PJM October 2016 Queue Generation Affected System Impact Study

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1. EXECUTIVE SUMMARY

This report documents the Affected System Impacts of 34 projects in the PJM generator interconnection queue on the Midcontinent Independent System Operator ("MISO") transmission system. The projects are listed in Table 1-1 below.

Table 1-1 List of PJM Group Generation Interconnection Projects

Project	POI	MW	FUEL	State	TO
AA2-107	Waterman 34kV	20	Battery/Storage	IL	ComEd
AA2-141	Washington 345kV	45	Natural Gas CC	OH	AEP
AA2-148	Madison-Tanners Creek 138kV	174.2	Wind	IN	AEP
AA2-186	Forest 69kV	20	Battery/Storage	OH	AEP
AB1-006	Meadow Lake 345kV	200	Wind	IN	AEP
AB1-086	Pontiac Midpoint 345kV	575	Natural Gas	IL	ComEd
AB1-087	Sullivan 345kV #1	575	Natural Gas	IN	AEP
AB1-088	Sullivan 345kV #2	575	Natural Gas	IN	AEP
AB1-089	Byron-Wayne 345kV #1	575	Natural Gas	IL	ComEd
AB1-090	Byron-Wayne 345kV #2	575	Natural Gas	IL	ComEd
AB1-091	Davis Creek 345kV	575	Natural Gas	IL	ComEd
AB1-107	Bay Shore-Lallendorf 345kV	955	Natural Gas	OH	ATSI
AB1-121	Byron 345 kV - DC Line - 989 MW Firm Injection (1927 MW Total)	1927	HVDC	IL	ComEd
AB1-122	Kendall-Tazewell & Dresden-Mole Creek	1150	Natural Gas	IL	ComEd
AB1-169	Stuart 345kV	1150	Natural Gas	KY	Dayton
AB2-016	Maddox Creek 345kV	100	Wind	OH	AEP
AB2-028	Fall Creek-Desoto 345kV	200	Wind	IN	AEP
AB2-047	Brokaw-Pontiac Midpoint	250	Wind	IL	ComEd

Project	POI	MW	FUEL	State	TO
AB2-054	JK Smith 345kV	614	Natural Gas	KY	EKPC
AB2-065	Madison-Tanners Creek 138kV	124.2	Wind	IN	AEP
AB2-067	Kammer-Vassell 765kV	1100	Natural Gas	OH	AEP
AB2-070	Brokaw-Lanesville	200	Wind	IL	ComEd
AB2-083	Delano 138kV	40	Solar	OH	AEP
AB2-085	Adams 138kV	80	Solar	OH	AEP
AB2-096	Silver Lake-Cherry Valley	350	Natural Gas CC	IL	ComEd
AB2-131	Galion-Roberts South 138kV	150	Solar	OH	ATSI
AB2-170	East Lima-Marysville 345kV	130	Solar	OH	AEP
AB2-173	Nelson 345kV	16	Natural Gas CC	IL	ComEd
AB2-178	Beckjord 138kV	19.8	Battery/Storage	OH	DEOK
AB2-191	Mendota Hills	20	Wind	IL	ComEd
AB1-172	Joliet - Wilmington	6.2	Methane	IL	ComEd
AB2-093	Ormet 138 kV	485	Natural Gas	OH	AEP
AB2-103	Seaman 138 kV	40	Solar	OH	AEP
AC1-072	Covert 345kV	20	Natural Gas	MI	AEP

Table 1-2 lists the PJM projects which considered remote to MISO footprint.

Table 1-2 List of Remote PJM Projects

Project	Point of Interconnection	MW	State	Transmission Owner
Y3-092 MTX	Erie West 345 kV - DC Line - 1000 MW Firm Injection; 500 MW Firm Withdraw (1000 MW Total)	1000	PA	PN
AB2-010	Saltville-Holston 34.5kV - Phase I	5	VA	AEP
AB2-011	Saltville-Holstone 34.5kV - Phase II	5	VA	AEP
AB2-101	George Washington 138kV	31	WV	AEP
AB2-109	Reusens 34.5kV	12.5	VA	AEP

Project	Point of Interconnection	MW	State	Transmission Owner
AB2-141	George Washington 138kV	394	WV	AEP
AB2-145	Axton 765kV	572	VA	AEP

Steady State AC analysis was performed to identify any reliability criteria violations caused by the study generators. The study identified injection constraints in both the 2021 off peak scenario analysis and the 2021 peak scenario analysis. Network upgrades were identified and cost allocation was performed. A summary of cost estimates identified for each scenario is provided in Table 1-3, detailed information regarding network upgrades is provided in section 3 of the report.

Table 1-3 Planning Level Cost Estimate for Proposed Network Upgrades

Monitor Element	Planning Level Estimate	Queue Projects with Impact
348848 4BROKAW 138 348898 4N LEROY TAP 138 CKT 1	$5 million	AB2-070
349662 7TAZEWELL 345 930760 AB1-122 TAP 345 CKT 1	$300,000	AB1-122

2. STUDY METHODOLOGY & ASSUMPTIONS

2.1. STUDY CRITERIA

All interconnection requirements are based on the applicable MISO Interconnection Planning Criteria and in accordance with the NERC Reliability Standards. Steady state violations of applicable planning criteria were attributed to the PJM group generation requests by the usage of MISO injection criteria, and applicable local planning criteria, especially, Northern Indiana Power Service Co. (NIPSCO) generation interconnection criteria. NIPSCO's Generation Interconnection criteria can be found under section 4.5 of the planning methodology document available at:
https://www.misoenergy.org/Library/Repository/Study/TO%20Planning%20Criteria/NIPSCO%20TO%20Planning%20Criteria.pdf

2.1.1. MISO 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 Cumulative MW Impact from study generators is greater than or equal to 20% of the applicable (normal or Emergency) facility rating, where study generators whose Individual MW Impact is greater than 5% of the facility rating and has a larger than 5% DF will be responsible to mitigate the Cumulative MW Impact Constraint, or
4) The overloaded facility or the overload-causing contingency is at generator's outlet.

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 generation projects in the study group must mitigate thermal injection constraints in order to obtain unconditional Interconnection Service.

2.1.2. TOs' LOCAL PLANNING CRITERIA

A constraint is identified as an injection constraint if it violates applicable Transmission Owner FERC filed Local Planning Criteria.

2.2. CONTINGENCY CRITERIA

A comprehensive list of contingencies was considered for steady-state analysis:

- NERC Category P0 with system intact (no contingencies)
- NERC category P1, P2, P4, P5, P7 contingencies
    - AMMO (area 356), AMIL (area 357), WEC (area 295), MIUP (area 296), ALTE (area 694), WPS (area 696), MGE (area 697), UPPC (area 698), HE (area 207), DEI (area 208), SIGE (area 210), IPL (area 216), NIPS (area 217), BREC (area 314), CWLD (area 333), CWLP (area 360), SIPC (area 361), METC (area 218), ITCT (area 219).
- NERC Category P3
    - Selected NERC Category P3 events provided by ad-hoc study group in the study region of areas.
- For all the contingencies and post-disturbance analyses, cases were solved with transformer tap adjustment enabled, area interchange adjustment disabled, phase shifter adjustment enabled and switched shunt adjustment enabled.

2.3. MONITORED ELEMENTS

Table 2-1 listed the area monitored in this study.

Table 2-1 Monitored Area

Area #	Voltage	Area ID	Area Name
356	100kV and above	AMMO	Ameren Missouri
357	100kV and above	AMIL	Ameren Illinois
295	69kV and above	WEC	Wisconsin Electric Power Company (ATC)
296	69kV and above	MIUP	Michigan Upper Peninsula (ATC)
694	69kV and above	ALTE	Alliant Energy East (ATC)
696	69kV and above	WPS	Wisconsin Public Service Corporation (ATC)
697	69kV and above	MGE	Madison Gas and Electric Company (ATC)
698	69kV and above	UPPC	Upper Peninsula Power Company (ATC)
207	69kV and above	HE	Hoosier Energy
208	69kV and above	DEI	Duke Energy Indiana
210	69kV and above	SIGE	Southern Indiana Gas & Electric Company
216	69kV and above	IPL	Indianapolis Power & Light Company
217	69kV and above	NIPS	Northern Indiana Public Service Company
314	69kV and above	BREC	Big Rivers Electric Corporation
333	69kV and above	CWLD	Columbia, MO Water and Light
360	69kV and above	CWLP	City Water Light & Power(Springfield)
361	69kV and above	SIPC	Southern Illinois Power Co.
218	69kV and above	METC	Michigan Electric Transmission Co., LLC
219	69kV and above	ITCT	International Transmission Company
600	69kV and above	XEL	Xcel Energy North
608	69kV and above	MP	Minnesota Power & Light
613	69kV and above	SMMPA	Southern Minnesota Municipal Power Association
615	69kV and above	GRE	Great River Energy
620	69kV and above	OTP	Otter Tail Power Company
627	69kV and above	ALTW	Alliant Energy West
633	69kV and above	MPW	Muscatine Power & Water
635	69kV and above	MEC	MidAmerican Energy
661	69kV and above	MDU	Montana-Dakota Utilities Co.
680	69kV and above	DPC	Dairyland Power Cooperative

2.4. MODEL DEVELOPMENT

The following MTEP base case load profiles were used for the study:

- 2021 Summer Shoulder
- 2021 Summer Peak

The study cases were built by adding and dispatching the appropriate queue projects to the base cases. The detail of each PJM interconnection request is listed in Appendix A. The study projects were dispatched per MISO criteria to the entire PJM footprint, where generators were scaled in proportion to the available reserve.

2.5. STUDY ASSUMPTIONS

This affected system impact study was conducted with all the participating generators operating together as a group. Analysis was not performed on individual generating units or subsets of the generating units unless specifically noted otherwise. Higher queued PJM projects were modeled as outlined in Appendix A of the report. The results obtained in this analysis may change if any of the data or assumptions made during the development of the study models is revised.

3. STEADY STATE ANALYSIS

3.1. OUT YEAR (2021) SUMMER SHOULDER ANALYSIS

Table 3-1 2021Summer Shoulder Constraints

Monitor Element	Contflow (MVA)	Baseflow (MVA)	Rating	Loading%	Contingency	Constraint Criteria	Queue Projects with Impact
348848 4BROKAW 138 348898 4N LEROY TAP 138 CKT 1	205.94	100.1	202	101.95	P71:345:AMIL::CLINTON: GOOSECREEK:45:CLINTON:OREANA	Cumulative MW Impact	AB2-070

Table 3-2 Proposed 2021 Summer Shoulder Network Upgrades

Monitor Element	Limiting Element	Mitigation	Planning Level Estimate	Queue Projects with Impact
348848 4BROKAW 138 348898 4N LEROY TAP 138 CKT 1	Rating limited by 10.09 miles 477 ACSR conductor	replacement with 477 ACSS, new rating of 243/276 MVA SN/SE.	$5 million	AB2-070

3.2. OUT YEAR (2021) SUMMER PEAK ANALYSIS

Table 3-3 2021Summer Peak Constraints

Monitor Element	Contflow	Baseflow	Rating	Loading %	Contingency	Constraint Criteria	Queue Projects with Impact
324104 7DAVIESS 345 340563 7COLEMAN 345 CKT 1***Note**	854.98	314.3	717	119.24	P23:765:AEP:2929_C2	Cumulative MW Impact	AB1-087, AB1-088
349662 7TAZEWELL 345 930760 AB1-122 TAP 345 CKT 1	1205.13	103.1	1195	100.85	274702 KENDALL ;BU 345 930760 AB1-122 TAP 345 1	DF Impact	AB1-122

*Note: Big Rivers intends to upgrade the Coleman EHV to Daviess EHV 345 kV circuit by January 2021. The upgrade will increase the rating from 717 MVA to 956 MVA (MISO Project ID 12783). AB1-087 and AB1-088 should be granted conditional service if come to service prior to the completion of the transmission project.

Table 3-4 Proposed 2021Summer Peak Network Upgrades

Monitor Element	Limiting Element	Mitigation	Planning Level Estimate	Queue Projects with Impact
349662 7TAZEWELL 345 930760 AB1-122 TAP 345 CKT 1	Rating limited by line switch 4525-17	Replacement of switch 4525-17 would rating the limit to 1275MW due to a relay limit	$300,000	AB1-122

4. CONCLUSION

The Affected system study has identified Steady State thermal violations with the interconnection of the 34 PJM projects on the monitored MISO transmission system. Both Out-year Summer Shoulder (2021) and Out-year Summer Peak (2021) analysis were performed as part of the study. The generators with adverse impact will need to mitigate for the constraints prior to being granted any injection on the PJM system.

5. APPENDIX A PJM HIGHER QUEUED PROJECTS

Table 5-1 PJM Higher Queued Projects

Queue Number	PJM Cycle	POI	Size(MW)	Fuel Type	State
T94	PJM2013APRIL	Cook – Palesades 345kV	1035	CC	MI
T99	PJM2013APRIL	Caledonia Wind 100 MW	100	wind	IL
T131	PJM2013APRIL	Lincoln – Sterling 138kV	150	wind	OH
T142	PJM2013APRIL	Southwest Lima – Marysville 345kV	300	wind	OH
T148	PJM2013APRIL	Caledonia Wind II 100 MW	100	wind	IL
U2-072	PJM2013APRIL	East Lima – Marysville 345kV	300	wind	OH
U3-021	PJM2013APRIL	Silver Lake – Cherry Valley 345kV	100	CT	IL
U4-027	PJM2013APRIL	Normandy-Kewanee 138kV	100	CT	IL
V1-011	PJM2013APRIL	Haviland 138kV	100	wind	OH
V1-012	PJM2013APRIL	Haviland 138kV	150	wind	OH
V2-006	PJM2013APRIL	East Leipsic 138kV	150	wind	OH
V3-007	PJM2013APRIL	Desoto-Tanners Creek #1 345kV	200	wind	IN
V3-008	PJM2013APRIL	Desoto-Tanners Creek #1 345kV	200	wind	IN
V3-009	PJM2013APRIL	Desoto-Tanners Creek #1 345kV	200	wind	IN
V4-010	PJM2013APRIL	Tiffin Center 138kV	200	wind	OH
W1-072A_AT5	PJM2013APRIL	Lemoyne 345kV	640	CC	OH
W3-088	PJM2013APRIL	South West Lima 345kV	200	wind	OH
W3-128	PJM2013APRIL	Sporn – Waterford 345kV	652	CC	OH
X1-027A_AT12	PJM2013APRIL	Davis Besse – Beaver 345kV	500	wind	OH
Y1-006	PJM2013APRIL	Jubal Early – Austinville 138kV	72	wind	VA
Y1-069	PJM2013APRIL	Bay Shore – Fostoria Central 345kV	799	CC	OH
V1-024	PJM2013OCT	LaSalle 1	1188	nuclear	LaSalle, IL
V1-025	PJM2013OCT	LaSalle 2	1191	nuclear	LaSalle, IL
V4-046	PJM2013OCT	Byron 1	1249	nuclear	Ogle, IL
V4-047	PJM2013OCT	Byron 2	1223	nuclear	Ogle, IL
V4-048	PJM2013OCT	Braidwood 1	1247	nuclear	Will, IL
V4-049	PJM2013OCT	Braidwood 2	1219	nuclear	Will, IL
W2-048	PJM2013OCT	Pontiac MidPoint – Lanesville 345kV	62.5	wind	Logan, IL
W3-046	PJM2013OCT	Powerton 345kV – Katydid 345kV	207.5	wind	Mason, IL
W4-005	PJM2013OCT	Pontiac Midpoint – Latham 345kV	351	wind	Macon
X1-096	PJM2013OCT	Loretto-Kings Creek 138kV	150	wind	Somerset
X2-022	PJM2013OCT	Pontiac Midpoint-Lanesville II	189	wind	Logan
X2-031	PJM2013OCT	Krayn 115kV	50	wind	Cambria
X2-052	PJM2013OCT	Dumont-Olive 345kV	675	CC	Adams
X3-051	PJM2013OCT	Flatlick 765kV	1460	CC	Unknown
X4-025	PJM2013OCT	Millbrook Park 138kV	80	coal	Greenup
Y1-065	PJM2013OCT	Rock Spring 500kV	834.1	CC	Cecil
X1-087	PJM2014MAY	Stillman Valley	15.3	methane	IL
X3-023	PJM2014MAY	S. Greenwich-Willard 69kV	60	wind	OH

Queue Number	PJM Cycle	POI	Size(MW)	Fuel Type	State
Y2-050	PJM2014MAY	Tidd-Canton Central	742	CC	OH
Y3-088	PJM2014MAY	Kendall I	1158.8	CC	IL
Y3-089	PJM2014MAY	Kendall II	1178.8	CC	IL
Y3-090	PJM2014MAY	Kendall III	1198.8	CC	IL
Y3-091	PJM2014MAY	Kendall IV	1218.8	CC	IL
Y3-103	PJM2014MAY	Valley-Raccoon 138kV	205	CT	PA
V4-033	PJM2014NOV	AEP	299.2	wind	Randolph, IN
W4-004	PJM2014NOV	AEP	90	wind	Henry, IN
W4-008	PJM2014NOV	AEP	180	wind	Henry, IN
X2-006	PJM2014NOV	AEP	585	CC	Lawrence, KY
Y3-038	PJM2014NOV	AEP	1356	coal	Spencer, IN
Z1-035	PJM2014NOV	ATSI	18	wind	Unknown, OH
Z1-051	PJM2014NOV	AEP	1192	nuclear	Berrien, MI
Z1-079	PJM2014NOV	DEOK	513	CC	Butler, OH
Z1-127	PJM2014NOV	ComEd	320	CT	Will, IL
X1-020	PJM2015APRIL	Dumont-Greentown 765kV	1500	wind	IN
Y2-103	PJM2015APRIL	Zion Energy Center	945	CC	IL
Y3-013	PJM2015APRIL	Zion Energy Center	945	CC	IL
Z2-081	PJM2015APRIL	Streator 34.5kV	13.3	methane	IL
Z2-087	PJM2015APRIL	Pontiac MidPoint-Brokaw 345kV	200	wind	IL
AA1-018	PJM2015APRIL	Powerton-Goodings Grove	150	wind	IL
AA1-040	PJM2015APRIL	Morris	140	CC	IL
AA1-078	PJM2015APRIL	University Park North	560	CC	IL
AA1-116	PJM2015APRIL	Kensington/Kankakee	20	storage	IL
AA1-117	PJM2015APRIL	Kensington/Kankakee	20	storage	IL
AA1-129	PJM2015APRIL	Northbrook-Skokie	27	CT	IL
AA1-146	PJM2015APRIL	Nelson	190	CT	IL
AA2-100	PJM2015OCT	Brown 34.5kV	6.4	methane	OH
AA2-106	PJM2015OCT	Bluff Point 69kV	20	storage	IN
AA2-137	PJM2015OCT	Hanging Rock 765kV - Power Block 1	1340	natural gas	OH
AA2-138	PJM2015OCT	Hanging Rock 765kV - Power Block 2	1235	natural gas	OH
AB1-058	PJM2016APR	Gavin Unit #1 765kV	11	coal	OH(AEP)
AA1-123	PJM2016APR	Highland-Sammis 345kV	1152	natural gas	OH(ATSI)
AA2-030	PJM2016APR	Nelson	190	natural gas	IL(ComEd)
AA2-035	PJM2016APR	Collins	1019.3	natural gas	IL(ComEd)
AA2-116	PJM2016APR	Cook-East Elkhart 345kV	994	natural gas	MI(AEP)

Queue Number	PJM Cycle	POI	Size(MW)	Fuel Type	State
AB1-015	PJM2016APR	Evergreen 138kV	16.5	natural gas	OH(APS)
AB1-017	PJM2016APR	Highland-Sammis 34kV & Highland-Mansfield 34kV	140	natural gas	OH(ATSI)
AB1-080	PJM2016APR	Dumont-Olive 345kV	40	natural gas	IN(AEP)
AB1-105	PJM2016APR	Highland-Hanna 345kV	940	natural gas	OH(ATSI)
AB1-178	PJM2016APR	Pidgeon 69kV	19.9	natural gas	OH(ATSI)
AB1-014	PJM2016APR	Hillcrest 138kV	125	solar	OH(DEOK)
AB1-032	PJM2016APR	Lee Station Southwest 12kV	3.3	solar	OH(AEP)
AB1-174	PJM2016APR	Thornville12kV	10	solar	OH(AEP)
Z2-113	PJM2016APR	Watervliet 12.47kV	4.6	solar	MI(AEP)
Z2-114	PJM2016APR	Olive 12.47kV	5	solar	IN(AEP)
Z2-116	PJM2016APR	Twin Branch 12.47kV	2.6	solar	IN(AEP)
AB1-167	PJM2016APR	South Cumberland 69kV	50	storage	OH(AEP)
AA2-039	PJM2016APR	Kewanee 138kV	150	wind	IL(ComEd)
AA2-075	PJM2016APR	Southwest Lima 345kV	250	wind	OH(AEP)

6. APPENDIX B STUDY SCENARIOS AND STUDY CONTINGENCIES

Table 6-1 Study Scenarios and Study Contingencies

Study_Year	Con File	Con Type	Num of Contingency
2021SH	AEP_ADDL_P1_contingencies.con	P1	2
2021SH	AEP_ADDL_P2-P7_contingencies.con	P2-P7	16
2021SH	AMIL_addl_contingencies_P1.con	P1	10
2021SH	AMRN_addl_P11.con	P1-1	71
2021SH	AMRN-P1-1 2021.con	P1-1	52
2021SH	AMRN-P1-2 2021DPP-2016-AUG-Central.con	P1-2	506
2021SH	AMRN-P1-3 2021.con	P1-3	94
2021SH	AMRN-P1-4 2021.con	P1-4	21
2021SH	AMRN-P2-1 2021.con	P2-1	321
2021SH	AMRN-P2-2 2021DPP-2016-AUG-Central.con	P2-2	210
2021SH	AMRN-P2-3 2021.con	P2-3	356
2021SH	AMRN-P2-4 2021.con	P2-4	147
2021SH	AMRN-P7 2021.con	P7	86
2021SH	BREC_addl_P1_contingencies.con	P1	6
2021SH	BREC_addl_P2-P7_contingencies.con	P2-P7	2

Study_Year	Con File	Con Type	Num of Contingency
2021SH	BREC_P1_Contingencies.con	P1	79
2021SH	BREC_P2-P7_Contingencies.con	P2-P7	42
2021SH	ComEd_RTEP_Cat_P1.con	P1	467
2021SH	ComEd_RTEP_Cat_P2-P7.con	P2-P7	1163
2021SH	CWLD_P1.con	P1	21
2021SH	CWLD_P2_Load_Loss.con	P2	11
2021SH	CWLP_addl_contingencies_P1.con	P1	2
2021SH	CWLP_MTEP16_CatP1.con	P1	65
2021SH	CWLP_MTEP16_CatP2.con	P2	95
2021SH	CWLP_MTEP16_CatP7.con	P7	1
2021SH	DEI_addl-P1_contingencies.con	P1	1
2021SH	DEI_addl-P2-P7_contingencies.con	P2-P7	31
2021SH	DEI_P1 ALL.con	P1	1
2021SH	DEI_P2 ALL.con	P2	670
2021SH	DEI_P4 ALL.con	P4	388
2021SH	DEI_P5 ALL.con	P5	296
2021SH	DEI_P7 ALL.con	P7	70
2021SH	HE Category P1.con	P1	47
2021SH	HE Category P2.con	P2	28
2021SH	HE_addl_P1_contingencies.con	P1	3
2021SH	IPL_addl_P1_contingencies.con	P1	1
2021SH	IPL_addl_P2-P7_contingencies.con	P2-P7	5
2021SH	IPL_P1_MTEP16.con	P1	138
2021SH	IPL_P2_MTEP16.con	P2	364
2021SH	IPL_P4_MTEP16.con	P4	263
2021SH	IPL_P5_MTEP16.con	P5	61
2021SH	IPL_P7_MTEP16.con	P7	20
2021SH	ITCT-METC_P11_gen.con	P11	216
2021SH	ITCT-METC_P12_line.con	P12	697
2021SH	ITCT-METC_P13_xfmr.con	P13	106
2021SH	ITCT-METC_P14_shunt.con	P14	62
2021SH	ITCT-METC_P21_open_line_section.con	P21	1214
2021SH	ITCT-METC_P22_P23_P24_bus_and breaker.con	P22_P23_P24	2012
2021SH	ITCT-METC_P4_stuck_breaker.con	P4	1333
2021SH	ITCT-METC_P5_protection_failure.con	P5	76
2021SH	ITCT-METC_P7_dbl_ckt.con	P7	397
2021SH	MTEP16_ATC_DPC_P1_addl.con	P1	9
2021SH	MTEP16_Lansing_P1.con	P1	38

Study_Year	Con File	Con Type	Num of Contingency
2021SH	MTEP16_Lansing_P2_P7.con	P2-P7	22
2021SH	MTEP16_Lansing_P4.con	P4	38
2021SH	MTEP16_Lansing_P5.con	P5	13
2021SH	NIPS_addl_P1_contingencies.con	P1	4
2021SH	NIPS_addl_P2-P7_contingencies.con	P2-P7	1
2021SH	NIPS_CATP1_MTEP16_2021.con	P1	259
2021SH	NIPS_CATP2_MTEP16_2021.con	P2	340
2021SH	NIPS_CATP5_MTEP16_2021.con	P5	26
2021SH	NIPS_CATP7_MTEP16_2021.con	P7	113
2021SH	P1-1_ATC_MTEP16_20160215.con	P1-1	247
2021SH	P1-2_ATC_MTEP16_20160215.con	P1-2	826
2021SH	P1-3_ATC_MTEP16_20160215.con	P1-3	227
2021SH	P1-4_ATC_MTEP16_20160215.con	P1-4	164
2021SH	P2-1_ATC_MTEP16_20160215.con	P2-1	198
2021SH	P2-2_ATC_MTEP16_20160215.con	P2-2	461
2021SH	P2-3_ATC_MTEP16_20160215.con	P2-3	938
2021SH	P2-4_ATC_MTEP16_20160215.con	P2-4	158
2021SH	P5-5_ATC_MTEP16_20160215.con	P5-5	135
2021SH	P7-1_ATC_MTEP16_20160215.con	P7-1	159
2021SH	SIPC_MTEP16_CatP1.con	P1	17
2021SH	SIPC_MTEP16_CatP2-7.con	P2-P7	9
2021SH	Vectren_SIGE_MTEP16_CatP1_Cont.con	P1	70
2021SH	Vectren_SIGE_MTEP16_CatP2-P7_Cont.con	P2-P7	108
2021SH	WPSC Category P1.con	P1	122
2021SH	WPSC Category P2.con	P2	295
2021SH	WPSC Category P4.con	P4	158
2021SH	WPSC Category P5.con	P5	11
2021SH	WPSC Category P7.con	P7	5
2021SH	PJM2016OCT_AEP.con	P1	3908
2021SH	PJM2016OCT_AMRN.con	P1	1131
2021SH	PJM2016OCT_ATC.con	P1	1978
2021SH	PJM2016OCT_CE.con	P1	1520
2021SH	PJM2016OCT_Central.con	P1	4053
2021SH	PJM2016OCT_MI.con	P1	2268
2021SP	AEP_ADDL_P1_contingencies.con	P1	2
2021SP	AEP_ADDL_P2-P7_contingencies.con	P2-P7	16
2021SP	AMIL_addl_contingencies_P1.con	P1	10
2021SP	AMRN_addl_P11.con	P1-1	71

Study_Year	Con File	Con Type	Num of Contingency
2021SP	AMRN-P1-1 2021.con	P1-1	52
2021SP	AMRN-P1-2 2021DPP-2016-AUG-Central.con	P1-2	506
2021SP	AMRN-P1-3 2021.con	P1-3	94
2021SP	AMRN-P1-4 2021.con	P1-4	21
2021SP	AMRN-P2-1 2021.con	P2-1	321
2021SP	AMRN-P2-2 2021DPP-2016-AUG-Central.con	P2-2	210
2021SP	AMRN-P2-3 2021.con	P2-3	356
2021SP	AMRN-P2-4 2021.con	P2-4	147
2021SP	AMRN-P7 2021.con	P7	86
2021SP	BREC_addl_P1_contingencies.con	P1	6
2021SP	BREC_addl_P2-P7_contingencies.con	P2-P7	2
2021SP	BREC_P1_Contingencies.con	P1	79
2021SP	BREC_P2-P7_Contingencies.con	P2-P7	42
2021SP	ComEd_RTEP_Cat_P1.con	P1	467
2021SP	ComEd_RTEP_Cat_P2-P7.con	P2-P7	1163
2021SP	CWLD_P1.con	P1	21
2021SP	CWLD_P2_Load_Loss.con	P2	11
2021SP	CWLP_addl_contingencies_P1.con	P1	2
2021SP	CWLP_MTEP16_CatP1.con	P1	65
2021SP	CWLP_MTEP16_CatP2.con	P2	95
2021SP	CWLP_MTEP16_CatP7.con	P7	1
2021SP	DEI_addl-P1_contingencies.con	P1	1
2021SP	DEI_addl-P2-P7_contingencies.con	P2-P7	31
2021SP	DEI_P1 ALL.con	P1	1
2021SP	DEI_P2 ALL.con	P2	670
2021SP	DEI_P4 ALL.con	P4	388
2021SP	DEI_P5 ALL.con	P5	296
2021SP	DEI_P7 ALL.con	P7	70
2021SP	HE Category P1.con	P1	47
2021SP	HE Category P2.con	P2	28
2021SP	HE_addl_P1_contingencies.con	P1	3
2021SP	IPL_addl_P1_contingencies.con	P1	1
2021SP	IPL_addl_P2-P7_contingencies.con	P2-P7	5
2021SP	IPL_P1_MTEP16.con	P1	138
2021SP	IPL_P2_MTEP16.con	P2	364
2021SP	IPL_P4_MTEP16.con	P4	263
2021SP	IPL_P5_MTEP16.con	P5	61
2021SP	IPL_P7_MTEP16.con	P7	20

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2021SP	ITCT-METC_P11_gen.con	P11	216
2021SP	ITCT-METC_P12_line.con	P12	697
2021SP	ITCT-METC_P13_xfmr.con	P13	106
2021SP	ITCT-METC_P14_shunt.con	P14	62
2021SP	ITCT-METC_P21_open_line_section.con	P21	1214
2021SP	ITCT-METC_P22_P23_P24_bus_and breaker.con	P22_P23_P24	2012
2021SP	ITCT-METC_P4_stuck_breaker.con	P4	1333
2021SP	ITCT-METC_P5_protection_failure.con	P5	76
2021SP	ITCT-METC_P7_dbl_ckt.con	P7	397
2021SP	MTEP16_ATC_DPC_P1_addl.con	P1	9
2021SP	MTEP16_Lansing_P1.con	P1	38
2021SP	MTEP16_Lansing_P2_P7.con	P2-P7	22
2021SP	MTEP16_Lansing_P4.con	P4	38
2021SP	MTEP16_Lansing_P5.con	P5	13
2021SP	NIPS_addl_P1_contingencies.con	P1	4
2021SP	NIPS_addl_P2-P7_contingencies.con	P2-P7	1
2021SP	NIPS_CATP1_MTEP16_2021.con	P1	259
2021SP	NIPS_CATP2_MTEP16_2021.con	P2	340
2021SP	NIPS_CATP5_MTEP16_2021.con	P5	26
2021SP	NIPS_CATP7_MTEP16_2021.con	P7	113
2021SP	P1-1_ATC_MTEP16_20160215.con	P1-1	247
2021SP	P1-2_ATC_MTEP16_20160215.con	P1-2	826
2021SP	P1-3_ATC_MTEP16_20160215.con	P1-3	227
2021SP	P1-4_ATC_MTEP16_20160215.con	P1-4	164
2021SP	P2-1_ATC_MTEP16_20160215.con	P2-1	198
2021SP	P2-2_ATC_MTEP16_20160215.con	P2-2	461
2021SP	P2-3_ATC_MTEP16_20160215.con	P2-3	938
2021SP	P2-4_ATC_MTEP16_20160215.con	P2-4	158
2021SP	P5-5_ATC_MTEP16_20160215.con	P5-5	135
2021SP	P7-1_ATC_MTEP16_20160215.con	P7-1	159
2021SP	SIPC_MTEP16_CatP1.con	P1	17
2021SP	SIPC_MTEP16_CatP2-7.con	P2-P7	9
2021SP	Vectren_SIGE_MTEP16_CatP1_Cont.con	P1	70
2021SP	Vectren_SIGE_MTEP16_CatP2-P7_Cont.con	P2-P7	108
2021SP	WPSC Category P1.con	P1	122
2021SP	WPSC Category P2.con	P2	295
2021SP	WPSC Category P4.con	P4	158
2021SP	WPSC Category P5.con	P5	11

Study_Year	Con File	Con Type	Num of Contingency
2021SP	WPSC Category P7.con	P7	5
2021SP	PJM2016OCT_AEP.con	P1	3908
2021SP	PJM2016OCT_AMRN.con	P1	1131
2021SP	PJM2016OCT_ATC.con	P1	1978
2021SP	PJM2016OCT_CE.con	P1	1520
2021SP	PJM2016OCT_Central.con	P1	4053
2021SP	PJM2016OCT_MI.con	P1	2268