Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-359

OLIVE-UNIVERSITY PARK 345 KV

75 MW Capacity / 125 MW Energy

July 2020

Table of Contents

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 LaPorte County, Indiana. The installed facilities will have a total capability of 125 MW with 75 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 15, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-359
Project Name	OLIVE-UNIVERSITY PARK 345 KV
State	Indiana
County	LaPorte
Transmission Owner	AEP
MFO	125
MWE	125
MWC	75
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

AF2-359 will interconnect with the AEP transmission system along one of the following Points of Interconnection:

Primary POI: Tap - Olive to University Park 345 kV line

To accommodate the interconnection on the Olive (AEP) – University Park (ComEd) 345 kV circuit, a new three (3) circuit breaker 345 kV 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: Tap - Olive to Reynolds 345 kV line

To accommodate the interconnection on the Olive – Reynolds 345 kV circuit #2, a new three (3) circuit breaker 345 kV 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 AF2-359 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$19,777,000
Total System Network Upgrade Costs	$5,962,440
Total Costs	**$25,739,440**

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 on-site 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 345 kV 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, and SCADA will 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 – University Park T-Line Cut in	$1,210,000
Review Protection and Control Settings at the Olive 345 kV Substation	$45,000
Review Protection and Control Settings at the University park 345 kV Substation	To be provided by ComEd
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/meter^2)
- 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 AF2-359 was evaluated as a 125.0 MW (Capacity 75.0 MW) injection tapping the Olive to University Park 345 kV line in the AEP area. Project AF2-359 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-359 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)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
9550152 7	960680	AF2-359 TAP	345.0	CE	243229	05OLIVE	345.0	AEP	1	COMED_P1-2_695_B2	single	971.0	95.26	102.15	DC	65.75

11.2 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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
955013 25	243918	05ELDERBERRY	345.0	AEP	243219	05DUMONT	345.0	AEP	1	AEP_P4_#8165_05OLIVE 345_B1	breaker	1868.0	96.95	100.46	DC	65.54

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
955012 39	960680	AF2-359 TAP	345.0	CE	243229	05OLIVE	345.0	AEP	1	AEP_P4_#2978_05DUMONT_NON_FSA	breaker	971.0	111.47	116.7	DC	109.28
955012 40	960680	AF2-359 TAP	345.0	CE	243229	05OLIVE	345.0	AEP	1	AEP_P4_#2978_05DUMONT_FSA	breaker	971.0	111.47	116.7	DC	109.28
955012 41	960680	AF2-359 TAP	345.0	CE	243229	05OLIVE	345.0	AEP	1	COMED_P4_023-65-BT2-3__	breaker	971.0	111.16	116.4	DC	109.59

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
95501526	960680	AF2-359 TAP	345.0	CE	243229	05OLIVE	345.0	AEP	1	COMED_P1-2_695_B2	operation	971.0	111.04	116.28	DC	109.59
96650902	960680	AF2-359 TAP	345.0	CE	274804	UNIV PK N;RP	345.0	CE	1	COMED_P1-2_695_B2	operation	971.0	111.81	113.39	DC	15.41

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
95501239,95501527,95501240,95501241	1	AF2-359 TAP 345.0 kV - 05OLIVE 345.0 kV Ckt 1	**AEP** **n4057 (502) : A Sag Study will be required on the 40.64 miles of ACSR/PE 1414 62/19 conductor to mitigate the overload. The new ratings after sag study will be: S/N: 971 MVA, S/E: 1419 MVA, Depending on the sag study results, the cost for this upgrade is expected to be between $162,560 (no remediation required, just sag study) and $81.28 million (complete line Re-conductor/rebuild). 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 : $162,440** **Time Estimate : 6-12 Months** **ComEd** **CE_NUN_L97008 (914) : Sag mitigation on a portion of the line. A preliminary estimate for this work is $M with an estimated construction timeline of 30 months. Upon completion of the upgrade the rating swill be 1334/1334/1391/1523 MVA (SN/SLTE/SSTE/SLD).** **Project Type : FAC** **Cost : $4,800,000** **Time Estimate : 30.0 Months**	$4,962,440
95501325	2	05ELDERBRYSS 345.0 kV - 05DUMONT 345.0 kV Ckt 1	**AEP** **AEPI0032a (335) : Replace 3000A non-oil Circuit Breaker at Dumont** **Project Type : FAC** **Cost : $1,000,000** **Time Estimate : 12-18 Months**	$1,000,000
			TOTAL COST	**$5,962,440**

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
95501241	960680	AF2-359 TAP	CE	243229	05OLIVE	AEP	1	COMED_P4_023-65-BT2-3__	breaker	971.0	111.16	116.4	DC	109.59

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
274806	UNIV PK N;2U	1.8438	50/50	1.8438
274808	UNIV PK N;4U	1.8438	50/50	1.8438
274809	UNIV PK N;5U	1.8438	50/50	1.8438
274811	UNIV PK N;7U	1.8438	50/50	1.8438
274812	UNIV PK N;8U	1.8438	50/50	1.8438
274814	UNIV PK N;0U	1.8438	50/50	1.8438
274815	UNIV PK N;XU	1.8438	50/50	1.8438
274830	U3-021 1	4.2476	Adder	5.0
274831	U3-021 2	4.2476	Adder	5.0
274881	PILOT HIL;1E	12.8032	Adder	15.06
275149	KELLYCK ;1E	12.8032	Adder	15.06
276167	Z1-106 E2	0.8826	Adder	1.04
276168	Z1-106 E1	0.8825	Adder	1.04
276169	Z1-107 E	1.8729	Adder	2.2
276170	Z1-108 E	1.7374	Adder	2.04
290021	O50 E	13.4028	Adder	15.77
290051	GSG-6; E	7.3164	Adder	8.61
290108	LEEDK;1U E	16.9456	Adder	19.94
293061	N-015 E	10.8722	Adder	12.79
293644	O22 E1	6.7404	Adder	7.93
293645	O22 E2	13.0843	Adder	15.39
294392	P-010 E	13.8077	Adder	16.24
915011	Y3-013 1	2.6194	Adder	3.08
915021	Y3-013 2	2.6194	Adder	3.08
915031	Y3-013 3	2.6194	Adder	3.08
918052	AA1-018 E OP	12.3171	Adder	14.49
920272	AA2-123 E	1.7039	Adder	2.0
924471	AB2-096	29.4971	Adder	34.7
926311	AC1-109 1	1.3339	Adder	1.57
926321	AC1-109 2	1.3339	Adder	1.57
926331	AC1-110 1	1.3265	Adder	1.56
926341	AC1-110 2	1.3265	Adder	1.56
926351	AC1-111 1	0.5336	Adder	0.63
926361	AC1-111 2	0.5336	Adder	0.63
926371	AC1-111 3	0.5336	Adder	0.63
926381	AC1-111 4	0.5336	Adder	0.63
926391	AC1-111 5	0.5336	Adder	0.63
926401	AC1-111 6	0.5336	Adder	0.63
926431	AC1-114	1.6543	Adder	1.95
927451	AC1-142A 1	2.9724	Adder	3.5
927461	AC1-142A 2	2.9711	Adder	3.5
927511	AC1-113 1	0.8271	Adder	0.97

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
927521	AC1-113 2	0.8271	Adder	0.97
930481	AB1-089	45.7308	Adder	53.8
930501	AB1-091 O1	49.2090	Adder	57.89
930741	AB1-122 1O1	49.9014	Adder	58.71
930751	AB1-122 2O1	51.4116	Adder	60.48
932881	AC2-115 1	1.6543	Adder	1.95
932891	AC2-115 2	1.6543	Adder	1.95
932921	AC2-116	0.5790	Adder	0.68
932931	AC2-117	8.9559	Adder	10.54
933411	AC2-154 C	1.7377	Adder	2.04
933412	AC2-154 E	2.8353	Adder	3.34
933431	AC2-156 C O1	0.6670	Adder	0.78
933432	AC2-156 E O1	1.0883	Adder	1.28
933911	AD1-013 C	1.2925	Adder	1.52
933912	AD1-013 E	2.0647	Adder	2.43
933931	AD1-016 C	0.6475	Adder	0.76
933932	AD1-016 E	1.0564	Adder	1.24
934101	AD1-039 1	4.8903	Adder	5.75
934111	AD1-039 2	5.0383	Adder	5.93
934431	AD1-067 C	0.0919	Adder	0.11
934432	AD1-067 E	0.3863	Adder	0.45
934651	AD1-096 C	0.6191	Adder	0.73
934652	AD1-096 E	1.0100	Adder	1.19
934701	AD1-098 C O1	4.8123	Adder	5.66
934702	AD1-098 E O1	3.5135	Adder	4.13
934721	AD1-100 C	13.3798	Adder	15.74
934722	AD1-100 E	62.4393	Adder	73.46
934871	AD1-116 C	0.7173	Adder	0.84
934872	AD1-116 E	1.1704	Adder	1.38
934971	AD1-129 C	0.6293	Adder	0.74
934972	AD1-129 E	0.4195	Adder	0.49
936291	AD2-038 C O1	1.6921	Adder	1.99
936292	AD2-038 E O1	11.3243	Adder	13.32
936371	AD2-047 C O1	3.1096	Adder	3.66
936372	AD2-047 E O1	15.1824	Adder	17.86
936461	AD2-060	1.8292	Adder	2.15
936511	AD2-066 C O1	5.8817	Adder	6.92
936512	AD2-066 E O1	3.9211	Adder	4.61
936791	AD2-102 C	9.8257	Adder	11.56
936792	AD2-102 E	6.5504	Adder	7.71
937001	AD2-134 C	1.9126	Adder	2.25
937002	AD2-134 E	7.9011	Adder	9.3
937401	AD2-194 1	5.4728	Adder	6.44
937411	AD2-194 2	5.4769	Adder	6.44
938511	AE1-070 1	6.4306	Adder	7.57
938521	AE1-070 2	5.8877	Adder	6.93
938851	AE1-113 C	5.5287	Adder	6.5
938852	AE1-113 E	19.6016	Adder	23.06
939321	AE1-163 C O1	4.2520	Adder	5.0
939322	AE1-163 E O1	26.1197	Adder	30.73
939351	AE1-166 C O1	7.1193	Adder	8.38
939352	AE1-166 E O1	6.5717	Adder	7.73

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
940752	AE2-062 E	0.0901	Adder	0.11
941131	AE2-107 C	5.0975	Adder	6.0
941132	AE2-107 E	3.3983	Adder	4.0
941551	AE2-152 C O1	8.2146	Adder	9.66
941552	AE2-152 E O1	5.4764	Adder	6.44
941561	AE2-153 C O1	3.2948	Adder	3.88
941562	AE2-153 E O1	15.4256	Adder	18.15
942421	AE2-255 C O1	2.0942	Adder	2.46
942422	AE2-255 E O1	6.2826	Adder	7.39
942651	AE2-281 C O1	0.6074	Adder	0.71
942652	AE2-281 E O1	3.7314	Adder	4.39
942991	AE2-321 C	5.6990	Adder	6.7
942992	AE2-321 E	2.8070	Adder	3.3
943121	AE2-341 C	8.9093	Adder	10.48
943122	AE2-341 E	4.3749	Adder	5.15
943381	AF1-009 C	0.4163	Adder	0.49
943382	AF1-009 E	1.6651	Adder	1.96
943591	AF1-030 C O1	5.9248	Adder	6.97
943592	AF1-030 E O1	2.9314	Adder	3.45
943801	AF1-048 C	2.6641	Adder	3.13
943802	AF1-048 E	1.7760	Adder	2.09
944041	AF1-072	1.5041	Adder	1.77
944911	AF1-156 C	8.4242	Adder	9.91
944912	AF1-156 E	5.6161	Adder	6.61
945351	AF1-200 FTIR	216.1577	Merchant Transmission	216.1577
946661	AF1-330 C	1.3972	Adder	1.64
946662	AF1-330 E	0.3067	Adder	0.36
946671	AF1-331	1.6786	Adder	1.97
957021	AF2-003 C O1	2.3046	Adder	5.12
957022	AF2-003 E O1	10.7899	Adder	23.95
957331	AF2-027 C	0.9255	Adder	2.05
957332	AF2-027 E	1.3883	Adder	3.08
957471	AF2-041 C	7.8536	Adder	17.43
957472	AF2-041 E	5.2357	Adder	11.62
958011	AF2-095 C O1	6.5912	Adder	14.63
958012	AF2-095 E O1	3.1017	Adder	6.89
958021	AF2-096 C O1	12.8851	Adder	28.6
958022	AF2-096 E O1	6.0933	Adder	13.53
958481	AF2-142 C	4.5021	Adder	9.99
958482	AF2-142 E	3.0014	Adder	6.66
958491	AF2-143 C	4.1392	Adder	9.19
958492	AF2-143 E	2.7595	Adder	6.13
959081	AF2-199 C	2.6179	Adder	5.81
959082	AF2-199 E	1.7452	Adder	3.87
959091	AF2-200 C	5.2357	Adder	11.62
959092	AF2-200 E	3.4905	Adder	7.75
959351	AF2-226 C	0.8756	Adder	1.94
959352	AF2-226 E	1.3134	Adder	2.92
959761	AF2-267 C O1	0.0259	Adder	0.06
959762	AF2-267 E O1	0.1213	Adder	0.27
960281	AF2-319 C	0.8756	Adder	1.94
960282	AF2-319 E	1.3134	Adder	2.92

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960381	AF2-329	2.4501	Adder	5.44
960581	AF2-349 C	8.0603	Adder	17.89
960582	AF2-349 E	5.3736	Adder	11.93
960591	AF2-350 C O1	2.9082	Adder	6.46
960592	AF2-350 E O1	1.9388	Adder	4.3
960601	AF2-351 C O1	0.3878	Adder	0.86
960602	AF2-351 E O1	0.5816	Adder	1.29
960681	AF2-359 C	65.7532	50/50	65.7532
960682	AF2-359 E	43.8355	50/50	43.8355
960721	AF2-363 C O1	2.2009	Adder	4.89
960722	AF2-363 E O1	1.4673	Adder	3.26
960731	AF2-364 C O1	2.2737	Adder	5.05
960732	AF2-364 E O1	1.5158	Adder	3.36
960751	AF2-366 C O1	2.5726	Adder	5.71
960752	AF2-366 E O1	1.7151	Adder	3.81
WEC	WEC	3.0779	Confirmed LTF	3.0779
CALDERWOOD	CALDERWOOD	0.0691	Confirmed LTF	0.0691
CBM-W2	CBM-W2	14.5536	Confirmed LTF	14.5536
NY	NY	0.9246	Confirmed LTF	0.9246
CBM-W1	CBM-W1	47.2252	Confirmed LTF	47.2252
TVA	TVA	0.9016	Confirmed LTF	0.9016
O-066	O-066	10.9133	Confirmed LTF	10.9133
CHEOAH	CHEOAH	0.0776	Confirmed LTF	0.0776
CBM-S1	CBM-S1	3.0246	Confirmed LTF	3.0246
G-007	G-007	1.6879	Confirmed LTF	1.6879
MADISON	MADISON	15.8740	Confirmed LTF	15.8740
MEC	MEC	10.4477	Confirmed LTF	10.4477
GIBSON	GIBSON	0.1343	Confirmed LTF	0.1343
BLUEG	BLUEG	1.6666	Confirmed LTF	1.6666
TRIMBLE	TRIMBLE	0.5660	Confirmed LTF	0.5660
CATAWBA	CATAWBA	0.2394	Confirmed LTF	0.2394

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
95501325	243918	05ELDERBERRY	AEP	243219	05DUMONT	AEP	1	AEP_P4_#8165_05OLIVE 345_B1	breaker	1868.0	96.95	100.46	DC	65.54

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
244130	05ST.JOE CTR	65.6369	50/50	65.6369
247900	05FR-11G E	7.5001	Adder	8.82
247901	05FR-12G E	7.3756	Adder	8.68
247902	05FR-21G E	7.8832	Adder	9.27
247903	05FR-22G E	7.5480	Adder	8.88
247904	05FR-3G E	15.2875	Adder	17.99
247905	05FR-4G E	11.9733	Adder	14.09
247906	05MDL-1G E	17.4812	Adder	20.57
247907	05MDL-2G E	8.7570	Adder	10.3
247912	05MDL-3G E	8.7570	Adder	10.3
247913	05MDL-4G E	8.7570	Adder	10.3
247943	T-127 E	8.7570	Adder	10.3
274808	UNIV PK N;4U	1.1350	50/50	1.1350
274809	UNIV PK N;5U	1.1350	50/50	1.1350
274811	UNIV PK N;7U	1.1350	50/50	1.1350
274812	UNIV PK N;8U	1.1350	50/50	1.1350
274814	UNIV PK N;0U	1.1350	50/50	1.1350
274815	UNIV PK N;XU	1.1350	50/50	1.1350
274881	PILOT HIL;1E	8.3276	Adder	9.8
275149	KELLYCK ;1E	8.3276	Adder	9.8
918052	AA1-018 E OP	8.0132	Adder	9.43
922912	AB1-080	3.8896	50/50	3.8896
927451	AC1-142A 1	1.9018	Adder	2.24
927461	AC1-142A 2	1.9016	Adder	2.24
930042	AB1-006 E	19.0466	Adder	22.41
932601	AC2-080 C O1	5.4447	50/50	5.4447
932602	AC2-080 E O1	36.4373	50/50	36.4373
932931	AC2-117	5.5131	Adder	6.49
933411	AC2-154 C	1.1303	Adder	1.33
933412	AC2-154 E	1.8442	Adder	2.17
934871	AD1-116 C	0.4667	Adder	0.55
934872	AD1-116 E	0.7614	Adder	0.9
936371	AD2-047 C O1	2.0227	Adder	2.38
936372	AD2-047 E O1	9.8756	Adder	11.62
936461	AD2-060	1.1898	Adder	1.4
937041	AD2-138 C	7.3712	50/50	7.3712
937042	AD2-138 E	34.5108	50/50	34.5108
939631	AE1-193 C	6.0256	Adder	7.09
939632	AE1-193 E	40.3249	Adder	47.44
939641	AE1-194 C	6.0256	Adder	7.09
939642	AE1-194 E	40.3249	Adder	47.44
939651	AE1-195 C	6.0256	Adder	7.09
939652	AE1-195 E	40.3249	Adder	47.44

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
939681	AE1-198 C	17.8913	Adder	21.05
939682	AE1-198 E	15.2030	Adder	17.89
940581	AE2-045 C O1	24.7104	50/50	24.7104
940582	AE2-045 E O1	33.9244	50/50	33.9244
941561	AE2-153 C O1	2.1240	Adder	2.5
941562	AE2-153 E O1	9.9443	Adder	11.7
941571	AE2-154 C	3.5575	Adder	4.19
941572	AE2-154 E	23.8082	Adder	28.01
944911	AF1-156 C	5.4307	Adder	6.39
944912	AF1-156 E	3.6205	Adder	4.26
945421	AF1-207 C	4.0159	Adder	4.72
945422	AF1-207 E	17.2449	Adder	20.29
945501	AF1-215 C O1	60.9480	50/50	60.9480
945502	AF1-215 E O1	40.6320	50/50	40.6320
946581	AF1-322 C	9.1949	Adder	10.82
946582	AF1-322 E	12.6977	Adder	14.94
951811	J513 C	1.2392	PJM External (MISO)	1.2392
951812	J513 E	6.7043	PJM External (MISO)	6.7043
952581	J740 C	3.4563	PJM External (MISO)	3.4563
952582	J740 E	18.6997	PJM External (MISO)	18.6997
953161	J837 C	3.4581	PJM External (MISO)	3.4581
953162	J837 E	18.7090	PJM External (MISO)	18.7090
953171	J838 C	1.7282	PJM External (MISO)	1.7282
953172	J838 E	9.3498	PJM External (MISO)	9.3498
954421	J913 C	17.7248	PJM External (MISO)	17.7248
954941	J968 C	3.4563	PJM External (MISO)	3.4563
954942	J968 E	18.6997	PJM External (MISO)	18.6997
955741	J1058	24.8310	PJM External (MISO)	24.8310
955841	J1069 C	3.4563	PJM External (MISO)	3.4563
955842	J1069 E	18.6997	PJM External (MISO)	18.6997
957841	AF2-078 C O1	7.5122	Adder	16.68
957842	AF2-078 E O1	5.0081	Adder	11.12
958011	AF2-095 C O1	4.2875	Adder	9.52
958012	AF2-095 E O1	2.0177	Adder	4.48
958021	AF2-096 C O1	8.2605	Adder	18.34
958022	AF2-096 E O1	3.9064	Adder	8.67
958381	AF2-132 C	51.0966	50/50	51.0966
958382	AF2-132 E	34.0644	50/50	34.0644
958391	AF2-133 C	45.9972	50/50	45.9972
958392	AF2-133 E	30.6648	50/50	30.6648
958401	AF2-134 C	20.3160	50/50	20.3160
958402	AF2-134 E	13.5440	50/50	13.5440
958481	AF2-142 C	2.9290	Adder	6.5
958482	AF2-142 E	1.9526	Adder	4.33
958971	AF2-188 C O1	4.1072	Adder	9.12
958972	AF2-188 E O1	2.7381	Adder	6.08
958991	AF2-190 C	43.0560	50/50	43.0560
958992	AF2-190 E	28.7040	50/50	28.7040
959141	AF2-205 C	28.2108	50/50	28.2108
959142	AF2-205 E	18.8072	50/50	18.8072
960591	AF2-350 C O1	1.8916	Adder	4.2
960592	AF2-350 E O1	1.2610	Adder	2.8

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960601	AF2-351 C O1	0.2522	Adder	0.56
960602	AF2-351 E O1	0.3783	Adder	0.84
960681	AF2-359 C	39.3232	50/50	39.3232
960682	AF2-359 E	26.2155	50/50	26.2155
WEC	WEC	1.9291	Confirmed LTF	1.9291
LGEE	LGEE	0.4581	Confirmed LTF	0.4581
CBM-W2	CBM-W2	22.1785	Confirmed LTF	22.1785
NY	NY	0.7792	Confirmed LTF	0.7792
CBM-W1	CBM-W1	24.7698	Confirmed LTF	24.7698
TVA	TVA	2.0006	Confirmed LTF	2.0006
O-066	O-066	9.0854	Confirmed LTF	9.0854
CBM-S1	CBM-S1	11.1868	Confirmed LTF	11.1868
G-007	G-007	1.4030	Confirmed LTF	1.4030
MADISON	MADISON	10.7070	Confirmed LTF	10.7070
MEC	MEC	7.7130	Confirmed LTF	7.7130
CATAWBA	CATAWBA	0.0217	Confirmed LTF	0.0217

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
AA1-018	Powerton-Goodings Grove	In Service
AA2-123	Marengo 34kV	In Service
AB1-006	Meadow Lake 345kV	In Service
AB1-080	Dumont-Olive 345kV	In Service
AB1-089	Byron-Wayne 345kV #1	Active
AB1-091	Davis Creek 345kV	Active
AB1-122	Kendall-Tazewell & Dresden-Mole Creek	Active
AB2-096	Silver Lake-Cherry Valley	Active
AC1-109	Aurora 345kV	Active
AC1-110	Aurora 138kV	Active
AC1-111	Aurora 138kV	Active
AC1-113	Rockford	Active
AC1-114	Rockford II	Active
AC1-142A	Joliet	Active
AC2-080	Olive-Reynolds 345kV	Active
AC2-115	Rockford	Active
AC2-116	Rockford II	Active
AC2-117	University Park North	Engineering and Procurement
AC2-154	Davis Creek 138kV	Active
AC2-156	Sandwich 34.5kV	Active
AD1-013	Twombly Road 138kV	Active
AD1-016	Marengo	Active
AD1-039	Kendall-Tazewell & Dresden-Mole Creek	Active
AD1-067	Mendota Hills	Active
AD1-096	Stillman Valley 34 kV	Active
AD1-098	Dixon-McGirr	Active
AD1-100	Loretto-Wilton & Braidwood-Davis Creek	Active
AD1-116	Nevada 345 kV	Active
AD1-129	Belvidere 34 kV	Active
AD2-038	Powerton	Active
AD2-047	Davis Creek 138 kV	Active
AD2-060	Davis Creek 138kV	Active
AD2-066	Mazon-Crescent Ridge	Active
AD2-102	Wempletown 345 kV	Active
AD2-134	Shady Oaks	Active
AD2-138	Olive-Reynolds 345kV	Active
AD2-194	Elwood	Active
AE1-070	Elwood 345 kV	Active
AE1-113	Mole Creek 345 kV	Active
AE1-163	Powerton-Nevada 345 kV	Active
AE1-166	Loretto-Wilton & Braidwood-Davis Creek	Active

Queue Number	Project Name	Status
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
AE2-062	Normantown	Active
AE2-107	Haumesser Road 138 kV	Active
AE2-152	Loretto-Wilton & Braidwood-Davis Creek	Active
AE2-153	Braidwood-Davis Creek	Active
AE2-154	Meadow Lake 345 kV (MLV VIII)	Active
AE2-255	Molecreek 345 kV	Active
AE2-281	Powerton-Nevada 345 kV	Active
AE2-321	Belvidere-Marengo 138 kV	Active
AE2-341	Sandwich-Plano	Active
AF1-009	Dixon-McGirr	Active
AF1-030	Plano-R 138 kV	Active
AF1-048	Belvidere-Marengo	Active
AF1-072	Rocky Road	Active
AF1-156	Braidwood-Davis Creek	Active
AF1-200	Plano 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
AF1-330	Marengo	Active
AF1-331	Twombley Road	Active
AF2-003	Powerton-Mole Creek	Active
AF2-027	Zion Energy Center 345 kV	Active
AF2-041	Nelson-Electric Junction 345 kV	Active
AF2-078	Reynolds-Olive #1 345 kV	Active
AF2-095	Wilmington-Davis Creek	Active
AF2-096	Braidwood-East Frankfort 345 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
AF2-142	Nevada 345 kV	Active
AF2-143	Powerton-Nevada 345 kV	Active
AF2-188	Reynolds-Meadow Lake #1 345 kV	Active
AF2-190	Olive-Reynolds #2 345 kV	Active
AF2-199	Nelson-Electric Junction 345 kV	Active
AF2-200	Nelson-Electric Junction 345 kV	Active
AF2-205	Olive-Reynolds #2 345 kV	Active
AF2-226	Katydid Road 345 kV	Active
AF2-267	Lancaster 138 kV	Active
AF2-319	Katydid Road 345 kV	Active
AF2-329	Sandwich-Plano 138 kV	Active
AF2-349	Garden Prairie-Silver Lake 345 kV	Active
AF2-350	Kensington 138 kV	Active
AF2-351	Kensington 138 kV	Active
AF2-359	Olive-University Park 345 kV	Active
AF2-363	Glidden 138 kV	Active
AF2-364	Wayne Red 138 kV	Active
AF2-366	Glidden-Waterman 345 kV	Active

Queue Number	Project Name	Status
U3-021	Silver Lake-Cherry Valley	Active
Y3-013	Zion Energy Center	Active
Z1-106	West Chicago 34kV	In Service
Z1-107	Joliet 34kV	In Service
Z1-108	McHenry 34kV	In Service
J1058	MISO	MISO
J1069	MISO	MISO
J513	MISO	MISO
J740	MISO	MISO
J837	MISO	MISO
J838	MISO	MISO
J913	MISO	MISO
J968	MISO	MISO

11.8 Contingency Descriptions – Primary POI

Contingency Name	Contingency Definition
COMED_P1-2_695_B2	CONTINGENCY 'COMED_P1-2_695_B2' OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1 END
AEP_P4_#2978_05DUMONT_FSA	CONTINGENCY 'AEP_P4_#2978_05DUMONT_FSA' OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206 05DUMONT 765 X1-020 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1 END
AEP_P4_#8165_05OLIVE 345_B1	CONTINGENCY 'AEP_P4_#8165_05OLIVE 345_B1' OPEN BRANCH FROM BUS 243215 TO BUS 243229 CKT 1 / 243215 05COOK 345 243229 05OLIVE 345 1 OPEN BRANCH FROM BUS 243229 TO BUS 243353 CKT 2 / 243229 05OLIVE 345 243353 05OLIVE 138 2 END
AEP_P4_#2978_05DUMONT_NON_FSA	CONTINGENCY 'AEP_P4_#2978_05DUMONT_NON_FSA' OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206 05DUMONT 765 X1-020 OPEN BRANCH FROM BUS 243207 TO BUS 907040 CKT 1 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1 END
COMED_P4_023-65-BT2-3__	CONTINGENCY 'COMED_P4_023-65-BT2-3__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765 END

12 Light Load Analysis

Light Load Studies (As applicable)

Not applicable.

13 Short Circuit Analysis – Primary POI

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 LG&E

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

15.2 MISO

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

15.3 TVA

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

15.4 Duke Energy Progress

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

15 Summer Peak – Load Flow Analysis – Secondary POI

The Queue Project AF2-359 was evaluated as a 125.0 MW (Capacity 75.0 MW) injection tapping the Olive to Reynolds 345 kV line in the AEP area. Project AF2-359 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-359 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)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
9890618 1	26461 2	19MON1 2	345. 0	ITCT	24190 1	02LALLENDOR F	345. 0	ATSI	1	ATSI-P1-2-TE-345-604T-B	singl e	1244. 0	99.71	100.06	DC	4.33

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
955013 25	2439 18	05ELDERBE RRY	345. 0	AEP	2432 19	05DUMO NT	345. 0	AEP	1	AEP_P4_#8165_05 OLIVE 345_B1	breaker	1868. 0	97.2	100.7	DC	65.28

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)

None

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	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
144419683	960680	AF2-359 TAP	345.0	AEP	243229	05OLIVE	345.0	AEP	2	Base Case	operation	971.0	90.91	102.0	DC	107.68

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
98906181	264612	19MON12	ITCT	241901	02LALLENDORF	ATSI	1	ATSI-P1-2-TE-345-604T-B	single	1244.0	99.71	100.06	DC	4.33

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243071	05BERRINSP G	0.0763	80/20	0.0763
243440	05CKG1	12.6101	80/20	12.6101
243441	05CKG2	11.1348	80/20	11.1348
244130	05ST.JOE CTR	6.8172	80/20	6.8172
244412	05WTRV SLR C	0.0314	80/20	0.0314
244415	05OLIV SLR C	0.0264	80/20	0.0264
246397	05ELKHART HY	0.0282	80/20	0.0282
246416	05TWIN BRCH1	0.0457	80/20	0.0457
246422	05MAYFLWER	0.0553	80/20	0.0553
246431	05BUCHANAN	0.0104	80/20	0.0104
246536	05MOTTVILL	0.0184	80/20	0.0184
247528	05COVRT1	3.9488	80/20	3.9488
247529	05COVRT2	3.9488	80/20	3.9488
247530	05COVRT3	3.9488	80/20	3.9488
247531	05COVRT4	2.3700	80/20	2.3700
247532	05COVRT5	2.3700	80/20	2.3700
247533	05COVRT6	2.3700	80/20	2.3700
247604	X1-042	0.0420	80/20	0.0420
247620	Y3-023	0.0507	80/20	0.0507
247643	Z2-116 C	0.0142	80/20	0.0142
247651	AA2-116	11.6678	80/20	11.6678
274723	RIVER EC ;12	1.4288	80/20	1.4288
274751	CRETE EC ;1U	0.6582	80/20	0.6582
274752	CRETE EC ;2U	0.6582	80/20	0.6582
274753	CRETE EC ;3U	0.6582	80/20	0.6582
274754	CRETE EC ;4U	0.6582	80/20	0.6582
274788	**SE CHICAG;5U (Deactivation : 01/06/2020)**	**1.6162**	**Adder**	**1.9**
274789	**SE CHICAG;6U (Deactivation : 01/06/2020)**	**1.6205**	**Adder**	**1.91**
274790	**SE CHICAG;7U (Deactivation : 01/06/2020)**	**1.6418**	**Adder**	**1.93**
274791	**SE CHICAG;8U (Deactivation : 01/06/2020)**	**1.9315**	**80/20**	**1.9315**
274792	**SE CHICAG;9U (Deactivation : 01/06/2020)**	**1.9358**	**80/20**	**1.9358**

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
274793	SE CHICAG;0U (Deactivation : 01/06/2020)	1.9358	80/20	1.9358
274794	SE CHICAG;1U (Deactivation : 01/06/2020)	1.9358	80/20	1.9358
274795	SE CHICAG;2U (Deactivation : 01/06/2020)	1.9358	80/20	1.9358
922912	AB1-080	0.4040	80/20	0.4040
925961	AC1-072	0.3663	80/20	0.3663
926581	AC1-141	1.0682	80/20	1.0682
931951	AB1-107 1	-25.3455	Adder	-29.82
931961	AB1-107 2	-109.6845	Adder	-129.04
933281	AC2-140 C	2.1367	80/20	2.1367
936141	AD2-020 C O1	4.4983	80/20	4.4983
936601	AD2-075	15.3961	80/20	15.3961
936631	AD2-079 C O1	0.7579	80/20	0.7579
938261	AE1-039	0.0649	80/20	0.0649
939391	AE1-170 C O1	4.3596	80/20	4.3596
939631	AE1-193 C	3.2981	80/20	3.2981
939641	AE1-194 C	3.2981	80/20	3.2981
939651	AE1-195 C	3.2981	80/20	3.2981
939681	AE1-198 C	9.7928	80/20	9.7928
943001	AE2-323 C	3.5617	80/20	3.5617
943021	AE2-325 C	2.2782	80/20	2.2782
943781	AF1-046 C	1.6625	80/20	1.6625
944161	AF1-084 C	4.0651	80/20	4.0651
944931	AF1-158 C O1	5.5467	80/20	5.5467
944961	AF1-161 C	1.8167	80/20	1.8167
945111	AF1-176 C O1	10.5909	80/20	10.5909
945501	AF1-215 C O1	9.3636	80/20	9.3636
950311	G934 C	3.2973	PJM External (MISO)	3.2973
950351	J466	5.4858	PJM External (MISO)	5.4858
950791	J201 C	0.6468	PJM External (MISO)	0.6468
950871	J246 C	0.1689	PJM External (MISO)	0.1689
951531	J533 C	4.8248	PJM External (MISO)	4.8248
951571	J538 C	2.2149	PJM External (MISO)	2.2149
951941	J602 C	4.7471	PJM External (MISO)	4.7471
952161	J571	0.3721	PJM External (MISO)	0.3721
952201	J589 C	4.0030	PJM External (MISO)	4.0030
952401	J752 C	2.7865	PJM External (MISO)	2.7865
952611	J717 C	4.5041	PJM External (MISO)	4.5041
952761	J728 C	4.1887	PJM External (MISO)	4.1887
952881	J758	15.6760	PJM External (MISO)	15.6760
952971	J793	274.1167	PJM External (MISO)	274.1167
953071	J794 C	0.2644	PJM External (MISO)	0.2644
953271	J701 C	1.3557	PJM External (MISO)	1.3557
953291	J796	35.8859	PJM External (MISO)	35.8859
953321	J799	34.3470	PJM External (MISO)	34.3470
953361	J806	14.0269	PJM External (MISO)	14.0269
953771	J832	12.2180	PJM External (MISO)	12.2180
953781	J833	16.4810	PJM External (MISO)	16.4810

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
953811	J839	20.0540	PJM External (MISO)	20.0540
953941	J857	10.4733	PJM External (MISO)	10.4733
954111	J875	15.9795	PJM External (MISO)	15.9795
955071	J984 C	3.4292	PJM External (MISO)	3.4292
955121	J989	13.3704	PJM External (MISO)	13.3704
955181	J996	5.6624	PJM External (MISO)	5.6624
955261	J1005	30.1920	PJM External (MISO)	30.1920
955591	J1043 C	1.8138	PJM External (MISO)	1.8138
955861	J1071	7.8810	PJM External (MISO)	7.8810
956011	J1088	21.8445	PJM External (MISO)	21.8445
956021	J1089	25.2076	PJM External (MISO)	25.2076
956031	J1090	11.1420	PJM External (MISO)	11.1420
956161	J1103	3.5470	PJM External (MISO)	3.5470
956741	J1172	8.1865	PJM External (MISO)	8.1865
956751	J1173	8.3544	PJM External (MISO)	8.3544
956801	J1178	7.7656	PJM External (MISO)	7.7656
957371	AF2-031 C O2	0.4016	80/20	0.4016
957891	AF2-083 C O2	8.1720	80/20	8.1720
958381	AF2-132 C O2	9.0702	80/20	9.0702
958401	AF2-134 C O2	3.1164	80/20	3.1164
958991	AF2-190 C O2	8.0231	80/20	8.0231
959001	AF2-191 C O2	4.0643	80/20	4.0643
960681	AF2-359 C O2	4.3282	80/20	4.3282
960981	AF2-389 C	2.0436	80/20	2.0436
961051	AF2-396 O2	14.1400	80/20	14.1400
WEC	WEC	1.4364	Confirmed LTF	1.4364
LGEE	LGEE	1.1387	Confirmed LTF	1.1387
CPLE	CPLE	0.2209	Confirmed LTF	0.2209
CBM-W2	CBM-W2	21.2776	Confirmed LTF	21.2776
NY	NY	0.8118	Confirmed LTF	0.8118
CBM-W1	CBM-W1	140.4623	Confirmed LTF	140.4623
TVA	TVA	2.5018	Confirmed LTF	2.5018
CBM-S2	CBM-S2	3.5374	Confirmed LTF	3.5374
CBM-S1	CBM-S1	15.5575	Confirmed LTF	15.5575
MADISON	MADISON	5.0319	Confirmed LTF	5.0319
MEC	MEC	6.0525	Confirmed LTF	6.0525

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
95501325	243918	05ELDERBERRY	AEP	243219	05DUMONT	AEP	1	AEP_P4_#8165_05OLIVE 345_B1	breaker	1868.0	97.2	100.7	DC	65.28

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
244130	05ST.JOE CTR	65.6369	50/50	65.6369
247900	05FR-11G E	7.5007	Adder	8.82
247901	05FR-12G E	7.3762	Adder	8.68
247902	05FR-21G E	7.8839	Adder	9.28
247903	05FR-22G E	7.5486	Adder	8.88
247904	05FR-3G E	15.2889	Adder	17.99
247905	05FR-4G E	11.9744	Adder	14.09
247906	05MDL-1G E	17.4826	Adder	20.57
247907	05MDL-2G E	8.7577	Adder	10.3
247912	05MDL-3G E	8.7577	Adder	10.3
247913	05MDL-4G E	8.7577	Adder	10.3
247943	T-127 E	8.7577	Adder	10.3
274808	UNIV PK N;4U	1.1350	50/50	1.1350
274809	UNIV PK N;5U	1.1350	50/50	1.1350
274811	UNIV PK N;7U	1.1350	50/50	1.1350
274812	UNIV PK N;8U	1.1350	50/50	1.1350
274814	UNIV PK N;0U	1.1350	50/50	1.1350
274815	UNIV PK N;XU	1.1350	50/50	1.1350
274881	PILOT HIL;1E	8.3276	Adder	9.8
275149	KELLYCK ;1E	8.3276	Adder	9.8
918052	AA1-018 E OP	8.0132	Adder	9.43
922912	AB1-080	3.8896	50/50	3.8896
927451	AC1-142A 1	1.9018	Adder	2.24
927461	AC1-142A 2	1.9016	Adder	2.24
930042	AB1-006 E	19.0480	Adder	22.41
932601	AC2-080 C O1	5.4447	50/50	5.4447
932602	AC2-080 E O1	36.4373	50/50	36.4373
932931	AC2-117	5.5131	Adder	6.49
933411	AC2-154 C	1.1303	Adder	1.33
933412	AC2-154 E	1.8442	Adder	2.17
934871	AD1-116 C	0.4667	Adder	0.55
934872	AD1-116 E	0.7614	Adder	0.9
936371	AD2-047 C O1	2.0227	Adder	2.38
936372	AD2-047 E O1	9.8756	Adder	11.62
936461	AD2-060	1.1898	Adder	1.4
937041	AD2-138 C	7.3712	50/50	7.3712
937042	AD2-138 E	34.5108	50/50	34.5108
939631	AE1-193 C	6.0256	Adder	7.09
939632	AE1-193 E	40.3249	Adder	47.44
939641	AE1-194 C	6.0256	Adder	7.09

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
939642	AE1-194 E	40.3249	Adder	47.44
939651	AE1-195 C	6.0256	Adder	7.09
939652	AE1-195 E	40.3249	Adder	47.44
939681	AE1-198 C	17.8913	Adder	21.05
939682	AE1-198 E	15.2030	Adder	17.89
940581	AE2-045 C O1	24.7104	50/50	24.7104
940582	AE2-045 E O1	33.9244	50/50	33.9244
941561	AE2-153 C O1	2.1240	Adder	2.5
941562	AE2-153 E O1	9.9443	Adder	11.7
941571	AE2-154 C	3.5578	Adder	4.19
941572	AE2-154 E	23.8101	Adder	28.01
944911	AF1-156 C	5.4307	Adder	6.39
944912	AF1-156 E	3.6205	Adder	4.26
945421	AF1-207 C	4.0159	Adder	4.72
945422	AF1-207 E	17.2449	Adder	20.29
945501	AF1-215 C O1	60.9480	50/50	60.9480
945502	AF1-215 E O1	40.6320	50/50	40.6320
946581	AF1-322 C	9.1956	Adder	10.82
946582	AF1-322 E	12.6987	Adder	14.94
951811	J513 C	1.2392	PJM External (MISO)	1.2392
951812	J513 E	6.7043	PJM External (MISO)	6.7043
952581	J740 C	3.4560	PJM External (MISO)	3.4560
952582	J740 E	18.6980	PJM External (MISO)	18.6980
953161	J837 C	3.4578	PJM External (MISO)	3.4578
953162	J837 E	18.7073	PJM External (MISO)	18.7073
953171	J838 C	1.7280	PJM External (MISO)	1.7280
953172	J838 E	9.3490	PJM External (MISO)	9.3490
954421	J913 C	17.7232	PJM External (MISO)	17.7232
954941	J968 C	3.4560	PJM External (MISO)	3.4560
954942	J968 E	18.6980	PJM External (MISO)	18.6980
955741	J1058	24.8310	PJM External (MISO)	24.8310
955841	J1069 C	3.4560	PJM External (MISO)	3.4560
955842	J1069 E	18.6980	PJM External (MISO)	18.6980
957841	AF2-078 C O2	7.3343	Adder	16.28
957842	AF2-078 E O2	4.8895	Adder	10.85
958021	AF2-096 C O2	8.3913	Adder	18.63
958022	AF2-096 E O2	3.9682	Adder	8.81
958381	AF2-132 C O2	51.4638	50/50	51.4638
958382	AF2-132 E O2	34.3092	50/50	34.3092
958391	AF2-133 C O2	45.7128	50/50	45.7128
958392	AF2-133 E O2	30.4752	50/50	30.4752
958401	AF2-134 C O2	20.1432	50/50	20.1432
958402	AF2-134 E O2	13.4288	50/50	13.4288
958481	AF2-142 C	2.9290	Adder	6.5
958482	AF2-142 E	1.9526	Adder	4.33
958971	AF2-188 C O2	4.1448	Adder	9.2
958972	AF2-188 E O2	2.7632	Adder	6.13
958991	AF2-190 C O2	49.8420	50/50	49.8420
958992	AF2-190 E O2	33.2280	50/50	33.2280
959141	AF2-205 C	28.2108	50/50	28.2108
959142	AF2-205 E	18.8072	50/50	18.8072
960591	AF2-350 C O2	1.8916	Adder	4.2

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
960592	AF2-350 E O2	1.2610	Adder	2.8
960601	AF2-351 C O2	0.2522	Adder	0.56
960602	AF2-351 E O2	0.3783	Adder	0.84
960681	AF2-359 C O2	39.1703	50/50	39.1703
960682	AF2-359 E O2	26.1135	50/50	26.1135
WEC	WEC	1.9291	Confirmed LTF	1.9291
LGEE	LGEE	0.4581	Confirmed LTF	0.4581
CBM-W2	CBM-W2	22.1785	Confirmed LTF	22.1785
NY	NY	0.7792	Confirmed LTF	0.7792
CBM-W1	CBM-W1	24.7698	Confirmed LTF	24.7698
TVA	TVA	2.0006	Confirmed LTF	2.0006
O-066	O-066	9.0854	Confirmed LTF	9.0854
CBM-S1	CBM-S1	11.1868	Confirmed LTF	11.1868
G-007	G-007	1.4030	Confirmed LTF	1.4030
MADISON	MADISON	10.7070	Confirmed LTF	10.7070
MEC	MEC	7.7130	Confirmed LTF	7.7130
CATAWBA	CATAWBA	0.0217	Confirmed LTF	0.0217

15.6 Contingency Descriptions – Secondary POI

Contingency Name	Contingency Definition
Base Case	
ATSI-P1-2-TE-345-604T-B	CONTINGENCY 'ATSI-P1-2-TE-345-604T-B' /*LINE OUTAGE: LEMOYNE TO ITC MAJESTIC DISCONNECT BRANCH FROM BUS 955620 TO BUS 264599 CKT 1 END
AEP_P4_#8165_05OLIVE 345_B1	CONTINGENCY 'AEP_P4_#8165_05OLIVE 345_B1' OPEN BRANCH FROM BUS 243215 TO BUS 243229 CKT 1 / 243215 05COOK 345 243229 05OLIVE 345 1 OPEN BRANCH FROM BUS 243229 TO BUS 243353 CKT 2 / 243229 05OLIVE 345 243353 05OLIVE 138 2 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 LG&E

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

19.2 MISO

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

19.3 TVA

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

19.4 Duke Energy Progress

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