



**Generation Interconnection
Feasibility Study Report
for
Queue Project AF2-190
OLIVE-REYNOLDS #2 345 KV
156 MW Capacity / 260 MW Energy**

July 2020

Table of Contents

1	Introduction.....	4
2	Preface.....	4
3	General	5
4	Point of Interconnection.....	6
5	Cost Summary	6
6	Transmission Owner Scope of Work	8
6.1	Attachment Facilities.....	8
6.2	Direct Connection Cost Estimate	8
6.3	Non-Direct Connection Cost Estimate	8
7	Incremental Capacity Transfer Rights (ICTRs)	9
8	Schedule.....	9
9	Interconnection Customer Requirements.....	9
10	Revenue Metering and SCADA Requirements	9
10.1	PJM Requirements	9
10.2	Meteorological Data Reporting Requirements	10
10.3	Interconnected Transmission Owner Requirements.....	10
11	Summer Peak - Load Flow Analysis – Primary POI	11
11.1	Generation Deliverability	12
11.2	Multiple Facility Contingency	12
11.3	Contribution to Previously Identified Overloads.....	12
11.4	Potential Congestion due to Local Energy Deliverability.....	12
11.5	System Reinforcements - Summer Peak Load Flow - Primary POI.....	13
11.6	Flow Gate Details - Primary POI	14
11.6.1	Index 1	15
11.6.2	Index 2	18
11.6.3	Index 3	22
11.7	Queue Dependencies	26
11.8	Contingency Descriptions - Primary POI.....	29
12	Light Load Analysis	30
13	Short Circuit Analysis.....	30
14	Stability and Reactive Power Assessment.....	30

15	Affected Systems	30
15.1	TVA.....	30
15.2	Duke Energy Progress.....	30
15.3	MISO	30
15.4	LG&E.....	30
15	Summer Peak – Load Flow Analysis – Secondary POI.....	31
15.1	Generation Deliverability	32
15.2	Multiple Facility Contingency	32
15.3	Contribution to Previously Identified Overloads.....	32
15.4	Potential Congestion due to Local Energy Deliverability.....	33
15.5	Flow Gate Details - Secondary POI.....	34
15.5.1	Index 1	35
15.5.2	Index 2	36
15.5.3	Index 3	37
15.5.4	Index 4	40
15.5.5	Index 5	44
15.6	Contingency Descriptions - Secondary POI.....	48
16	Light Load Analysis – Secondary POI	51
17	Short Circuit Analysis – Secondary POI.....	51
18	Stability and Reactive Power Assessment – Secondary POI	51
19	Affected Systems – Secondary POI	51
19.1	TVA.....	51
19.2	Duke Energy Progress.....	51
19.3	MISO	51
19.4	LG&E.....	51

1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is AEP.

2 Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

An Interconnection Customer with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Pulaski County, Indiana. The installed facilities will have a total capability of 260 MW with 156 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is June 30, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-190
Project Name	OLIVE-REYNOLDS #2 345 KV
State	Indiana
County	Pulaski
Transmission Owner	AEP
MFO	260
MWE	260
MWC	156
Fuel	Solar
Basecase Study Year	2023

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AF2-190 will interconnect with the AEP transmission system along one of the following points of interconnection:

Primary POI: Olive – Reynolds 345 kV circuit #2.

To accommodate the interconnection on the Olive – Reynolds 345 kV circuit #2, a new three (3) circuit breaker 345kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Attachment 1). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

Installation of the generator lead first span exiting the POI station, including the first structure outside the AEP fence, will also be included in AEP's scope. In the case where the generator lead is a single span, the structure in the customer station will be the customer's responsibility.

Secondary POI: Olive – Reynolds 345 kV circuit #1.

To accommodate the interconnection on the Olive – Reynolds 345 kV circuit #1, a new three (3) circuit breaker 345kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Attachment 2). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

5 Cost Summary

The AF2-190 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$19,777,000
Total System Network Upgrade Costs	\$ 5,363,900
Total Costs	\$25,140,900

The estimates provided in this report are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an onsite review and coordination to determine final construction requirements. In addition, Stability analysis will be completed during the Facilities Study stage. It is possible that a need for additional upgrades could be identified by these studies.

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined

that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

The total physical interconnection costs is given in the tables below:

6.1 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
345 kV Revenue Metering	\$431,000
Generator lead first span exiting the POI station, including the first structure outside the fence	\$651,000
Total Attachment Facility Costs	\$1,082,000

6.2 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
A new three (3) circuit breaker 345kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Figure 1). Installation of associated protection and control equipment, 345 kV line risers, and SCADA will also be required.	\$17,440,000
Total Direct Connection Facility Costs	\$17,440,000

6.3 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Olive-Reynolds T-Line Cut In	\$1,210,000
Review Protection and Control Settings at the Olive 345 kV substation	\$45,000
Total Non-Direct Connection Facility Costs	\$1,255,000

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase.

8 Schedule

It is anticipated that the time between receipt of executed Agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would generally be between 24 to 36 months after signing Agreement execution.

9 Interconnection Customer Requirements

It is understood that the Interconnection Customer (IC) is responsible for all costs associated with this interconnection. The costs above are reimbursable to the Transmission Owner. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Point of Interconnection are not included in this report; these are assumed to be the IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for the Transmission Owner to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.
2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

10 Revenue Metering and SCADA Requirements

10.1 PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

10.2 Meteorological Data Reporting Requirements

Solar generation facilities shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter²)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (Accepted, not required)
- Wind direction (decimal degrees from true north) – (Accepted, not required)

10.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

<http://www.pjm.com/planning/design-engineering/to-tech-standards/>

11 Summer Peak - Load Flow Analysis – Primary POI

The Queue Project AF2-190 was evaluated as a 260.0 MW (Capacity 156.0 MW) injection tapping the Olive to Reynolds 345 kV line, ckt. 2 in the AEP area. Project AF2-190 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-190 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

11.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

11.3 Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC/DC	MW IMPACT
95339777	242865	05JEFRSO	345.0	AEP	248000	06CLIFTY	345.0	OVERC	Z1	AEP_P4_#6189_05 HANG R 765_D1	breaker	2354.0	108.45	109.15	DC	33.41
98761724	256583	18MOROCO	345.0	METC	238530	02ALLEN	345.0	ATSI	1	ATSI-P7-1-TE-345-022T	tower	1793.0	136.19	136.2	DC	19.36
98761088	264612	19MON12	345.0	ITCT	241901	02LALLENDORF	345.0	ATSI	1	ATSI-P2-3-TE-345-015T	breaker	1244.0	120.8	121.27	DC	13.03

11.4 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC/DC	MW IMPACT
95340191	242865	05JEFRSO	345.0	AEP	248000	06CLIFTY	345.0	OVERC	Z1	AEP_P1-2_#709	operation	2354.0	106.98	107.68	DC	33.47
98761347	264612	19MON12	345.0	ITCT	241901	02LALLENDORF	345.0	ATSI	1	ATSI-P1-2-TE-345-604T-A	operation	1244.0	120.66	121.14	DC	13.02

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
98761088	3	19MON12 345.0 kV - 02LALLENDORF 345.0 kV Ckt 1	<u>ITCT</u> NonPJMArea (1532) : The external (i.e. Non-PJM) Transmission Owner, ITCT, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : N/A Months	\$0
98761724	2	18MOROCCO 345.0 kV - 02ALLEN 345.0 kV Ckt 1	<u>ATSI</u> TE-007A (814) : Build new Line exit at Allen Junction 345kV substation for the new (2nd) Allen Junction-Morocco 345kV line. Install new 345kV Breaker, Metering, Disconnect Switches and Protection Relaying. New Line will be built and owned by ITC. ITC has indicated that the new line rating will be 2036 MVA SN / 2298 MVA SE and plans to use the same size conductor as the existing Allen Junction-Morocco 345kV line. Project Type : FAC Cost : \$3,343,900 Time Estimate : 9.0 Months <u>METC</u> NonPJMArea (1636) : The external (i.e. Non-PJM) Transmission Owner, METC, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : N/A Months	\$3,343,900
95339777	1	05JEFRSO 345.0 kV - 06CLIFTY 345.0 kV Ckt Z1	<u>AEP</u> AEP10045a (1681) : Replace 4 Clifty Switches Project Type : FAC Cost : \$2,000,000 Time Estimate : 12-18 Months AEP10045b (1682) : A Sag Study will be required on the 0.75 mile section of ACSR ~ 2156 ~ 64/19 ~ BLUEBIRD line to mitigate the overload . New Rating after the Sag Study: S/N: 2354 MVA S/E: 3212 MVA. Depending on the sag study results, cost for this upgrade is expected to be between \$20,000 (No remediations required just sag study) and 1.96 million (complete line reconductor/rebuild required). Time Estimate: a) Sag Study: 6-12 months b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement. Project Type : FAC Cost : \$20,000 Time Estimate : 6-12 Months	\$2,020,000
			TOTAL COST	\$5,363,900

11.6 Flow Gate Details - Primary POI

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

11.6.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPAC T
95339777	242865	05JEFRS O	AEP	248000	06CLIFT Y	OVE C	Z1	AEP_P4_#6189_05HAN G R 765_D1	break er	2354.0	108.45	109.15	DC	33.41

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243441	05CKG2	21.5468	50/50	21.5468
243442	05RKG1	71.7661	50/50	71.7661
243443	05RKG2	70.6787	50/50	70.6787
243859	05FR-11G C	0.4541	50/50	0.4541
243862	05FR-12G C	0.4471	50/50	0.4471
243864	05FR-21G C	0.4772	50/50	0.4772
243866	05FR-22G C	0.4564	50/50	0.4564
243870	05FR-3G C	0.9243	50/50	0.9243
243873	05FR-4G C	0.7158	50/50	0.7158
244130	05ST.JOE CTR	12.4444	50/50	12.4444
246909	05MDL-1G C	0.9511	50/50	0.9511
246910	05MDL-2G C	0.4708	50/50	0.4708
246976	05MDL-3G C	0.4803	50/50	0.4803
246979	05MDL-4G C	0.4684	50/50	0.4684
247556	T-127 C	0.4755	50/50	0.4755
247900	05FR-11G E	10.5157	50/50	10.5157
247901	05FR-12G E	10.3411	50/50	10.3411
247902	05FR-21G E	11.0529	50/50	11.0529
247903	05FR-22G E	10.5828	50/50	10.5828
247904	05FR-3G E	21.4343	50/50	21.4343
247905	05FR-4G E	16.7875	50/50	16.7875
247906	05MDL-1G E	22.0130	50/50	22.0130
247907	05MDL-2G E	11.0272	50/50	11.0272
247912	05MDL-3G E	11.0272	50/50	11.0272
247913	05MDL-4G E	11.0272	50/50	11.0272
247943	T-127 E	11.0272	50/50	11.0272
250163	Y3-099 BAT	0.2470	50/50	0.2470
250167	Y3-100 BAT	0.2470	50/50	0.2470
251823	Z1-065 BAT	0.6559	50/50	0.6559
274775	LINCOLN ;6U	1.3730	50/50	1.3730
274776	LINCOLN ;7U	1.3730	50/50	1.3730
274777	LINCOLN ;8U	1.3730	50/50	1.3730
922912	AB1-080	0.7374	50/50	0.7374
930041	AB1-006 C	0.6182	50/50	0.6182
930042	AB1-006 E	23.9842	50/50	23.9842
930461	AB1-087	93.7805	50/50	93.7805
930471	AB1-088	93.7805	50/50	93.7805
932601	AC2-080 C O1	3.4757	50/50	3.4757
932602	AC2-080 E O1	23.2603	50/50	23.2603
933281	AC2-140 C	4.1348	50/50	4.1348
933282	AC2-140 E	0.2176	50/50	0.2176
933441	AC2-157 C	12.9588	50/50	12.9588

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
933442	AC2-157 E	21.1432	50/50	21.1432
937041	AD2-138 C	4.7055	50/50	4.7055
937042	AD2-138 E	22.0305	50/50	22.0305
940581	AE2-045 C O1	15.7742	50/50	15.7742
940582	AE2-045 E O1	21.6562	50/50	21.6562
941341	AE2-130 C	151.2912	50/50	151.2912
941342	AE2-130 E	100.8608	50/50	100.8608
941571	AE2-154 C	4.4798	50/50	4.4798
941572	AE2-154 E	29.9802	50/50	29.9802
942601	AE2-276	8.5255	50/50	8.5255
944201	AF1-088 FTIR	170.5100	50/50	170.5100
945391	AF1-204 C O1	6.7014	50/50	6.7014
945392	AF1-204 E O1	20.1042	50/50	20.1042
945421	AF1-207 C	4.7318	50/50	4.7318
945422	AF1-207 E	20.3188	50/50	20.3188
945501	AF1-215 C O1	22.2516	50/50	22.2516
945502	AF1-215 E O1	14.8344	50/50	14.8344
946581	AF1-322 C	11.5786	50/50	11.5786
946582	AF1-322 E	15.9894	50/50	15.9894
957141	AF2-008 FTIR	85.2550	50/50	85.2550
957142	AF2-008 NFTI	170.5100	50/50	170.5100
957403	AF2-034 BAT	2.2148	50/50	2.2148
957841	AF2-078 C O1	16.7004	50/50	16.7004
957842	AF2-078 E O1	11.1336	50/50	11.1336
958381	AF2-132 C	23.0184	50/50	23.0184
958382	AF2-132 E	15.3456	50/50	15.3456
958391	AF2-133 C	23.4162	50/50	23.4162
958392	AF2-133 E	15.6108	50/50	15.6108
958401	AF2-134 C	7.4172	50/50	7.4172
958402	AF2-134 E	4.9448	50/50	4.9448
958971	AF2-188 C O1	9.3643	50/50	9.3643
958972	AF2-188 E O1	6.2429	50/50	6.2429
958981	AF2-189 C O1	13.5756	50/50	13.5756
958982	AF2-189 E O1	9.0504	50/50	9.0504
958991	AF2-190 C	20.0460	50/50	20.0460
958992	AF2-190 E	13.3640	50/50	13.3640
959141	AF2-205 C	15.8016	50/50	15.8016
959142	AF2-205 E	10.5344	50/50	10.5344
960621	AF2-353 C	176.5064	50/50	176.5064
960622	AF2-353 E	75.6456	50/50	75.6456
960681	AF2-359 C	7.9995	50/50	7.9995
960682	AF2-359 E	5.3330	50/50	5.3330
WEC	WEC	3.0105	Confirmed LTF	3.0105
CALDERWOOD	CALDERWOOD	1.0064	Confirmed LTF	1.0064
LGE-0012019	LGE-0012019	6.3129	LTF	6.3129
CBM-W2	CBM-W2	25.5446	Confirmed LTF	25.5446
NY	NY	1.1386	Confirmed LTF	1.1386
CBM-W1	CBM-W1	84.7928	Confirmed LTF	84.7928
O-066	O-066	12.7882	Confirmed LTF	12.7882
CHEOAH	CHEOAH	1.0105	Confirmed LTF	1.0105
G-007	G-007	1.9822	Confirmed LTF	1.9822
MADISON	MADISON	36.3807	Confirmed LTF	36.3807

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
MEC	MEC	12.0955	Confirmed LTF	12.0955
BLUEG	BLUEG	29.7030	Confirmed LTF	29.7030
TRIMBLE	TRIMBLE	10.3576	Confirmed LTF	10.3576
CATAWBA	CATAWBA	0.7238	Confirmed LTF	0.7238

11.6.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
98761724	256583	18MOROCCO	METC	238530	02ALLEN	ATSI	1	ATSI-P7-1-TE-345-022T	tower	1793.0	136.19	136.2	DC	19.36

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243071	05BERRINSP G	0.1151	50/50	0.1151
243440	05CKG1	19.0289	50/50	19.0289
244357	05GRANGER EL	-0.2468	Adder	-0.29
244412	05WTRV SLR C	0.0475	50/50	0.0475
246422	05MAYFLWER	0.0832	50/50	0.0832
246431	05BUCHANAN	0.0157	50/50	0.0157
246536	05MOTTVILL	0.0279	50/50	0.0279
247528	05COVRT1	6.0314	50/50	6.0314
247529	05COVRT2	6.0314	50/50	6.0314
247530	05COVRT3	6.0314	50/50	6.0314
247531	05COVRT4	3.6200	50/50	3.6200
247532	05COVRT5	3.6200	50/50	3.6200
247533	05COVRT6	3.6200	50/50	3.6200
247604	X1-042	0.0636	50/50	0.0636
247651	AA2-116	17.5557	50/50	17.5557
247966	05WTRV SLR E	0.2753	50/50	0.2753
247967	05OLIV SLR E	0.1951	Adder	0.23
247969	Z2-116 E	0.1046	Adder	0.12
274788	SE CHICAG;5U (Deactivation : 01/06/2020)	2.4036	Adder	2.83
274789	SE CHICAG;6U (Deactivation : 01/06/2020)	2.4099	Adder	2.84
274790	SE CHICAG;7U (Deactivation : 01/06/2020)	2.4416	Adder	2.87
274791	SE CHICAG;8U (Deactivation : 01/06/2020)	2.4416	Adder	2.87
274792	SE CHICAG;9U (Deactivation : 01/06/2020)	2.4468	Adder	2.88
274793	SE CHICAG;0U (Deactivation : 01/06/2020)	2.4468	Adder	2.88
274794	SE CHICAG;1U (Deactivation : 01/06/2020)	2.4468	Adder	2.88
274795	SE CHICAG;2U (Deactivation : 01/06/2020)	2.4468	Adder	2.88

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
925961	AC1-072	0.5595	50/50	0.5595
926581	AC1-141	1.6072	50/50	1.6072
931951	AB1-107 1	-41.9666	Adder	-49.37
931961	AB1-107 2	-73.8919	Adder	-86.93
932931	AC2-117	2.9008	Adder	3.41
933281	AC2-140 C	2.7132	Adder	3.19
933282	AC2-140 E	0.1428	Adder	0.17
934252	AD1-052 E1	-0.7196	Adder	-0.85
934262	AD1-052 E2	-0.7196	Adder	-0.85
936141	AD2-020 C O1	6.7972	50/50	6.7972
936142	AD2-020 E O1	4.1838	50/50	4.1838
936601	AD2-075	23.5161	50/50	23.5161
936631	AD2-079 C O1	0.9643	Adder	1.13
936632	AD2-079 E O1	0.6429	Adder	0.76
938261	AE1-039	0.0984	50/50	0.0984
939391	AE1-170 C O1	6.5690	50/50	6.5690
939392	AE1-170 E O1	9.0715	50/50	9.0715
939631	AE1-193 C	4.1703	Adder	4.91
939632	AE1-193 E	27.9087	Adder	32.83
939641	AE1-194 C	4.1703	Adder	4.91
939642	AE1-194 E	27.9087	Adder	32.83
939651	AE1-195 C	4.1703	Adder	4.91
939652	AE1-195 E	27.9087	Adder	32.83
939681	AE1-198 C	12.3825	Adder	14.57
939682	AE1-198 E	10.5219	Adder	12.38
943001	AE2-323 C	4.3620	Adder	5.13
943002	AE2-323 E	2.1388	Adder	2.52
943021	AE2-325 C	3.4425	50/50	3.4425
943022	AE2-325 E	2.2895	50/50	2.2895
943781	AF1-046 C	2.0361	Adder	2.4
943782	AF1-046 E	1.3574	Adder	1.6
944161	AF1-084 C	6.1495	50/50	6.1495
944162	AF1-084 E	3.5124	50/50	3.5124
944931	AF1-158 C O1	7.0678	Adder	8.32
944932	AF1-158 E O1	4.7119	Adder	5.54
944961	AF1-161 C	2.7453	50/50	2.7453
944962	AF1-161 E	2.7453	50/50	2.7453
945111	AF1-176 C O1	15.9883	50/50	15.9883
945112	AF1-176 E O1	14.8217	50/50	14.8217
945501	AF1-215 C O1	11.8529	Adder	13.94
945502	AF1-215 E O1	7.9019	Adder	9.3
950311	G934 C	3.4658	PJM External (MISO)	3.4658
950312	G934 E	13.8632	PJM External (MISO)	13.8632
950351	J466	7.4874	PJM External (MISO)	7.4874
950791	J201 C	0.9044	PJM External (MISO)	0.9044
950792	J201 E	3.6178	PJM External (MISO)	3.6178
950871	J246 C	0.2453	PJM External (MISO)	0.2453
950872	J246 E	0.9811	PJM External (MISO)	0.9811
950942	J325 E	1.0278	PJM External (MISO)	1.0278
951531	J533 C	7.0080	PJM External (MISO)	7.0080
951532	J533 E	28.0320	PJM External (MISO)	28.0320
951571	J538 C	8.5020	PJM External (MISO)	8.5020

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
951572	J538 E	34.0080	PJM External (MISO)	34.0080
951941	J602 C	6.7545	PJM External (MISO)	6.7545
951942	J602 E	36.5435	PJM External (MISO)	36.5435
952201	J589 C	5.7786	PJM External (MISO)	5.7786
952202	J589 E	31.2634	PJM External (MISO)	31.2634
952312	J646 E	0.4444	PJM External (MISO)	0.4444
952401	J752 C	3.8161	PJM External (MISO)	3.8161
952402	J752 E	20.6459	PJM External (MISO)	20.6459
952611	J717 C	6.3780	PJM External (MISO)	6.3780
952612	J717 E	34.5065	PJM External (MISO)	34.5065
952761	J728 C	5.9314	PJM External (MISO)	5.9314
952762	J728 E	32.1334	PJM External (MISO)	32.1334
952971	J793	366.2865	PJM External (MISO)	366.2865
953071	J794 C	0.3783	PJM External (MISO)	0.3783
953072	J794 E	2.0466	PJM External (MISO)	2.0466
953271	J701 C	1.8586	PJM External (MISO)	1.8586
953272	J701 E	10.0553	PJM External (MISO)	10.0553
953291	J796	50.6823	PJM External (MISO)	50.6823
953321	J799	65.8117	PJM External (MISO)	65.8117
953361	J806	28.5514	PJM External (MISO)	28.5514
953771	J832	17.7220	PJM External (MISO)	17.7220
953781	J833	36.0170	PJM External (MISO)	36.0170
953811	J839	26.9670	PJM External (MISO)	26.9670
953941	J857	21.9999	PJM External (MISO)	21.9999
954111	J875	49.3725	PJM External (MISO)	49.3725
955071	J984 C	5.0497	PJM External (MISO)	5.0497
955072	J984 E	27.3203	PJM External (MISO)	27.3203
955121	J989	19.1528	PJM External (MISO)	19.1528
955181	J996	32.3832	PJM External (MISO)	32.3832
955261	J1005	42.3960	PJM External (MISO)	42.3960
955781	J1062	43.8135	PJM External (MISO)	43.8135
956011	J1088	32.0565	PJM External (MISO)	32.0565
956021	J1089	36.6333	PJM External (MISO)	36.6333
956031	J1090	21.2733	PJM External (MISO)	21.2733
956161	J1103	4.8628	PJM External (MISO)	4.8628
956741	J1172	11.5105	PJM External (MISO)	11.5105
956751	J1173	27.5488	PJM External (MISO)	27.5488
956801	J1178	13.6890	PJM External (MISO)	13.6890
957371	AF2-031 C O1	0.2685	Adder	0.6
957372	AF2-031 E O1	0.4028	Adder	0.89
957891	AF2-083 C O1	12.4632	50/50	12.4632
957892	AF2-083 E O1	3.1158	50/50	3.1158
958381	AF2-132 C	6.0688	Adder	13.47
958382	AF2-132 E	4.0459	Adder	8.98
958401	AF2-134 C	2.0940	Adder	4.65
958402	AF2-134 E	1.3960	Adder	3.1
958991	AF2-190 C	5.2329	Adder	11.62
958992	AF2-190 E	3.4886	Adder	7.74
959001	AF2-191 C	2.7316	Adder	6.06
959002	AF2-191 E	1.8210	Adder	4.04
960681	AF2-359 C	2.9341	Adder	6.51
960682	AF2-359 E	1.9561	Adder	4.34

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960981	AF2-389 C	3.0819	50/50	3.0819
960982	AF2-389 E	2.0546	50/50	2.0546
961051	AF2-396 O1	21.4320	50/50	21.4320
961501	AF2-441 C O1	2.6608	Adder	5.91
961502	AF2-441 E O1	3.9912	Adder	8.86
WEC	WEC	2.1300	Confirmed LTF	2.1300
LGEE	LGEE	1.6100	Confirmed LTF	1.6100
CPL	CPL	0.2798	Confirmed LTF	0.2798
CBM-W2	CBM-W2	30.9091	Confirmed LTF	30.9091
NY	NY	1.1851	Confirmed LTF	1.1851
CBM-W1	CBM-W1	195.2436	Confirmed LTF	195.2436
TVA	TVA	3.5840	Confirmed LTF	3.5840
O-066	O-066	12.6941	Confirmed LTF	12.6941
CBM-S2	CBM-S2	4.7801	Confirmed LTF	4.7801
CBM-S1	CBM-S1	22.2287	Confirmed LTF	22.2287
G-007	G-007	1.9531	Confirmed LTF	1.9531
MADISON	MADISON	7.8140	Confirmed LTF	7.8140
MEC	MEC	8.9270	Confirmed LTF	8.9270

11.6.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
98761088	264612	19MON12	ITCT	241901	02LALLENDORF	ATSI	1	ATSI-P2-3-TE-345-015T	breaker	1244.0	120.8	121.27	DC	13.03

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
244357	05GRANGER EL	-0.1368	Adder	-0.16
247528	05COVRT1	3.9492	50/50	3.9492
247529	05COVRT2	3.9492	50/50	3.9492
247530	05COVRT3	3.9492	50/50	3.9492
247531	05COVRT4	2.3702	50/50	2.3702
247532	05COVRT5	2.3702	50/50	2.3702
247533	05COVRT6	2.3702	50/50	2.3702
247966	05WTRV SLR E	0.1545	Adder	0.18
247967	05OLIV SLR E	0.1302	Adder	0.15
247969	Z2-116 E	0.0699	Adder	0.08
274788	SE CHICAG;5U (Deactivation : 01/06/2020)	1.6165	Adder	1.9
274789	SE CHICAG;6U (Deactivation : 01/06/2020)	1.6208	Adder	1.91
274790	SE CHICAG;7U (Deactivation : 01/06/2020)	1.6421	Adder	1.93
274791	SE CHICAG;8U (Deactivation : 01/06/2020)	1.6421	Adder	1.93
274792	SE CHICAG;9U (Deactivation : 01/06/2020)	1.6454	Adder	1.94
274793	SE CHICAG;0U (Deactivation : 01/06/2020)	1.6454	Adder	1.94
274794	SE CHICAG;1U (Deactivation : 01/06/2020)	1.6454	Adder	1.94
274795	SE CHICAG;2U (Deactivation : 01/06/2020)	1.6454	Adder	1.94
925961	AC1-072	0.3663	50/50	0.3663
931951	AB1-107 1	-25.5001	Adder	-30.0
931961	AB1-107 2	-109.7147	Adder	-129.08
933281	AC2-140 C	1.8166	Adder	2.14
933282	AC2-140 E	0.0956	Adder	0.11
934252	AD1-052 E1	-0.3893	Adder	-0.46
934262	AD1-052 E2	-0.3893	Adder	-0.46
936141	AD2-020 C O1	3.8241	Adder	4.5

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
936142	AD2-020 E O1	2.3537	Adder	2.77
936601	AD2-075	15.3976	50/50	15.3976
936631	AD2-079 C O1	0.6443	Adder	0.76
936632	AD2-079 E O1	0.4296	Adder	0.51
938261	AE1-039	0.0552	Adder	0.06
939391	AE1-170 C O1	3.7067	Adder	4.36
939392	AE1-170 E O1	5.1188	Adder	6.02
939631	AE1-193 C	2.8039	Adder	3.3
939632	AE1-193 E	18.7648	Adder	22.08
939641	AE1-194 C	2.8039	Adder	3.3
939642	AE1-194 E	18.7648	Adder	22.08
939651	AE1-195 C	2.8039	Adder	3.3
939652	AE1-195 E	18.7648	Adder	22.08
939681	AE1-198 C	8.3255	Adder	9.79
939682	AE1-198 E	7.0745	Adder	8.32
943001	AE2-323 C	3.0280	Adder	3.56
943002	AE2-323 E	1.4847	Adder	1.75
943021	AE2-325 C	1.9367	Adder	2.28
943022	AE2-325 E	1.2881	Adder	1.52
943781	AF1-046 C	1.4134	Adder	1.66
943782	AF1-046 E	0.9422	Adder	1.11
944161	AF1-084 C	3.4558	Adder	4.07
944162	AF1-084 E	1.9738	Adder	2.32
944931	AF1-158 C O1	4.7162	Adder	5.55
944932	AF1-158 E O1	3.1442	Adder	3.7
944961	AF1-161 C	1.5444	Adder	1.82
944962	AF1-161 E	1.5444	Adder	1.82
945111	AF1-176 C O1	9.0036	Adder	10.59
945112	AF1-176 E O1	8.3466	Adder	9.82
945501	AF1-215 C O1	7.9606	Adder	9.37
945502	AF1-215 E O1	5.3071	Adder	6.24
950311	G934 C	3.2976	PJM External (MISO)	3.2976
950312	G934 E	13.1904	PJM External (MISO)	13.1904
950351	J466	5.4861	PJM External (MISO)	5.4861
950791	J201 C	0.6468	PJM External (MISO)	0.6468
950792	J201 E	2.5874	PJM External (MISO)	2.5874
950871	J246 C	0.1689	PJM External (MISO)	0.1689
950872	J246 E	0.6755	PJM External (MISO)	0.6755
950942	J325 E	0.7567	PJM External (MISO)	0.7567
951531	J533 C	4.8252	PJM External (MISO)	4.8252
951532	J533 E	19.3008	PJM External (MISO)	19.3008
951571	J538 C	2.2161	PJM External (MISO)	2.2161
951572	J538 E	8.8644	PJM External (MISO)	8.8644
951941	J602 C	4.7474	PJM External (MISO)	4.7474
951942	J602 E	25.6846	PJM External (MISO)	25.6846
952161	J571	0.3722	PJM External (MISO)	0.3722
952201	J589 C	4.0036	PJM External (MISO)	4.0036
952202	J589 E	21.6604	PJM External (MISO)	21.6604
952312	J646 E	0.3337	PJM External (MISO)	0.3337
952401	J752 C	2.7866	PJM External (MISO)	2.7866
952402	J752 E	15.0764	PJM External (MISO)	15.0764
952611	J717 C	4.5044	PJM External (MISO)	4.5044

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
952612	J717 E	24.3700	PJM External (MISO)	24.3700
952761	J728 C	4.1890	PJM External (MISO)	4.1890
952762	J728 E	22.6941	PJM External (MISO)	22.6941
952881	J758	15.6800	PJM External (MISO)	15.6800
952971	J793	274.1299	PJM External (MISO)	274.1299
953071	J794 C	0.2645	PJM External (MISO)	0.2645
953072	J794 E	1.4308	PJM External (MISO)	1.4308
953271	J701 C	1.3557	PJM External (MISO)	1.3557
953272	J701 E	7.3349	PJM External (MISO)	7.3349
953291	J796	35.8906	PJM External (MISO)	35.8906
953321	J799	34.3526	PJM External (MISO)	34.3526
953361	J806	14.0298	PJM External (MISO)	14.0298
953771	J832	12.2190	PJM External (MISO)	12.2190
953781	J833	16.4850	PJM External (MISO)	16.4850
953811	J839	20.0550	PJM External (MISO)	20.0550
953941	J857	10.4746	PJM External (MISO)	10.4746
954111	J875	15.9870	PJM External (MISO)	15.9870
955071	J984 C	3.4295	PJM External (MISO)	3.4295
955072	J984 E	18.5545	PJM External (MISO)	18.5545
955121	J989	13.3720	PJM External (MISO)	13.3720
955181	J996	5.6680	PJM External (MISO)	5.6680
955261	J1005	30.1940	PJM External (MISO)	30.1940
955591	J1043 C	1.8140	PJM External (MISO)	1.8140
955592	J1043 E	32.1441	PJM External (MISO)	32.1441
955781	J1062	25.8165	PJM External (MISO)	25.8165
955861	J1071	7.8820	PJM External (MISO)	7.8820
956011	J1088	21.8475	PJM External (MISO)	21.8475
956021	J1089	25.2093	PJM External (MISO)	25.2093
956031	J1090	11.1438	PJM External (MISO)	11.1438
956161	J1103	3.5472	PJM External (MISO)	3.5472
956741	J1172	8.1870	PJM External (MISO)	8.1870
956751	J1173	8.3576	PJM External (MISO)	8.3576
956801	J1178	7.7668	PJM External (MISO)	7.7668
957371	AF2-031 C O1	0.1806	Adder	0.4
957372	AF2-031 E O1	0.2709	Adder	0.6
957891	AF2-083 C O1	3.7253	Adder	8.27
957892	AF2-083 E O1	0.9313	Adder	2.07
958381	AF2-132 C	4.0821	Adder	9.06
958382	AF2-132 E	2.7214	Adder	6.04
958401	AF2-134 C	1.4064	Adder	3.12
958402	AF2-134 E	0.9376	Adder	2.08
958991	AF2-190 C	3.5209	Adder	7.82
958992	AF2-190 E	2.3473	Adder	5.21
959001	AF2-191 C	1.8229	Adder	4.05
959002	AF2-191 E	1.2153	Adder	2.7
960681	AF2-359 C	1.9614	Adder	4.35
960682	AF2-359 E	1.3076	Adder	2.9
960981	AF2-389 C	0.9208	Adder	2.04
960982	AF2-389 E	0.6139	Adder	1.36
961051	AF2-396 O1	6.3908	Adder	14.19
WEC	WEC	1.4367	Confirmed LTF	1.4367
LGEE	LGEE	1.1393	Confirmed LTF	1.1393

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CPLE	CPLE	0.2216	Confirmed LTF	0.2216
CBM-W2	CBM-W2	21.2858	Confirmed LTF	21.2858
NY	NY	0.8118	Confirmed LTF	0.8118
CBM-W1	CBM-W1	140.4748	Confirmed LTF	140.4748
TVA	TVA	2.5032	Confirmed LTF	2.5032
O-066	O-066	8.6352	Confirmed LTF	8.6352
CBM-S2	CBM-S2	3.5431	Confirmed LTF	3.5431
CBM-S1	CBM-S1	15.5660	Confirmed LTF	15.5660
G-007	G-007	1.3281	Confirmed LTF	1.3281
MADISON	MADISON	5.0299	Confirmed LTF	5.0299
MEC	MEC	6.0541	Confirmed LTF	6.0541

11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AA2-116	Cook-East Elkhart 345kV	Under Construction
AB1-006	Meadow Lake 345kV	In Service
AB1-080	Dumont-Olive 345kV	In Service
AB1-087	Sullivan 345kV #1	Active
AB1-088	Sullivan 345kV #2	Active
AB1-107	Bayshore-GM Powertrain 138 kV & Lallendorf 345kV	Engineering and Procurement
AC1-072	Segreto (Covert) 345kV	In Service
AC1-141	Cook-East Elkhart 345kV	Under Construction
AC2-080	Olive-Reynolds 345kV	Active
AC2-117	University Park North	Engineering and Procurement
AC2-140	DC Cook Unit 2	Engineering and Procurement
AC2-157	Sullivan 345 kV	Active
AD1-052	Freemont Energy Center	Under Construction
AD2-020	Valley 138 kV	Active
AD2-075	Segreto 345kV	Active
AD2-079	Capitol Ave 34.5kV	Active
AD2-138	Olive-Reynolds 345kV	Active
AE1-039	West Street (Orchard Hills) 12.47 kV	Engineering and Procurement
AE1-170	Kenzie Creek-Colby 138 kV	Active
AE1-193	Crete 345 kV	Active
AE1-194	Crete 345 kV	Active
AE1-195	Crete 345 kV	Active
AE1-198	Crete 345 kV	Active
AE2-045	Olive-Reynolds 345 kV	Active
AE2-130	Rockport 765 kV	Active
AE2-154	Meadow Lake 345 kV (MLV VIII)	Active
AE2-276	Sullivan 345kV	Active
AE2-323	Twin Branch-Guardian 138 kV	Active
AE2-325	Valley 138 kV	Active
AF1-046	Twin Branch-Guardian 138 kV	Active
AF1-084	East Hartford-Murch 69 kV	Active
AF1-088	Sullivan 345 kV	Active
AF1-158	Edison-Gravel Pit 138 kV	Active
AF1-161	Valley 138 kV	Active
AF1-176	Corey 138 kV	Active
AF1-204	Eugene 345 kV	Active
AF1-207	Reynolds-Olive #1 345 kV	Active
AF1-215	Reynolds-Olive 345 kV	Active
AF1-322	Meadow Lake 345 kV	Active
AF2-008	Sullivan 345 kV	Active
AF2-031	River E.C.	Active
AF2-034	Kendall	Active

Queue Number	Project Name	Status
AF2-078	Reynolds-Olive #1 345 kV	Active
AF2-083	Ed Lowe-Kenzie Creek 138 kV	Active
AF2-132	Reynolds-Olive #1 345 kV	Active
AF2-133	Reynolds-Olive #2 345 kV	Active
AF2-134	Reynolds-Olive #2 345 kV	Active
AF2-188	Reynolds-Meadow Lake #1 345 kV	Active
AF2-189	Greentown 138 kV	Active
AF2-190	Olive-Reynolds #2 345 kV	Active
AF2-191	New Carlisle 138 kV	Active
AF2-205	Olive-Reynolds #2 345 kV	Active
AF2-353	Rockport 765 kV	Active
AF2-359	Olive-University Park 345 kV	Active
AF2-389	Pokagon-Corey 69 kV	Active
AF2-396	Stinger 138 kV	Active
AF2-441	Burnham 138kV	Active
X1-042	Watervliet	In Service
Y3-099	Beckjord 2 MW-1	In Service
Y3-100	Beckjord 2 MW-2	In Service
Z1-065	Wiley 34.5kV	In Service
Z2-116	Twin Branch 12.47kV	In Service
J1005	MISO	MISO
J1043	MISO	MISO
J1062	MISO	MISO
J1071	MISO	MISO
J1088	MISO	MISO
J1089	MISO	MISO
J1090	MISO	MISO
J1103	MISO	MISO
J1172	MISO	MISO
J1173	MISO	MISO
J1178	MISO	MISO
J201	MISO	MISO
J246	MISO	MISO
J325	MISO	MISO
J466	MISO	MISO
J533	MISO	MISO
J538	MISO	MISO
J571	MISO	MISO
J589	MISO	MISO
J602	MISO	MISO
J646	MISO	MISO
J701	MISO	MISO
J717	MISO	MISO
J728	MISO	MISO
J752	MISO	MISO
J758	MISO	MISO
J793	MISO	MISO
J794	MISO	MISO
J796	MISO	MISO
J799	MISO	MISO
J806	MISO	MISO
J832	MISO	MISO

Queue Number	Project Name	Status
J833	MISO	MISO
J839	MISO	MISO
J857	MISO	MISO
J875	MISO	MISO
J984	MISO	MISO
J989	MISO	MISO
J996	MISO	MISO

11.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
ATSI-P1-2-TE-345-604T-A	CONTINGENCY 'ATSI-P1-2-TE-345-604T-A' /*LINE OUTAGE: LEMOYNE TO ITC MAJESTIC DISCONNECT BRANCH FROM BUS 238889 TO BUS 955620 CKT 1 END
AEP_P1-2_#709	CONTINGENCY 'AEP_P1-2_#709' OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 END
ATSI-P2-3-TE-345-015T	CONTINGENCY 'ATSI-P2-3-TE-345-015T' /* LEMOYNE BK-34505 345 DISCONNECT BRANCH FROM BUS 238889 TO BUS 238890 CKT 1 /* 02LEMOYN 345 02LEMOYN 138 DISCONNECT BRANCH FROM BUS 238889 TO BUS 955620 CKT 1 /* 02LEMOYN 345 J1046 TAP 345 END
ATSI-P7-1-TE-345-022T	CONTINGENCY 'ATSI-P7-1-TE-345-022T' /* Y1-069-MONROE/LEMOYNE-MAJ 345 DISCONNECT BRANCH FROM BUS 241901 TO BUS 264612 CKT 1 /* 02_Y1-069 345 19MON12 345 DISCONNECT BRANCH FROM BUS 238889 TO BUS 955620 CKT 1 /* 02LEMOYN 345 19MAJTC 345 END
AEP_P4_#6189_05HANG R 765_D1	CONTINGENCY 'AEP_P4_#6189_05HANG R 765_D1' OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNNU 765 242934 05CORNNU 345 1 REMOVE UNIT 1A FROM BUS 247245 / 247245 05HRKG1A 18.0 REMOVE UNIT 1B FROM BUS 247246 / 247246 05HRKG1B 18.0 REMOVE UNIT 1S FROM BUS 247247 / 247247 05HRKG1S 18.0 REMOVE UNIT 2A FROM BUS 247248 / 247248 05HRKG2A 18.0 REMOVE UNIT 2B FROM BUS 247249 / 247249 05HRKG2B 18.0 REMOVE UNIT 2S FROM BUS 247250 / 247250 05HRKG2S 18.0 END

12 Light Load Analysis

Light Load Studies (As applicable)

Not applicable.

13 Short Circuit Analysis

The following Breakers are overdutied:

To be determined during later study phases.

14 Stability and Reactive Power Assessment

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined during later study phases.

15 Affected Systems

15.1 TVA

TVA Impacts to be determined during later study phases (as applicable).

15.2 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

15.3 MISO

MISO Impacts to be determined during later study phases (as applicable).

15.4 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

15 Summer Peak – Load Flow Analysis – Secondary POI

The Queue Project AF2-190 was evaluated as a 260.0 MW (Capacity 156.0 MW) injection tapping the Olive to Reynolds 345 kV line, ckt. 1 in the AEP area. Project AF2-190 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-190 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

15.1 Generation Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

15.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPACT
144170645	958400	AF2-134 TAP	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P7-1_#11043-AI	tower	1414.0	89.08	107.47	DC	260.0
144170646	958400	AF2-134 TAP	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P7-1_#11043-AJ	tower	1414.0	89.08	107.47	DC	260.0
144170647	958400	AF2-134 TAP	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P7-1_#11043-AF	tower	1414.0	89.08	107.47	DC	260.0
144170648	958400	AF2-134 TAP	345.0	AEP	243229	05OLIVE	345.0	AEP	1	AEP_P7-1_#11043-AH	tower	1414.0	89.08	107.47	DC	260.0
144170687	958990	AF2-190 TAP	345.0	AEP	958400	AF2-134 TAP	345.0	AEP	1	AEP_P7-1_#11043-AF	tower	1414.0	82.01	100.4	DC	260.0
144170688	958990	AF2-190 TAP	345.0	AEP	958400	AF2-134 TAP	345.0	AEP	1	AEP_P7-1_#11043-AI	tower	1414.0	82.01	100.4	DC	260.0
144170689	958990	AF2-190 TAP	345.0	AEP	958400	AF2-134 TAP	345.0	AEP	1	AEP_P7-1_#11043-AE	tower	1414.0	82.01	100.4	DC	260.0
144170690	958990	AF2-190 TAP	345.0	AEP	958400	AF2-134 TAP	345.0	AEP	1	AEP_P7-1_#11043-AG	tower	1414.0	82.01	100.4	DC	260.0
144170691	958990	AF2-190 TAP	345.0	AEP	958400	AF2-134 TAP	345.0	AEP	1	AEP_P7-1_#11043-AJ	tower	1414.0	82.01	100.4	DC	260.0

15.3 Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPACT
95339777	242865	05JEFRSO	345.0	AEP	248000	06CLIFTY	345.0	OVERC	Z1	AEP_P4_#6189_05 HANG R 765_D1	breaker	2354.0	108.44	109.13	DC	32.53
98761724	256583	18MOROCO	345.0	METC	238530	02ALLEN	345.0	ATSI	1	ATSI-P7-1-TE-345-022T	tower	1793.0	136.19	136.2	DC	19.9
98761087	264612	19MON12	345.0	ITCT	241901	02LALLEND ORF	345.0	ATSI	1	ATSI-P2-3-TE-345-016T	breaker	1244.0	123.1	123.59	DC	13.34
98761088	264612	19MON12	345.0	ITCT	241901	02LALLEND ORF	345.0	ATSI	1	ATSI-P2-3-TE-345-015T	breaker	1244.0	120.79	121.28	DC	13.37

15.4 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC DC	MW IMPACT
95340191	242865	05JEFRS0	345.0	AEP	248000	06CLIFTY	345.0	OVERC	Z1	AEP_P1-2_#709	operation	2354.0	106.98	107.65	DC	32.59
98761347	264612	19MON12	345.0	ITCT	241901	02LALLENDORF	345.0	ATSI	1	ATSI-P1-2-TE-345-604T-A	operation	1244.0	120.67	121.15	DC	13.37
95340248	945420	AF1-207TAP	345.0	AEP	255205	17REYNOLDS	345.0	NIPS	1	AEP_P1-2_#8804-A	operation	1414.0	89.08	107.47	DC	260.0

15.5 Flow Gate Details - Secondary POI

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

15.5.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
144170648	958400	AF2-134 TAP	AEP	243229	05OLIVE	AEP	1	AEP_P7-1_#11043-AH	tower	1414.0	89.08	107.47	DC	260.0

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
932601	AC2-080 C O1	26.0000	50/50	26.0000
932602	AC2-080 E O1	174.0000	50/50	174.0000
937041	AD2-138 C	35.2000	50/50	35.2000
937042	AD2-138 E	164.8000	50/50	164.8000
940581	AE2-045 C O1	118.0000	50/50	118.0000
940582	AE2-045 E O1	162.0000	50/50	162.0000
945421	AF1-207 C	34.0000	50/50	34.0000
945422	AF1-207 E	146.0000	50/50	146.0000
958391	AF2-133 C O2	180.0000	50/50	180.0000
958392	AF2-133 E O2	120.0000	50/50	120.0000
958401	AF2-134 C O2	60.0000	50/50	60.0000
958402	AF2-134 E O2	40.0000	50/50	40.0000
958991	AF2-190 C O2	156.0000	50/50	156.0000
958992	AF2-190 E O2	104.0000	50/50	104.0000

15.5.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC/DC	MW IMPACT
144170691	958990	AF2-190 TAP	AEP	958400	AF2-134 TAP	AEP	1	AEP_P7-1_#11043-AJ	tower	1414.0	82.01	100.4	DC	260.0

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
932601	AC2-080 C O1	26.0000	50/50	26.0000
932602	AC2-080 E O1	174.0000	50/50	174.0000
937041	AD2-138 C	35.2000	50/50	35.2000
937042	AD2-138 E	164.8000	50/50	164.8000
940581	AE2-045 C O1	118.0000	50/50	118.0000
940582	AE2-045 E O1	162.0000	50/50	162.0000
945421	AF1-207 C	34.0000	50/50	34.0000
945422	AF1-207 E	146.0000	50/50	146.0000
958391	AF2-133 C O2	180.0000	50/50	180.0000
958392	AF2-133 E O2	120.0000	50/50	120.0000
958991	AF2-190 C O2	156.0000	50/50	156.0000
958992	AF2-190 E O2	104.0000	50/50	104.0000

15.5.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPAC T
95339777	242865	05JEFRS O	AEP	248000	06CLIFT Y	OVE C	Z1	AEP_P4_#6189_05HAN G R 765_D1	breaker	2354.0	108.44	109.13	DC	32.53

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243441	05CKG2	21.5468	50/50	21.5468
243442	05RKG1	71.7661	50/50	71.7661
243443	05RKG2	70.6787	50/50	70.6787
243859	05FR-11G C	0.4541	50/50	0.4541
243862	05FR-12G C	0.4471	50/50	0.4471
243864	05FR-21G C	0.4772	50/50	0.4772
243866	05FR-22G C	0.4564	50/50	0.4564
243870	05FR-3G C	0.9243	50/50	0.9243
243873	05FR-4G C	0.7158	50/50	0.7158
244130	05ST.JOE CTR	12.4444	50/50	12.4444
246909	05MDL-1G C	0.9511	50/50	0.9511
246910	05MDL-2G C	0.4708	50/50	0.4708
246976	05MDL-3G C	0.4803	50/50	0.4803
246979	05MDL-4G C	0.4684	50/50	0.4684
247556	T-127 C	0.4755	50/50	0.4755
247900	05FR-11G E	10.5157	50/50	10.5157
247901	05FR-12G E	10.3411	50/50	10.3411
247902	05FR-21G E	11.0529	50/50	11.0529
247903	05FR-22G E	10.5828	50/50	10.5828
247904	05FR-3G E	21.4343	50/50	21.4343
247905	05FR-4G E	16.7875	50/50	16.7875
247906	05MDL-1G E	22.0130	50/50	22.0130
247907	05MDL-2G E	11.0272	50/50	11.0272
247912	05MDL-3G E	11.0272	50/50	11.0272
247913	05MDL-4G E	11.0272	50/50	11.0272
247943	T-127 E	11.0272	50/50	11.0272
250163	Y3-099 BAT	0.2470	50/50	0.2470
250167	Y3-100 BAT	0.2470	50/50	0.2470
251823	Z1-065 BAT	0.6559	50/50	0.6559
274775	LINCOLN ;6U	1.3730	50/50	1.3730
274776	LINCOLN ;7U	1.3730	50/50	1.3730
274777	LINCOLN ;8U	1.3730	50/50	1.3730
922912	AB1-080	0.7374	50/50	0.7374
930041	AB1-006 C	0.6182	50/50	0.6182
930042	AB1-006 E	23.9842	50/50	23.9842
930461	AB1-087	93.7805	50/50	93.7805
930471	AB1-088	93.7805	50/50	93.7805
932601	AC2-080 C O1	3.4757	50/50	3.4757
932602	AC2-080 E O1	23.2603	50/50	23.2603
933281	AC2-140 C	4.1348	50/50	4.1348
933282	AC2-140 E	0.2176	50/50	0.2176
933441	AC2-157 C	12.9588	50/50	12.9588

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
933442	AC2-157 E	21.1432	50/50	21.1432
937041	AD2-138 C	4.7055	50/50	4.7055
937042	AD2-138 E	22.0305	50/50	22.0305
940581	AE2-045 C O1	15.7742	50/50	15.7742
940582	AE2-045 E O1	21.6562	50/50	21.6562
941341	AE2-130 C	151.2912	50/50	151.2912
941342	AE2-130 E	100.8608	50/50	100.8608
941571	AE2-154 C	4.4798	50/50	4.4798
941572	AE2-154 E	29.9802	50/50	29.9802
942601	AE2-276	8.5255	50/50	8.5255
944201	AF1-088 FTIR	170.5100	50/50	170.5100
945391	AF1-204 C O1	6.7014	50/50	6.7014
945392	AF1-204 E O1	20.1042	50/50	20.1042
945421	AF1-207 C	4.7318	50/50	4.7318
945422	AF1-207 E	20.3188	50/50	20.3188
945501	AF1-215 C O1	22.2516	50/50	22.2516
945502	AF1-215 E O1	14.8344	50/50	14.8344
946581	AF1-322 C	11.5786	50/50	11.5786
946582	AF1-322 E	15.9894	50/50	15.9894
957141	AF2-008 FTIR	85.2550	50/50	85.2550
957142	AF2-008 NFTI	170.5100	50/50	170.5100
957403	AF2-034 BAT	2.2148	50/50	2.2148
957841	AF2-078 C O2	16.7220	50/50	16.7220
957842	AF2-078 E O2	11.1480	50/50	11.1480
958381	AF2-132 C O2	22.9896	50/50	22.9896
958382	AF2-132 E O2	15.3264	50/50	15.3264
958391	AF2-133 C O2	23.4378	50/50	23.4378
958392	AF2-133 E O2	15.6252	50/50	15.6252
958401	AF2-134 C O2	7.4310	50/50	7.4310
958402	AF2-134 E O2	4.9540	50/50	4.9540
958971	AF2-188 C O2	9.3630	50/50	9.3630
958972	AF2-188 E O2	6.2420	50/50	6.2420
958981	AF2-189 C O2	13.4838	50/50	13.4838
958982	AF2-189 E O2	8.9892	50/50	8.9892
958991	AF2-190 C O2	19.5172	50/50	19.5172
958992	AF2-190 E O2	13.0114	50/50	13.0114
959141	AF2-205 C	15.8016	50/50	15.8016
959142	AF2-205 E	10.5344	50/50	10.5344
960621	AF2-353 C	176.5064	50/50	176.5064
960622	AF2-353 E	75.6456	50/50	75.6456
960681	AF2-359 C O2	8.1983	50/50	8.1983
960682	AF2-359 E O2	5.4655	50/50	5.4655
WEC	WEC	3.0105	Confirmed LTF	3.0105
CALDERWOOD	CALDERWOOD	1.0064	Confirmed LTF	1.0064
LGE-0012019	LGE-0012019	6.3129	LTF	6.3129
CBM-W2	CBM-W2	25.5446	Confirmed LTF	25.5446
NY	NY	1.1386	Confirmed LTF	1.1386
CBM-W1	CBM-W1	84.7928	Confirmed LTF	84.7928
O-066	O-066	12.7882	Confirmed LTF	12.7882
CHEOAH	CHEOAH	1.0105	Confirmed LTF	1.0105
G-007	G-007	1.9822	Confirmed LTF	1.9822
MADISON	MADISON	36.3807	Confirmed LTF	36.3807

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
MEC	MEC	12.0955	Confirmed LTF	12.0955
BLUEG	BLUEG	29.7030	Confirmed LTF	29.7030
TRIMBLE	TRIMBLE	10.3576	Confirmed LTF	10.3576
CATAWBA	CATAWBA	0.7238	Confirmed LTF	0.7238

15.5.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
98761724	256583	18MOROCCO	METC	238530	02ALLEN	ATSI	1	ATSI-P7-1-TE-345-022T	tower	1793.0	136.19	136.2	DC	19.9

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243071	05BERRINSP G	0.1151	50/50	0.1151
243440	05CKG1	19.0289	50/50	19.0289
244357	05GRANGER EL	-0.2468	Adder	-0.29
244412	05WTRV SLR C	0.0475	50/50	0.0475
246422	05MAYFLWER	0.0832	50/50	0.0832
246431	05BUCHANAN	0.0157	50/50	0.0157
246536	05MOTTVILL	0.0279	50/50	0.0279
247528	05COVRT1	6.0314	50/50	6.0314
247529	05COVRT2	6.0314	50/50	6.0314
247530	05COVRT3	6.0314	50/50	6.0314
247531	05COVRT4	3.6200	50/50	3.6200
247532	05COVRT5	3.6200	50/50	3.6200
247533	05COVRT6	3.6200	50/50	3.6200
247604	X1-042	0.0636	50/50	0.0636
247651	AA2-116	17.5557	50/50	17.5557
247966	05WTRV SLR E	0.2753	50/50	0.2753
247967	05OLIV SLR E	0.1951	Adder	0.23
247969	Z2-116 E	0.1046	Adder	0.12
274788	SE CHICAG;5U (Deactivation : 01/06/2020)	2.4036	Adder	2.83
274789	SE CHICAG;6U (Deactivation : 01/06/2020)	2.4099	Adder	2.84
274790	SE CHICAG;7U (Deactivation : 01/06/2020)	2.4416	Adder	2.87
274791	SE CHICAG;8U (Deactivation : 01/06/2020)	2.4416	Adder	2.87
274792	SE CHICAG;9U (Deactivation : 01/06/2020)	2.4468	Adder	2.88
274793	SE CHICAG;0U (Deactivation : 01/06/2020)	2.4468	Adder	2.88
274794	SE CHICAG;1U (Deactivation : 01/06/2020)	2.4468	Adder	2.88
274795	SE CHICAG;2U (Deactivation : 01/06/2020)	2.4468	Adder	2.88

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
925961	AC1-072	0.5595	50/50	0.5595
926581	AC1-141	1.6072	50/50	1.6072
931951	AB1-107 1	-41.9666	Adder	-49.37
931961	AB1-107 2	-73.8919	Adder	-86.93
932931	AC2-117	2.9008	Adder	3.41
933281	AC2-140 C	2.7132	Adder	3.19
933282	AC2-140 E	0.1428	Adder	0.17
934252	AD1-052 E1	-0.7196	Adder	-0.85
934262	AD1-052 E2	-0.7196	Adder	-0.85
936141	AD2-020 C O1	6.7972	50/50	6.7972
936142	AD2-020 E O1	4.1838	50/50	4.1838
936601	AD2-075	23.5161	50/50	23.5161
936631	AD2-079 C O1	0.9643	Adder	1.13
936632	AD2-079 E O1	0.6429	Adder	0.76
938261	AE1-039	0.0984	50/50	0.0984
939391	AE1-170 C O1	6.5690	50/50	6.5690
939392	AE1-170 E O1	9.0715	50/50	9.0715
939631	AE1-193 C	4.1703	Adder	4.91
939632	AE1-193 E	27.9087	Adder	32.83
939641	AE1-194 C	4.1703	Adder	4.91
939642	AE1-194 E	27.9087	Adder	32.83
939651	AE1-195 C	4.1703	Adder	4.91
939652	AE1-195 E	27.9087	Adder	32.83
939681	AE1-198 C	12.3825	Adder	14.57
939682	AE1-198 E	10.5219	Adder	12.38
943001	AE2-323 C	4.3620	Adder	5.13
943002	AE2-323 E	2.1388	Adder	2.52
943021	AE2-325 C	3.4425	50/50	3.4425
943022	AE2-325 E	2.2895	50/50	2.2895
943781	AF1-046 C	2.0361	Adder	2.4
943782	AF1-046 E	1.3574	Adder	1.6
944161	AF1-084 C	6.1495	50/50	6.1495
944162	AF1-084 E	3.5124	50/50	3.5124
944931	AF1-158 C O1	7.0678	Adder	8.32
944932	AF1-158 E O1	4.7119	Adder	5.54
944961	AF1-161 C	2.7453	50/50	2.7453
944962	AF1-161 E	2.7453	50/50	2.7453
945111	AF1-176 C O1	15.9883	50/50	15.9883
945112	AF1-176 E O1	14.8217	50/50	14.8217
945501	AF1-215 C O1	11.8529	Adder	13.94
945502	AF1-215 E O1	7.9019	Adder	9.3
950311	G934 C	3.4658	PJM External (MISO)	3.4658
950312	G934 E	13.8632	PJM External (MISO)	13.8632
950351	J466	7.4874	PJM External (MISO)	7.4874
950791	J201 C	0.9044	PJM External (MISO)	0.9044
950792	J201 E	3.6178	PJM External (MISO)	3.6178
950871	J246 C	0.2453	PJM External (MISO)	0.2453
950872	J246 E	0.9811	PJM External (MISO)	0.9811
950942	J325 E	1.0278	PJM External (MISO)	1.0278
951531	J533 C	7.0080	PJM External (MISO)	7.0080
951532	J533 E	28.0320	PJM External (MISO)	28.0320
951571	J538 C	8.5020	PJM External (MISO)	8.5020

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
951572	J538 E	34.0080	PJM External (MISO)	34.0080
951941	J602 C	6.7545	PJM External (MISO)	6.7545
951942	J602 E	36.5435	PJM External (MISO)	36.5435
952201	J589 C	5.7786	PJM External (MISO)	5.7786
952202	J589 E	31.2634	PJM External (MISO)	31.2634
952312	J646 E	0.4444	PJM External (MISO)	0.4444
952401	J752 C	3.8161	PJM External (MISO)	3.8161
952402	J752 E	20.6459	PJM External (MISO)	20.6459
952611	J717 C	6.3780	PJM External (MISO)	6.3780
952612	J717 E	34.5065	PJM External (MISO)	34.5065
952761	J728 C	5.9314	PJM External (MISO)	5.9314
952762	J728 E	32.1334	PJM External (MISO)	32.1334
952971	J793	366.2865	PJM External (MISO)	366.2865
953071	J794 C	0.3783	PJM External (MISO)	0.3783
953072	J794 E	2.0466	PJM External (MISO)	2.0466
953271	J701 C	1.8586	PJM External (MISO)	1.8586
953272	J701 E	10.0553	PJM External (MISO)	10.0553
953291	J796	50.6823	PJM External (MISO)	50.6823
953321	J799	65.8117	PJM External (MISO)	65.8117
953361	J806	28.5514	PJM External (MISO)	28.5514
953771	J832	17.7220	PJM External (MISO)	17.7220
953781	J833	36.0170	PJM External (MISO)	36.0170
953811	J839	26.9670	PJM External (MISO)	26.9670
953941	J857	21.9999	PJM External (MISO)	21.9999
954111	J875	49.3725	PJM External (MISO)	49.3725
955071	J984 C	5.0497	PJM External (MISO)	5.0497
955072	J984 E	27.3203	PJM External (MISO)	27.3203
955121	J989	19.1528	PJM External (MISO)	19.1528
955181	J996	32.3832	PJM External (MISO)	32.3832
955261	J1005	42.3960	PJM External (MISO)	42.3960
955781	J1062	43.8135	PJM External (MISO)	43.8135
956011	J1088	32.0565	PJM External (MISO)	32.0565
956021	J1089	36.6333	PJM External (MISO)	36.6333
956031	J1090	21.2733	PJM External (MISO)	21.2733
956161	J1103	4.8628	PJM External (MISO)	4.8628
956741	J1172	11.5105	PJM External (MISO)	11.5105
956751	J1173	27.5488	PJM External (MISO)	27.5488
956801	J1178	13.6890	PJM External (MISO)	13.6890
957371	AF2-031 C O2	0.2691	Adder	0.6
957372	AF2-031 E O2	0.4036	Adder	0.9
957891	AF2-083 C O2	12.3192	50/50	12.3192
957892	AF2-083 E O2	3.0798	50/50	3.0798
958381	AF2-132 C O2	6.0769	Adder	13.49
958382	AF2-132 E O2	4.0513	Adder	8.99
958401	AF2-134 C O2	2.0902	Adder	4.64
958402	AF2-134 E O2	1.3935	Adder	3.09
958991	AF2-190 C O2	5.3798	Adder	11.94
958992	AF2-190 E O2	3.5865	Adder	7.96
959001	AF2-191 C O2	2.7450	Adder	6.09
959002	AF2-191 E O2	1.8300	Adder	4.06
960681	AF2-359 C O2	2.9165	Adder	6.47
960682	AF2-359 E O2	1.9444	Adder	4.32

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960981	AF2-389 C	3.0819	50/50	3.0819
960982	AF2-389 E	2.0546	50/50	2.0546
961051	AF2-396 O2	21.3660	50/50	21.3660
961501	AF2-441 C O2	2.6569	Adder	5.9
961502	AF2-441 E O2	3.9853	Adder	8.85
WEC	WEC	2.1300	Confirmed LTF	2.1300
LGEE	LGEE	1.6100	Confirmed LTF	1.6100
CPL	CPL	0.2798	Confirmed LTF	0.2798
CBM-W2	CBM-W2	30.9091	Confirmed LTF	30.9091
NY	NY	1.1851	Confirmed LTF	1.1851
CBM-W1	CBM-W1	195.2436	Confirmed LTF	195.2436
TVA	TVA	3.5840	Confirmed LTF	3.5840
O-066	O-066	12.6941	Confirmed LTF	12.6941
CBM-S2	CBM-S2	4.7801	Confirmed LTF	4.7801
CBM-S1	CBM-S1	22.2287	Confirmed LTF	22.2287
G-007	G-007	1.9531	Confirmed LTF	1.9531
MADISON	MADISON	7.8140	Confirmed LTF	7.8140
MEC	MEC	8.9270	Confirmed LTF	8.9270

15.5.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
98761087	264612	19MON12	ITCT	241901	02LALLENDORF	ATSI	1	ATSI-P2-3-TE-345-016T	breaker	1244.0	123.1	123.59	DC	13.34

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
244357	05GRANGER EL	-0.1534	Adder	-0.18
247528	05COVRT1	4.0031	50/50	4.0031
247529	05COVRT2	4.0031	50/50	4.0031
247530	05COVRT3	4.0031	50/50	4.0031
247531	05COVRT4	2.4026	50/50	2.4026
247532	05COVRT5	2.4026	50/50	2.4026
247533	05COVRT6	2.4026	50/50	2.4026
247966	05WTRV SLR E	0.1558	Adder	0.18
247967	05OLIV SLR E	0.1304	Adder	0.15
247969	Z2-116 E	0.0701	Adder	0.08
274788	SE CHICAG;5U (Deactivation : 01/06/2020)	1.6114	Adder	1.9
274789	SE CHICAG;6U (Deactivation : 01/06/2020)	1.6156	Adder	1.9
274790	SE CHICAG;7U (Deactivation : 01/06/2020)	1.6369	Adder	1.93
274791	SE CHICAG;8U (Deactivation : 01/06/2020)	1.6369	Adder	1.93
274792	SE CHICAG;9U (Deactivation : 01/06/2020)	1.6402	Adder	1.93
274793	SE CHICAG;0U (Deactivation : 01/06/2020)	1.6402	Adder	1.93
274794	SE CHICAG;1U (Deactivation : 01/06/2020)	1.6402	Adder	1.93
274795	SE CHICAG;2U (Deactivation : 01/06/2020)	1.6402	Adder	1.93
925961	AC1-072	0.3713	50/50	0.3713
931951	AB1-107 1	-23.4947	Adder	-27.64
931961	AB1-107 2	-107.7254	Adder	-126.74
933281	AC2-140 C	1.8159	Adder	2.14
933282	AC2-140 E	0.0956	Adder	0.11
934252	AD1-052 E1	-0.3530	Adder	-0.42
934262	AD1-052 E2	-0.3530	Adder	-0.42
936141	AD2-020 C O1	3.8483	Adder	4.53

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
936142	AD2-020 E O1	2.3686	Adder	2.79
936601	AD2-075	15.6078	50/50	15.6078
936631	AD2-079 C O1	0.6461	Adder	0.76
936632	AD2-079 E O1	0.4307	Adder	0.51
938261	AE1-039	0.0557	Adder	0.07
939391	AE1-170 C O1	3.7255	Adder	4.38
939392	AE1-170 E O1	5.1447	Adder	6.05
939631	AE1-193 C	2.7956	Adder	3.29
939632	AE1-193 E	18.7093	Adder	22.01
939641	AE1-194 C	2.7956	Adder	3.29
939642	AE1-194 E	18.7093	Adder	22.01
939651	AE1-195 C	2.7956	Adder	3.29
939652	AE1-195 E	18.7093	Adder	22.01
939681	AE1-198 C	8.3009	Adder	9.77
939682	AE1-198 E	7.0536	Adder	8.3
943001	AE2-323 C	3.0194	Adder	3.55
943002	AE2-323 E	1.4805	Adder	1.74
943021	AE2-325 C	1.9490	Adder	2.29
943022	AE2-325 E	1.2962	Adder	1.52
943781	AF1-046 C	1.4094	Adder	1.66
943782	AF1-046 E	0.9396	Adder	1.11
944161	AF1-084 C	3.4801	Adder	4.09
944162	AF1-084 E	1.9877	Adder	2.34
944931	AF1-158 C O1	4.7262	Adder	5.56
944932	AF1-158 E O1	3.1508	Adder	3.71
944961	AF1-161 C	1.5542	Adder	1.83
944962	AF1-161 E	1.5542	Adder	1.83
945111	AF1-176 C O1	9.0473	Adder	10.64
945112	AF1-176 E O1	8.3871	Adder	9.87
945501	AF1-215 C O1	7.9422	Adder	9.34
945502	AF1-215 E O1	5.2948	Adder	6.23
950311	G934 C	3.3858	PJM External (MISO)	3.3858
950312	G934 E	13.5432	PJM External (MISO)	13.5432
950351	J466	5.6217	PJM External (MISO)	5.6217
950791	J201 C	0.6632	PJM External (MISO)	0.6632
950792	J201 E	2.6530	PJM External (MISO)	2.6530
950871	J246 C	0.1733	PJM External (MISO)	0.1733
950872	J246 E	0.6933	PJM External (MISO)	0.6933
950942	J325 E	0.7753	PJM External (MISO)	0.7753
951531	J533 C	4.9520	PJM External (MISO)	4.9520
951532	J533 E	19.8080	PJM External (MISO)	19.8080
951571	J538 C	2.3880	PJM External (MISO)	2.3880
951572	J538 E	9.5520	PJM External (MISO)	9.5520
951941	J602 C	4.8700	PJM External (MISO)	4.8700
951942	J602 E	26.3480	PJM External (MISO)	26.3480
952161	J571	0.3855	PJM External (MISO)	0.3855
952201	J589 C	4.1081	PJM External (MISO)	4.1081
952202	J589 E	22.2259	PJM External (MISO)	22.2259
952312	J646 E	0.3417	PJM External (MISO)	0.3417
952401	J752 C	2.8557	PJM External (MISO)	2.8557
952402	J752 E	15.4503	PJM External (MISO)	15.4503
952611	J717 C	4.6202	PJM External (MISO)	4.6202

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
952612	J717 E	24.9966	PJM External (MISO)	24.9966
952761	J728 C	4.2967	PJM External (MISO)	4.2967
952762	J728 E	23.2775	PJM External (MISO)	23.2775
952881	J758	16.2680	PJM External (MISO)	16.2680
952971	J793	280.7531	PJM External (MISO)	280.7531
953071	J794 C	0.2713	PJM External (MISO)	0.2713
953072	J794 E	1.4679	PJM External (MISO)	1.4679
953271	J701 C	1.3894	PJM External (MISO)	1.3894
953272	J701 E	7.5173	PJM External (MISO)	7.5173
953291	J796	36.8084	PJM External (MISO)	36.8084
953321	J799	35.6114	PJM External (MISO)	35.6114
953361	J806	14.5737	PJM External (MISO)	14.5737
953771	J832	12.5400	PJM External (MISO)	12.5400
953781	J833	17.1840	PJM External (MISO)	17.1840
953811	J839	20.5430	PJM External (MISO)	20.5430
953941	J857	10.8944	PJM External (MISO)	10.8944
954111	J875	16.9725	PJM External (MISO)	16.9725
955071	J984 C	3.5212	PJM External (MISO)	3.5212
955072	J984 E	19.0508	PJM External (MISO)	19.0508
955121	J989	13.7208	PJM External (MISO)	13.7208
955181	J996	6.3368	PJM External (MISO)	6.3368
955261	J1005	30.9640	PJM External (MISO)	30.9640
955591	J1043 C	1.8640	PJM External (MISO)	1.8640
955592	J1043 E	33.0301	PJM External (MISO)	33.0301
955781	J1062	26.6490	PJM External (MISO)	26.6490
955861	J1071	8.1080	PJM External (MISO)	8.1080
956011	J1088	22.4325	PJM External (MISO)	22.4325
956021	J1089	25.8774	PJM External (MISO)	25.8774
956031	J1090	11.5479	PJM External (MISO)	11.5479
956161	J1103	3.6354	PJM External (MISO)	3.6354
956741	J1172	8.3960	PJM External (MISO)	8.3960
956751	J1173	8.9104	PJM External (MISO)	8.9104
956801	J1178	8.0236	PJM External (MISO)	8.0236
957371	AF2-031 C O2	0.1804	Adder	0.4
957372	AF2-031 E O2	0.2706	Adder	0.6
957891	AF2-083 C O2	3.6999	Adder	8.21
957892	AF2-083 E O2	0.9250	Adder	2.05
958381	AF2-132 C O2	4.0740	Adder	9.04
958382	AF2-132 E O2	2.7160	Adder	6.03
958401	AF2-134 C O2	1.4007	Adder	3.11
958402	AF2-134 E O2	0.9338	Adder	2.07
958991	AF2-190 C O2	3.6053	Adder	8.0
958992	AF2-190 E O2	2.4035	Adder	5.34
959001	AF2-191 C O2	1.8354	Adder	4.07
959002	AF2-191 E O2	1.2236	Adder	2.72
960681	AF2-359 C O2	1.9512	Adder	4.33
960682	AF2-359 E O2	1.3008	Adder	2.89
960981	AF2-389 C	0.9252	Adder	2.05
960982	AF2-389 E	0.6168	Adder	1.37
961051	AF2-396 O2	6.4079	Adder	14.22
WEC	WEC	1.4285	Confirmed LTF	1.4285
LGEE	LGEE	1.0845	Confirmed LTF	1.0845

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CPLE	CPLE	0.1832	Confirmed LTF	0.1832
CBM-W2	CBM-W2	20.7698	Confirmed LTF	20.7698
NY	NY	0.8007	Confirmed LTF	0.8007
CBM-W1	CBM-W1	142.1887	Confirmed LTF	142.1887
TVA	TVA	2.4038	Confirmed LTF	2.4038
O-066	O-066	8.5814	Confirmed LTF	8.5814
CBM-S2	CBM-S2	3.1732	Confirmed LTF	3.1732
CBM-S1	CBM-S1	14.9185	Confirmed LTF	14.9185
G-007	G-007	1.3208	Confirmed LTF	1.3208
MADISON	MADISON	5.2275	Confirmed LTF	5.2275
MEC	MEC	5.9905	Confirmed LTF	5.9905

15.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
AEP_P7-1_#11043-AE	CONTINGENCY 'AEP_P7-1_#11043-AE' OPEN BRANCH FROM BUS 945420 TO BUS 255205 CKT 1 / 945420 AF1-207 TAP 345 255205 17REYNOLDS 345 1 OPEN BRANCH FROM BUS 243229 TO BUS 960680 CKT 2 / 243229 05OLIVE 345 960680 AF2-359 TAP 345 2 END
AEP_P7-1_#11043-AG	CONTINGENCY 'AEP_P7-1_#11043-AG' OPEN BRANCH FROM BUS 945420 TO BUS 255205 CKT 1 / 945420 AF1-207 TAP 345 255205 17REYNOLDS 345 1 OPEN BRANCH FROM BUS 945500 TO BUS 958380 CKT 2 / 945500 AF1-215 TAP 345 958380 AF2-132 TAP 345 2 END
AEP_P7-1_#11043-AF	CONTINGENCY 'AEP_P7-1_#11043-AF' OPEN BRANCH FROM BUS 945420 TO BUS 255205 CKT 1 / 945420 AF1-207 TAP 345 255205 17REYNOLDS 345 1 OPEN BRANCH FROM BUS 960680 TO BUS 945500 CKT 2 / 960680 AF2-359 TAP 345 945500 AF1-215 TAP 345 2 END
ATSI-P2-3-TE-345-016T	CONTINGENCY 'ATSI-P2-3-TE-345-016T' /* LEMOYNE BK-34506 345 DISCONNECT BRANCH FROM BUS 238889 TO BUS 955620 CKT 1 /* 02LEMOYN 345 J1046 TAP 345 DISCONNECT BRANCH FROM BUS 238889 TO BUS 242936 CKT 1 /* 02LEMOYN 345 05FOSTOR 345 END
ATSI-P1-2-TE-345-604T-A	CONTINGENCY 'ATSI-P1-2-TE-345-604T-A' /*LINE OUTAGE: LEMOYNE TO ITC MAJESTIC DISCONNECT BRANCH FROM BUS 238889 TO BUS 955620 CKT 1 END
AEP_P1-2_#709	CONTINGENCY 'AEP_P1-2_#709' OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 END

Contingency Name	Contingency Definition
ATSI-P2-3-TE-345-015T	CONTINGENCY 'ATSI-P2-3-TE-345-015T' /* LEMOYNE BK-34505 345 DISCONNECT BRANCH FROM BUS 238889 TO BUS 238890 CKT 1 /* 02LEMOYN 345 02LEMOYN 138 DISCONNECT BRANCH FROM BUS 238889 TO BUS 955620 CKT 1 /* 02LEMOYN 345 J1046 TAP 345 END
AEP_P7-1_#11043-AI	CONTINGENCY 'AEP_P7-1_#11043-AI' OPEN BRANCH FROM BUS 945420 TO BUS 255205 CKT 1 / 945420 AF1-207 TAP 345 255205 17REYNOLDS 345 1 OPEN BRANCH FROM BUS 959140 TO BUS 958970 CKT 2 / 959140 AF2-205 TAP 345 958970 AF2-188 TAP 345 2 END
AEP_P7-1_#11043-AH	CONTINGENCY 'AEP_P7-1_#11043-AH' OPEN BRANCH FROM BUS 945420 TO BUS 255205 CKT 1 / 945420 AF1-207 TAP 345 255205 17REYNOLDS 345 1 OPEN BRANCH FROM BUS 958380 TO BUS 959140 CKT 2 / 958380 AF2-132 TAP 345 959140 AF2-205 TAP 345 2 END
ATSI-P7-1-TE-345-022T	CONTINGENCY 'ATSI-P7-1-TE-345-022T' /* Y1-069-MONROE/LEMOYNE-MAJ 345 DISCONNECT BRANCH FROM BUS 241901 TO BUS 264612 CKT 1 /* 02_Y1-069 345 19MON12 345 DISCONNECT BRANCH FROM BUS 238889 TO BUS 955620 CKT 1 /* 02LEMOYN 345 19MAJTC 345 END
AEP_P7-1_#11043-AJ	CONTINGENCY 'AEP_P7-1_#11043-AJ' OPEN BRANCH FROM BUS 945420 TO BUS 255205 CKT 1 / 945420 AF1-207 TAP 345 255205 17REYNOLDS 345 1 OPEN BRANCH FROM BUS 958970 TO BUS 255205 CKT 2 / 958970 AF2-188 TAP 345 255205 17REYNOLDS 345 2 END
AEP_P1-2_#8804-A	CONTINGENCY 'AEP_P1-2_#8804-A' OPEN BRANCH FROM BUS 243229 TO BUS 958400 CKT 1 / 243229 05OLIVE 345 958400 AF2-134 TAP 345 1 END

Contingency Name	Contingency Definition
AEP_P4_#6189_05HANG R 765_D1	CONTINGENCY 'AEP_P4_#6189_05HANG R 765_D1' OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNNU 765 242934 05CORNNU 345 1 REMOVE UNIT 1A FROM BUS 247245 / 247245 05HRKG1A 18.0 REMOVE UNIT 1B FROM BUS 247246 / 247246 05HRKG1B 18.0 REMOVE UNIT 1S FROM BUS 247247 / 247247 05HRKG1S 18.0 REMOVE UNIT 2A FROM BUS 247248 / 247248 05HRKG2A 18.0 REMOVE UNIT 2B FROM BUS 247249 / 247249 05HRKG2B 18.0 REMOVE UNIT 2S FROM BUS 247250 / 247250 05HRKG2S 18.0 END

16 Light Load Analysis – Secondary POI

Light Load Studies (As applicable)

Not applicable.

17 Short Circuit Analysis – Secondary POI

The following Breakers are overdutied:

To be determined during later study phases.

18 Stability and Reactive Power Assessment – Secondary POI

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined during later study phases.

19 Affected Systems – Secondary POI

19.1 TVA

TVA Impacts to be determined during later study phases (as applicable).

19.2 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

19.3 MISO

MISO Impacts to be determined during later study phases (as applicable).

19.4 LG&E

LG&E Impacts to be determined during later study phases (as applicable).