000	1	Withdrawn
J2253	52530	J2253 GEN 0.8000	1	Withdrawn
J2257	52570	J2257 GEN 0.6300	1	Withdrawn
J2300	53000	J2300 GEN 0.6300	1	Withdrawn
J2313	53130	J2313 GEN 0.6600	1	Withdrawn

Table A-2: Recently Withdrawn MISO Classic Prior Queued Project

Prj #	Bus Number	Bus Name	Id	Status
J1191	41910	J1191 GEN 0.6000	1	Withdrawn
J1231	42310	J1231 GEN 0.6450	1	Withdrawn
J1877	48770	J1877 GEN 0.6900	B1	Withdrawn
J1960	49600	J1960 GEN 0.6300	S1	Withdrawn
J1976	49760	J1976 GEN 0.6300	B1	Withdrawn
J2000	50000	J2000 GEN 0.6300	S1	Withdrawn
J2016	50160	J2016 GEN 0.6300	B1	Withdrawn
J2039	50390	J2039 GEN1 0.7200	W1	Withdrawn
J2039	50391	J2039 GEN2 0.6900	B1	Withdrawn
J2046	50460	J2046 GEN 0.6300	S1	Withdrawn
J2121	51210	J2121 GEN 0.6300	S1	Withdrawn
J2130	51300	J2130 GEN 0.6600	S1	Withdrawn
J2147	51470	J2147 GEN 0.6300	S1	Withdrawn
J2150	51500	J2150 GEN 0.6600	S1	Withdrawn
J2221	52210	J2221 GEN 0.6300	S1	Withdrawn
J2229	52290	J2229 GEN 0.6300	B1	Withdrawn
J2236	52360	J2236 GEN 0.6300	B1	Withdrawn
J2239	52390	J2239 GEN 0.6300	S1	Withdrawn
J2251	52510	J2251 GEN 0.6300	S1	Withdrawn
J2255	52550	J2255 GEN 0.6300	B1	Withdrawn
J2259	52590	J2259 GEN 0.6600	S1	Withdrawn
J2263	52630	J2263 GEN 0.4340	B1	Withdrawn
J2269	52690	J2269 GEN 0.6600	S1	Withdrawn
J2278	52780	J2278 GEN 0.6000	S1	Withdrawn
J2282	52820	J2282 GEN1 0.6300	S1	Withdrawn
J2282	52821	J2282 GEN2 0.6300	B1	Withdrawn
J2318	53180	J2318 GEN1 0.6300	S1	Withdrawn
J2318	53181	J2318 GEN2 0.6300	B1	Withdrawn

Table A-3: Recently Withdrawn SPP Prior Queued Project

Prj #	Status	Bus Number	Bus Name	Id
GEN-2017-202	WITHDRAWN	761421	G17-202GEN1 0.6900	1
GEN-2018-063	WITHDRAWN	762991	G18-063-GEN10.6000	1
GEN-2018-088	WITHDRAWN	763178	G18-088-GEN10.6600	1
GEN-2019-013	WITHDRAWN	763541	G19-013-GEN10.7200	1
GEN-2019-035	WITHDRAWN	763695	G19-035-GEN10.6300	1
GEN-2020-009	WITHDRAWN	766292	G20-009-GEN10.6600	1
GEN-2020-009	WITHDRAWN	766295	G20-009-GEN20.6600	1
GEN-2020-009	WITHDRAWN	766298	G20-009-GEN30.6600	1
GEN-2020-009	WITHDRAWN	766301	G20-009-GEN40.6600	1
GEN-2020-009	WITHDRAWN	766304	G20-009-GEN50.6600	1
GEN-2020-009	WITHDRAWN	766307	G20-009-GEN60.6600	1
GEN-2020-009	WITHDRAWN	766310	G20-009-GEN70.6600	1
GEN-2020-009	WITHDRAWN	766313	G20-009-GEN80.6600	1
GEN-2020-059	WITHDRAWN	764841	G20-059-GEN10.6300	1
GEN-2020-059	WITHDRAWN	764843	G20-059-GEN20.6300	1
GEN-2020-059	WITHDRAWN	764846	G20-059-GEN30.6300	1
GEN-2020-059	WITHDRAWN	764848	G20-059-GEN40.6300	1
GEN-2020-062	WITHDRAWN	764891	G20-062-GEN10.6300	1
GEN-2020-062	WITHDRAWN	764894	G20-062-GEN20.6300	1
GEN-2020-075	WITHDRAWN	764541	G20-075-GEN10.5200	1
GEN-2021-075	WITHDRAWN	765982	G21-075-GEN10.6300	1
GEN-2021-075	WITHDRAWN	765985	G21-075-GEN20.6300	1
GEN-2021-075	WITHDRAWN	765988	G21-075-GEN30.6300	1
GEN-2021-075	WITHDRAWN	765989	G21-075-GEN40.6300	1

Table A-4: Removed Withdrawn Generation Projects in DISIS 2022-001

Project #	Pmax	Fuel type	Town / County	State	Point of Interconnection
GEN-2022-001	100	Battery	Rogers	OK	Catoosa 138 kV
GEN-2022-011	374	Solar	Tillman	OK	Oklaunion-Lawton Eastside 345 kV
GEN-2022-019	100	Battery	Tillman	OK	Oklaunion-Lawton Eastside 345 kV
GEN-2022-021	100	Battery	Tillman	OK	Oklaunion-Lawton Eastside 345 kV
GEN-2022-042	174	Solar	Carter	OK	Sunnyside-Pooleville 138 kV
GEN-2022-048	250	Wind	Woodward	OK	Mooreland 138 kV
GEN-2022-072	181	Solar	Mayes	OK	Grand River Dam-Claremore 161 kV
GEN-2022-074	220.86	Wind	Eufaula, McIntosh	OK	Hanna 138 kV
GEN-2022-082	180	Solar	Hale	TX	Tuco-Carlisle 230 kV
GEN-2022-085	241.4	Wind	Ofuskee, Hughes	OK	Seminole-Muskogee 345 kV
GEN-2022-088	74.99	Solar	Little River	AR	South Foreman 138 kV
GEN-2022-089	74.99	Battery	Little River	AR	South Foreman 138 kV
GEN-2022-090	150	Solar	McCurtain	OK	Valiant 138 kV
GEN-2022-091	150	Battery	McCurtain	OK	Valiant 138 kV
GEN-2022-092	299.2	Wind	Nowata, Craig	OK	Neosho-Delaware 345 kV
GEN-2022-093	83	Solar	Hempstead	AR	Turk-Hope 115 kV
GEN-2022-103	74.99	Battery	Christian	MO	Ozark South 161 kV
GEN-2022-105	300	Solar	Tillman	OK	Oklaunion-Lawton Eastside 345 kV
GEN-2022-106	300	Solar	Tillman	OK	Oklaunion-Lawton Eastside 345 kV
GEN-2022-107	400	Solar	Tillman	OK	Oklaunion-Lawton Eastside 345 kV
GEN-2022-108	100	Solar	DeSoto Parish	LA	SW Shreveport-Dolet Hills 345 kV
GEN-2022-110	150	Battery	Coal	OK	Lehigh 138 kV
GEN-2022-114	250	Wind	Tillman	OK	Lawton-Oklaunion 345 kV
GEN-2022-129	200	Battery	Osage	OK	Webb City Tap-Shidler 138 kV

Project #	Pmax	Fuel type	Town / County	State	Point of Interconnection
GEN-2022-132	300	Battery	Caddo	OK	Anadarko 138 kV
GEN-2022-137	200	Battery	Cleveland	OK	Canadian Switchyard 138 kV
GEN-2022-138	300	Battery	Roger	OK	Tulsa North-Northeast Station 345 kV
GEN-2022-159	280	Wind	Chaves, Lea	NM	Crossroads-Hobbs 345 kV
GEN-2022-160	280	Wind	Chaves, Lea	NM	Crossroads-Hobbs 345 kV
GEN-2022-163	200	Battery	Canadian	OK	Cimarron 345 kV
GEN-2022-167	250	Solar	Tulsa	OK	Tulsa North-Northeastern 345 kV
GEN-2022-171	200	Wind	Curry	NM	Pleasant Hill 230 kV
GEN-2022-196	215	Wind	Pittsburg	OK	Pittsburg 345 kV
GEN-2022-237	150	Solar	Pottawatomie	OK	Maud 138 kV
GEN-2022-239	350	Solar	Hempstead	AR	John W Turk Jr Power Plant 345 kV
GEN-2022-240	200	Battery	Hempstead	AR	John W Turk Jr Power Plant 345 kV
GEN-2022-241	200	Battery	Hempstead	AR	John W Turk Jr Power Plant 345 kV

A.2 SPP Prior Queued Generation Projects

Table A-5: SPP Prior Queued Generation Projects

Projects	Cluster	MW	Generation Type	Town or County	State	Substation or Line	TO at POI
GEN-2016-037	DISIS-2017-001	300	Wind	Washita County	OK	Chisholm-Gracemont 345kV	AEP
GEN-2017-023	DISIS-2017-001	85	Solar	Choctaw County	OK	Hugo Power Plant 138 kV Sub	WFEC
GEN-2017-027	DISIS-2017-001	140	Wind	Carter County	OK	Pooleville-Ratliff (Carter County) 138kV	OGE
GEN-2017-040	DISIS-2017-001	200.1	Solar	Ochiltree County	TX	Canadian River-Muskogee and Muskogee-Seminole 345kV	OGE
GEN-2017-057	DISIS-2017-001	72.5	Solar	Caddo Parish	LA	Hosston 69kV	AEP
GEN-2017-061	DISIS-2017-001	101.5	Solar	Mayes County	OK	GRDA1 to CLARMR 5 161kV line	GRDA
GEN-2017-071	DISIS-2017-001	124.7	Solar	Payne County	OK	Greenwood 138kV sub	OGE
GEN-2017-075	DISIS-2017-001	200	Solar	Johnston County	OK	Hugo-Sunnyside 345 kV	OGE
GEN-2017-077	DISIS-2017-001	124.7	Solar	Mayes County	OK	Explorer Claremore Tap EXCLART4	AEP
GEN-2017-092	DISIS-2017-001	200	Solar	Muskogee County	OK	Canadian River-Muskogee and Muskogee-Seminole 345kV	OGE
GEN-2017-133	DISIS-2017-002	200	Wind	Oklahoma	OK	Arcadia 345kV	OGE
GEN-2017-134	DISIS-2017-002	250	Wind	Oklahoma	OK	Arcadia 345kV	OGE
GEN-2017-137	DISIS-2017-002	295	Wind	Oklahoma	OK	Arcadia 345kV	OGE
GEN-2017-140	DISIS-2017-002	160	Solar	Wagoner	OK	Clarksville 345kV Switching Station	AEP
GEN-2017-141	DISIS-2017-002	241.7	Solar	Wagoner	OK	Clarksville 345kV Switching Station	AEP
GEN-2017-149	DISIS-2017-002	258	Wind	Johnston	OK	Johnson County 345kV Substation	OGE
GEN-2017-150	DISIS-2017-002	250	Solar	Grady	OK	Minco 345kV	OGE
GEN-2017-151	DISIS-2017-002	300	Wind	Crosby	TX	TUCO-Oklaunion 345kV	SPS
GEN-2017-164	DISIS-2017-002	250	Solar	Garfield	OK	Woodring 345kV Substation	OGE
GEN-2017-171	DISIS-2017-002	150	Solar	Stephen	OK	Lawton Eastside - Terry Road 345kV	AEP
GEN-2017-231	DISIS-2017-002	72.5	Solar	Franklin County	AR	Branch 161kV Substation	OGE
GEN-2017-233	DISIS-2017-002	215	Wind	Grady	OK	Minco 345kV	OGE
GEN-2018-003	DISIS-2018-001	150	Solar	Bowie	TX	North Boston-Bann 138kV Line	AEP
GEN-2018-011	DISIS-2018-001	74.1	Battery	Kingfisher	OK	Dover 138 kV Switching Station	WFEC
GEN-2018-015	DISIS-2018-001	252	Solar	Paducah	TX	Tuco-Oklaunion 345kV Line	SPS
GEN-2018-021	DISIS-2018-001	74.1	Solar	Washita	OK	Chisholm-Gracemont 345kV Line	AEP

Projects	Cluster	MW	Generation Type	Town or County	State	Substation or Line	TO at POI
GEN-2018-024	DISIS-2018-001	100	Battery	Muskogee	OK	Canadian River-Muskogee and Muskogee-Seminole 345kV	OGE
GEN-2018-026	DISIS-2018-001	100	Battery	Canadian	OK	Mustang 138kV Substation	OGE
GEN-2018-027	DISIS-2018-001	100	Battery	Tulsa	OK	Tulsa Power Station 138kV Substation	AEP
GEN-2018-028	DISIS-2018-001	200	Battery	Tulsa	OK	Tulsa North 138kV Substation	AEP
GEN-2018-029	DISIS-2018-001	100	Battery	Oklahoma	OK	Horseshoe Lake 138kV Substation	OGE
GEN-2018-048	DISIS-2018-001	300	Solar	Caddo	OK	Pecan Creek 345kV Substation	OGE
GEN-2018-050	DISIS-2018-001	200	Solar	Caddo	LA	Longwood 345kV Substation	AEP
GEN-2018-055	DISIS-2018-001	252	Solar	Grady	OK	Terry Road 345kV station (shared with Rush Springs Windfarm on a common gentie)	AEP
GEN-2018-064	DISIS-2018-002	80	Solar	Benton	AR	Tonnece Substation 69kV	GRDA
GEN-2018-071	DISIS-2018-002	151	Battery	Kay	OK	Interconnecting into OG&E's Ranch Road 345kV substation by tapping a 0.1 gen tie line into the existing Frontier II gen-tie line	OGE
GEN-2018-072	DISIS-2018-002	151	Battery	Kay	OK	Interconnecting into OG&E's Ranch Road 345kV substation by tapping a 0.1 gen tie line into the existing Frontier II gen-tie line	OGE
GEN-2018-079	DISIS-2018-002	148	Solar	Craig / Novata	OK	Farmland-Delaware 138kV line	AEP
GEN-2018-082	DISIS-2018-002	215	Wind	Pittsburg	OK	Pittsburg 345kV Substation	AEP
GEN-2018-106	DISIS-2018-002	165	Solar	Caddo	LA	Longwood 345kV substation	AEP
GEN-2018-115	DISIS-2018-002	250	Hybrid	Lawton	OK	Lawton East Side 345kV/138kv	AEP
GEN-2019-002	DISIS-2019-001	100	Battery	Mayes	OK	Maid 161kV substation	GRDA
GEN-2019-065	DISIS-2019-001	180	Battery	Smith	TX	Overton-Northwest Henderson 138kV	AEP
GEN-2020-010	DISIS-2020-001	140	Hybrid	Mutual	OK	Seiling-Taloga Substations 138kV	WFEC
GEN-2020-012	DISIS-2020-001	113	Hybrid	Headrick	OK	Snyder â€“ Altus Jct. 138kV	AEP
GEN-2020-020	DISIS-2020-001	201.6	Hybrid	McCurtain	OK	Tap the 345 kV Northwest Texarkana - Valliant line	AEP
GEN-2020-054	DISIS-2020-001	298	Solar	Bowie	TX	Lydia 345 kV Station	AEP
GEN-2020-060	DISIS-2020-001	200	Battery	Lubbock	TX	Lubbock East Substation 230 kV	SPS
GEN-2020-065	DISIS-2020-001	1003	Thermal	Gaines	NM	Hobbs-Andrews 345 kV Line	SPS
GEN-2020-067	DISIS-2020-001	352.5	Wind	Terry & Hockley	TX	Tuco to Yoakum 345kV line	SPS
GEN-2020-068	DISIS-2020-001	400	Solar	Terry & Hockley	TX	Tuco to Yoakum 345kV line	SPS
GEN-2020-074	DISIS-2020-001	200	Battery	Carter	OK	Lawton to Sunnyside 345 kV Substation	AEP

Projects	Cluster	MW	Generation Type	Town or County	State	Substation or Line	TO at POI
GEN-2020-081	DISIS-2020-001	200	Battery	Rusk	TX	Tenaska Switching Substation 345kV	AEP
GEN-2020-085	DISIS-2020-001	500	Solar	Carter	OK	Lawton to Sunnyside 345 kV Line	AEP
GEN-2020-087	DISIS-2020-001	500	Solar	Comanche	OK	Cimmarron to Lawton 345 kV Line	AEP
GEN-2020-092	DISIS-2020-001	100	Solar	Mayes	OK	Pryor Junction - Midwest Carbide 138kV	AEP
GEN-2021-001	DISIS-2021-001	100	Battery	Bryan	OK	138kV Brown Substation	OGE
GEN-2021-016	DISIS-2021-001	250	Wind	Johnston and Murray	OK	Sunnyside-Johnston 345 kV	AEP
GEN-2021-018	DISIS-2021-001	231	Solar	Noble	OK	Sooner 345 kV	OGE
GEN-2021-033	DISIS-2021-001	204.12	Solar	Franklin	AR	Grand Prairie 161kV Substation	OGE
GEN-2021-036	DISIS-2021-001	204.12	Solar	Little River	AR	Craig to Patterson 138 kV	AEP
GEN-2021-038	DISIS-2021-001	200	Battery	Titus	TX	Welsh 345kV Substation	AEP
GEN-2021-041	DISIS-2021-001	100	Battery	Canadian	OK	Mustang 138kV Substation	OGE
GEN-2021-047	DISIS-2021-001	250	Solar	Mayes	OK	Tulsa (Bus #509852) - Igloo (Bus #513596) 345kV line	GRDA
GEN-2021-052	DISIS-2021-001	75	Battery	Muskogee	OK	Pecan Creek 345kV substation	OGE
GEN-2021-053	DISIS-2021-001	300	Solar	Muskogee	OK	Pecan Creek 345 kV Substation	OGE
GEN-2021-063	DISIS-2021-001	155	Hybrid	McCurtain	OK	Craig JCT 138kV	AEP
GEN-2021-064	DISIS-2021-001	100	Hybrid	Caddo	OK	Carnegie South 138kV	AEP
GEN-2021-088	DISIS-2021-001	100	Battery	Cleveland	OK	Cedar Lane - Canadian 138 kV	OGE
GEN-2021-090	DISIS-2021-001	400	Hybrid	Yoakum	TX	Yoakum 345kV Substation	SPS

Table A-6: SPP DISIS-2022-001 Generation Projects in MISO South

Project #	Fuel type	Town / County	State	Point of Interconnection	Pmax	SH (MW)	SPK (MW)
GEN-2022-016	Solar	Woodward	OK	Woodward 345 kV	144 144	0 0	144 144
GEN-2022-038	Solar	Harrison	TX	Longwood-Scottville 138 kV	200	0	200
GEN-2022-055	Solar	Grady	OK	Sunshine North-Anadarko 138 kV	200	0	200
GEN-2022-071	Solar	Pittsburg	OK	Talawanda-Canadian River 138 kV	90.824	0	90.824
GEN-2022-098	Solar	Johnston	OK	Bison 345 kV	200	0	200
GEN-2022-104	Solar	Bryan	OK	Brown-South Coleman Jct 138 kV	113.078	0	113.078
GEN-2022-111	Solar / BESS	Marion	TX	Wilkes 345 kV	158.84 166.25	0 155	155 0
GEN-2022-130	Battery	Sebastian	AR	Battlefield BESS 161 kV	200	200	200
GEN-2022-136	Battery	Bryan	OK	Colbert 138 kV	200	200	200
GEN-2022-139	Battery	Harrison	TX	Pirkey 345 kV	150 150	150 150	150 150
GEN-2022-143	Battery	Marshall	OK	Caney Creek 138 kV	200	200	200
GEN-2022-145	Battery	Cluster	OK	Weatherford Jct.-Hinton 138 kV	195	195	195
GEN-2022-147	CT	Hale	TX	Tuco 345 kV	203	0	203
GEN-2022-154	Battery	Cleveland	OK	Canadian Switch 138 kV	100	100	100
GEN-2022-155	Battery	Oklahoma	OK	Horseshoe Lake 138 kV	200	200	200
GEN-2022-156	Battery	Creek	OK	Silver City 138 kV	100	100	100
GEN-2022-176	Wind	Nowata	OK	Northeastern-Delaware 345 kV	215	215	33.54
GEN-2022-231	Solar	Logan	OK	Crescent-Cottonwood Creek 138 kV	166	0	166
GEN-2022-234	Solar	Rogers	OK	Alluwe Tap-Chelsea 138 kV	200	0	200
GEN-2022-235	Battery	Canadian	OK	El Reno SW 138 kV	150	150	150
GEN-2022-238	Battery	Pottawatomie	OK	Maud 138 kV	150	150	150

A.3 AECI Prior Queued Generation Projects

Table A-7: AECI Prior Queued Generation Projects

Projects	MW	Generation Type	State	Substation or Line
GIA-61	230	Wind	MO	Maryville 161 kV
GIA-83	1018	Wind	MO	McCredie 345 kV
GIA-86	100	Solar	MO	Thomas Hill 69 kV
GIA-90	100	Solar	MO	Montgomery City 161 kV
GIA-91	96	Solar	MO	Sedalia 69 kV
GIA-93	100	Solar	MO	Palmyra 161 kV
GIA-95	247	Wind	MO	Jasper-Morgan 345 kV
GIA-96	97.5	Wind	OK	Stroud 138kV
GIA-101	460	CT Gas	MO	Rockies Express 161 kV
GIA-102	75	CT Gas	MO	Rockies Express 161 kV
GIA-103	460	Gas, CT	OK	Bristow 138 kV
GIA-104	460	Gas, CT	OK	Stillwater 138 kV

A.4 Prior Queued Network Upgrades Added

Table A-8: Prior Queued Network Upgrades Added

Assigned Project	Network Upgrade
GI-083	2nd Overton 345-161kV 560 MVA Transformer
GI-083	Apache Tap-California 161kV Line Rebuild to 1600 A
GI-083	California-Overton 161kV Reconductor and California Terminal Upgrades
GI-083	J1145-McCredie 345kV Line Rebuild to 3000 A
GI-083	J1145-Montgomery-1 345kV Line Rebuild to 3000 A
GI-083	Loy Martin-Guthrie 161kV Reconductor and Loy Martin Terminal Upgrades
GI-083	Loy Martin-McBain Tap 161kV Reconductor and Loy Martin Terminal Upgrades
J1488/J1490	McCredie-Overton-5475 345kV Line, upgrade (2) 345kV Overton switches
J1488/J1490	Big Creek-Warrenton-3 161kV Line
J1488/J1490	Guthrie-Moreau section of Guthrie-Mariosa Delta-1 161kV Line
J1488/J1490	Montgomery-HVDC POI (J1145) 345kV Line (double ckt)
J1488/J1490	Montgomery-HVDC POI (J1145) 345kV Line (3rd ckt)
MTEP Project ID 23952	DPP-2021-South Phase 3_MTEP#23952.idv

A.5 Removed Recently Retired MISO Generation

Table A-9: Removed Recently Retired MISO Generation in MISO South Area

Unit(s) Description	State	Power Flow Area	Bus Name	Bus Number	Unit ID	Derate To MW	Requested Change of Status
Teche Unit 3	LA	CLEC	G3TECHE	501823	1	0	Retirement
Baxter Wilson Unit 1	MS	EES	1B.WLSN U1	336801	18	0	Retirement
Waterford Unit 1	LA	EES	1WAT U1	336151	1	0	Retirement
Dolet Hills	LA	CLEC	G1DOLHIL	501801	1	330	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U1	303010	1	0	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U1	303010	2	0	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U2	303011	1	0	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U2	303011	2	0	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U3	303012	1	0	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U3	303012	2	0	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U4	303013	1	0	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U4	303013	2	0	Retirement
Sterlington 1-4 & 6-10	LA	LAGN	1KOCH U1	303010	1A	0	Retirement
Sabine Cogen	TX	EES	1BAYORU1	334740	1	0	Retirement
Sabine Cogen	TX	EES	1BAYORU2	334738	1	0	Retirement
Sabine Cogen	TX	EES	1BAYORU3	334739	1	0	Retirement
Nelson 4	LA	EES	1NELSON_G4!	335204	1	0	Retirement
Sterlington Unit 7C	LA	EES	1STERL_7C	337419	1	0	Retirement
Woodville Renewable Power Project	TX	EES	1WOODVILLE	334313	1	0	Retirement
Rex Brown 4 & 5	MS	EES-EMI	1REX BRWN U4	336944	1	0	Retirement
Rex Brown 4 & 5	MS	EES-EMI	1REX BRN U5	336941	1	0	Retirement
Dow GT300	LA	EES	1DOW_AEP_5!	335545	1	0	Retirement
Henderson Station	MS	EES-EMI	3GREENWOOD!	337054	1	0	Retirement
Henderson Station	MS	EES-EMI	3GREENWOOD!	337054	2	0	Retirement
Henderson Station	MS	EES-EMI	3GREENWOOD!	337054	3	0	Retirement
Henderson Station	MS	EES-EMI	3GREENWOOD!	337054	4	0	Retirement
Baxter Wilson 2	MS	EES-EMI	1B.WLSN U2	336831	1	0	Retirement
Rex Brown Plant Unit 3	MS	EES-EMI	1REX BRWN U3	336943	1	0	Retirement

Unit(s) Description	State	Power Flow Area	Bus Name	Bus Number	Unit ID	Derate To MW	Requested Change of Status
Morrow Units 1 and 2	MS	SMEPA	MOR GEN 1	318600	1	0	Retirement
Morrow Units 1 and 2	MS	SMEPA	MOR GEN 2	318601	1	0	Retirement

Table A-10: Removed Recently Retired MISO Generation in MISO Central Area

Unit(s) Description	State	Power Flow Area	Bus Name	Bus Number	Unit ID	Derate To MW	Requested Change of Status
Grand Tower Units 1-4	IL	AMIL	1GRTW 1	347170	1	0	Retirement
Grand Tower Units 1-4	IL	AMIL	1GRTW 2	347171	2	0	Retirement
Grand Tower Units 1-4	IL	AMIL	1GRTW 3	347168	3	0	Retirement
Grand Tower Units 1-4	IL	AMIL	1GRTW 4	347169	4	0	Retirement
Meramec CTG 2	MO	AMMO	1MER 6	345172	6	0	Retirement
Dallman Units 31 & 32	IL	CWLP	1DALMAN 31	343549	1	0	Retirement
Dallman Units 31 & 32	IL	CWLP	1DALMAN 32	343550	2	0	Retirement
Meramec CTG 1	MO	AMMO	1MER 5	345164	5	0	Retirement
Bailly Unit 10	IN	NIPS	17BAILLY-10	255246	10	0	Retirement
Coffeen Units 1 and 2	IL	AMIL	1COFFEN 1	346896	1	0	Retirement
Coffeen Units 1 and 2	IL	AMIL	1COFFEN 2	346897	2	0	Retirement
Hennepin Units 1 and 2	IL	AMIL	1HENNEPIN G1	349106	1	0	Retirement
Hennepin Units 1 and 2	IL	AMIL	1HENNEPIN G2	349107	H	0	Retirement
Hennepin Units 1 and 2	IL	AMIL	1HENNEPIN G2	349107	L	0	Retirement
Havana Unit 6	IL	AMIL	1HAVANA G6	349121	6	0	Retirement
Duck Creek Unit 1	IL	AMIL	1DCK GEN1	349633	1	0	Retirement
Baldwin 3	IL	AMIL	1BALDWIN G3	349128	3	0	Retirement
Reid Unit1	KY	BREC	1REID1	340574	5	0	Retirement
Plant D7	MO	CWLD	2PLANT2	343051	7	0	Retirement
Northeast - NET Units 1 & 2	IN	SIGE	10NE_GT	253512	1	0	Retirement
Henderson Municipal Power & Light Units 1&2	KY	BREC	HMP&L1	340577	3	0	Retirement
Henderson Municipal Power & Light Units 1&2	KY	BREC	HMP&L2	340578	4	0	Retirement
Bailly 7 & 8	IN	NIPS	17BAILLY-7	255234	7	0	Retirement
Bailly 7 & 8	IN	NIPS	17BAILLY-8	255235	8	0	Retirement

Unit(s) Description	State	Power Flow Area	Bus Name	Bus Number	Unit ID	Derate To MW	Requested Change of Status
Coleman 1,2,3	KY	BREC	COLEMAN1	340579	1	0	Retirement
Coleman 1,2,3	KY	BREC	COLEMAN2	340580	2	0	Retirement
Coleman 1,2,3	KY	BREC	COLEMAN3	340581	3	0	Retirement

A.6 MISO North for Power Balance

Table A-11. MISO North for Power Balance

Area #	Area Name	Area #	Area Name
207	HE	600	Xcel
208	DEI	608	MP
210	SIGE	613	SMMPA
216	IPL	615	GRE
217	NIPS	620	OTP
218	METC	627	ALTW
219	ITC	633	MPW
295	WEC	635	MEC
296	MIUP	661	MDU
314	BREC	663	BEPC-MISO
315	HMPL	680	DPC
333	CWLD	694	ALTE
356	AMMO	696	WPS
357	AMIL	697	MGE
360	CWLP	698	UPPC
361	SIPC	701	Classic Prior
362	GLH		

A.7 MISO South for Power Balance

Table A-12. MISO South for Power Balance

Area #	Area Name
326	EES-EMI
327	EES-EAI
332	LAGN
349	SMEPA
351	EES

Area #	Area Name
502	CLEC
503	LAFA
504	LEPA
700	South Prior

A.8 SPP Market for Power Balance

Table A-13. SPP Market for Power Balance

Area #	Area Name	Area #	Area Name
515	SWPA	542	KACY
520	AEPW	544	EMDE
523	GRDA	545	INDN
524	OKGE	546	SPRM
525	WFEC	640	NPPD
526	SPS	641	HAST
527	OMPA	642	KACY
531	MIDW	645	OPPD
534	SUNC	650	LES
536	WERE	652	WAPA
541	KCPL	659	BEPC-SPP

A.9 AECI for Power Balance

Table A-14. AECI for Power Balance

Area #	Area Name
330	AECI
750	AECI PQ

A.10 Contingency Files used in MISO South AFSIS Analysis

Table A-15: List of Contingencies used in the MISO South AFSIS Analysis

Contingency File Name	Description
Automatic single element contingencies	Single element outages at buses 60 kV and above in the study region
MISO21_2026_SUM_TA_South_P1_P2_P4_P5_P7 240206.con	Specified category P1, P2, P4, P5, P7 contingencies in MISO South
MISO21_2026_SUM_TA_Central_P1_P2_P4_P5_P7 240110.con	Specified category P1, P2, P4, P5, P7 contingencies in MISO Central
City of Jonesboro.con	Specified category P2 contingencies
Lakeover.con	Specified category P5 contingencies
Pickens.con	Specified contingencies
AECI_Neighboring_Impacts_2020.con	Specified contingencies in AECI
External_P1s.con	Specified category P1 external contingencies
External_P1-P7.con	Specified category P1-P7 external contingencies
SPP_Filtered_Cons.con	Specified contingencies in SPP
TVA_P1_P2_E2_renamed.con	Specified category P1, P2 contingencies in TVA

Appendix

B

MISO West AFSIS Model Development for Steady-State and Stability Analysis

B.1 Recently Withdrawn Prior Queued Projects

Table B-1: Recently Withdrawn MISO West & Central Prior Queued Project

Prj #	Bus Number	Bus Name	Id	Status
J1191	41910	J1191 GEN 0.6000	1	Withdrawn
J1526	45260	J1526 GEN 0.6300	1	Withdrawn
J1527	45270	J1527 GEN 0.6300	1	Withdrawn
J1860	48600	J1860 GEN 0.6900	1	Withdrawn
J1862	48620	J1862 GEN 0.6900	1	Withdrawn
J1980	49800	J1980 GEN 0.6300	1	Withdrawn
J2056	50560	J2056 GEN1 0.6600	1	Withdrawn
J2056	50561	J2056 GEN2 0.6600	1	Withdrawn
J2119	51190	J2119 GEN1 0.6000	1	Withdrawn
J2279	52790	J2279 GEN1 0.6600	1	Withdrawn
J2279	52791	J2279 GEN2 0.6600	1	Withdrawn

Table B-2: Recently Withdrawn SPP Prior Queued Project

Prj #	Status	Bus Number	Bus Name	Id
ASGI-2017-014	Withdrawn	761546	AS17-014GEN10.5500	1
GEN-2016-007	TERMINATED	587053	G16-007-GEN10.6500	1
GEN-2016-063	TERMINATED	587433	G16-063-GEN10.6900	1
GEN-2017-013	WITHDRAWN	588583	G17-013-GEN10.6900	1
GEN-2017-032	WITHDRAWN	588753	G17-032-GEN10.6900	1
GEN-2017-090	WITHDRAWN	589283	G17-090-GEN10.6900	1
GEN-2017-090	WITHDRAWN	589287	G17-090-GEN20.6900	1
GEN-2017-125	TERMINATED	761904	G17-125GEN1 0.6900	1
GEN-2017-202	WITHDRAWN	761421	G17-202GEN1 0.6900	1
GEN-2017-209	TERMINATED	760917	G17-209GEN1 0.6900	1
GEN-2017-209	TERMINATED	760917	G17-209GEN1 0.6900	2
GEN-2017-209	TERMINATED	760920	G17-209GEN2 0.6300	1
GEN-2017-209	TERMINATED	760920	G17-209GEN2 0.6300	2
GEN-2018-008	WITHDRAWN	762540	G18-008-GEN10.6900	1
GEN-2018-008	WITHDRAWN	762543	G18-008-GEN20.6900	1
GEN-2018-012	WITHDRAWN	762507	G18-012-GEN10.6900	1
GEN-2018-022	WITHDRAWN	762584	G18-022GEN1 0.6000	1
GEN-2018-022	WITHDRAWN	762587	G18-022GEN2 0.6000	1
GEN-2018-022	WITHDRAWN	762588	G18-022GEN3 0.6300	1
GEN-2018-030	WITHDRAWN	762661	G18-030GEN1 0.6600	1
GEN-2018-039	WITHDRAWN	762738	G18-039GEN1 0.6600	1
GEN-2018-056	WITHDRAWN	762914	G18-056-GEN10.6600	1
GEN-2018-062	WITHDRAWN	762979	G18-062-GEN10.6900	1
GEN-2018-063	WITHDRAWN	762991	G18-063-GEN10.6000	1
GEN-2019-048	WITHDRAWN	763805	G19-048-GEN10.6500	1
GEN-2020-001	WITHDRAWN	764256	G20-001-GEN10.6300	1
GEN-2020-006	WITHDRAWN	764166	G20-006-GEN10.6300	1
GEN-2020-027	WITHDRAWN	764616	G20-027-GEN10.6300	1
GEN-2020-027	WITHDRAWN	764619	G20-027-GEN20.8000	1
GEN-2020-030	WITHDRAWN	764646	G20-030-GEN10.6300	1
GEN-2020-030	WITHDRAWN	764649	G20-030-GEN20.8000	1
GEN-2020-033	WITHDRAWN	764676	G20-033-GEN10.6300	1

Prj #	Status	Bus Number	Bus Name	Id
GEN-2020-033	WITHDRAWN	764679	G20-033-GEN20.8000	1
GEN-2020-036	WITHDRAWN	764691	G20-036-GEN10.6300	1
GEN-2020-036	WITHDRAWN	764694	G20-036-GEN20.8000	1
GEN-2020-070	WITHDRAWN	765026	G20-070-GEN10.7200	1
GEN-2020-071	WITHDRAWN	765131	G20-071-GEN10.7200	1
GEN-2020-076	WITHDRAWN	765146	G20-076-GEN10.5200	1
GEN-2020-077	WITHDRAWN	764481	G20-077-GEN10.7200	1
GEN-2020-086	WITHDRAWN	765161	G20-086-GEN10.6900	1
GEN-2020-086	WITHDRAWN	765164	G20-086-GEN20.6900	1
GEN-2020-089	WITHDRAWN	765176	G20-089-GEN10.6300	1
GEN-2021-007	WITHDRAWN	765362	G21-007-GEN10.6900	1
GEN-2021-007	WITHDRAWN	765365	G21-007-GEN20.6900	1
GEN-2021-007	WITHDRAWN	765368	G21-007-GEN30.6900	1
GEN-2021-024	WITHDRAWN	765522	G21-024-GEN10.6900	1
GEN-2021-037	WITHDRAWN	765652	G21-037-GEN10.6900	1
GEN-2021-072	WITHDRAWN	765952	G21-072-GEN10.6600	1
GEN-2021-072	WITHDRAWN	765955	G21-072-GEN20.6600	1
GEN-2021-072	WITHDRAWN	765958	G21-072-GEN30.6600	1
GEN-2021-072	WITHDRAWN	765961	G21-072-GEN40.6600	1
GEN-2021-073	WITHDRAWN	765972	G21-073-GEN10.6300	1
GEN-2021-073	WITHDRAWN	765975	G21-073-GEN20.6300	1
GEN-2021-106	WITHDRAWN	766232	G21-106-GEN10.6300	1

B.2 SPP Prior Queued Generation Projects

Table B-3: SPP Prior Queued Generation Projects

Projects	Cluster	MW	Generation Type	Nearest Town or County	State	Substation or Line	TO at POI
GEN-2016-036	DISIS-2016-002-1	44.6	Wind	Chippewa	MN	Granite Falls 115kV substation	WAPA
GEN-2016-074	DISIS-2016-002-1	200	Wind	Custer	NE	Sweetwater 345kV	NPPD
GEN-2016-087	DISIS-2016-002-1	98.9	Wind	Campbell	SD	Bismark-Glenham 230 kV line	WAPA
GEN-2016-094	DISIS-2016-002-1	200	Wind	Hyde	SD	Tap Ft Thompson - Oahe 230kV	WAPA
GEN-2016-115	DISIS-2016-002-1	300	Wind	Atchison	MO	Nebraska City-Mullen Creek (Holt County MO) 345kV	GMO
GEN-2016-130	DISIS-2016-002-1	202	Wind	Mercer	ND	Leland Olds 345 kV	BEPC
GEN-2016-147	DISIS-2016-002-1	40	Solar	Cheyenne	NE	Sidney 115 kV Sub	Tri-State
GEN-2016-151	DISIS-2016-002-1	202	Wind	Burke	ND	Tande 345kV	BEPC
GEN-2017-004	DISIS-2017-001	201.6	Wind	Cloud	KS	Elm Creek - Summit 345 kV	ITCGP
GEN-2017-005	DISIS-2017-001	190	Wind	Bourbon & Crawford	OK	Marmaton - Litchfield 161 kV	WERE
GEN-2017-009	DISIS-2017-001	302	Wind	Neoshoe	KS	Neosho - Caney River 345 kV	WERE
GEN-2017-010	DISIS-2017-001	200.1	Wind	Bowman	ND	Rhame 230 kV Sub	BEPC
GEN-2017-014	DISIS-2017-001	300	Wind	Haakon	SD	Philip Tap 230 kV	WAPA
GEN-2017-048	DISIS-2017-001	300	Wind	Williams	ND	Neset 230 kV Substation	BEPC
GEN-2017-060	DISIS-2017-001	149.4	Wind	Barton	MO	LaRussell Energy Center 161kV	EDE
GEN-2017-082	DISIS-2017-001	149.4	Wind	Barton / Jasper	MO	Asbury Plant 161 kV	EDE
GEN-2017-094	DISIS-2017-001	200	Wind	Wessington / Hand	SD	Fort Thompson-Huron 230 kV	WAPA
GEN-2017-097	DISIS-2017-001	128	Solar	Pennington	SD	Underwood 115 kV Sub	WAPA
GEN-2017-105	DISIS-2017-002	75	Wind	Burt	NE	Tekamah - Raun 161 kV Line	OPPD
GEN-2017-108	DISIS-2017-002	400	Solar	Henry	MO	Stillwell - Clinton 161kV Line	KCPL
GEN-2017-115	DISIS-2017-002	244	Wind	Atchinson / Nodaway	MO	Holt County 345 kV	KCPL
GEN-2017-119	DISIS-2017-002	180	Wind	Cloud / Mitchell	KS	Elm Creek 345kV	SUNC
GEN-2017-120	DISIS-2017-002	260	Wind	Dickinson / Marion	KS	Abilene Energy Center-Northview 115kV	WERE
GEN-2017-144	DISIS-2017-002	200	Wind	Holt, Antelope, Wheeler	NE	Holt County 345kV	NPPD
GEN-2017-175	DISIS-2017-002	300	Wind	Turner	SD	Vfodnes-Utica Jct. 230kV	WAPA
GEN-2017-181	DISIS-2017-002	300	Wind	Lancaster	NE	Tobias 345kV Substation	NPPD

Projects	Cluster	MW	Generation Type	Nearest Town or County	State	Substation or Line	TO at POI
GEN-2017-182	DISIS-2017-002	128	Wind	Lancaster	NE	Tobias 345kV	NPPD
GEN-2017-183	DISIS-2017-002	400	Wind	Hodgeman / Ford	KS	Nashua-St. Joe 345kV	KCPL
GEN-2017-184	DISIS-2017-002	400	Solar	Hodgeman / Ford	KS	Nashua-St. Joe 345kV	KCPL
GEN-2017-188	DISIS-2017-002	130	Solar	Barry	MO	Asbury 161 kV	EDE
GEN-2017-195	DISIS-2017-002	500.4	Solar	Johnson	KS	West Gardner 345kV	KCPL
GEN-2017-196	DISIS-2017-002	128	Battery	Johnson	KS	West Gardner 345kV	KCPL
GEN-2017-201	DISIS-2017-002	250	Wind	Wayne	NE	Hoskins 345kV	NPPD
GEN-2017-210	DISIS-2017-002	310	Hybrid	Cedar	NE	McCool 345kV Substation	NPPD
GEN-2017-214	DISIS-2017-002	100	Wind	Ward	ND	Logan 230kV Substation	BEPC
GEN-2017-215	DISIS-2017-002	100	Wind	Ward	ND	Logan 230kV Substation	BEPC
GEN-2017-222	DISIS-2017-002	180	Wind	Denison	IA	Denison 230kV Substation	WAPA
GEN-2017-234	DISIS-2017-002	115	Wind	Greeley	NE	Spalding to North Loup 115kV	NPPD
ASGI-2017-013	DISIS-2018-001	40	Wind	#N/A	#N/A	655239	WAPA
ASGI-2018-003	DISIS-2018-001	20	Solar	#N/A	#N/A	541306	KCPL
ASGI-2018-006	DISIS-2018-001	20	Solar	#N/A	#N/A	541309	KCPL
ASGI-2018-007	DISIS-2018-001	20	Solar	#N/A	#N/A	543062	KCPL
ASGI-2018-010	DISIS-2018-001	35	Solar	#N/A	#N/A	543077	KCPL
ASGI-2018-011	DISIS-2018-001	35	Solar	#N/A	#N/A	543066	KCPL
GEN-2018-010	DISIS-2018-001	74.1	Battery	Montrail	ND	Neset 230kV Substation	BEPC
GEN-2018-013	DISIS-2018-001	74.1	Wind	Dickinson	KS	Abilene Energy Center-Northview 115kV	WERE
GEN-2018-025	DISIS-2018-001	200	Battery	Washington	NE	Fort Calhoun 345kV	OPPD
GEN-2018-031	DISIS-2018-001	50	Battery	Jackson	MO	Blue Valley 161kV	INDN
GEN-2018-032	DISIS-2018-001	310	Wind	McPhearson	KS	Neosho 345kV Substation	WERE
GEN-2018-033	DISIS-2018-001	200	Battery	Cass	NE	Cass County 345kV	OPPD
GEN-2018-037	DISIS-2018-001	100	Battery	Douglas	NE	Looping in OPPD (S1211) (S1220) (S1211) (S1299) 161kV	OPPD
GEN-2018-043	DISIS-2018-001	500	Solar	Burt	NE	Ft. Calhoun - Raun 345 kV	OPPD
GEN-2018-057	DISIS-2018-001	203.4	Solar	Sedgwick	KS	Gordon Evans 138kV	WERE
GEN-2018-060	DISIS-2018-001	50	Wind	Webster	NE	Axtell-Post Rock 345 kV	NPPD
GEN-2018-065	DISIS-2018-002	19.8	Wind	Madison	NE	Antelope - Hoskins 345 kV	NPPD

Projects	Cluster	MW	Generation Type	Nearest Town or County	State	Substation or Line	TO at POI
GEN-2018-067	DISIS-2018-002	255	Wind	Williams	ND	115kV Strandahl sub	MWEC
GEN-2018-068	DISIS-2018-002	302.4	Wind	Madison	NE	Antelope - Hoskins 345 kV	NPPD
GEN-2018-069	DISIS-2018-002	125	Wind	Wibaux	MT	WAPA-UGP Mingusville 230kV	WAPA
GEN-2018-074	DISIS-2018-002	72	Wind	Crawford & Carrol	IA	Denison 230kV	WAPA
GEN-2018-083	DISIS-2018-002	250	Wind	Madison	NE	Shell Creek-Hoskins 345kv	NPPD
GEN-2018-125	DISIS-2018-002	231	Wind	Lincoln	NE	Gentleman to Sweetwater 345kV	NPPD
GEN-2018-131	DISIS-2018-002	221.4	Solar	Pierce	NE	Antelope - Hoskins 345 kV	NPPD
GEN-2018-132	DISIS-2018-002	201.6	Solar	Pierce	NE	Antelope - Hoskins 345 kV	NPPD
GEN-2019-009	DISIS-2019-001	100	Solar	Nemaha	NE	S1263 Brock 161kV	OPPD
GEN-2019-016	DISIS-2019-001	200	Solar	Polk & Dade	MO	Dadeville 161kV	EDE
GEN-2019-019	DISIS-2019-001	15.15	Thermal	Sioux	IA	Siouxland 69kV	NIPCO
GEN-2019-023	DISIS-2019-001	110	Hybrid	Wibaux	MT	WAPA-UGP Mingusville 230kV	WAPA
GEN-2019-037	DISIS-2019-001	150	Solar	Mercer	ND	Leland Olds 345kV	BEPC
GEN-2019-039	DISIS-2019-001	174.5	Solar	Butler	NE	Columbus Southeast-Rising City 115kV	NPPD
GEN-2019-041	DISIS-2019-001	78	Solar	Lancaster	NE	115kV Monolith Substation	NPPD
GEN-2019-069	DISIS-2019-001	100	Solar	Madison	NE	Shell Creek-Hoskins 345kV	NPPD
GEN-2019-070	DISIS-2019-001	50	Solar	Madison	NE	Shell Creek-Hoskins 345kv	NPPD
GEN-2019-073	DISIS-2019-001	100	Solar	Madison	NE	Shell Creek-Hoskins 345kv	NPPD
ASGI-2020-001	DISIS-2020-001	35	Hybrid	#N/A	#N/A	543094	KCPL
ASGI-2020-003	DISIS-2020-001	35	Hybrid	#N/A	#N/A	543060	KCPL
GEN-2020-002	DISIS-2020-001	81	Solar	Yutan	NE	6846 Substation 69 kV	OPPD
GEN-2020-007	DISIS-2020-001	650	Hybrid	Linn & Bates	KS	Evergy La Cygne to Wolf Creek 345kV	KCPL
GEN-2020-008	DISIS-2020-001	250	Hybrid	Stevens	KS	Corporation Carpenter 345kV	SPS
GEN-2020-011	DISIS-2020-001	320	Hybrid	Funk	NE	Axtell-Sweetwater 345kV	NPPD
GEN-2020-013	DISIS-2020-001	215	Hybrid	Orleans	NE	Orleans-Holdrege 115kV	NPPD
GEN-2020-014	DISIS-2020-001	45	Thermal	Alexander	ND	Lonesome Creek 115kV	BEPC
GEN-2020-021	DISIS-2020-001	235	Wind	Sioux	ND	LeLand Olds-Chapelle Creek 345kV	BEPC
GEN-2020-025	DISIS-2020-001	255	Thermal	Sarpy	NE	Substation 1363; 161kV	OPPD
GEN-2020-028	DISIS-2020-001	255	Thermal	Sarpy	NE	Substation 1363; 161kV	OPPD
GEN-2020-031	DISIS-2020-001	272.7	Thermal	Sarpy	NE	Substation 1363; 161kV	OPPD

Projects	Cluster	MW	Generation Type	Nearest Town or County	State	Substation or Line	TO at POI
GEN-2020-038	DISIS-2020-001	272.7	Thermal	Plattsmouth	NE	Substation 3740; 345kV	OPPD
GEN-2020-043	DISIS-2020-001	56.52	Thermal	Douglas	NE	Between Substation 1209 and 1252; 161kV	OPPD
GEN-2020-044	DISIS-2020-001	56.52	Thermal	Douglas	NE	1209 and 1252; 161kV	OPPD
GEN-2020-045	DISIS-2020-001	56.52	Thermal	Douglas	NE	1209 and 1252; 161kV	OPPD
GEN-2020-056	DISIS-2020-001	20	Solar	Russell	KS	Russell 115 kV	SUNC
GEN-2020-057	DISIS-2020-001	424.5	Battery	Garner	KS	Atlantic 345 kV	WERE
GEN-2020-058	DISIS-2020-001	424.5	Solar	Garner	KS	Atlantic 345 kV	WERE
GEN-2020-061	DISIS-2020-001	29	Thermal	Pleasant Hill	MO	Pleasant Hill 345/161/69 kV	GMO
GEN-2020-064	DISIS-2020-001	64	Thermal	Joplin	MO	4544 Stateline CC 161kV	EDE
GEN-2020-069	DISIS-2020-001	52.85	Wind	Cherry	NE	Cody to Valentine 115kV	NPPD
GEN-2020-072	DISIS-2020-001	150	Hybrid	Windsor	MO	Windsor to AEC Sedalia 161 kV	GMO
GEN-2020-073	DISIS-2020-001	150	Hybrid	Franklin	KS	SE Ottawa to Pleasant Valley 161kV	KCPL
GEN-2020-078	DISIS-2020-001	100	Solar	Washington	NE	Substation 1226 to Substation 1237, 161kV Tap	OPPD
GEN-2020-079	DISIS-2020-001	225	Hybrid	Cherokee	KS	Riverton-Neosho 161kV	EDE
GEN-2020-083	DISIS-2020-001	74.5	Hybrid	Fairview	MT	Fairview 115kV	WAPA
GEN-2020-084	DISIS-2020-001	350	Solar	Burt	NE	Raun - Fort Calhoun 345 kV	OPPD
GEN-2020-088	DISIS-2020-001	150	Solar	Jasper	MO	La Russell 161 kV	EDE
GEN-2020-090	DISIS-2020-001	204.3	Battery	Bourbon	KS	Wolf Creek - Blackberry 345 kV	WERE
GEN-2020-091	DISIS-2020-001	150	Solar	McKenzie	ND	Patent Gate Substation 345 kV	BEPC
GEN-2020-094	DISIS-2020-001	250	Solar	Syracuse	NE	Neb. City - 103rd & Rokeby 345 kV	OPPD
GEN-2021-005	DISIS-2021-001	350	Battery	Saline	KS	Summit 345 kV	WERE
GEN-2021-006	DISIS-2021-001	300	Battery	Labette	KS	Neosho 345kV	WERE
GEN-2021-008	DISIS-2021-001	200	Solar	McKenzie	ND	345kV Bus at BEPC Patent Gate	BEPC
GEN-2021-017	DISIS-2021-001	37.5	Wind	Cloud & Mitchell	KS	Elm Creek 345 kV	ITCGP
GEN-2021-023	DISIS-2021-001	306.18	Solar	Grant	KS	Wild Plains 345kV	WERE
GEN-2021-027	DISIS-2021-001	102.06	Solar	Lancaster	NE	Olive Creek 115 kV	NPPD
GEN-2021-029	DISIS-2021-001	253.8	Battery/Storage	Linn / Bates	KS	Evergy Tap the La Cygne to Stillwel 345 kV	KCPL
GEN-2021-030	DISIS-2021-001	510.3	Solar	Linn / Bates	KS	Evergy Tap the La Cygne to Stillwel 345 Kv	KCPL

Projects	Cluster	MW	Generation Type	Nearest Town or County	State	Substation or Line	TO at POI
GEN-2021-034	DISIS-2021-001	113	Solar	Lancaster	NE	Rokeby 115 kV	LES
GEN-2021-039	DISIS-2021-001	100	Battery	Douglas	NE	New 161kV substation looping in OPPD 161kV lines S1211 to S1220 and S1211 to S1299	OPPD
GEN-2021-040	DISIS-2021-001	200	Battery	Cass	NE	OPPD District, Cass County Power Plant Substation, 345kV Bus	OPPD
GEN-2021-042	DISIS-2021-001	50	Battery	Jackson	MO	Independence Power & Light, Blue Valley Substation, 161kV Bus	INDN
GEN-2021-043	DISIS-2021-001	250	Battery	Lancaster	NE	8000 SW 12th (Rokeby) Station, 115kV Bus	LES
GEN-2021-048	DISIS-2021-001	75	Battery	Lancaster	NE	Wagener 115kV	LES
GEN-2021-049	DISIS-2021-001	250	Solar	Lancaster	NE	Wagener 115kV	LES
GEN-2021-050	DISIS-2021-001	200	Solar	Henry	MO	161kV Stilwell-Clinton	KCPL
GEN-2021-051	DISIS-2021-001	75	Battery	Henry	MO	161kV Stilwell-Clinton	KCPL
GEN-2021-056	DISIS-2021-001	300	Wind	Harper & Kingman	KS	Viola 345kV	WERE
GEN-2021-057	DISIS-2021-001	300	Wind	Antelope	NE	Antelope 345kV	NPPD
GEN-2021-068	DISIS-2021-001	249.6	Wind	Hodgeman / Ford	KS	SUNC Spearville - Holcomb 345kV	SUNC
GEN-2021-069	DISIS-2021-001	249.6	Wind	Hodgeman / Ford	KS	SUNC Spearville - Holcomb 345kV	SUNC
GEN-2021-070	DISIS-2021-001	504	Wind	Hodgeman and Ford	KS	SUNC Spearville - Holcomb 345kV	SUNC
GEN-2021-076	DISIS-2021-001	113	Solar	Ellis	KS	ITC Post Rock 345 kV	ITCGP
GEN-2021-077	DISIS-2021-001	95	Hybrid	Pettis	MO	Windsor to AEC Sedalia 161 kV	GMO
GEN-2021-096	DISIS-2021-001	500	Solar	Coffey	KS	Wolf Creek - Benton 345 kV	WERE
GEN-2021-101	DISIS-2021-001	159	Solar	Douglas	KS	Evergy's Midland Substation 115kV	WERE
GEN-2021-103	DISIS-2021-001	150	Battery	Johnson	KS	Evergy's Atlantic Substation115kV	WERE
GEN-2021-107	DISIS-2021-001	201.6	Solar	Pottawatomie	KS	Evergy 345kV Jeffrey Energy Center	WERE
GEN-2021-108	DISIS-2021-001	182.25	Solar	Cass	NE	OPPD 345KV Cass County	OPPD

Table B-4: SPP DISIS-2022-001 Generation Projects in MISO West

Project #	Fuel type	Town / County	State	Point of Interconnection	Pmax	SH (MW)	SPK (MW)
GEN-2022-004	Solar	Sedgwick	KS	Murray Gill 138 kV	33	0	33
GEN-2022-005	Solar	Labette	KS	Northeast Parsons 138 kV	200	0	200
GEN-2022-006	Solar	Labette	KS	Neosho-N345 161 kV	200	0	200
GEN-2022-007	Solar	Lyon	KS	Lang-Reading 115 kV	135	0	135
GEN-2022-009	CT	Williams	ND	Judson 345 kV	62.5 62.5	0 0	62.5 62.5
GEN-2022-010	CT	Williams	ND	Judson 345 kV	250	0	250
GEN-2022-013	Solar	Bourbon	KS	Neosho-LaCygne 345 kV	150 150	0	150 150
GEN-2022-015	Solar	Decatur	KS	Mingo-Red Willow 345 kV	135 135	0	135 135
GEN-2022-024	Battery	Bourbon	KS	Neosho-LaCygne 345 kV	200	200	200
GEN-2022-054	Solar	Bourbon	KS	Wolf Creek-Blackberry 345 kV	200	0	200
GEN-2022-065	Solar	Edwards	KS	Arthur Mullergreen-Spearville 230 kV	145	0	145
GEN-2022-073	Battery	Kay	MO	Nashua 161 kV	150 150	150 150	150 150
GEN-2022-075	Solar	Ellis	KS	Spearville-Post Rock 345 kV	175	0	175
GEN-2022-083	CT	Williams	ND	Judson 345 kV	250	0	250
GEN-2022-100	Solar / BESS	Cooper	MO	Overton-Sedalia East 161 kV	80 40	0 40	80 0
GEN-2022-102	Battery	Clay	MO	Liberty West 161 kV	100	100	100
GEN-2022-142	Battery	Clay	MO	Shoal Creek 161 kV	200	200	200
GEN-2022-144	Battery	Jackson	MO	Blue Mills BESS 161 kV	200	200	200
GEN-2022-161	Wind	Butler	KS	Burns 345 kV	173.13 226.87	173.13 226.87	27.01 35.39
GEN-2022-214	Solar	Sumner	KS	Gill-Viola 138 kV	119.5 119.5	0	119.5 119.5

B.3 Modeled Network Upgrades

Table B-5: Modeled Prior Queued Network Upgrades

Network Upgrades	Owner	Study Cycle
Build Brookings Co-Lyon Co 2nd 345 kV line; Build Helena-Hampton Corner 345 kV line	XEL	MTEP Appendix A
Capacitor at Bagley 115: 1x20 Mvar	SPTI	DISIS-2016-002
100 MVAR switched cap at Blackhawk 345 kV (MEC)	SPTI	DISIS-2017-001
40 MVar switched cap at Wahpeton 230 kV (620329)	SPTI	DISIS-2017-001
60 MVar switched cap at Buffalo 345 kV (620358)	SPTI	DISIS-2017-001
Add breaker to the Bison shunt reactor	SPTI	MISO AFS on MPC Grp 2021
1x75 MVAr MSC at Alexandria 345 kV (658047)	SPTI	MISO AFS on MPC Grp 2021

Table B-6: Modeled MPC04300 Network Upgrades

Network Upgrades	Study Cycle	Comments
New 50-mile line from MPC04300 to a new substation approximately 60% on Jamestown-Buffalo (closer to Buffalo)	MPC 04300	in SPK and SH
Drayton 230 (657752) 2x40 MVAr MSC	MPC 04300	Only in SH
Jamestown 345 (620369) 4x75 MVAr MSC	MPC 04300	Only in SH
Maple River 230 (657754) 2x40 MVAr MSC	MPC 04300	Only in SH
Winger 230 (657758) 1x30 MVAr MSC (addition)	MPC 04300	Only in SH

B.4 MPC Prior Queued Generation Projects

Table B-7: MPC Prior Queued Generation Projects

Projects	Cluster	MW	Generation Type	Town or County	State	Substation or Line
MPC03600	MPC Group 2020	167.2	Solar	Richland	ND	Frontier-Wahpeton 230 kV
MPC03700	MPC Group 2020	127.9	Solar	Richland	ND	Frontier-Wahpeton 230 kV
MPC03800	MPC Group 2021	230	Wind	Eddy; Wells	ND	Center-Prairie 345 kV
MPC03900	MPC Group 2021	140	Wind	Eddy; Wells	ND	Center-Prairie 345 kV
MPC04000	MPC Group 2021	284	Wind	Oliver; Morton	ND	Square Butte 230 kV
MPC04300	NA	400	Wind	Steele	ND	Center-Prairie 345 kV

B.5 AECI Prior Queued Generation Projects

Table B-8: AECI Prior Queued Generation Projects

Projects	MW	Generation Type	Town or County	State	Substation or Line
GIA-61	230	Wind	Nodaway	MO	Maryville 161 kV
GIA-83	1018	Wind	Randolph	MO	McCredie 345 kV
GIA-86	100	Solar	Clifton Hill	MO	Thomas Hill 69 kV
GIA-90	100	Solar	Randolph	MO	Montgomery City 161 kV
GIA-91	96	Solar	Carroll	MO	Sedalia 69 kV
GIA-93	100	Solar	Macon		Palmyra 161 kV
GIA-95	247	Wind	Dade	MO	Jasper-Morgan 345 kV
GIA-96	97.5	Wind	Lincoln	OK	Stroud 138kV
GIA-101	460	CT Gas	Clinton	MO	Rockies Express 161 kV
GIA-102	75	CT Gas	Clinton	MO	Rockies Express 161 kV
GIA-103	460	CT Gas	Creek	OK	Bristow 138 kV
GIA-104	460	CT Gas	Payne	OK	Stillwater 138 kV

B.6 Removed Recently Retired MISO Generation

Table B-9: Removed Recently Retired MISO Generation in MISO West & Central Area

Unit(s) Description	State	Power Flow Area	Bus Name	Bus Number	Unit ID	Derate To MW	Requested Change of Status
Genoa Unit 3	WI	DPC	GENOA53G	681522	3	0	Retirement
Grand Tower Units 1-4	IL	AMIL	1GRTW 1	347170	1	0	Retirement
Grand Tower Units 1-4	IL	AMIL	1GRTW 2	347171	2	0	Retirement
Grand Tower Units 1-4	IL	AMIL	1GRTW 3	347168	3	0	Retirement
Grand Tower Units 1-4	IL	AMIL	1GRTW 4	347169	4	0	Retirement
Moulton and Champepadan Wind	MN	GRE	GRE-CHANWNDW	615108	W	0	Retirement
Meramec CTG 2	MO	AMMO	1MER 6	345172	6	0	Retirement
Elk River Station	MN	GRE	GRE-ELK RIV869	615020	1	0	Retirement
Elk River Station	MN	GRE	GRE-ELK RIV869	615020	2	0	Retirement
Elk River Station	MN	GRE	GRE-ELK RIV869	615020	3	0	Retirement
Boswell Units 1 and 2	MN	MP	BOSWE71G	608776	1	0	Retirement
Boswell Units 1 and 2	MN	MP	BOSWE72G	608777	2	0	Retirement
Schahfer Unit 14 & 15	IN	NIPS	17SCHAFER-14	255238	14	0	Retirement
Schahfer Unit 14 & 15	IN	NIPS	17SCHAFER-15	255237	15	0	Retirement
Dallman Units 31 & 32	IL	CWLP	1DALMAN 31	343549	1	0	Retirement
Dallman Units 31 & 32	IL	CWLP	1DALMAN 32	343550	2	0	Retirement
Petersburg Unit 1	IN	IPL	PETERSBURG 1	254811	1	0	Retirement
Bailly Unit 10	IN	NIPS	17BAILLY-10	255246	10	0	Retirement
Community Wind North (G586)	MN	XEL	G586 - CWN 1	600130	W	13.2	Retirement
Community Wind North (G586)	MN	XEL	G586 - CWN 2	600131	W	13.2	Retirement
Jeffers Wind (G442)	MN	XEL	G442 JEFFERW	600124	W	44	Retirement
Granite City Units 1,2,3,4	MN	XEL	GRNT CTY 1G	600126	1	0	Retirement
Granite City Units 1,2,3,4	MN	XEL	GRNT CTY 1G	600126	2	0	Retirement
Granite City Units 1,2,3,4	MN	XEL	GRNT CTY 2G	600127	3	0	Retirement
Granite City Units 1,2,3,4	MN	XEL	GRNT CTY 2G	600127	4	0	Retirement
Bailly 7 & 8	IN	NIPS	17BAILLY-7	255234	7	0	Retirement
Bailly 7 & 8	IN	NIPS	17BAILLY-8	255235	8	0	Retirement
Stoneman 1 & 2	WI	DPC	STONE	186860	1	0	Retirement

B.7 Fictitious SVCs and Switched-Off Line Reactors

Table B-10: Fictitious SVCs and Switched-Off Line Reactors

SVCs or Line Reactors	SPK Benchmark Study Model	SPK Study Model	SH Benchmark Model	SH Study Model
Spearville (531469)	NA	±250 MVAR	NA	±300 MVAR
CARPENTER 7 (523823)	NA	±600 MVAR	±200 MVAR	±550 MVAR
HITCHLAND 7 (523097)	±350 MVAR	±950 MVAR	NA	±200 MVAR
TUCO_INT 7 (525832)	NA	±500 MVAR	NA	NA
BORDER 7 (515458)	NA	±250 MVAR	NA	NA
CLARKCOUNTY7 (539800)	NA	±400 MVAR	NA	NA
NEOSHO 7 (532793)	NA	±850 MVAR	NA	NA
POTTER_CO 6 (523959)	NA	±650 MVAR	NA	NA
THISTLE7 (539801)	NA	NA	±300 MVAR	±600 MVAR
SETAB 7 (531465)	NA	NA	NA	±450 MVAR
G22-015-TAP (767280)	NA	NA	NA	±400 MVAR
Line reactor (523823 - 523097)	Turn off	Turn off	Turn off	Turn off
Line reactor (523823 - 523853)	Turn off	Turn off	Turn off	Turn off
Line reactor (525832 - 511456)	Turn off	Turn off	Turn off	Turn off
Line reactor (525832 - 515458)	Turn off	Turn off	Turn off	Turn off
Line reactor (525832 - 526936)	Turn off	Turn off	Turn off	Turn off

B.8 Contingency Files used in MISO West AFSIS Analysis

Table B-11: List of Contingencies used in the MISO West AFSIS Analysis

Contingency File Name	Description
Automatic single element contingencies	Single element outages at buses 60 kV and above in the study region
DPP2021 Ph2 LRTP Tranche 1 Projects 7 8 MEC CONs.con	MEC category P2 and P7 Contingency Updates for LRTP Tranche 1 Project 7 and 8
LRTP 6_P1.con	Specified category P1 contingency for LRTP Tranche 1 Project 6
LRTP 6_P1_P2.con	Specified category P1, P2 contingencies for LRTP Tranche 1 Project 6
MDU DPP 2021 Phase 2 Cat P1 2023.11.03.con	Specified category P1 contingencies in MDU
MDU DPP 2021 Phase 2 Cat P1_P2_P4 2023.11.03.con	Specified category P1, P2, P4 contingencies in MDU
MEC DPP 2021 Phase 2 Cat P1 2023.11.03.con	Specified category P1 contingencies in MEC
MEC DPP 2021 Phase 2 Cat P2 2023.11.03.con	Specified category P2 contingencies in MEC
MEC DPP 2021_P1.con	Specified category P1 contingencies in MEC
MEC DPP 2021_P2.con	Specified category P2 contingencies in MEC
MEC_P1.con	Specified category P1 contingencies in MEC
MEC DPP 2021 Phase 2 Cat P5 2023.11.03.con	Specified category P5 contingencies in MEC
MEC DPP 2021 Phase 2 Cat P7 2023.11.03.con	Specified category P7 contingencies in MEC
MEC DPP 2021_P5.con	Specified category P5 contingencies in MEC
MEC DPP 2021_P7.con	Specified category P7 contingencies in MEC
MISO21_2026_SUM_TA_Central_P1.con	Specified category P1 contingencies in MISO Central
MISO21_2026_SUM_TA_Central_P1_P2_P4_P5_P7.con	Specified category P1, P2, P4, P5, P7 contingencies in MISO Central
MISO21_2026_SUM_TA_IOWA_P1.con	Specified category P1 contingencies in Iowa
MISO21_2026_SUM_TA_IOWA_P1_P2_P4_P5_P7.con	Specified category P1, P2, P4, P5, P7 contingencies in Iowa
MISO21_2026_SUM_TA_MINN-DAKS_P1.con	Specified category P1 contingencies in MN, Dakotas
MISO21_2026_SUM_TA_MINN-DAKS_P1_P2_P4_P5_P7.con	Specified category P1, P2, P4, P5, P7 contingencies in MN, Dakotas
XEL_LRTP_P1.con	Specified category P1 contingencies in Xcel
MISO_DPP_2021_PRELIM_MH.con	Specified contingencies in MH
AECI-AMMO.CON	Specified category P1, P2 contingencies in AECI-AMMO
AECI-EES.con	Specified category P2, P3, P6 contingencies in AECI-EES

Contingency File Name	Description
160303-KACY_P1.con	Specified category P1 contingencies in KACY
160303-KACY_P2.con	Specified category P2 contingencies in KACY
KCPL_P1.con	Specified category P1 contingencies in KCPL
KCPL_P2.con	Specified category P2 contingencies in KCPL
KCPL_P4.con	Specified category P4 contingencies in KCPL
KCPL_P5.con	Specified category P5 contingencies in KCPL
KCPL_P7.con	Specified category P7 contingencies in KCPL

Appendix

C

MISO South AFSIS Thermal and Voltage Analysis Results

C.1 2026 Summer Peak (SPK) MISO South AFSIS Constraints

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C.2 2026 Summer Shoulder (SH) MISO South AFSIS Constraints

Table C-7. 2026 SH System Intact MISO South Thermal Constraints

Table C-8. 2026 SH System Intact MISO South Voltage Constraints

Table C-9. 2026 SH Category P1 MISO South Thermal Constraints

Table C-10. 2026 SH Category P1 MISO South Voltage Constraints

Table C-11. 2026 SH Category P2-P7 MISO South Thermal Constraints

Table C-12. 2026 SH Category P2-P7 MISO South Voltage Constraints

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Appendix

D

MISO South AFSIS Stability Analysis Results

D.1 2026 Summer Peak (SPK) MISO South AFSIS Stability Results

Stability simulation was performed in the 2026 summer peak (SPK) stability model.

D.1.1 2026 SPK MISO South AFSIS Stability Summary

MISO South AFSIS summer peak stability study results are summarized in Table D-1.

Table D-1: 2026 Summer Peak MISO South AFSIS Stability Analysis Results Summary

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D.1.2 2026 SPK MISO South AFSIS Stability Plots

Plots of stability simulations for 2026 summer peak study case are in separate files which are listed below:

AppendixD1-2_2026SPK_SPP South_Study_Plots.zip

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D.2 2026 Summer Shoulder MISO South AFSIS Stability Results

Stability simulation was performed in the 2026 summer shoulder (SH) stability model.

D.2.1 2026 SH MISO South AFSIS Stability Summary

MISO South AFSIS summer shoulder stability study results are summarized in Table D-2.

Table D-2: 2026 Summer Shoulder MISO South AFSIS Stability Analysis Results Summary

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D.2.2 2026 SH MISO South AFSIS Stability Plots

Plots of stability simulations for 2026 summer shoulder study case are in separate files which are listed below:

AppendixD2-2_2026SH_SPP South_Study_Plots.zip

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Appendix

E

MISO West AFSIS Thermal and Voltage Analysis Results

E.1 2026 Summer Peak (SPK) MISO West AFSIS Constraints

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E.2 2026 Summer Shoulder (SH) MISO West AFSIS Constraints

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Appendix

F

MISO West AFSIS Stability Analysis Results

F.1 2026 Summer Peak (SPK) MISO West AFSIS Stability Results

Stability simulation was performed in the 2026 summer peak (SPK) stability model.

F.1.1 2026 SPK MISO West AFSIS Stability Summary

MISO West AFSIS summer peak stability study results are summarized in Table F-1.

Table F-1: 2026 Summer Peak MISO West AFSIS Stability Analysis Results Summary

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F.1.2 2026 SPK MISO West AFSIS Stability Plots

Plots of stability simulations for 2026 summer peak study case are in separate files which are listed below:

AppendixF1-2_2026SPK_SPP West_Study_Plots.zip

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F.2 2026 Summer Shoulder MISO West AFSIS Stability Results

Stability simulation was performed in the 2026 summer shoulder (SH) stability model.

F.2.1 2026 SH MISO West AFSIS Stability Summary

MISO West AFSIS summer shoulder stability study results are summarized in Table F-2.

Table F-2: 2026 Summer Shoulder MISO West AFSIS Stability Analysis Results Summary

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F.2.2 2026 SH MISO West AFSIS Stability Plots

Plots of stability simulations for 2026 summer shoulder study case are in separate files which are listed below:

AppendixF2-2_2026SH_SPP West_Study_Plots.zip

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Appendix

G

2026 Cost Allocation Results

G.1 MISO South AFSIS Network Upgrade Cost Allocation

G.1.1 Distribution Factor (DF) and MW Contribution Results for MISO South AFSIS Cost Allocation

Table G-1: Distribution Factor and MW Contribution on Constraints for MISO South Affected System Thermal NU Cost Allocation

Table G-2: Voltage Impact on MISO South Voltage NUs Cost Allocation

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G.1.2 MISO South AFSIS Network Upgrade Cost Allocation Details

Table G-3: MISO South Affected System Network Upgrades Cost Allocation

Table G-3: MISO South Affected System Network Upgrades Cost Allocatio

Monitored Element	English Name	Owner	Cost	GEN-2023-001	GEN-2023-005	GEN-2023-009	GEN-2023-010	GEN-2023-022	GEN-2023-027	GEN-2023-028	GEN-2023-030	GEN-2023-035	GEN-2023-038
334197 7ROCKYCRK% 345 334198 6ROCKYCRK 230 1	Rocky Creek 345-230 kV xfmr	EES	$32,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
337502 3COUCH% 115 338874 3LEWISVILLE# 115 1	Couch-Lewisville 115 kV	EES-EAI	$14,380,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
337672 4MURFBORO 138 775000 G23-151-TAP 138 1	Murfreesboro - G23-151 Tap 138 kV	EES-EAI AEPW	$20,050,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
337673 3MURFBORO.S! 115 337672 4MURFBORO 138 337671 1MURFBORO 13.8	Murfreesboro 138-115-13.8 kV xfmr	EES-EAI	$15,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
337674 3AMITY% 115 338849 3MURFBORO.E# 115 1	Amity-Murfreesboro E. 138 kV	EES-EAI	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
338188 8SANS SOUCI% 500 338198 8DRIVER% 500 1	Sans Souci-Driver 500 kV	EES-EAI	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
338198 8DRIVER% 500 338400 8SANDYBAYOU% 500 1	Driver-Sandy Bayou 500 kV	EES-EAI	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
338874 3LEWISVILLE# 115 338875 3PATMOS.W# 115 1	Lewisville-Patmos 115 kV	EES-EAI AECC	$15,560,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
338875 3PATMOS.W# 115 503912 FULTON 3 115 1	Patmos-Fulton 115 kV	EES-EAI AEPW AECC	$33,390,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
300 MVAR STATCOM at Grimes 138 kV	300 MVAR STATCOM at Grimes 138 kV	EES	$51,000,000	$439,655	$571,552	$1,626,724	$131,897	$175,862	$395,690	$615,517	$131,897	$703,448	$879,310
Total Cost Per Project for each Project	**Total Cost Per Project**		**$181,380,000**	**$439,655**	**$571,552**	**$1,626,724**	**$131,897**	**$175,862**	**$395,690**	**$615,517**	**$131,897**	**$703,448**	**$879,310**

English Name	GEN-2023-049	GEN-2023-055	GEN-2023-056	GEN-2023-057	GEN-2023-059	GEN-2023-060	GEN-2023-063	GEN-2023-064	GEN-2023-069	GEN-2023-075	GEN-2023-076	GEN-2023-081
Rocky Creek 345-230 kV xfmr	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Couch-Lewisville 115 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Murfreesboro - G23-151 Tap 138 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Murfreesboro 138-115-13.8 kV xfmr	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Amity-Murfreesboro E. 138 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sans Souci-Driver 500 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Driver-Sandy Bayou 500 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lewisville-Patmos 115 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Patmos-Fulton 115 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
300 MVAR STATCOM at Grimes 138 kV	$395,690	$263,793	$263,793	$483,621	$1,934,483	$571,552	$395,690	$395,690	$483,621	$87,931	$43,966	$1,318,966
Total Cost Per Project	**$395,690**	**$263,793**	**$263,793**	**$483,621**	**$1,934,483**	**$571,552**	**$395,690**	**$395,690**	**$483,621**	**$87,931**	**$43,966**	**$1,318,966**

English Name	GEN-2023-086	GEN-2023-088	GEN-2023-092	GEN-2023-100	GEN-2023-102	GEN-2023-110	GEN-2023-123	GEN-2023-132	GEN-2023-134	GEN-2023-135	GEN-2023-138	GEN-2023-142
Rocky Creek 345-230 kV xfmr	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Couch-Lewisville 115 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$438,275	$0	$0
Murfreesboro - G23-151 Tap 138 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Murfreesboro 138-115-13.8 kV xfmr	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Amity-Murfreesboro E. 138 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sans Souci-Driver 500 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Driver-Sandy Bayou 500 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lewisville-Patmos 115 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$474,239	$0	$0
Patmos-Fulton 115 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,017,663	$0	$0
300 MVAR STATCOM at Grimes 138 kV	$879,310	$43,966	$791,379	$923,276	$1,406,897	$659,483	$131,897	$43,966	$131,897	$483,621	$87,931	$615,517
Total Cost Per Project	**$879,310**	**$43,966**	**$791,379**	**$923,276**	**$1,406,897**	**$659,483**	**$131,897**	**$43,966**	**$131,897**	**$2,413,798**	**$87,931**	**$615,517**

English Name	GEN-2023-151	GEN-2023-158	GEN-2023-164	GEN-2023-165	GEN-2023-167	GEN-2023-168	GEN-2023-174	GEN-2023-176	GEN-2023-177	GEN-2023-180	GEN-2023-183	GEN-2023-188
Rocky Creek 345-230 kV xfmr	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Couch-Lewisville 115 kV	$1,217,775	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Murfreesboro - G23-151 Tap 138 kV	$11,423,690	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Murfreesboro 138-115-13.8 kV xfmr	$15,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Amity-Murfreesboro E. 138 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sans Souci-Driver 500 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Driver-Sandy Bayou 500 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lewisville-Patmos 115 kV	$1,317,703	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Patmos-Fulton 115 kV	$2,827,642	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
300 MVAR STATCOM at Grimes 138 kV	$571,552	$703,448	$747,414	$747,414	$923,276	$659,483	$615,517	$87,931	$791,379	$263,793	$527,586	$571,552
Total Cost Per Project	**$32,358,361**	**$703,448**	**$747,414**	**$747,414**	**$923,276**	**$659,483**	**$615,517**	**$87,931**	**$791,379**	**$263,793**	**$527,586**	**$571,552**

English Name	GEN-2023-193	GEN-2023-195	GEN-2023-201	GEN-2023-203	GEN-2023-204	GEN-2023-205	GEN-2023-206	GEN-2023-210	GEN-2023-211	GEN-2023-212	GEN-2023-213	GEN-2023-227
Rocky Creek 345-230 kV xfmr	$0	$0	$0	$0	$32,000,000	$0	$0	$0	$0	$0	$0	$0
Couch-Lewisville 115 kV	$0	$0	$0	$0	$8,449,345	$0	$0	$0	$0	$4,274,606	$0	$0
Murfreesboro - G23-151 Tap 138 kV	$0	$0	$0	$0	$8,626,310	$0	$0	$0	$0	$0	$0	$0
Murfreesboro 138-115-13.8 kV xfmr	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Amity-Murfreesboro E. 138 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sans Souci-Driver 500 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Driver-Sandy Bayou 500 kV	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lewisville-Patmos 115 kV	$0	$0	$0	$0	$9,142,685	$0	$0	$0	$0	$4,625,373	$0	$0
Patmos-Fulton 115 kV	$0	$0	$0	$0	$19,619,168	$0	$0	$0	$0	$9,925,527	$0	$0
300 MVAR STATCOM at Grimes 138 kV	$2,550,000	$527,586	$615,517	$615,517	$8,573,276	$659,483	$87,931	$659,483	$747,414	$3,341,379	$263,793	$2,286,207
Total Cost Per Project	**$2,550,000**	**$527,586**	**$615,517**	**$615,517**	**$86,410,784**	**$659,483**	**$87,931**	**$659,483**	**$747,414**	**$22,166,885**	**$263,793**	**$2,286,207**

English Name	GEN-2023-228	GEN-2023-229	GEN-2023-230	GEN-2023-236	GEN-2023-237	GEN-2023-241
Rocky Creek 345-230 kV xfmr	$0	$0	$0	$0	$0	$0
Couch-Lewisville 115 kV	$0	$0	$0	$0	$0	$0
Murfreesboro - G23-151 Tap 138 kV	$0	$0	$0	$0	$0	$0
Murfreesboro 138-115-13.8 kV xfmr	$0	$0	$0	$0	$0	$0
Amity-Murfreesboro E. 138 kV	$0	$0	$0	$0	$0	$0
Sans Souci-Driver 500 kV	$0	$0	$0	$0	$0	$0
Driver-Sandy Bayou 500 kV	$0	$0	$0	$0	$0	$0
Lewisville-Patmos 115 kV	$0	$0	$0	$0	$0	$0
Patmos-Fulton 115 kV	$0	$0	$0	$0	$0	$0
300 MVAR STATCOM at Grimes 138 kV	$703,448	$131,897	$1,362,931	$835,345	$175,862	$1,143,103
Total Cost Per Project	**$703,448**	**$131,897**	**$1,362,931**	**$835,345**	**$175,862**	**$1,143,103**

G.2 MISO West AFSIS Network Upgrade Cost Allocation

G.2.1 Distribution Factor (DF), Voltage Impact, and MW Contribution Results for MISO West AFSIS Cost Allocation

Table G-4: Distribution Factor and MW Contribution on Constraints for MISO West Affected System Thermal NU Cost Allocation

Table G-5: Voltage Impact on MISO West Voltage NUs Cost Allocation

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G.2.2 MISO West AFSIS Network Upgrade Cost Allocation Details

Table G-6: MISO West Affected System Network Upgrades Cost Allocation

Table G-6: MISO West Affected System Network Upgrades Cost Allocation

Monitored Element	English Name	Owner	Cost	GEN-2023-006	GEN-2023-011	GEN-2023-012	GEN-2023-015	GEN-2023-023	GEN-2023-032	GEN-2023-033	GEN-2023-036	GEN-2023-037	GEN-2023-050
40400 J976 POI 345 344536 7ENON_TP 345 1	J976 POI-Enon Tap 345 kV	Ameren	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
40400 J976 POI 345 345230 7MONTGMRY 345 1	J976 POI-Montgomery 345 kV	Ameren	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
65700 NEW SUB 345 620358 BUFFALO3 345 1	MPC4300 New Sub-Buffalo 345 kV	OTP	$100,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
338104 5HARRISON.E! 161 338121 5SUMMIT 161 1	Harrison East-Summit 161 kV	EES-EAI	$29,730,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
601067 BISON 3 345 620358 BUFFALO3 345 1	Bison-Buffalo 345 kV	XEL OTP MPC	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
602006 SHEYNNE4 230 620337 LAKE PARK T4 230 1	Sheyenne-Lake Park 230 kV	XEL OTP	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
620336 AUDUBON4 230 620337 LAKE PARK T4 230 1	Audubon-Lake Park 230 kV	OTP	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
635200 RAUN 3 345 762779 G18-043-TAP 345 1	Raun - Gen-2018-043 POI 345 kV	MEC OPPD	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
661038 GLENHAM4 230 652499 CAMPBELL 4 230 1	Glenham-Campbell 230 kV	MDU WAPA	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	EES	$4,500,000	$0	$281,250	$0	$0	$0	$0	$0	$0	$0	$0
DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	Ameren	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
27 MVAR cap bank at Pilot Knob 1 (345511)	27 MVAR cap bank at Pilot Knob 1 (345511)	Ameren	$2,100,000	$7,778	$46,667	$38,889	$0	$54,444	$62,222	$62,222	$62,222	$54,444	$0
4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	MRES	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	OTP	$1,750,000	$22,976	$42,123	$51,696	$0	$26,805	$0	$26,805	$21,061	$26,805	$22,976
3x50 MVAR 230 kV MSC at Big Stone South (620322)	3x50 MVAR 230 kV MSC at Big Stone South (620322)	OTP	$10,750,000	$128,316	$242,374	$470,491	$0	$142,573	$0	$142,573	$114,058	$142,573	$128,316
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	MRES	$11,900,000	$147,087	$273,161	$483,284	$0	$168,099	$0	$168,099	$133,078	$175,103	$147,087
3x50 MVAR MSC at the Forman 230 kV (620363)	3x50 MVAR MSC at the Forman 230 kV (620363)	OTP	$10,750,000	$99,274	$184,367	$156,003	$0	$99,274	$0	$99,274	$85,092	$99,274	$99,274
3x40MVAR MSC at Audubon 230 kV (620336)	3x40MVAR MSC at Audubon 230 kV (620336)	OTP	$10,250,000	$115,169	$216,788	$311,633	$0	$135,492	$0	$135,492	$108,394	$135,492	$121,943
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	OTP	$4,250,000	$48,023	$92,043	$120,056	$0	$56,026	$0	$56,026	$44,021	$56,026	$48,023
LRTP-1: Jamestown - Ellendale	LRTP-1: Jamestown - Ellendale	TBD	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LRTP-2: Big Stone South - Alexandria - Cassie's Crossing	LRTP-2: Big Stone South - Alexandria - Cassie's Crossing	TBD	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost Per Project for each Project	**Total Cost Per Project**		**$86,080,000**	**$568,621**	**$1,378,772**	**$1,632,051**	**$0**	**$682,715**	**$62,222**	**$690,492**	**$567,927**	**$689,719**	**$567,618**

Monitored Element	GEN-2023-061	GEN-2023-062	GEN-2023-065	GEN-2023-073	GEN-2023-077	GEN-2023-078	GEN-2023-079	GEN-2023-082	GEN-2023-085	GEN-2023-087	GEN-2023-097	GEN-2023-099	GEN-2023-105	GEN-2023-107
40400 J976 POI 345 344536 7ENON_TP 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
40400 J976 POI 345 345230 7MONTGMRY 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
65700 NEW SUB 345 620358 BUFFALO3 345 1	$0	$11,040	$0	$0	$0	$0	$0	$0	$0	$0	$28,052	$0	$27,280	$0
338104 5HARRISON.E! 161 338121 5SUMMIT 161 1	$0	$0	$0	$0	$0	$0	$0	$0	$29,730,000	$0	$0	$0	$0	$0
601067 BISON 3 345 620358 BUFFALO3 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
602006 SHEYNNE4 230 620337 LAKE PARK T4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
620336 AUDUBON4 230 620337 LAKE PARK T4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
635200 RAUN 3 345 762779 G18-043-TAP 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
661038 GLENHAM4 230 652499 CAMPBELL 4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	$0	$281,250	$0	$0	$0	$0	$0	$281,250	$0	$0	$281,250	$0	$281,250	$0
DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
27 MVAR cap bank at Pilot Knob 1 (345511)	$0	$58,333	$0	$0	$73,889	$73,889	$77,778	$73,889	$0	$42,778	$81,667	$19,444	$46,667	$27,222
4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	$11,488	$101,477	$19,147	$32,549	$0	$0	$0	$70,842	$13,403	$0	$195,295	$0	$130,197	$57,440
3x50 MVAR 230 kV MSC at Big Stone South (620322)	$57,029	$427,719	$99,801	$171,088	$0	$0	$0	$826,923	$57,029	$0	$1,069,297	$0	$855,438	$285,146
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	$70,041	$469,276	$119,070	$203,119	$0	$0	$0	$875,515	$77,045	$0	$1,155,680	$0	$917,540	$322,190
3x50 MVAR MSC at the Forman 230 kV (620363)	$42,546	$808,377	$85,092	$127,639	$0	$0	$0	$141,821	$42,546	$0	$2,042,216	$0	$1,049,472	$255,277
3x40MVAR MSC at Audubon 230 kV (620336)	$54,197	$514,871	$94,845	$162,591	$0	$0	$0	$487,773	$60,972	$0	$1,300,727	$0	$846,827	$277,759
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	$24,011	$236,111	$40,019	$68,032	$0	$0	$0	$168,079	$28,013	$0	$568,267	$0	$348,164	$120,056
LRTP-1: Jamestown - Ellendale	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LRTP-2: Big Stone South - Alexandria - Cassie's Crossing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost Per Project for each Project	**$259,313**	**$2,908,455**	**$457,974**	**$765,018**	**$73,889**	**$73,889**	**$77,778**	**$2,926,092**	**$30,009,008**	**$42,778**	**$6,722,451**	**$19,444**	**$4,502,835**	**$1,345,090**

Monitored Element	GEN-2023-116	GEN-2023-117	GEN-2023-133	GEN-2023-149	GEN-2023-153	GEN-2023-154	GEN-2023-169	GEN-2023-170	GEN-2023-171	GEN-2023-172	GEN-2023-182
40400 J976 POI 345 344536 7ENON_TP 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
40400 J976 POI 345 345230 7MONTGMRY 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
65700 NEW SUB 345 620358 BUFFALO3 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$33,628
338104 5HARRISON.E! 161 338121 5SUMMIT 161 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
601067 BISON 3 345 620358 BUFFALO3 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
602006 SHEYNNE4 230 620337 LAKE PARK T4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
620336 AUDUBON4 230 620337 LAKE PARK T4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
635200 RAUN 3 345 762779 G18-043-TAP 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
661038 GLENHAM4 230 652499 CAMPBELL 4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	$562,500	$562,500	$281,250	$0	$281,250	$281,250	$0	$0	$0	$0	$281,250
DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
27 MVAR cap bank at Pilot Knob 1 (345511)	$58,333	$50,556	$50,556	$0	$62,222	$73,889	$62,222	$101,111	$58,333	$19,444	$50,556
4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	$114,880	$86,160	$72,757	$38,293	$44,037	$0	$15,317	$11,488	$19,147	$36,379	$187,637
3x50 MVAR 230 kV MSC at Big Stone South (620322)	$812,666	$499,005	$384,947	$199,602	$213,859	$0	$85,544	$57,029	$99,801	$185,345	$1,340,186
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	$896,527	$546,321	$427,251	$238,140	$245,144	$0	$105,062	$77,045	$126,074	$217,128	$1,393,820
3x50 MVAR MSC at the Forman 230 kV (620363)	$836,741	$510,554	$354,551	$156,003	$212,731	$0	$56,728	$42,546	$70,910	$156,003	$1,843,668
3x40MVAR MSC at Audubon 230 kV (620336)	$772,307	$480,998	$365,829	$189,689	$203,239	$0	$81,295	$60,972	$101,619	$176,140	$1,382,022
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	$308,145	$200,094	$152,072	$80,038	$88,041	$0	$32,015	$24,011	$40,019	$76,036	$572,269
LRTP-1: Jamestown - Ellendale	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LRTP-2: Big Stone South - Alexandria - Cassie's Crossing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost Per Project for each Project	**$4,362,099**	**$2,936,188**	**$2,089,213**	**$901,765**	**$1,350,524**	**$355,139**	**$438,184**	**$374,203**	**$515,904**	**$866,474**	**$7,085,035**

Monitored Element	GEN-2023-194	GEN-2023-199	GEN-2023-216	GEN-2023-217	GEN-2023-218	GEN-2023-219	GEN-2023-220	GEN-2023-221	GEN-2023-222	GEN-2023-223	GEN-2023-224	GEN-2023-225	GEN-2023-231
40400 J976 POI 345 344536 7ENON_TP 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
40400 J976 POI 345 345230 7MONTGMRY 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
65700 NEW SUB 345 620358 BUFFALO3 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
338104 5HARRISON.E! 161 338121 5SUMMIT 161 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
601067 BISON 3 345 620358 BUFFALO3 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
602006 SHEYNNE4 230 620337 LAKE PARK T4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
620336 AUDUBON4 230 620337 LAKE PARK T4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
635200 RAUN 3 345 762779 G18-043-TAP 345 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
661038 GLENHAM4 230 652499 CAMPBELL 4 230 1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Install a 20 MVAR capacitor bank at Glenwood 115 kV (337676)	$0	$0	$281,250	$281,250	$281,250	$0	$0	$0	$0	$0	$0	$0	$0
DPP 2021 upgrade, 27 MVAR cap bank at Camden (344257)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
27 MVAR cap bank at Pilot Knob 1 (345511)	$0	$81,667	$46,667	$46,667	$46,667	$38,889	$11,667	$11,667	$62,222	$70,000	$62,222	$70,000	$0
4x40 MVAr MSC at McLeod 230 (658276). Currently assigned to DISIS-2018-002/2019-001 cluster. $10.9M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1x19.4MVAR 115 kV MSC at CSLTNE 7 (620180). (Total 2x19.4 MVAR)	$0	$65,098	$49,781	$49,781	$49,781	$0	$0	$0	$0	$0	$0	$0	$36,379
3x50 MVAR 230 kV MSC at Big Stone South (620322)	$0	$413,462	$299,403	$299,403	$299,403	$0	$0	$0	$0	$0	$0	$0	$199,602
2x75 MVAr additional MSC at Alexandria 345 (658047). (Total is 4x75 MVAR)	$0	$469,276	$343,202	$343,202	$343,202	$0	$0	$0	$0	$0	$0	$0	$224,132
3x50 MVAR MSC at the Forman 230 kV (620363)	$0	$255,277	$198,549	$198,549	$198,549	$0	$0	$0	$0	$0	$0	$0	$141,821
3x40MVAR MSC at Audubon 230 kV (620336)	$0	$359,055	$270,985	$270,985	$270,985	$0	$0	$0	$0	$0	$0	$0	$182,915
1x60 MVAR additional MSC at Buffalo 345 kV (620358) (Total is 2x60 MVAR)	$0	$144,068	$112,053	$112,053	$112,053	$0	$0	$0	$0	$0	$0	$0	$76,036
LRTP-1: Jamestown - Ellendale	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
LRTP-2: Big Stone South - Alexandria - Cassie's Crossing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost Per Project for each Project	**$0**	**$1,787,902**	**$1,601,889**	**$1,601,889**	**$1,601,889**	**$38,889**	**$11,667**	**$11,667**	**$62,222**	**$70,000**	**$62,222**	**$70,000**	**$860,884**

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