MISO identified regional issues and planned solutions near the MISO-PJM Seam

Supplemental material for *Annual Issues Review*
IPSAC meeting

February 17, 2022

Notes

- This presentation provides an overview/highlight of significant MISO MTEP transmission projects near the MISO-PJM seam which have been either approved in MTEP21 Appendix A or proposed for MTEP22
- It is not a comprehensive review of all planned projects in MISO. For the complete list of information see the following public documents:
  - MTEP21 Report (notably, *Appendix A*): https://www.misoenergy.org/planning/planning/mtep21/
  - *MTEP Projects Under Evaluation* status report: https://cdn.misoenergy.org/MTEP%20Projects%20Under%20Evaluation368757.xlsx
  - Planning Advisory Committee (PAC) Materials https://www.misoenergy.org/stakeholder-engagement/committees/planning-advisory-committee/
  - Subregional Planning Meeting (SPM) Materials https://www.misoenergy.org/stakeholder-engagement/committees/subregional-planning-meeting/

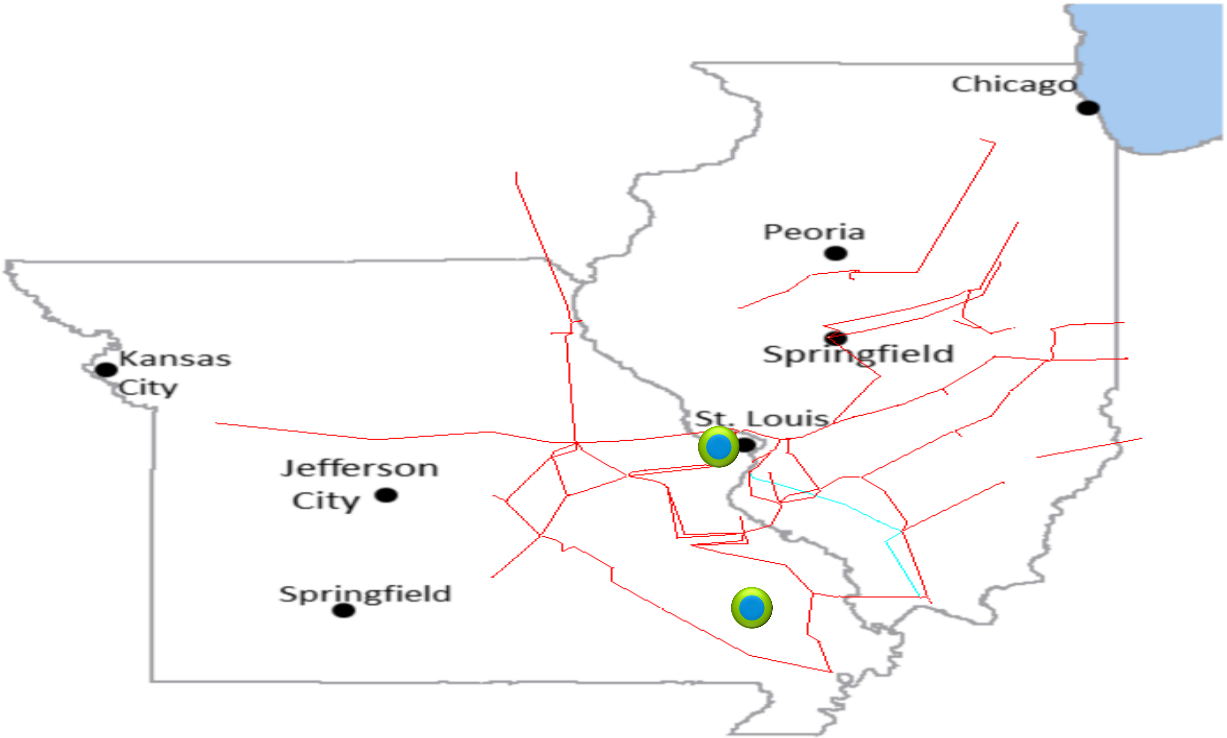
MTEP21 Approved Project Highlights –

MISO East and Central Subregion

AmerenMO

AmerenMO: Two (2) BRPs proposed to address reliability issues on bulk energy system

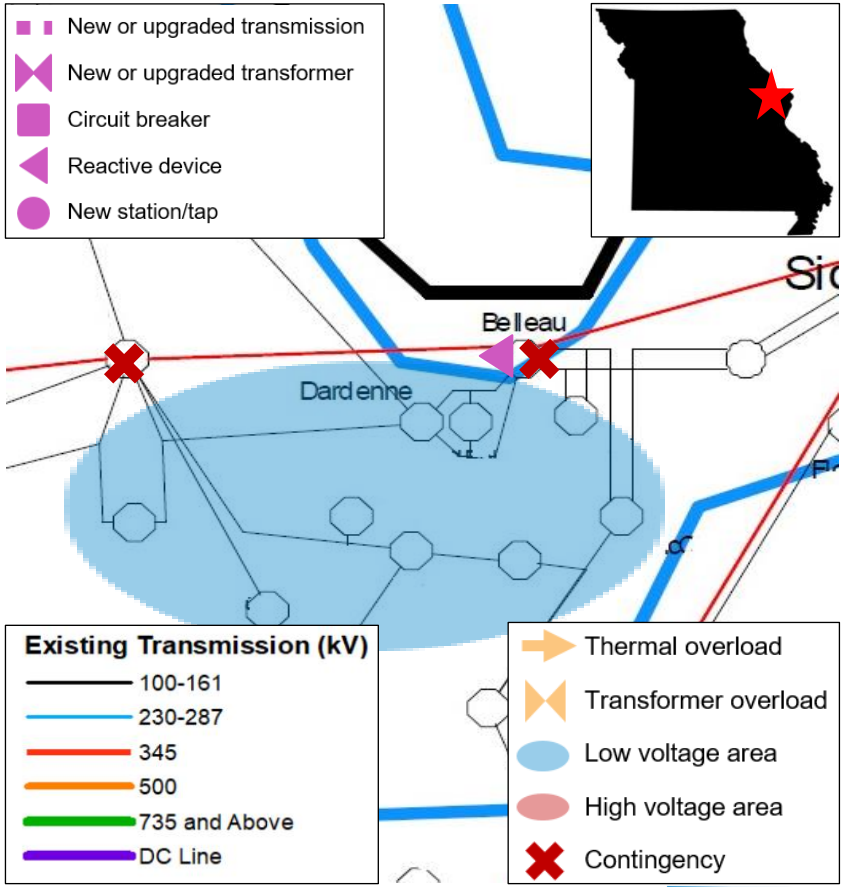
- TO proposed project
- MISO identified reliability need
- Need + Project



A detailed list of needs is tabulated in spreadsheet Issues_Tracker_Central_SPM2.xlsx

New Belleau 138 kV Capacitor Bank solves a transient voltage response issue

- **P19969 - Baseline Reliability Project**
- **Project description**
  - Install 120 Mvar capacitor bank at Belleau 138 kV
- **System Need**
  - Without the cap bank, could not meet the 90% of nominal or higher 10 seconds after fault clearing required by Ameren Criteria.
- **Estimated Cost:** $3.5M
- **Expected ISD:** June 1, 2025
- **Target Appendix:** A in MTEP21
- **Alternatives:** Ameren considered several alternatives; however, this was the best and most efficient project
- **NTA Eligibility:** No, needed for Transient Voltage Recovery



AmerenMO - P19969 New Belleau 138 kV Capacitor Bank – Analysis Summary

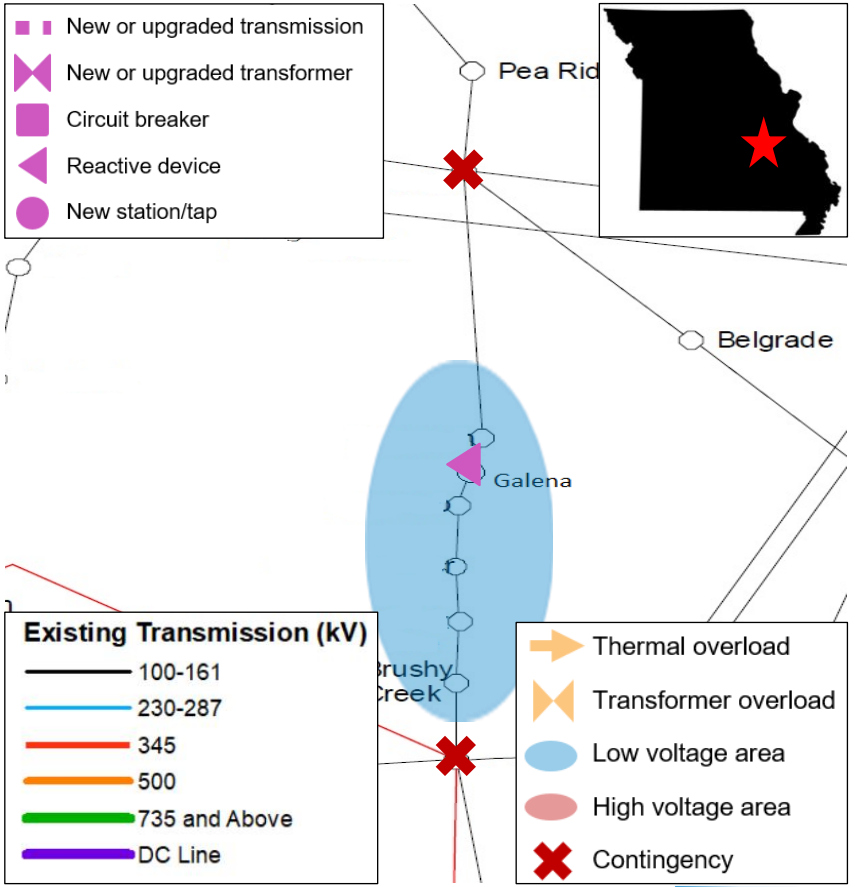
Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Voltage Violation (p.u.)**	**Comment**
[AECI] Enon 161 kV bus	161	P6-1-1	0.95	Post-project voltage is 0.98 p.u.
[AECI] O'Fallon 161 kV bus	161	P6-1-1	0.95	Post-project voltage is 0.98 p.u.
[AECI] Lake Street 161 kV bus	161	P6-1-1	0.95	Post-project voltage is 0.98 p.u.
[AMMO] Pointe Prarie 161 kV bus	161	P6-1-1	0.95	Post-project voltage is 0.99 p.u.

This project is also needed to aid in transient recovery in the same O'Fallon Missouri area. A separate dynamics stability analysis was performed to confirm that this project addresses the stability issues.

Preliminary Recommendation: Move to Appendix A

New Galena 161 kV Capacitor Bank solves P6-2-2 low voltage issues

- **P20156 - Baseline Reliability Project**
- **Project description**
  - Install 28.8 Mvar capacitor bank at Galena 161 kV.
- **System Need**
  - Baseline reliability to address P6-2-2 event, which is the loss of two BES transformers.
- **Estimated Cost:** $900k
- **Expected ISD:** December 1, 2022
- **Target Appendix:** A in MTEP21
- **Alternatives:** Ameren considered several alternatives; however, this was the best and most efficient project
- **NTA Eligibility:** No, load serving needs



AmerenMO – P20156 New Galena 161 kV Capacitor Bank– Analysis Summary

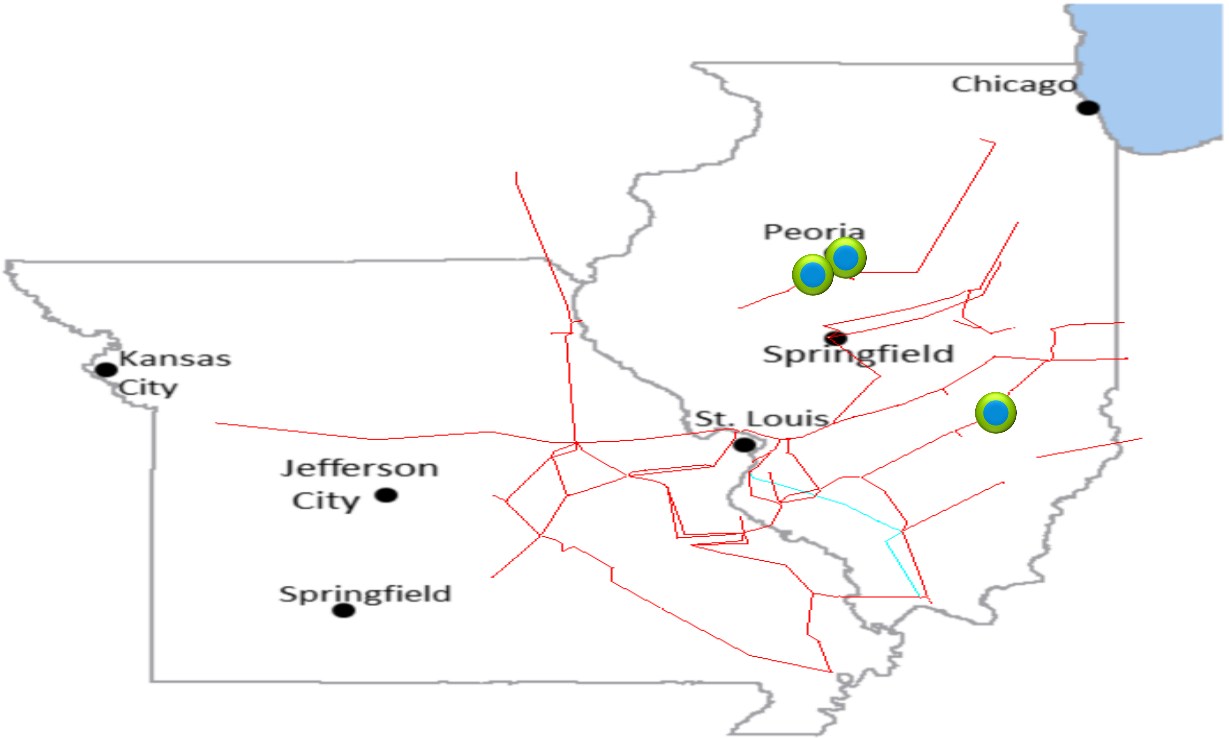
Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Voltage Violation (p.u.)**	**Comment**
[AMMO] Galena 161 kV bus	161	P6-2-2	0.90	Post-project voltage is 0.94 p.u.
[AMMO Buick Mine 161 kV bus	161	P6-2-2	0.90	Post-project voltage is 0.94 p.u.
[AMMO] Cominco 161 kV bus	161	P6-2-2	0.90	Post-project voltage is 0.94 p.u.
[AMMO Buick Smelter 161 kV bus	161	P6-2-2	0.90	Post-project voltage is 0.94 p.u.

Preliminary Recommendation: Move to Appendix A

AmerenIL

AmerenIL: Three (3) BRPs proposed to address reliability issues on bulk energy system

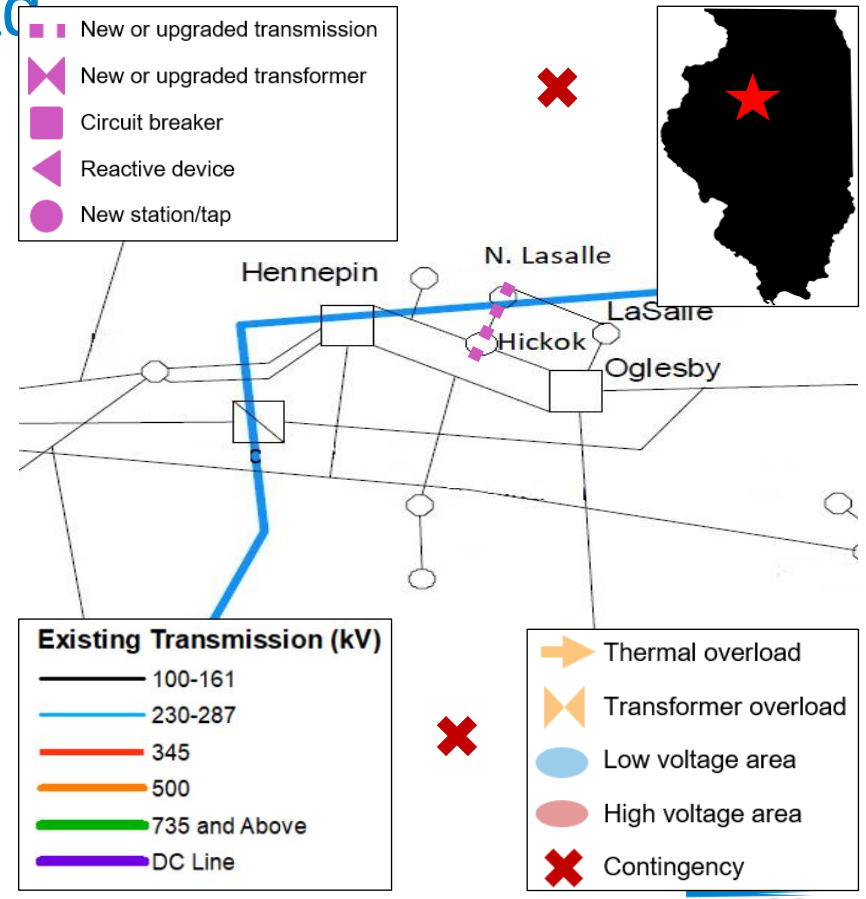
- TO proposed project
- MISO identified reliability need
- Need + Project



A detailed list of needs is tabulated in spreadsheet Issues_Tracker_Central_SPM2.xlsx

Rebuild [AMIL] Hickok—[AMIL] N. LaSalle 138 kV line solves P6-1-1 thermal overload

- **P18889 - Baseline Reliability Project**
- **Project description**
  - Address an overload on the Hickok—North LaSalle 138 kV line (1659) upon completion of the N. Utica Statcom.
- **System Need**
  - Rebuild this line
- **Estimated Cost:** $10 M
- **Expected ISD:** December 1, 2023
- **Target Appendix:** A in MTEP21
- **Alternatives:** Ameren considered several alternatives; however, this was the best and most efficient project
- **NTA Eligibility:** Yes



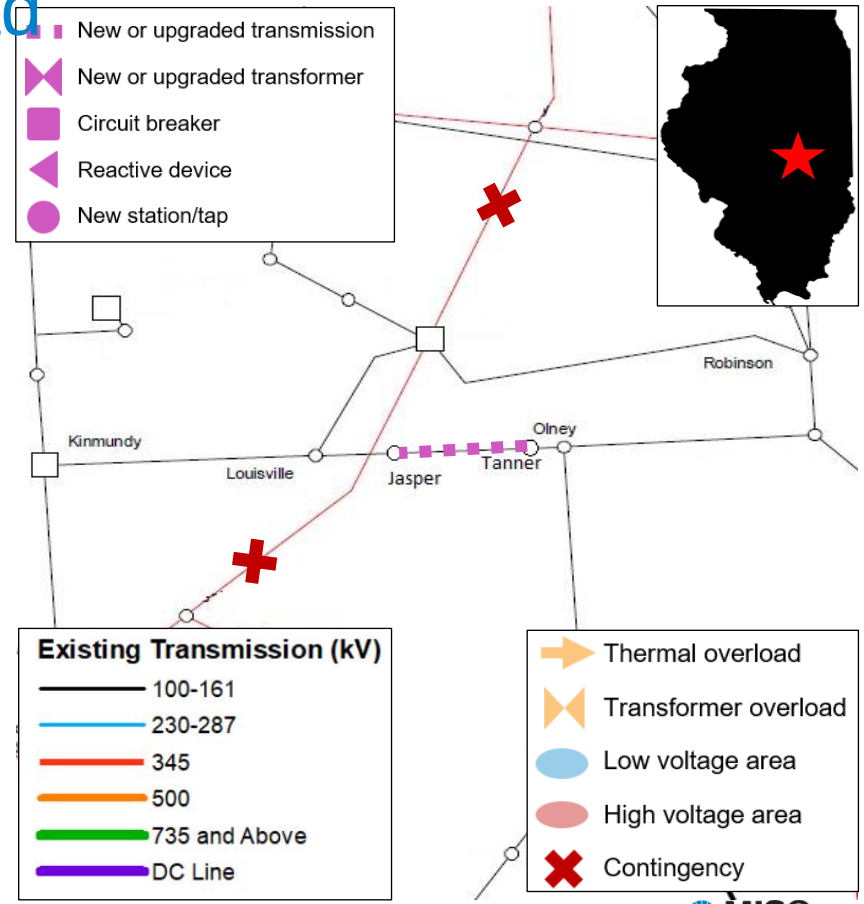
AmerenIL – P18889 Rebuild [AMIL] Hickok—[AMIL] N. LaSalle 138 kV line – Analysis Summary

Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Max Loading (%)**	**Comment**
[AMIL] Hickok—[AMIL] North LaSalle 138 kV line	138	P6-1-1	103	Post-project loading is 40%.

Preliminary Recommendation: Move to Appendix A

Rebuild [AMIL] Tanner—[AMIL] Jasper 138 kV line solves P6-1-1 thermal overload

- **P19956 - Baseline Reliability Project**
- **Project description**
  - Replace limiting switch 1602L at Tanner with 2000A switch.
- **System Need**
  - P6-1-1 Event: 104% loading 2024 Summer peak based on 2019 analysis.
- **Estimated Cost:** $9 M
- **Expected ISD:** December 1, 2022
- **Target Appendix:** A in MTEP21
- **Alternatives:** Ameren considered several alternatives; however, this was the best and most efficient project
- **NTA Eligibility:** No, load serving needs



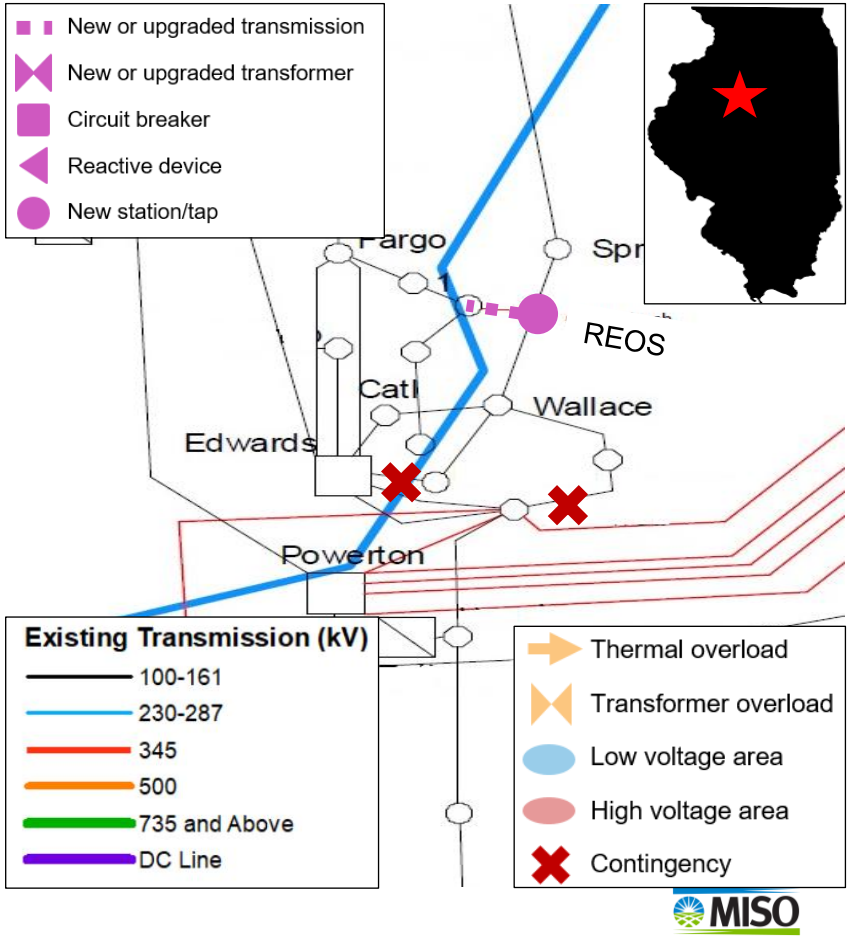
AmerenIL – P19956 Rebuild [AMIL] Tanner—[AMIL] Jasper 138 kV line – Analysis Summary

Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Max Loading (%)**	**Comment**
[AMIL] Tanner—[AMIL] Jasper 138 kV line	138	P6-1-1	176	Post-project loading is 60%.

Preliminary Recommendation: Move to Appendix A

New [AMIL] REOS 138 kV substation solves P6-1-1 thermal overloads

- **P20184 - Baseline Reliability Project**
- **Project description**
  - Ring bus North of RS Wallace that ties together RS Wallace - Spring Bay and CAT2 - Hines 138 kV lines.
- **System Need**
  - Baseline reliability (P6-1-1) event loss of two 138 kV lines.
- **Estimated Cost:** $9.5 M
- **Expected ISD:** December 1, 2024
- **Target Appendix:** A in MTEP21
- **Alternatives:** P20157: Reconductor Edwards-CAT 138 kV line
- **NTA Eligibility:** No, load serving needs



AmerenIL – P20184 New [AMIL] REOS 138 kV substation – Analysis Summary

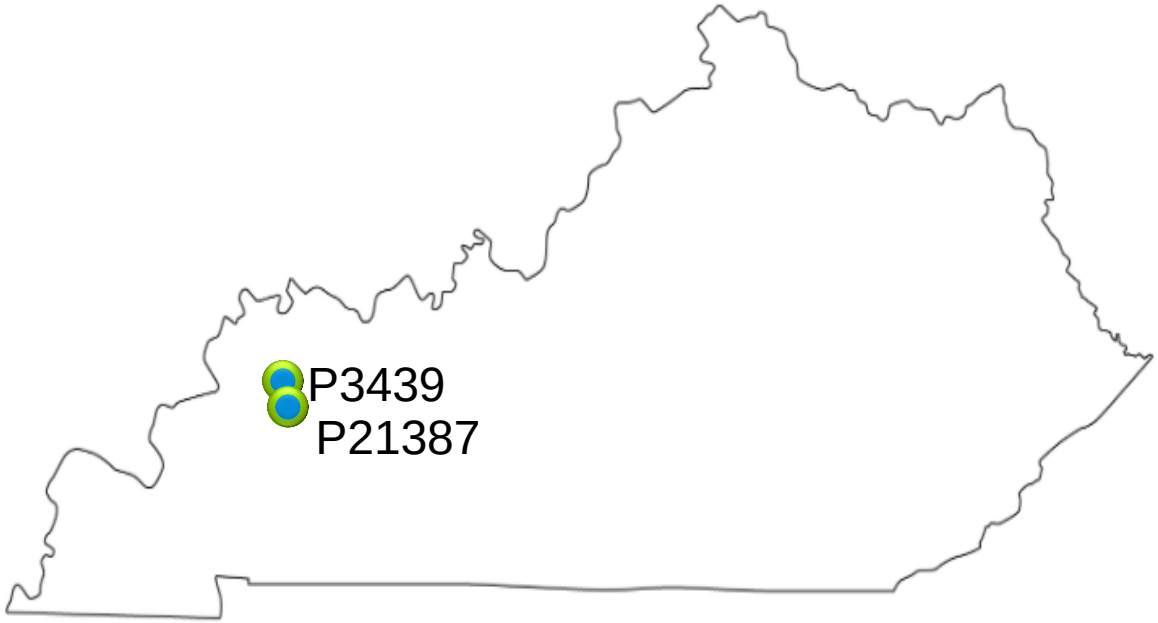
Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Max Loading (%)**	**Comment**
[AMIL] Edwards—[AMIL] CAT 138 kV line	138	P6-1-1	103	Post-project loading is 83%.

Preliminary Recommendation: Move to Appendix A

Big Rivers Electric Corporation (BREC)

BREC: Two (2) BRP proposed to address reliability issues on bulk energy system

- TO proposed project
- MISO identified reliability need
- Need + Project



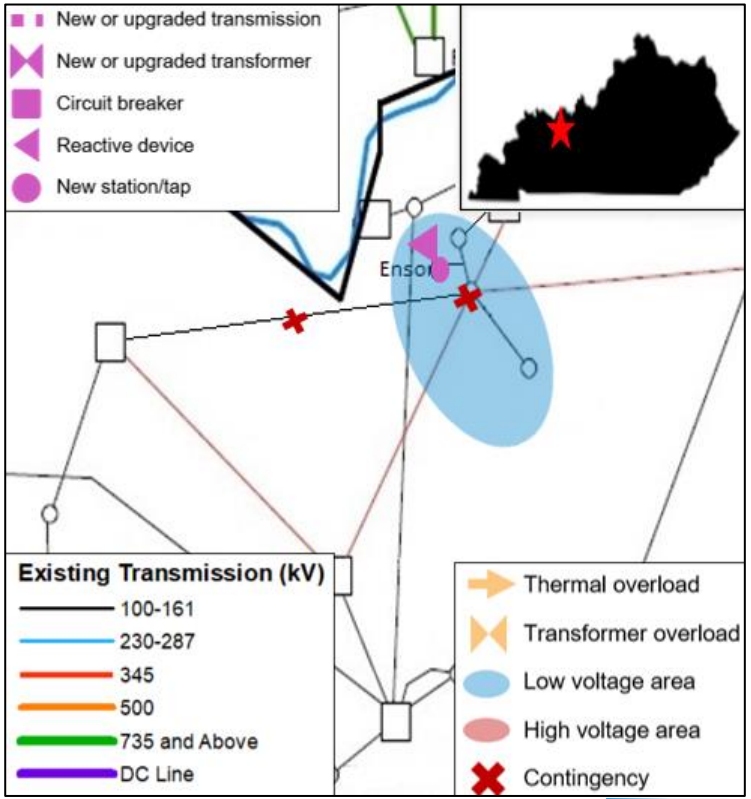
A detailed list of needs is tabulated in spreadsheet Issues_Tracker_Central_SPM2.xlsx

BREC: New [BREC] Ensor 161/69 kV substation solve(s) *P1-2 and P1-3 voltage and thermal issue*

- **P3439 Baseline Reliability Project**
- **Project description**

  Construct new 161/69 kV substation with 56 MVA transformer. Include a 69 kV 30 Mvar capacitor.
- **System Need**

  Address low voltage issues for the loss of a NERC defined P1-2 contingency event and 111% loading for P1-3 contingency event in 2026 Summer peak.
- **Estimated Cost:** $5.0M
- **Expected ISD:** December 31, 2024
- **Target Appendix:** A in MTEP21
- **Alternatives:** BREC considered several transmission alternatives. However, this upgrade was found to be the best and cheapest option to address this reliability issue.
- **NTA Eligibility:** yes



BREC — New [BREC] Ensor 161/69 kV substation — Analysis Summary

Voltage Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Voltage Violation (p.u.)**	**Comment**
[BREC] Local 69 kV Buses	69	P1-2	0.92	Post-project voltage is 0.92 p.u.
[BREC] Newman 161 kV	161	P1-2	0.92	Post-project voltage is 0.93 p.u.
[BREC] Daviess County 161 kV	161	P1-2	0.92	Post-project voltage is 0.94 p.u.

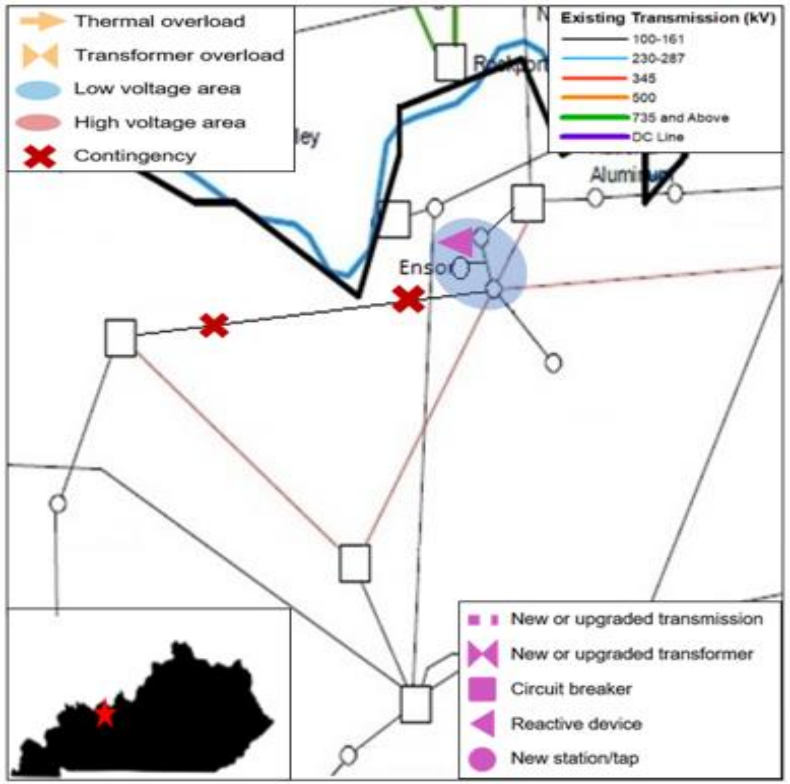
Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Max Loading (%)**	**Comment**
[BREC] Daviess County 161/69 kV transformer	161	P1-3	111	Post-project loading is 82%.

BREC: New [BREC] Hancock County Capacitor Bank addition solve(s) *P1-2 voltage issue*

- **P21387 Baseline Reliability Project**
- **Project description**

  Add a 35 MVar capacitor bank on the 69 kV bus at the existing Hancock County substation.
- **System Need**

  Low voltage mitigation at Daviess County 161 kV bus for loss of [BREC] Reid-[BREC] Daviess 161 kV line.
- **Estimated Cost:** $0.5M
- **Expected ISD:** October 1, 2022
- **Target Appendix:** A in MTEP21
- **Alternatives:** BREC considered several transmission alternatives. However, this upgrade was found to be the best and cheapest option to address this reliability issue.
- **NTA Eligibility:** yes



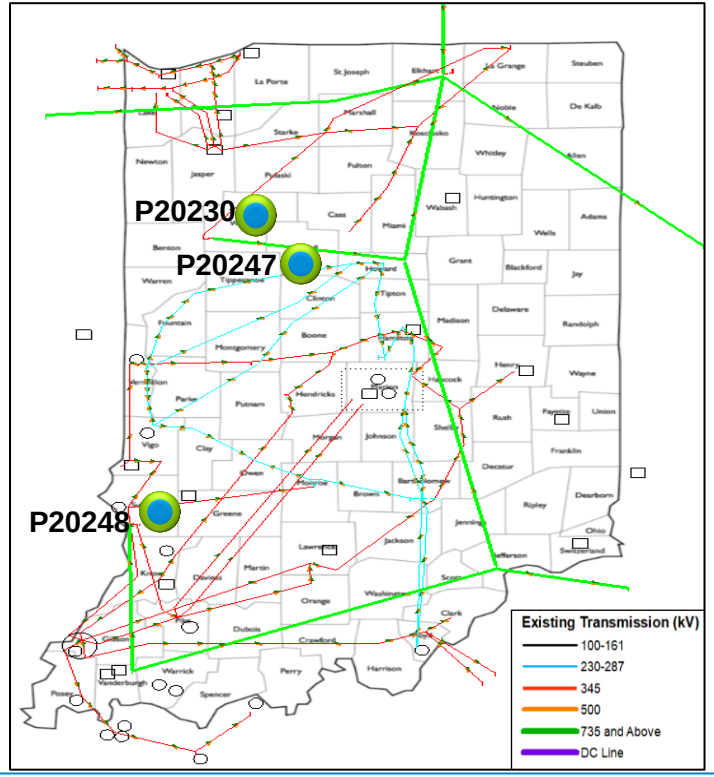
BREC — New [BREC] Hancock County Capacitor Bank Addition — Analysis Summary

Voltage Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Voltage Violation (p.u.)**	**Comment**
[BREC] Davis 161 kV Bus	161	P1-2	0.92	Post-project voltage is 0.94 p.u.
[BREC] Newman 161 kV Bus	161	P1-2	0.92	Post-project voltage is 0.93 p.u.

Duke Energy (DEI)

Duke: Three (3) BRPs proposed to address reliability issues on bulk energy system

- TO proposed project
- MISO identified reliability need
- Need + Project



A detailed list of needs is tabulated in spreadsheet Issues_Tracker_Central_SPM3.xlsx

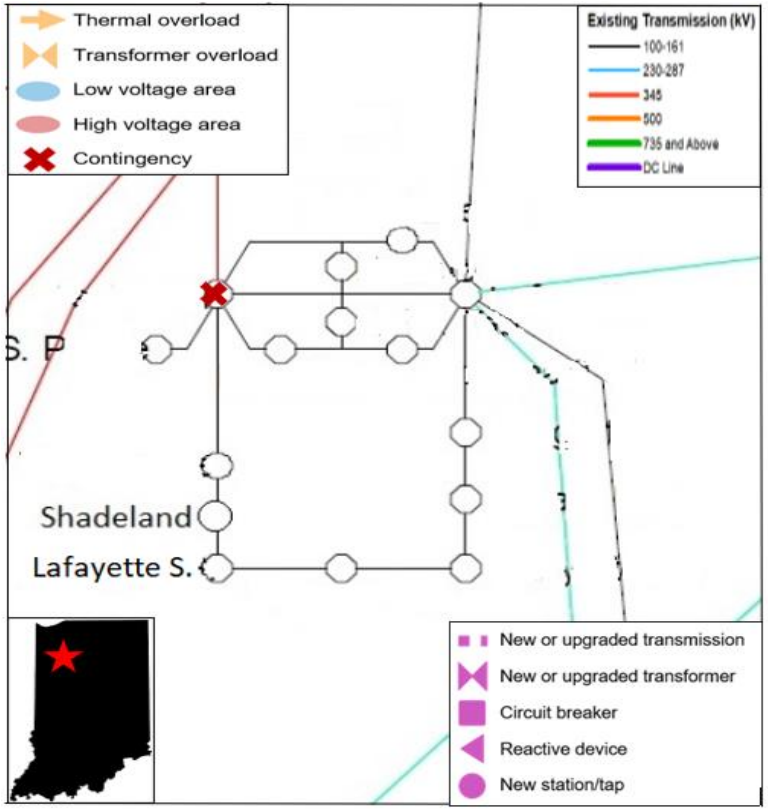
Duke: Rebuild [DEI] Purdue NW Tap—[DEI] Purdue 138 kV line solve(s) *P4-2 thermal issue*

- **P20230 Baseline Reliability Project**
- **Project description**

  Rebuild [DEI] Purdue NW Tap—[DEI] Purdue 138 kV line with summer emergency rating 243 MVA
- **System Need**

  P4-2 Event: 111% loading in year 2023 summer peak

  Estimated Cost: $9.5M
- **Expected ISD:** December 31, 2023
- **Target Appendix:** A in MTEP21
- **Alternatives:** DEI considered several transmission alternatives. However, this upgrade was found to be the best and cheapest option to address this reliability issue
- **NTA Eligibility:** yes



Duke — Rebuild [DEI] Purdue NW Tap—[DEI] Purdue 138 kV line — Analysis Summary

Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Max Loading (%)**	**Comment**
[DEI] Purdue NW Jct Tap 2- [DEI] West Lafayette Airport 138 kV line	138	P4-2	111	Post-project loading is 73%.
[DEI] Purdue - [DEI] West Lafayette Airport 138 kV line	138	P4-2	103	Post-project loading is 67%.

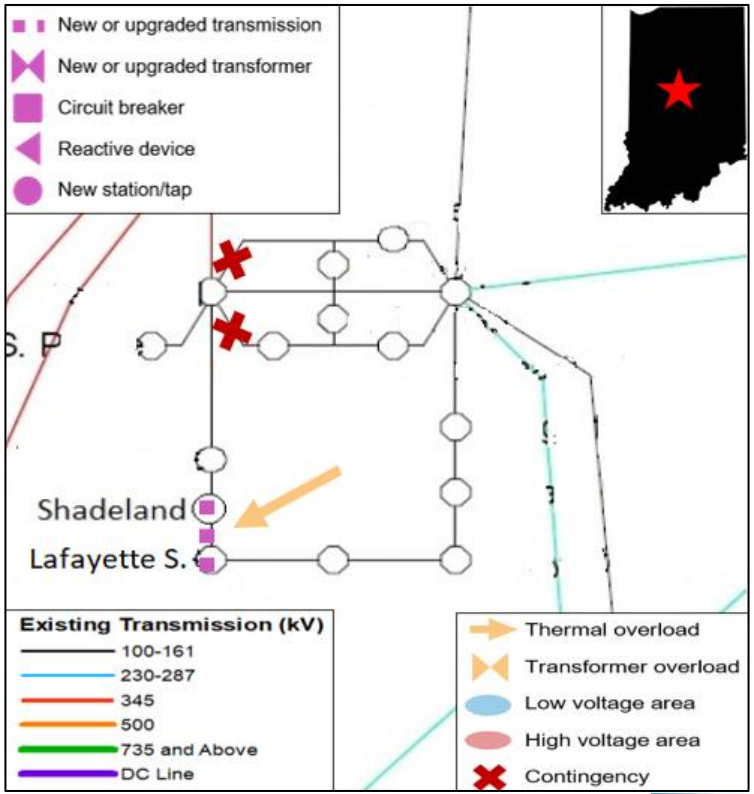
Duke: Rebuild [DEI] Lafayette South—[DEI] Shadeland 138 kV solve(s) *P6-1-1 and P7 thermal issue*

- **P20247 Baseline Reliability Project**
- **Project description**

  Rebuild [DEI] Lafayette South—[DEI] Shadeland 138 kV line with summer emergency rating of 291 MVA
- **System Need**

  P6-1-1 and P7 Events: 99% loading in year 2026 summer peak

  Estimated Cost: $6.4M
- **Expected ISD:** June 1, 2023
- **Target Appendix:** A in MTEP21
- **Alternatives:** DEI considered several transmission alternatives. However, this upgrade was found to be the best and cheapest option to address this reliability issue.
- **NTA Eligibility:** yes



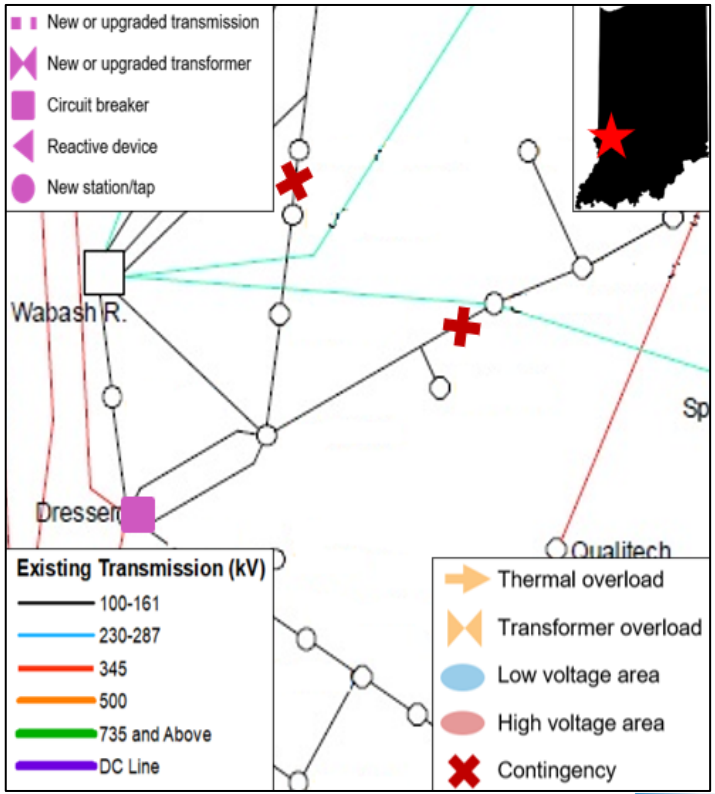
Duke —Rebuild [DEI] Lafayette South—[DEI] Shadeland 138 kV line — Analysis Summary

Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Max Loading (%)**	**Comment**
[DEI] Lafayette South—[DEI] Shadeland 138 kV line	138	P6-1-1	99	Post-project loading is 61%.
[DEI] Lafayette South—[DEI] Shadeland 138 kV line	138	P7	99	Post-project loading is 61%.

Duke: New [DEI] Dresser 345 kV Redundant Ckt Breaker solve(s) *P4-3* thermal issue

- **P20248 Baseline Reliability Project**
- **Project description**

  New [DEI] Dresser 345 kV Redundant circuit breaker addition between Bank-1 and Bank-2 with fully redundant protection scheme per future TPL-001-5 P5 contingency definition.
- **System Need**
  - P2/P4 Events: Thermal violation: [DEI] Dresser 345/138kV Bk3 transformer
- **Estimated Cost:** $8.0M
- **Expected ISD: June** 1, 2023
- **Target Appendix:** A in MTEP21
- **Alternatives:** Duke is currently investigating feasibility of a less expensive project that would add relaying/control logic for an auto-isolation and restoration scheme.
- **NTA Eligibility:** yes



Duke —New [DEI] Dresser 345 kV Redundant Circuit Breaker — Analysis Summary

Thermal Violations				
Substation	**Voltage Level (kV)**	**Contingency Category**	**Max Loading (%)**	**Comment**
[DEI] Dresser 345/138 kV transformer	345	P4-3	102	Post-project loading is 61%.

METC

Projects are tabulated for space considerations. Complete project details available with East SPM3 materials

MISO MTEP21 Recommendations show 37 projects recommended for Appendix A and 20 projects recommended for Appendix B

Project ID	Project Name	Project Type	Target Appendix	Expected ISD	Cost [$M]	Recommendation
19958	Whiting 2nd 138-120kV Transformer	BRP	A	12/31/2024	6.7	Appendix B
19960	Rebuild Dort (Calvary) - Garfield 138kV	BRP	A	12/31/2024	18.1	Appendix B
19964	Sag Remediate Arthur Jct. - Tallmadge 138kV	BRP	A	12/31/2023	0.66	Appendix B
19970	Rebuild Alma - Vestaburg 138 kV 477 ACSR	BRP	A	12/31/2024	2.8	Appendix A
20015	Rebuild Bingham - Cornell 138 kV	BRP	A	6/1/2025	31	Appendix B
20016	Rebuild Eureka - Deja Jct 138 kV	BRP	A	6/1/2025	19	Appendix B
20017	Rebuild Alma - Regal #1 138 kV	BRP	A	6/1/2025	11	Appendix B
20018	Rebuild Bullock - Shale 138 kV	BRP	A	6/1/2025	33	Appendix A

MISO MTEP21 Recommendations show 37 projects recommended for Appendix A and 20 projects recommended for Appendix B

Project ID	Project Name	Project Type	Target Appendix	Expected ISD	Cost [$M]	Recommendation
20019	Rebuild Bullock - Edenville Jct 138 kV	BRP	A	6/1/2025	21.1	Appendix B
20020	Gaylord - Mio Dam 138kV Rebuild	BRP	A	6/1/2025	75.1	Appendix B
20021	Rebuild Bullock - Salt River 138 kV	BRP	A	12/31/2024	29.31	Appendix B
20022	Rebuild Salt River - Summerton 138 kV	BRP	A	12/31/2024	12.33	Appendix B
20031	Sag Remediate Corwith - Rondo 138kV	BRP	A	6/1/2025	1.7	Appendix B
20033	Sag Remediate Weadock - Carter Jct 138 kV	BRP	A	6/1/2025	0.88	Appendix A
20034	Sag Remediate Higgins - Mio Dam 138kV	BRP	A	6/1/2025	1.005	Appendix B
20041	Sag Remediate Bard Road - Higgins 138kV	BRP	A	6/1/2025	0.8	Appendix B

MISO MTEP21 Recommendations show 37 projects recommended for Appendix A and 20 projects recommended for Appendix B

Project ID	Project Name	Project Type	Target Appendix	Expected ISD	Cost [$M]	Recommendation
20048	Sag Remediate Bard Rd - Grout Jct 138kV	BRP	A	6/1/2025	0.26	Appendix B
20049	Rebuild and Sag Remediate Gallagher - Twining 138kV	BRP	A	6/1/2025	0.97	Appendix A
20050	Vanderbilt 138 kV Station Equipment Upgrades	BRP	A	6/1/2025	0.11	Appendix B
20051	Whittemore 138 kV Trainer Upgrade	BRP	A	6/1/2025	0.084	Appendix B
20052	Summerton 138 kV 500 Bus Upgrade	BRP	A	12/31/2023	0.37	Appendix B
20053	Warren 138 kV 188 Bus Upgrade	BRP	A	12/31/2023	0.15	Appendix A
20054	Warren 138 kV 377 Equipment Upgrades	BRP	A	12/31/2023	1.05	Appendix A
20117	Rebuild Monroe – Lallendorf 345 kV (METC)	BRP	A	12/31/2024	45.7	Project Withdrawn

MISO MTEP21 Recommendations show 37 projects recommended for Appendix A and 20 projects recommended for Appendix B

Project ID	Project Name	Project Type	Target Appendix	Expected ISD	Cost [$M]	Recommendation
20119	Sag Remediate Claremont - Cornell #2 138kV	BRP	A	6/1/2025	0.25	Appendix B
20120	Wackerly 138 kV Station Equipment Upgrades	BRP	A	12/31/2023	0.14	Appendix A
20131	Sag Remediate Lemoyne – Majestic 345 kV	BRP	A	12/31/2023	0.50	Appendix B
20160	Delaney 138 kV 177 Bus Upgrades	BRP	A	6/1/2025	0.16	Appendix B

Open issues with corrective action plan

Thermal Violations					
Monitored Facility	**Voltage Level (kV)**	**Contingency Category**	**Highest N-1 (%)**	**Highest N-1-1 (%)**	**Corrective Action Plan**
Savidge [256104] – Sternberg [256836] Ckt 1	138	**P6**	**---**	**102.64**	**METC to submit a project in MTEP22**
Lawndale [256193] – Murphy [256499] Ckt 1	138	**P7, P6**	**96.4**	**113.95**	**METC to submit a project in MTEP22**
Emmet [256137] – Livingston [256201] Ckt 1	138	**N1, P6**	**116.34**	**109.24**	**HVDC guide - No project needed**
Gallagher [256148] – Ogemaw Jct [256777] Ckt 1	138	**N1, P6**	**105.83**	**105.78**	**METC to submit a project in MTEP22**
Emmet [256137] – Oden [263656] Ckt 1	138	**N1,P6**	**123.11**	**138.9**	**METC submitted a Project to MTEP22 – Age & Condition Related (Non-BRP)**

ITCT

Projects are tabulated for space considerations. Complete project details available with East SPM3 materials

MISO MTEP21 Recommendations show 25 projects recommended for Appendix A and 13 projects recommended for Appendix B

Project ID	Project Name	Project Type	Target Appendix	Expected ISD	Cost [$M]	Recommendation
20109	Sterling - Mustang 1 Tap 120 kV Rebuild	BRP – Line Rebuild	A	12/31/2024	0.516	Appendix B
20110	Pontiac - Sunbird 120 kV Rebuild	BRP – Line Rebuild	A	12/31/2024	7.0	Appendix B
20111	Superior - Wayne #1 and #2 120 kV Rebuild	BRP – Line Rebuild	A	12/31/2024	18.4	Appendix B
20116	Monroe - Lallendorf 345 kV Rebuild (ITCT)	BRP – Line Rebuild	B	12/31/2024	7.8	Appendix B
21206*	Coventry to Hager 120 kV Projects	BRP – Line Rebuild	A	12/31/2023	10.95	Appendix A
15959* (MTEP20)	Hager – Sunset 120 kV Rebuild	BRP – Line Rebuild	A	12/31/2025	9.66	Appendix B
20150	Monroe – Lulu 345 kV Sag Remediation (ITCT)	BRP – Sag Remediation	A	12/31/2024	0.72	Appendix B
15874	Custer 120 kV – Upgrade GA Station Equipment	BRP – Station Equipment	A	12/31/2022	0.15	Appendix B

P#21206 proposed Alternative for MTEP20 Appendix A P#15959. MISO's independent analysis recommends P#21206 for Appendix A and P#15959 for Appendix B.
ITC to move P#15959 to Appendix B in Portal and MOD

MISO MTEP21 Recommendations show 25 projects recommended for Appendix A and 13 projects recommended for Appendix B

Project ID	Project Name	Project Type	Target Appendix	Expected ISD	Cost [$M]	Recommendation
20115	Bloomfield 120 kV HG Upgrades	BRP – Station Equipment	A	12/31/2022	0.056	Appendix B
20105	Atlanta 120 kV Reactors	BRP - Reactor	A	12/31/2024	2.8	Appendix B
20182*	Northeast 120 kV 55 MVAR Reactor	BRP - Reactor	A	12/31/2023	1.32	Appendix B
20183*	Stephens 345 kV 55 MVAR Reactor	BRP - Reactor	A	12/1/2023	3.5	Appendix B
20185*	Warren 120 kV 55 MVAR Reactor	BRP - Reactor	A	12/31/2023	1.7	Appendix B
20186*	Mack 120 kV 55 MVAR Reactor	BRP - Reactor	A	12/31/2023	1.7	Appendix B

*Stakeholders will be notified of any change of status

MTEP22 Projects and Issues Under Review –

MISO East and Central Subregion

Preliminary projects and issues are detailed in 1st Subregional planning meeting (SPM) materials

- East Subregional SPM 1 February 3, 2022 https://www.misoenergy.org/events/east-subregional-planning-meeting-espm---february-3-2022/

- Central Subregional SPM 1 January 31, 2022 https://www.misoenergy.org/events/central-subregional-planning-meeting-cspm---january-31-2022/

- MTEP22 powerflow models expected March 2022. Please see MISO modeling page for updates