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MISO Affected System Impact Restudy on SPP DISIS-18-002 / 19-001 West Phase 3 Cluster

Prepared for

MISO

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Executive Summary

This report presents restudy results of an Affected System Impact Study (AFSIS) on MISO transmission system performed for generator interconnection requests in the Southwest Power Pool (SPP) queue 2018-002 / 2019-001 Phase 3 cluster west region (Study Projects). The AFSIS restudy results are summarized below.

1.1 Study Project List

The generation projects (Study Projects) in SPP DISIS-2018-002 / 2019-001 Phase 3 cluster west region have 10 generation projects with combined energy of 1598.65 MW, which are listed in Table ES-1.

Table ES-1: SPP DISIS-2018-002 / 2019-001 West Phase 3 Study Projects

Project #	Town / County	State	Point of Interconnection	Generation Type	Pmax	SH (MW)	SPK (MW)
GEN-2018-067	Williams	ND	Strandahl 115 kV	Wind	255	255	39.8
GEN-2018-074	Crawford / Carrol	IA	Denison 230 kV	Wind	72	72	11.2
GEN-2018-125	Lincoln	NE	Gentleman-Sweetwater 345 kV	Wind	231	231	36.0
GEN-2018-131	Pierce	NE	Antelope 345 kV	Solar	221.4	0	221.4
GEN-2018-132	Pierce	NE	Antelope 345 kV	Solar	201.6	0	201.6
GEN-2019-016	Polk / Dade	MO	Dadeville 161 kV	Solar	200	0	200.0
GEN-2019-019	Sioux	IA	Siouxland 69 kV	CT	15.15	0	15.15
GEN-2019-037	Mercer	ND	Leland Olds 345 kV	Solar	150	0	150.0
GEN-2019-039	Butler	NE	Columbus Southeast-Rising City 115 kV	Solar	174.5	0	174.5
GEN-2019-041	Lancaster	NE	Monolith 115 kV	Solar	78	0	78.0

1.2 MISO AFSIS Restudy Summary

MISO AFSIS restudy steady state models and stability packages were developed from the final models and stability package used in MISO AFSIS study for DISIS-2018-002 / 2019-001 West Phase 3 cycle.

Steady state thermal and voltage analysis was performed to identify any thermal and voltage violations in MISO region. Thermal AFSIS Network Upgrades identified in the steady state analysis are listed in Table ES-2. No MISO AFSIS voltage Network Upgrades (NUs) were identified.

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Table ES-2: MISO AFSIS Thermal Network Upgrades Identified for SPP Study Projects

Constraint	Owner	Mitigation	Cost ($)
Merricourt-Wishek 230 kV	MDU	MTEP ID: 25503, Facility ID:28741. Reconductor and pole replacement. Post upgrade rating:730 MVA/803 MVA SUM, and 767 MVA/844 MVA WIN (Normal/Emergency)	$0

Transient stability analysis was performed to identify any transient stability violations caused by the DISIS-2018-002 / 2019-001 West Study Projects. No transient stability constraints were identified in the summer peak and summer shoulder scenarios. No MISO AFSIS stability Network Upgrades are required for the Study Projects in DISIS 2018-002 / 2019-001 West Cluster. The GEN-2018-067 issue of active power output reduction and low terminal voltage is unrelated to MISO Affected System.

A short circuit screening analysis was conducted by comparing three phase fault currents in the benchmark and study cases for the DISIS-2018-002 / 2019-001 West Study Projects. Based on the screening results, MISO Transmission Owners do not plan to conduct additional studies.

Contingent facilities were identified. Details are in Section 4.

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, no injection is allowed until the allocated upgrades and contingent facilities are in service.

1.3 Total MISO AFSIS Network Upgrades

The total cost of MISO AFSIS Network Upgrades required for the Study Projects in DISIS-2018-002 / 2019-001 West Phase 3 cycle is listed in Table ES-3. The costs for Network Upgrades are planning level estimates and subject to be revised in the facility studies.

Table ES-3: Total Cost of MISO AFSIS Network Upgrades for DISIS-2018-002 / 2019-001 West Study Projects

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2018-067	$0	$0	$0	$0
GEN-2018-074	$0	$0	$0	$0
GEN-2018-125	$0	$0	$0	$0
GEN-2018-131	$0	$0	$0	$0
GEN-2018-132	$0	$0	$0	$0
GEN-2019-016	$0	$0	$0	$0
GEN-2019-019	$0	$0	$0	$0
GEN-2019-037	$0	$0	$0	$0
GEN-2019-039	$0	$0	$0	$0
GEN-2019-041	$0	$0	$0	$0
Total ($)	**$0**	**$0**	**$0**	**$0**

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-2018-002 / 2019-001 West cluster.

All the Study Projects in SPP DISIS-2018-002 / 2019-001 West cluster do not have MISO AFSIS Network Upgrade cost allocated to the projects

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Section

1

Model Development and Study Criteria

1.1 Model Development

Models used in this AFSIS restudy were developed from the final models used in MISO AFSIS study for DISIS-2018-002 / 2019-001 West Phase 3 cycle, which were originally developed from MISO DPP 2020 West Area Phase 3 final models. The MISO AFSIS final benchmark models for DISIS-2018-002 / 2019-001 West Phase 3 cycle are listed below:

- 2025 summer peak model: SPP DISIS-West_AFSIS-Ph3-2025SUM-Benchmark_231118.sav
- 2025 summer shoulder model: SPP DISIS-West_AFSIS-Ph3-2025SH90-Benchmark_231118.sav

1.1.1 MISO AFSIS Benchmark Models

The summer peak and summer shoulder benchmark cases for the AFSIS restudy were created as follows:

- Removed recently withdrawn MISO Classic prior queued generation projects (Table A-1). Power mismatch was balanced by scaling generation in the MISO North (Table A-10).
- Removed recently withdrawn SPP prior and current queued generation projects (Table A-2). Power mismatch was balanced by scaling generation in SPP market (Table A-11) based on the load-ratio share of the TO) power flow modeling areas.
- Turned off MISO generation projects in DPP 2020 Central area. Power mismatch was balanced by scaling generation in the MISO North (Table A-10).
- Added and dispatched SPP prior queued generation projects (Table A-4) close to MISO West. Power mismatch was balanced by scaling generation in SPP market (Table A-11) based on the load-ratio share of the TO power flow modeling areas.
- Added and dispatched AECI prior queued generation projects (Table A-6). Removed withdrawn AECI project GI-084 (Table A-3). Power mismatch was balanced by scaling generation in AECI (Table A-12).
- Added and dispatched MPC prior queued generation projects (Table A-5). Removed duplicated MPC 04000 project and withdrawn project MPC04300. Power mismatch was balanced by scaling generation in the MISO North (Table A-10) except generation in Dakotas.
- Removed Scott County – Hazel Creek 345 kV Network Upgrade which was originally required for DPP 2020 West projects. Removed fictitious shunt capacitors at Jamestown 345 kV bus (bus #: 620369) and Wahpeton 230 kV bus (bus #: 620329) which were originally modeled in DPP 2020 West summer shoulder models.
- Removed Gentleman – Keystone – Red Willow – Post Rock 345 kV line which is no longer required by prior queued SPP projects. Removed Antelope Valley – Grand Prairie 345 kV line which is no longer required by prior queued SPP projects.

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- Removed withdrawn Network Upgrades (Table A-7).
- Added MISO LRTP-1 project “Jamestown – Ellendale” and MISO LRTP-2 project “Big Stone South - Alexandria - Cassie's Crossing” (Table A-8).
- Network Upgrades for prior queued projects and MTEP Appendix A projects were added into the models (Table A-8).
- Added the SPP Study Projects with offline status in DISIS 2018-002 / 2019-001 West Cluster. The SPP Study Projects in MISO West are listed in Table ES-1.
- Updated bus voltage limits based on MTEP25
- Corrected modeling errors based on reviewing comments (Table A-9).

1.1.1.1 MISO AFSIS Study Models

Summer peak (SPK) study case was created by dispatching the DISIS-2018-002 / 2019-001 West Study Projects at the specified summer peak level from the benchmark case.

Summer shoulder (SH) study case was created by dispatching the DISIS-2018-002 / 2019-001 West Study Projects 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.

1.1.2 Contingency Criteria

The following contingencies were considered in the AFSIS steady-state 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.11.

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 Monitored Elements

The MISO AFSIS study area is defined in Table 1-1. 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 1-1: MISO 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
ATCLLC	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
EES	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

<u>Notes</u>

1: PSS®E Rate A, Rate B or Rate C

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1.2 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.

Section

2

MISO Steady-State Thermal and Voltage Analysis

Nonlinear (AC) contingency analysis was performed on the benchmark and study cases, and the incremental impact of the DISIS-2018-002 / 2019-001 West Study Projects was 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 TARA were used in the study.

2.1 MISO Contingency Analysis for Summer Peak Condition

Steady state AC contingency analysis was performed on the MISO AFSIS summer peak (SPK) study and benchmark cases developed in Section 1.1. The summer peak MISO AFSIS thermal and voltage results are in Appendix B.1.

2.1.1 Summer Peak System Intact Conditions

For NERC category P0 (system intact) conditions, no thermal constraints (Table B-1) or voltage constraints (Table B-2) were identified.

2.1.2 Summer Peak Post Contingency Conditions

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

For P1 contingencies, no thermal constraints (Table B-3) or voltage constraints (Table B-4) were identified.

For P2-P7 contingencies, no thermal constraints (Table B-5) or voltage constraints (Table B-6) were identified.

2.1.3 Summary of Summer Peak Results

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

2.2 MISO Contingency Analysis for Summer Shoulder Condition

Steady state AC contingency analysis was performed on the MISO AFSIS summer shoulder (SH) study and benchmark cases developed in Section 1.1. The summer shoulder MISO AFSIS thermal and voltage results are in Appendix B.2.

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2.2.1 Summer Shoulder System Intact Conditions

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

2.2.2 Summer Shoulder Post Contingency Conditions

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

For P1 contingencies, thermal constraints are listed in Table B-9, no voltage constraints were identified (Table B-10).

One category P2-P7 contingencies (Table B-13) were not converged in both the benchmark and study cases. No mitigation plan is required for the SPP Study Projects for this non-converged contingency.

For the non-converged contingencies in Table B-13, DC contingency analysis was performed to get the dc thermal results. The dc thermal results for non-converged contingencies are listed in Table B-14.

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

2.2.3 Summer Shoulder Worst Constraints

In the summer shoulder scenario, MISO AFSIS worst thermal constraints are listed in Table 2-1. No MISO AFSIS voltage constraints were identified.

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

Generator	Constraint	Rating	Owner	Worst Loading		Contingency	Cont Type
				(MVA)	(%)		
GEN-2018-067	Merricourt-Wishek 230 kV	343.0	MDU	388.7	113.3	CEII Redacted	P0
GEN-2018-067	Merricourt-Wishek 230 kV	343.0	MDU	386.4	112.6	CEII Redacted	P1

2.2.4 Summary of Summer Shoulder Results

In the summer shoulder scenario, Table 2-2 lists MISO AFSIS thermal constraints and Network Upgrades. No MISO AFSIS voltage Network Upgrades are required.

Table 2-2: MISO AFSIS Thermal Constraints and Network Upgrades in Summer Shoulder Scenario

Generator	Constraint	Owner	Mitigation	Cost ($)
GEN-2018-067	Merricourt-Wishek 230 kV	MDU	MTEP ID: 25503, Facility ID:28741. Reconductor and pole replacement. Post upgrade rating:730 MVA/803 MVA SUM, and 767 MVA/844 MVA WIN (Normal/Emergency)	$0

2.2.5 Summary of MISO AFSIS Steady State Analysis

MISO AFSIS steady state analyses were performed on the MISO summer peak and summer shoulder scenarios. The steady state thermal constraints and required Network Upgrades are listed in Table 2-3. No MISO AFSIS voltage Network Upgrades are required.

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

Generator	Constraint	Owner	Mitigation	Cost ($)
GEN-2018-067	Merricourt-Wishek 230 kV	MDU	MTEP ID: 25503, Facility ID:28741. Reconductor and pole replacement. Post upgrade rating:730 MVA/803 MVA SUM, and 767 MVA/844 MVA WIN (Normal/Emergency)	$0

Section

3

MISO AFSIS Stability Analysis

Stability analysis was performed to evaluate transient stability and impact on the MISO region of the Study Projects in SPP DISIS-2018-002 / 2019-001 West Cluster.

3.1 Procedure

3.1.1 Computer Programs

Stability analysis was performed using TSAT.

3.1.2 Methodology

Stability package representing summer peak (SPK) and summer shoulder (SH) scenarios with generating facilities in the SPP DISIS-2018-002 / 2019-001 West Cluster was created from MISO AFSIS stability package for DISIS-2018-002 / 2019-001 West Phase 3 cycle, which was originally developed from MISO DPP 2020 West Area Phase 3 final stability package. Power flow models are the same as steady state power flow models, which were developed in Section 1.1. Disturbances were simulated to evaluate the transient stability and impact on the region of the DISIS-2018-002 / 2019-001 West Study Projects. MISO transient stability criteria and local TOs' planning criteria specified in MTEP20 were adopted for checking stability violations.

3.2 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.

3.3 Disturbance Criteria

The stability simulations performed as part of this study considered all the regional and local contingencies listed in Table 3-1. Regional contingencies with pre-defined switching sequences were selected from the MISO MTEP20 study; switching sequences for local contingencies were developed based on the generic clearing times shown in Table 3-2. 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 3-1: MISO AFSIS Regional and Local Disturbance Descriptions

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Table 3-2: 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

3.4 Performance Criteria

MISO transient stability criteria and local TOs' planning criteria specified in MTEP20 were adopted. All Study Generators in SPP DISIS-2018-002 / 2019-001 West Cluster must mitigate the stability constraints to obtain any type of Interconnection Service.

3.5 Summer Peak Stability Results

The contingencies listed in Table 3-1 were simulated using the summer peak stability model as developed in Section 1.1.

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

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

3.5.1.1 Post-Fault Small Oscillation of Generation Output

Under two contingencies listed in Table 3-3, small oscillations were observed on active and reactive power output of several conventional generators (Coal Creek unit 1 or 2, Young 1) after faults were cleared. The same power output oscillations were also observed in the benchmark case. The oscillation issues were not caused by the SPP DISIS-2018-002 / 2019-001 West Study Projects.

Table 3-3: Post-Fault Small Oscillation of Generation Output

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3.5.2 Transient Low Voltage Recovery

Under two contingencies listed in Table 3-4, voltages at Firth 115 kV (640171) and Sterling 115 kV (640362) were around 0.83 p.u. after the faults were cleared. The two 115 kV buses were back fed by 69 kV system via a 3-winding transformer. Same low voltage recovery issues were also observed in the benchmark case. The low voltage recovery issues were not caused by the SPP DISIS-2018-002 / 2019-001 West Study Projects.

Table 3-4: Transient Low Voltage Recovery

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3.5.3 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 Network Upgrades are required in summer peak stability study

3.6 Summer Shoulder Stability Results

The contingencies listed in Table 3-1 were simulated using the summer shoulder stability model as developed in Section 1.1.

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

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

3.6.1 Transient Low Voltage Recovery

Under two contingencies listed in Table 3-5, voltages at Firth 115 kV (640171) and Sterling 115 kV (640362) were below 0.9 p.u. after the faults were cleared. The two 115 kV buses were back fed by 69 kV system via a 3-winding transformer. Same low voltage recovery issues were also observed in the benchmark case. The low voltage recovery issues were not caused by the SPP DISIS-2018-002 / 2019-001 West Study Projects.

Table 3-5: Transient Low Voltage Recovery

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3.6.2 GEN-2018-067 Active Power Reduction and Low Terminal Voltage

Under two local contingencies at GEN-2018-067 POI (Table 3-6), GEN-2018-067 active power output was reduced and its terminal voltage was around 0.82 p.u. after the fault was cleared. Nearby 115 kV buses also had post-fault low voltages. This is an indication of local voltage collapse. The GEN-2018-067 generation project is responsible for fixing this issue.

Table 3-6: GEN-2018-067 Active Power Reduction and Low Terminal Voltage

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3.6.3 Stability Constraints Identified in Summer Shoulder

In summary, no MISO Affected System stability constraints were identified in the summer shoulder scenario. The GEN-2018-067 issue of active power output reduction and low terminal voltage is unrelated to MISO Affected System. No MISO AFSIS stability NUs are required.

3.7 Summary of MISO AFSIS Transient Stability Analysis

Based on the MISO summer peak and summer shoulder transient stability analysis, no MISO AFSIS stability Network Upgrades are required for the Study Projects in DISIS 2018-002 / 2019-001 West Cluster. The GEN-2018-067 issue of active power output reduction and low terminal voltage is unrelated to MISO Affected System.

Section

4

Contingent Facilities

Table 4-1 describes transmission assumptions modeled in the studies that were deemed necessary to mitigate the voltage violations identified in the study. If the transmission assumptions are not completed or significantly modified, the Interconnection Service of study unit may be restricted until a re-study is performed to determine the applicable service level that results. If any of the higher queued and/or same group study generators in MISO and/or SPP are to drop out, the Interconnection Customer may be subject to restudy.

If there are no modifications to the table, the study projects shall not be allowed for injection until the identified contingent facilities are in service.

Table 4-1: Contingent Facility and Conditional Projects

MTEP ID	MTEP Cycle	Project Name	Project Description	Status	Expected ISD	Conditional Projects
25503	MTEP24	MDU Network and Interconnection Upgrades - J1040	Facility ID:28741, Facility Name: 28741-Wishek-Merricourt. Description: reconductor and pole replacement. Post upgrade rating:730 MVA/803 MVA SUM, and 767 MVA/844 MVA WIN (Normal/Emergency)	M2 - Appendix A Approved	07/24/2026	GEN-2018-067

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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 AFSIS Network Upgrades Required for the DISIS 2018-002 / 2019-001 West Study Projects

Based on the MISO summer peak and summer shoulder steady state analysis, thermal constraints were identified in MISO system for the DISIS-2018-002 / 2019-001 West Study Projects. No MISO AFSIS voltage constraints were identified. MISO AFSIS thermal NUs are required for the DISIS-2018-002 / 2019-001 West Study Projects.

Based on the MISO summer peak and summer shoulder transient stability analysis, no additional MISO AFSIS stability Network Upgrades are required for the DISIS-2018-002 / 2019-001 West Study Projects.

A short circuit screening analysis was conducted by comparing three phase fault currents in the benchmark and study cases for the DISIS-2018-002 / 2019-001 West Study Projects. Based on the screening results, MISO Transmission Owners do not plan to conduct additional studies.

Contingent facilities were identified. The study projects will be included in MISO's Annual studies to determine available injection until assumptions reach their expected In-Service Date. Details are in Section 4.

The total costs of MISO AFSIS Network Upgrades for DISIS-2018-002 / 2019-001 West Study Projects are summarized in Table 5-1.

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Table 5-1: Summary of MISO AFSIS Network Upgrades

Category of Network Upgrades	Cost ($)
Thermal Network Upgrades Identified in MISO Steady-State Analysis	$0
Voltage Network Upgrades Identified in MISO Steady-State Analysis	$0
Network Upgrades Identified in Stability Analysis	$0
Network Upgrades Identified in Short Circuit Analysis	$0
Total	**$0**

MISO AFSIS Network Upgrades for DISIS-2018-002 / 2019-001 West Study Projects are listed below:

Table 5-2: MISO Thermal NUs and Cost

Constraint	Owner	Mitigation	Cost ($)
Merricourt-Wishek 230 kV	MDU	MTEP ID: 25503, Facility ID:28741. Reconductor and pole replacement. Post upgrade rating:730 MVA/803 MVA SUM, and 767 MVA/844 MVA WIN (Normal/Emergency)	$0

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

Network Upgrades	Owner	Cost ($)
No voltage NUs		$0

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

Constraint	Network Upgrades	Owner	Cost ($)
No stability constraints	No stability Network Upgrades		$0

5.3.1.1 MISO AFSIS NU Cost Allocation

Assuming all generation projects in the DISIS-2018-002 / 2019-001 West Study Projects advance, a summary of the costs for total MISO AFSIS NUs allocated to each generation project is listed in Table 5-5.

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

Project Num	Network Upgrades ($)			Total Network Upgrade Cost ($)
	MISO Thermal & Voltage	Transient Stability	Short Circuit	
GEN-2018-067	$0	$0	$0	$0
GEN-2018-074	$0	$0	$0	$0
GEN-2018-125	$0	$0	$0	$0
GEN-2018-131	$0	$0	$0	$0
GEN-2018-132	$0	$0	$0	$0
GEN-2019-016	$0	$0	$0	$0
GEN-2019-019	$0	$0	$0	$0
GEN-2019-037	$0	$0	$0	$0
GEN-2019-039	$0	$0	$0	$0
GEN-2019-041	$0	$0	$0	$0
Total ($)	**$0**	**$0**	**$0**	**$0**

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Appendix

A

Model Development for Steady-State and Stability Analysis

A.1 Recently Withdrawn Prior Queued Projects

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

Prj #	Bus Number	Bus Name	Id	Status
J803	88035	J803 0.6000	PV	Withdrawn
J1042	40420	J1042 GEN 0.6300	PV	Withdrawn
J1043	40430	J1043 GEN 0.6500	1	Withdrawn
J1074	40740	J1074 GEN 0.6000	1	Withdrawn
J1225	42250	J1225 GEN 0.6300	1	Withdrawn
J1350	43500	J1350 GEN 0.6000	1	Withdrawn
J1353	43530	J1353 GEN 0.3850	1	Withdrawn
J1497	44970	J1497 GEN 0.6300	1	Withdrawn
J1510	45100	J1510 GEN 0.6300	1	Withdrawn
J1567	45670	J1567 GEN 0.6300	1	Withdrawn
J1708	47080	J1708 GEN 0.6300	1	Withdrawn
J1735	47350	J1735 GEN 0.6300	1	Withdrawn
J897	88977	J897 G1 0.6900	W	Withdrawn
J897	88978	J897 G2 0.6900	W	Withdrawn
J1101	41010	J1101 GEN 0.6900	BT	Withdrawn
J1191	41910	J1191 GEN 0.6000	1	Withdrawn
J1204	42040	J1204 GEN 0.6000	1	Withdrawn
J1231	42310	J1231 GEN 0.6450	1	Withdrawn
J1253	42530	J1253 GEN 0.6450	PV	Withdrawn
J1332	43320	J1332 GEN 0.6000	1	Withdrawn
J1408	44080	J1408 GEN 0.7200	1	Withdrawn
J1408	44081	J1408 GEN1 0.4800	1	Withdrawn

Prj #	Bus Number	Bus Name	Id	Status
J1408	44082	J1408 GEN2 0.6600	1	Withdrawn
J1447	44470	J1447 GEN 0.6300	1	Withdrawn
J1516	45160	J1516 GEN 0.6300	1	Withdrawn
J1526	45260	J1526 GEN 0.6300	1	Withdrawn
J1527	45270	J1527 GEN 0.6300	1	Withdrawn
J1716	47160	J1716 GEN 0.6450	1	Withdrawn
J750	87500	J750 GEN 0.7200	1	Withdrawn
J801	88011	J801 0.5500	PV	Withdrawn
J974	89740	J974 GEN 0.6900	1	Withdrawn
J974	89741	J974 GEN1 0.6900	1	Withdrawn
J987	89870	J987 GEN 0.6000	1	Withdrawn
J991	89910	J991 GEN 0.6000	1	Withdrawn
J994	89940	J994 GEN 0.6000	1	Withdrawn
J815	348308	J815G1 0.5500	S1	Withdrawn
J815	348309	J815G2 0.6300	S2	Withdrawn

Table A-2: Recently Withdrawn SPP Prior & Current Queued Project

Prj #	Status	Bus Number	Bus Name	Id
GEN-2016-088	TERMINATED	587733	G16-088-GEN10.6900	1
GEN-2016-092	WITHDRAWN	587753	G16-092-GEN10.6900	1
GEN-2016-103	WITHDRAWN	587833	G16-103-GEN10.6900	1
GEN-2016-106	WITHDRAWN	587853	G16-106-GEN10.6900	1
GEN-2016-110	WITHDRAWN	587873	G16-110-GEN10.6900	1
GEN-2016-127	WITHDRAWN	588033	G16-127-GEN10.6900	1
GEN-2016-127	WITHDRAWN	588036	G16-127-GEN20.6900	1
GEN-2017-001	WITHDRAWN	588373	G17-001-GEN10.6900	1
GEN-2016-159	WITHDRAWN	588383	G16-159-GEN10.6900	1
GEN-2016-159	WITHDRAWN	588386	G16-159-GEN20.6900	1
GEN-2017-013	WITHDRAWN	588583	G17-013-GEN10.6900	1
GEN-2017-030	WITHDRAWN	588733	G17-030-GEN10.6900	1
GEN-2017-031	WITHDRAWN	588743	G17-031-GEN10.6900	1

Prj #	Status	Bus Number	Bus Name	Id
GEN-2017-032	WITHDRAWN	588753	G17-032-GEN10.6900	1
GEN-2017-038	WITHDRAWN	588793	G17-038-GEN10.6900	1
GEN-2017-041	WITHDRAWN	588823	G17-041-GEN10.6900	1
GEN-2017-095	WITHDRAWN	589333	G17-095-GEN10.6900	1
GEN-2016-109	WITHDRAWN	589453	G16-109-GEN112.000	1
GEN-2017-008	WITHDRAWN	588533	G17-008-GEN10.6900	1
GEN-2017-008	WITHDRAWN	588537	G17-008-GEN20.6900	1
GEN-2017-024	WITHDRAWN	588683	G17-024-GEN10.6000	1
GEN-2017-055	WITHDRAWN	588943	G17-055-GEN10.5500	1
GEN-2017-064	WITHDRAWN	589023	G17-064-GEN10.5500	1
GEN-2017-064	WITHDRAWN	589027	G17-064-GEN20.5500	1
GEN-2017-067	WITHDRAWN	589053	G17-067-GEN10.5500	1
GEN-2017-067	WITHDRAWN	589057	G17-067-GEN20.5500	1
GEN-2017-090	WITHDRAWN	589283	G17-090-GEN10.6900	1
GEN-2017-090	WITHDRAWN	589287	G17-090-GEN20.6900	1
GEN-2017-148	WITHDRAWN	760896	G17-148GEN1 0.6900	1
GEN-2017-216	WITHDRAWN	761043	G17-216GEN1 0.6900	1
GEN-2017-229	WITHDRAWN	761757	G17-229GEN1 0.6900	1
GEN-2017-128	WITHDRAWN	761925	G17-128GEN1 0.6900	1
GEN-2017-191	WITHDRAWN	761946	G17-191GEN1 0.6900	1
GEN-2017-111	WITHDRAWN	762009	G17-111-GEN10.6300	1
GEN-2018-054	WITHDRAWN	762892	G18-054-GEN10.6600	1
GEN-2018-070	WITHDRAWN	763057	G18-070-GEN10.6900	1
GEN-2018-090	WITHDRAWN	763199	G18-090-GEN10.6450	1
GEN-2018-121	WITHDRAWN	763364	G18-121-GEN10.6450	1
GEN-2019-029	WITHDRAWN	763662	G19-029-GEN10.5500	1
GEN-2019-029	WITHDRAWN	763665	G19-029-GEN20.5500	1
GEN-2019-033	WITHDRAWN	763684	G19-033-GEN10.6600	1
GEN-2016-007	TERMINATED	587053	G16-007-GEN10.6500	1
GEN-2016-063	TERMINATED	587433	G16-063-GEN10.6900	1
GEN-2017-048	TERMINATED	588873	G17-048-GEN10.6900	1
GEN-2017-120	WITHDRAWN	760003	G17-120-GEN10.6900	1

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Prj #	Status	Bus Number	Bus Name	Id
GEN-2017-120	WITHDRAWN	760006	G17-120-GEN20.6900	1
GEN-2017-119	WITHDRAWN	760581	G17-119-GEN10.6900	1
GEN-2017-119	WITHDRAWN	760584	G17-119-GEN20.6900	1
GEN-2017-115	TERMINATED	760749	G17-115GEN1 0.6900	1
GEN-2017-115	TERMINATED	760752	G17-115GEN2 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-2017-210	WITHDRAWN	761211	G17-210-GEN10.6900	1
GEN-2017-210	WITHDRAWN	761211	G17-210-GEN10.6900	2
GEN-2017-210	WITHDRAWN	761214	G17-210-GEN20.6900	1
GEN-2017-210	WITHDRAWN	761214	G17-210-GEN20.6900	2
GEN-2017-202	WITHDRAWN	761421	G17-202GEN1 0.6900	1
GEN-2017-125	TERMINATED	761904	G17-125GEN1 0.6900	1
GEN-2018-010	TERMINATED	762485	G18-010-GEN10.6300	1
GEN-2018-012	WITHDRAWN	762507	G18-012-GEN10.6900	1
GEN-2018-013	WITHDRAWN	762517	G18-013-GEN10.7200	1
GEN-2018-008	WITHDRAWN	762540	G18-008-GEN10.6900	1
GEN-2018-008	WITHDRAWN	762543	G18-008-GEN20.6900	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-2018-032	TERMINATED	762683	G18-032GEN1 0.6500	1
GEN-2018-032	TERMINATED	762686	G18-032GEN2 0.6500	1
GEN-2018-039	WITHDRAWN	762738	G18-039GEN1 0.6600	1
GEN-2018-056	WITHDRAWN	762914	G18-056-GEN10.6600	1
GEN-2018-060	WITHDRAWN	762957	G18-060-GEN10.6300	1
GEN-2018-062	WITHDRAWN	762979	G18-062-GEN10.6900	1
GEN-2018-063	WITHDRAWN	762991	G18-063-GEN10.6000	1
GEN-2018-065	WITHDRAWN	763013	G18-065-GEN10.6900	1
GEN-2018-068	WITHDRAWN	763035	G18-068-GEN10.6900	1

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Prj #	Status	Bus Number	Bus Name	Id
GEN-2018-068	WITHDRAWN	763038	G18-068-GEN20.6900	1
GEN-2018-069	WITHDRAWN	763046	G18-069-GEN10.6900	1
GEN-2018-083	WITHDRAWN	763145	G18-083-GEN10.6900	1
GEN-2018-083	WITHDRAWN	763148	G18-083-GEN20.6900	1
GEN-2019-009	WITHDRAWN	763508	G19-009-GEN10.6900	1
GEN-2019-023	WITHDRAWN	763629	G19-023-GEN10.6300	1
GEN-2019-023	WITHDRAWN	763632	G19-023-GEN20.6300	1
GEN-2019-048	WITHDRAWN	763805	G19-048-GEN10.6500	1
GEN-2019-069	WITHDRAWN	763981	G19-069GEN1 0.6600	1
GEN-2019-070	WITHDRAWN	763991	G19-070-GEN10.6600	1
GEN-2019-073	WITHDRAWN	764002	G19-073-GEN10.6600	1

Table A-3: Recently Withdrawn AECI Prior Queued Project

Projects	MW	Generation Type	Substation or Line
GIA-84	196	Solar	New Madrid 345 kV

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A.2 SPP Prior Queued Generation Projects

Table A-4: SPP Prior Queued Generation Projects

Projects	Cluster	MW	Generation Type	Town or County	State	Substation or Line	TO at POI
ASGI-2017-013	NA	40	Wind	WAPA	ND	Wolsey 69 kV	WAPA
ASGI-2017-014	NA	40	Solar	NA	KS	Post Oak 34.5 kV	KCPL
ASGI-2018-003	NA	20	Solar	KCPL	KS	Appleton 69 kV	KCPL
ASGI-2018-006	NA	20	Solar	KCPL	KS	Metz 69 kV	KCPL
ASGI-2018-007	NA	20	Solar	KCPL	KS	Salisbury 161 kV	KCPL
ASGI-2018-010	NA	35	Solar	KCPL	KS	Pleasant Valley 161 kV	KCPL
ASGI-2018-011	NA	35	Solar	KCPL	KS	South Ottawa 161 kV	KCPL
GEN-2016-036	DISIS-2016-002-1	44.6	Wind	Chippewa	MN	Granite Falls 115 kV	WAPA
GEN-2016-074	DISIS-2016-002-1	200	Wind	Custer	NE	Sweetwater 345 kV	NPPD
GEN-2016-087	DISIS-2016-002-1	98.9	Wind	Campbell	SD	Bismark-Glenham 230 kV	WAPA
GEN-2016-094	DISIS-2016-002-1	200	Wind	Hyde	SD	Ft Thompson-Oahe 230 kV	WAPA
GEN-2016-115	DISIS-2016-002-1	300	Wind	Atchison	MO	Nebraska City-Mullen Creek 345 kV	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	Tri-State
GEN-2016-151	DISIS-2016-002-1	202	Wind	Burke	ND	Tande 345 kV	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	BEPC
GEN-2017-014	DISIS-2017-001	300	Wind	Haakon	SD	Philip Tap 230 kV	WAPA
GEN-2017-060	DISIS-2017-001	149.4	Wind	Barton	MO	LaRussell Energy Center 161 kV	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	WAPA
GEN-2017-105	DISIS-2017-002	75	Wind	Burt	NE	Tekamah-Raun 161 kV	OPPD
GEN-2017-108	DISIS-2017-002	400	Solar	Henry	MO	Stillwell-Clinton 161 kV	KCPL
GEN-2017-144	DISIS-2017-002	200	Wind	Holt, Antelope, Wheeler	NE	Holt County 345 kV	WAPA

Projects	Cluster	MW	Generation Type	Town or County	State	Substation or Line	TO at POI
GEN-2017-175	DISIS-2017-002	300	Wind	Turner	SD	Vfodnes-Utica Jct. 230 kV	WAPA
GEN-2017-181	DISIS-2017-002	300	Wind	Lancaster	NE	Tobias 345 kV	NPPD
GEN-2017-182	DISIS-2017-002	128	Wind	Lancaster	NE	Tobias 345 kV	NPPD
GEN-2017-183	DISIS-2017-002	400	Wind	Hodgeman / Ford	KS	Nashua-St. Joe 345 kV	KCPL
GEN-2017-184	DISIS-2017-002	400	Solar	Hodgeman / Ford	KS	Nashua-St. Joe 345 kV	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 345 kV	KCPL
GEN-2017-196	DISIS-2017-002	128	Battery	Johnson	KS	West Gardner 345 kV	KCPL
GEN-2017-201	DISIS-2017-002	250	Wind	Wayne	NE	Hoskins 345 kV	NPPD
GEN-2017-214	DISIS-2017-002	100	Wind	Ward	ND	Logan 230 kV	BEPC
GEN-2017-215	DISIS-2017-002	100	Wind	Ward	ND	Logan 230 kV	BEPC
GEN-2017-222	DISIS-2017-002	180	Wind	Denison	IA	Denison 230 kV	WAPA
GEN-2017-234	DISIS-2017-002	115	Wind	Greeley	NE	Spalding-North Loup 115 kV	NPPD
GEN-2018-025	DISIS-2018-001	200	Battery	Washington	NE	Fort Calhoun 345 kV	OPPD
GEN-2018-031	DISIS-2018-001	50	Battery	Jackson	MO	Blue Valley 161 kV	INDN
GEN-2018-033	DISIS-2018-001	200	Battery	Cass	NE	Cass County 345 kV	OPPD
GEN-2018-037	DISIS-2018-001	100	Battery	Douglas	NE	Looping in OPPD (S1211) (S1220) (S1211) (S1299) 161 kV	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 138 kV	WERE

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A.3 MPC Prior Queued Generation Projects

Table A-5: MPC Prior Queued Generation Projects

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

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A.4 AECI Prior Queued Generation Projects

Table A-6: AECI Prior Queued Generation Projects

Projects	MW	Generation Type	Substation or Line
GIA-90	100	Solar	Montgomery City 161 kV
GIA-91	96	Solar	Sedalia 69 kV
GIA-93	100	Solar	Palmyra 161 kV
GIA-95	247	Wind	Jasper-Morgan 345 kV
GIA-96	97.5	Wind	Stroud 138kV

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A.5 Withdrawn Network Upgrades to Be Removed

Table A-7: Withdrawn Network Upgrades to Be Removed

Network Upgrades	Study Cycle
Astoria-Brookings 345 kV 2nd line	J1456 withdrawn
100 MVAR Capacitor Bank at Montezuma 345 kV (635730)	DISIS-2017-001
Replace 100 MVAR SVC at Blackhawk 345 kV (636197) with 100 MVAR MSC	
40 MVar switched cap at Wahpeton 230 kV (620329)	DISIS-2017-001
60 MVar switched cap at Buffalo 345 kV (620358)	DISIS-2017-001
Capacitor at Maynard 115: 1x40 Mvar (603177)	DISIS-2018-001
1x75 MVAr MSC at Alexandria 345 (658047)	MPC Group 2021
Reduced from 3x75 MVAr MSC at Bison 345 (601067) to 1x75 MVAr (assigned to DPP 2018 West)	MPC Group 2021
1x30 Mvar MSC and ±50 Mvar STATCOM at Winger 230 kV (657758)	MPC Group 2021
Capacitor at Prairie 115 kV: 3x40 Mvar (603007)	MTEP
New 345 kV outlet line from MPC04300 to a new substation tapping the Buffalo-Jamestown 345 kV line.	MPC 04300
Maple River 230 (657754) 2x40 MVAr MSC	MPC 04300

A.6 Network Upgrades Required for Prior Queued Projects

Table A-8: Modeled Prior Queued Network Upgrades

Network Upgrades	Study Cycle
LRTP-1 project: Jamestown – Ellendale 345 kV	MTEP Appendix A
LRTP-2 project: Big Stone South - Alexandria - Cassie's Crossing	MTEP Appendix A
Build Brookings Co-Lyon Co 2nd 345 kV line; Build Helena-Hampton Corner 345 kV line	MTEP Appendix A
Reactor at Prairie 115 (657712): 1x50 Mvar	MTEP Appendix A
Capacitor at Bagley 115: 1x20 Mvar	DISIS-2016-002
100 MVAR switched cap at Blackhawk 345 kV (MEC)	DISIS-2017-001
40 MVar switched cap at Wahpeton 230 kV (620329)	DISIS-2017-001
60 MVar switched cap at Buffalo 345 kV (620358)	DISIS-2017-001
Add breaker to the Bison shunt reactor	MISO AFS on MPC Grp 2021
Jamestown Load.idv	MTEP
MDU-50037-EPR-EllendaleDataCenter2.idv	MTEP
MDU-50152-EPR-EllendaleDataCenter3.idv	MTEP
OTP_EXPEDITED_50603_Big_Stone_South_Load_Addtion-155MW.idv	MTEP

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A.7 Model Reviewing Comments

Table A-9: Model Reviewing Comments

Company	Python/ Idev File Name	2025 SH	2025 SPK	Comments
MPC	DPP20-2025SH90-PhaseIII-MPC Ratings.idv	X	X	
MPC	LakeArdoch.idv	X	X	
MISO	RMV Duplicated GEN-2017-060_GEN-2017-082.py	X	X	Remove duplicated GEN-2017-060, GEN-2017-082
SPTI	psspy.purgmac(531451,r"""1""")	X	X	Remove fictitious SVC at Mingo 345 kV
SPTI	RMV Extra MPC04000.py	X	X	Remove duplicated MPC04000 model
SPTI	Update_MPC038_039_043_Pgen_Pmax_Mbase_SUM.py		X	
SPTI	SH_MPC_03800_03900_04300_Pmax_Mbase_to_Pgen.py	X		
SPTI	Correct Bus Name.py	X	X	

A.8 MISO North for Power Balance

Table A-10. MISO North for Power Balance

Area #	Area Name
207	HE
208	DEI
210	SIGE
216	IPL
217	NIPS
218	METC
219	ITC
295	WEC
296	MIUP
314	BREC
333	CWLD
356	AMMO
357	AMIL
360	CWLP
361	SIPC
600	Xcel

Area #	Area Name
608	MP
613	SMMPA
615	GRE
620	OTP
627	ALTW
633	MPW
635	MEC
661	MDU
663	BEPC-MISO
680	DPC
694	ALTE
696	WPS
697	MGE
698	UPPC
701	Classic Prior

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A.9 SPP Market for Power Balance

Table A-11. 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

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A.10 AECI for Power Balance

Table A-12. AECI for Power Balance

Area #	Area Name
330	AECI

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A.11 Contingency Files used in MISO AFSIS Analysis

Table A-13: List of Contingencies used in the MISO AFSIS Steady-State Analysis

Contingency File Name	Description
Automatic single element contingencies	Single element outages at buses 60 kV and above in the study region
MISO20_2025_SUM__TA_P1_AMRN.con	Specified category P1 contingencies in Ameren
MISO20_2025_SUM__TA_P1_ATC.con	Specified category P1 contingencies in ATC
MISO20_2025_SUM__TA_P1_IOWA.con	Specified category P1 contingencies in Iowa
MISO20_2025_SUM__TA_P1_IOWA_ITCM_MPW.con	Specified category P1 contingencies in ITCM and MPW
MISO20_2025_SUM__TA_P1_IOWA_MEC.con	Specified category P1 contingencies in MEC
MISO20_2025_SUM__TA_P1_MINN-DAKS.con	Specified category P1 contingencies in MN, ND and SD
MISO20_2025_SUM__TA_P1_P2_P4_P5_NoLoadLoss.con	Specified category P1, P2, P4, P5 contingencies in MISO
MISO20_2025_SUM__TA_P2_P5_P7_ATC.con	Specified category P2, P5, P7 contingencies in ATC
MISO20_2025_SUM__TA_P2_P7_MEC.con	Specified category P2, P7 contingencies in MEC
MISO20_2025_SUM__TA_P2_P4_P5_P6_P7_LoadLoss.con	Specified category P2, P4, P5, P7 contingencies in MISO
AECI-AMMO.CON	Specified category P1, P2 contingencies in AECI-AMMO
AECI-EES.con	Specified category P2, P3, P6 contingencies in AECI-EES
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
B

MISO AFSIS Thermal and Voltage Analysis Results

B.1 Summer Peak (SPK) MISO AFSIS Constraints

Table B-1. SPK System Intact MISO Thermal Constraints

Table B-2. SPK System Intact MISO Voltage Constraints

Table B-3. SPK Category P1 MISO Thermal Constraints

Table B-4. SPK Category P1 MISO Voltage Constraints

Table B-5. SPK Category P2-P7 MISO Thermal Constraints

Table B-6. SPK Category P2-P7 MISO Voltage Constraints

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B.2 Summer Shoulder (SH) MISO AFSIS Constraints

Table B-7. SH System Intact MISO Thermal Constraints

Table B-8. SH System Intact MISO Voltage Constraints

Table B-9. SH Category P1 MISO Thermal Constraints

Table B-10. SH Category P1 MISO Voltage Constraints

Table B-11. SH Category P2-P7 MISO Thermal Constraints

Table B-12. SH Category P2-P7 MISO Voltage Constraints

Table B-13. SH MISO Non-Converged Contingencies

Table B-14. SH MISO Non-Converged Contingencies DCCC Results

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Appendix
C

MISO AFSIS Stability Analysis Results

C.1 Summer Peak (SPK) MISO AFSIS Stability Results

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

C.1.1 SPK MISO AFSIS Stability Summary

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

Table C-1: Summer Peak MISO AFSIS Stability Analysis Results Summary

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C.1.2 SPK MISO AFSIS Stability Plots

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

AppendixC1-2_SPK_DISIS-18-2_19-1_Restudy_Plots.zip

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C.2 Summer Shoulder MISO AFSIS Stability Results

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

C.2.1 SH MISO AFSIS Stability Summary

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

Table C-2: Summer Shoulder MISO AFSIS Stability Analysis Results Summary

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C.2.2 SH MISO AFSIS Stability Plots

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

AppendixC2-2_SH_DISIS-18-2_19-1_Restudy_Plots.zip

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