Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-453

GUARDIAN 138 KV

84 MW Capacity / 140 MW Energy

January 2021

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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.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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 Noble County, Indiana. The installed facilities will have a total capability of 140 MW with 84 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is December 31, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-453
Project Name	GUARDIAN 138 KV
State	Indiana
County	Noble
Transmission Owner	AEP
MFO	140
MWE	140
MWC	84
Fuel	Solar
Basecase Study Year	2024

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

AG1-453 will interconnect with the AEP transmission system along one of the following Points of Interconnection:

Primary POI: Guardian 138 kV substation.

AG1-453 will interconnect with the AEP transmission system via a direct connection to the Guardian 138 kV substation.

To accommodate the interconnection to the Guardian 138 kV substation, two (2) new 138 kV circuit breaker(s) will be installed (Attachment 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 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: Charger to Countryside 138 kV line.

AG1-453 will interconnect with the AEP transmission system via a new station cut into the Charger - Countryside section of the Charger - Concord 138 kV circuit.

To accommodate the interconnection on the Charger - Countryside section of the Charger - Concord 138 kV circuit, a new three (3) circuit breaker 138 kV switching station physically configured and operated as a ring-bus will be constructed (see Attachment 2). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 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.

5 Cost Summary

The AG1-453 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$2,103,000
Total System Network Upgrade Costs	$0
Total Costs	**$2,103,000**

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 2016-36, 2016-25 I.R.B. (6/20/2016). 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.

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.

6 Transmission Owner Scope of Work

The total physical interconnection costs is given in the table 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
138 kV Revenue Metering	$388,000
Generator lead first span exiting the POI station, including the first structure outside the fence	$400,000
Total Attachment Facility Costs	**$788,000**

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
Two (2) new 138 kV circuit breaker(s) will be installed at the Guardian 138 kV substation (Attachment 1). Installation of associated protection and control equipment, 138 kV line risers, and SCADA will also be required.	$1,270,000
Total Direct Connection Facility Costs	**$1,270,000**

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
Review line protection and control settings at the Guardian 138 kV substation	$45,000
Total Non-Direct Connection Facility Costs	**$45,000**

7 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.

8 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.

9 Revenue Metering and SCADA Requirements

9.1 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.

9.2 Meteorological Data Reporting Requirements

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Irradiance (Watts/meter2) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

9.3 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/

10 Summer Peak - Load Flow Analysis - Primary POI

The Queue Project AG1-453 was evaluated as a 140.0 MW (Capacity 84.0 MW) injection at the Guardian 138 kV substation in the AEP area. Project AG1-453 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-453 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

10.1 Generation Deliverability

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

None

10.2 Multiple Facility Contingency

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

None

10.3 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

10.4 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
168245747	243279	05DIAMND	138.0	AEP	243890	05WOODSR	138.0	AEP	1	AEP_P1-2_#5625_3105-B	operation	335.0	84.39	126.18	DC	140.0
168245660	243284	05DUPONT	138.0	AEP	243366	05ROBPK12	138.0	AEP	1	AEP_P1-2_#5625_3105-B	operation	255.0	100.08	154.98	DC	140.0
168245679	243304	05GUARDN	138.0	AEP	243279	05DIAMND	138.0	AEP	1	AEP_P1-2_#5625_3105-B	operation	286.0	101.08	150.03	DC	140.0
168245680	243304	05GUARDN	138.0	AEP	243279	05DIAMND	138.0	AEP	1	Base Case	operation	226.0	79.19	109.3	DC	68.06
168245657	243890	05WOODSR	138.0	AEP	243284	05DUPONT	138.0	AEP	1	AEP_P1-2_#5625_3105-B	operation	255.0	108.63	163.53	DC	140.0
168245658	243890	05WOODSR	138.0	AEP	243284	05DUPONT	138.0	AEP	1	Base Case	operation	219.0	76.19	107.27	DC	68.06
169761118	943000	AE2-323 TAP	138.0	AEP	243385	05TWIN B	138.0	AEP	1	AEP_P1-2_#5530_1741	operation	330.0	87.61	130.03	DC	140.0

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
169761119	943000	AE2-323 TAP	138.0	AEP	243385	05TWIN B	138.0	AEP	1	AEP_P2-1_243279 05DIAMND 138 243304 05GUARDN 138 1	operation	330.0	87.61	130.03	DC	140.0
170042580	965420	AG1-410 TAP	345.0	AEP	246929	05MADDOX	345.0	AEP	1	AEP_P1-2_#7441_100545-A	operation	1301.0	107.72	108.96	DC	16.13
170042582	965420	AG1-410 TAP	345.0	AEP	246929	05MADDOX	345.0	AEP	1	Base Case	operation	897.0	102.49	103.09	DC	11.88

10.5 System Reinforcements - Summer Peak Load Flow - Primary POI

None.

10.6 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
Base Case	
AEP_P1-2_#7441_100545-A	CONTINGENCY 'AEP_P1-2_#7441_100545-A' OPEN BRANCH FROM BUS 242928 TO BUS 958430 CKT 1 / 242928 05MARYSV 765 958430 AF2-137 TAP 765 1 END
AEP_P2-1_243279 05DIAMND 138 243304 05GUARDN 138 1	CONTINGENCY 'AEP_P2-1_243279 05DIAMND 138 243304 05GUARDN 138 1' OPEN BRANCH FROM BUS 243279 TO BUS 243304 CKT 1 END
AEP_P1-2_#5625_3105-B	CONTINGENCY 'AEP_P1-2_#5625_3105-B' OPEN BRANCH FROM BUS 943000 TO BUS 243385 CKT 1 / 943000 AE2-323 TAP 138 243385 05TWIN B 138 1 END
AEP_P1-2_#5530_1741	CONTINGENCY 'AEP_P1-2_#5530_1741' OPEN BRANCH FROM BUS 243279 TO BUS 243304 CKT 1 / 243279 05DIAMND 138 243304 05GUARDN 138 1 OPEN BRANCH FROM BUS 243279 TO BUS 243890 CKT 1 / 243279 05DIAMND 138 243890 05WOODSR 138 1 OPEN BRANCH FROM BUS 243284 TO BUS 243366 CKT 1 / 243284 05DUPONT 138 243366 05ROB PK12 138 1 OPEN BRANCH FROM BUS 243284 TO BUS 243890 CKT 1 / 243284 05DUPONT 138 243890 05WOODSR 138 1 END

11 Short Circuit Analysis - Primary POI

The following Breakers are overdutied:

None.

12 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AG1-453 was evaluated as a 140.0 MW (Capacity 84.0 MW) injection tapping the Charger to Countryside 138 kV line in the AEP area. Project AG1-453 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-453 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

12.1 Generation Deliverability

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

None

12.2 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
172684638	965840	AG1-453 TAP	138.0	AEP	247433	05CHARGER	138.0	AEP	1	AEP_P7-1_#11092	tower	167.0	64.31	112.01	DC	79.66
172684639	965840	AG1-453 TAP	138.0	AEP	247433	05CHARGER	138.0	AEP	1	AEP_P7-1_#11090	tower	167.0	64.35	111.64	DC	78.97
173911176	965840	AG1-453 TAP	138.0	AEP	247433	05CHARGER	138.0	AEP	1	AEP_P4_#24_05COLNGW 345_A	breaker	167.0	64.29	111.58	DC	78.97

12.3 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
174483213	242933	05RPMONE	345.0	AEP	246929	05MADDOX	345.0	AEP	1	AEP_P4_#7445_05MARYSV 765_B	breaker	1301.0	101.86	103.05	DC	15.54

12.4 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
174725255	965840	AG1-453 TAP	138.0	AEP	247433	05CHARGER	138.0	AEP	1	AEP_P1-2_#6388	operation	167.0	61.8	109.57	DC	79.78

12.5 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".

12.5.1 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
172684638	965840	AG1-453 TAP	AEP	247433	05CHARGER	AEP	1	AEP_P7-1_#11092	tower	167.0	64.31	112.01	DC	79.66

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247620	Y3-023	0.1246	50/50	0.1246
965841	AG1-453 C O2	47.7985	50/50	47.7985
965842	AG1-453 E O2	31.8657	50/50	31.8657
965851	AG1-454 O2	28.4515	50/50	28.4515
WEC	WEC	0.1458	Confirmed LTF	0.1458
CALDERWOOD	CALDERWOOD	0.0094	Confirmed LTF	0.0094
CBM-W2	CBM-W2	0.7795	Confirmed LTF	0.7795
NY	NY	0.0619	Confirmed LTF	0.0619
TVA	TVA	0.0434	Confirmed LTF	0.0434
O-066	O-066	0.7403	Confirmed LTF	0.7403
SIGE	SIGE	0.0096	Confirmed LTF	0.0096
CHEOAH	CHEOAH	0.0100	Confirmed LTF	0.0100
CBM-S1	CBM-S1	0.0049	Confirmed LTF	0.0049
G-007	G-007	0.1155	Confirmed LTF	0.1155
HAMLET	HAMLET	0.0335	Confirmed LTF	0.0335
MEC	MEC	0.5196	Confirmed LTF	0.5196
GIBSON	GIBSON	0.0098	Confirmed LTF	0.0098
BLUEG	BLUEG	0.0990	Confirmed LTF	0.0990
TRIMBLE	TRIMBLE	0.0328	Confirmed LTF	0.0328
LAGN	LAGN	0.1435	Confirmed LTF	0.1435
CATAWBA	CATAWBA	0.0178	Confirmed LTF	0.0178
CBM-W1	CBM-W1	5.4958	Confirmed LTF	5.4958

12.5.2 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
174483213	242933	05RPMONE	AEP	246929	05MADDOX	AEP	1	AEP_P4_#7445_05MARYSV 765_B	breaker	1301.0	101.86	103.05	DC	15.54

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
244357	05GRANGER EL	-0.2443	Adder	-0.29
247270	05RPMNG1	9.8922	50/50	9.8922
247271	05RPMNG2	9.8856	50/50	9.8856
247272	05RPMNG3	9.8922	50/50	9.8922
247521	T131	0.4904	50/50	0.4904
247911	05TIMB G E	9.3059	Adder	10.95
247969	Z2-116 E	0.0994	Adder	0.12
270164	T-131 E	12.4332	50/50	12.4332
926865	AC1-173 C	0.1618	50/50	0.1618
926866	AC1-173 E	6.8383	50/50	6.8383
936631	AD2-079 C O1	0.9248	Adder	1.09
936632	AD2-079 E O1	0.6166	Adder	0.73
936722	AD2-091 BAT	6.9955	50/50	6.9955
940981	AE2-089 C O1	7.2916	Adder	8.58
940982	AE2-089 E O1	4.8610	Adder	5.72
942042	AE2-216 BAT	7.6950	50/50	7.6950
942221	AE2-234 C O1	2.0444	Adder	2.41
942222	AE2-234 E O1	0.9246	Adder	1.09
942241	AE2-236 C O1	4.5368	50/50	4.5368
942242	AE2-236 E O1	1.9444	50/50	1.9444
943001	AE2-323 C	7.3850	50/50	7.3850
943002	AE2-323 E	3.6210	50/50	3.6210
943781	AF1-046 C	3.4471	50/50	3.4471
943782	AF1-046 E	2.2981	50/50	2.2981
944231	AF1-091 C O1	16.5263	50/50	16.5263
944232	AF1-091 E O1	4.9675	50/50	4.9675
944241	AF1-092 C O1	12.5891	50/50	12.5891
944242	AF1-092 E O1	3.8315	50/50	3.8315
944531	AF1-118 C O1	27.4977	50/50	27.4977
944532	AF1-118 E O1	8.2933	50/50	8.2933
944761	AF1-141 C O1	8.4001	50/50	8.4001
944762	AF1-141 E O1	4.4408	50/50	4.4408
944831	AF1-148 C O1	9.5429	50/50	9.5429
944832	AF1-148 E O1	6.3619	50/50	6.3619
945111	AF1-176 C O1	11.7828	Adder	13.86
945112	AF1-176 E O1	10.9224	Adder	12.85
945623	AF1-227 BAT	9.2210	Merchant Transmission	9.2210
946203	AF1-285 BAT	2.5852	50/50	2.5852
958001	AF2-094 C	2.8900	50/50	2.8900
958002	AF2-094 E	1.4888	50/50	1.4888
958311	AF2-125 C	4.7485	50/50	4.7485
958312	AF2-125 E	2.4746	50/50	2.4746

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
958431	AF2-137 C	21.3423	50/50	21.3423
958432	AF2-137 E	29.4727	50/50	29.4727
958861	AF2-177 C O1	1.9762	Adder	2.32
958862	AF2-177 E O1	13.2252	Adder	15.56
959131	AF2-204 C	6.0655	Adder	7.14
959132	AF2-204 E	3.2013	Adder	3.77
959181	AF2-209 C	7.3581	Adder	8.66
959182	AF2-209 E	3.4400	Adder	4.05
959331	AF2-224 C O1	8.4365	50/50	8.4365
959332	AF2-224 E O1	11.6505	50/50	11.6505
960851	AF2-376 C	1.5407	Adder	1.81
960852	AF2-376 E	2.3111	Adder	2.72
960861	AF2-377 C	2.0722	50/50	2.0722
960862	AF2-377 E	3.1083	50/50	3.1083
960971	AF2-388 C	2.7404	Adder	3.22
960972	AF2-388 E	12.8299	Adder	15.09
961631	AG1-003 C	22.9684	50/50	22.9684
961632	AG1-003 E	17.6836	50/50	17.6836
961641	AG1-004	20.3260	50/50	20.3260
963701	AG1-222 C	9.1240	50/50	9.1240
963702	AG1-222 E	7.3850	50/50	7.3850
963731	AG1-225 C	21.9917	50/50	21.9917
963732	AG1-225 E	14.7674	50/50	14.7674
963791	AG1-232 C	10.2643	50/50	10.2643
963792	AG1-232 E	6.8429	50/50	6.8429
965011	AG1-365 C	12.0522	50/50	12.0522
965012	AG1-365 E	8.0348	50/50	8.0348
965021	AG1-366 C	4.0174	50/50	4.0174
965022	AG1-366 E	6.0261	50/50	6.0261
965041	AG1-368 C	7.2918	50/50	7.2918
965042	AG1-368 E	4.8612	50/50	4.8612
965051	AG1-369 C	3.1021	50/50	3.1021
965052	AG1-369 E	2.0681	50/50	2.0681
965101	AG1-375 C	2.4170	Adder	5.37
965102	AG1-375 E	1.6113	Adder	3.58
965111	AG1-376 C	0.4834	Adder	1.07
965112	AG1-376 E	0.7251	Adder	1.61
965432	AG1-411 BAT	46.7730	50/50	46.7730
965491	AG1-417 C O2	3.5610	50/50	3.5610
965492	AG1-417 E O2	2.3740	50/50	2.3740
965561	AG1-424 C	6.1770	50/50	6.1770
965562	AG1-424 E	4.1180	50/50	4.1180
965651	AG1-433 C	0.7262	Adder	1.61
965652	AG1-433 E	3.3999	Adder	7.55
965841	AG1-453 C O2	9.3240	50/50	9.3240
965842	AG1-453 E O2	6.2160	50/50	6.2160
965851	AG1-454 O2	5.5500	50/50	5.5500
WEC	WEC	2.2280	Confirmed LTF	2.2280
LGEE	LGEE	1.6342	Confirmed LTF	1.6342
CBM-W2	CBM-W2	33.9674	Confirmed LTF	33.9674
NY	NY	1.1602	Confirmed LTF	1.1602
TVA	TVA	3.3474	Confirmed LTF	3.3474

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
O-066	O-066	13.4331	Confirmed LTF	13.4331
SIGE	SIGE	0.6173	Confirmed LTF	0.6173
CBM-S2	CBM-S2	3.1842	Confirmed LTF	3.1842
CBM-S1	CBM-S1	0.9230	Confirmed LTF	0.9230
G-007	G-007	2.0906	Confirmed LTF	2.0906
MEC	MEC	9.3449	Confirmed LTF	9.3449
LAGN	LAGN	5.2640	Confirmed LTF	5.2640
CBM-W1	CBM-W1	67.8568	Confirmed LTF	67.8568

12.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
AEP_P7-1_#11090	CONTINGENCY 'AEP_P7-1_#11090' OPEN BRANCH FROM BUS 243214 TO BUS 243231 CKT 1 / 243214 05COLNGW 345 243231 05ROB PK 345 1 OPEN BRANCH FROM BUS 243214 TO BUS 255105 CKT 1 / 243214 05COLNGW 345 255105 17HIPLE 345 1 END
AEP_P1-2_#6388	CONTINGENCY 'AEP_P1-2_#6388' / 1728 OPEN BRANCH FROM BUS 243220 TO BUS 255105 CKT 1 / 243220 05E.ELKHART 345 255105 17HIPLE 345 1 END
AEP_P7-1_#11092	CONTINGENCY 'AEP_P7-1_#11092' OPEN BRANCH FROM BUS 243220 TO BUS 255105 CKT 1 / 243220 05E.ELKHART 345 255105 17HIPLE 345 1 OPEN BRANCH FROM BUS 247894 TO BUS 255105 CKT 1 / 247894 05E.ELKHA BP 345 255105 17HIPLE 345 1 OPEN BRANCH FROM BUS 247894 TO BUS 256509 CKT 1 / 247894 05E.ELKHA BP 345 256509 18WEEDLK 345 1 END
AEP_P4_#24_05COLNGW 345_A	CONTINGENCY 'AEP_P4_#24_05COLNGW 345_A' / 66 OPEN BRANCH FROM BUS 243214 TO BUS 255105 CKT 1 / 243214 05COLNGW 345 255105 17HIPLE 345 1 OPEN BRANCH FROM BUS 243214 TO BUS 247105 CKT 1 / 243214 05COLNGW 345 247105 05VARNER 345 1 END
AEP_P4_#7445_05MARYSV 765_B	CONTINGENCY 'AEP_P4_#7445_05MARYSV 765_B' / 2263 OPEN BRANCH FROM BUS 242928 TO BUS 962760 CKT 1 / 242928 05MARYSV 765 962760 AG1-125 TAP 765 1 OPEN BRANCH FROM BUS 242928 TO BUS 958430 CKT 1 / 242928 05MARYSV 765 958430 AF2-137 TAP 765 1 END

13 Affected Systems

13.1 TVA

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

13.2 Duke Energy Progress

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

13.3 MISO

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

13.4 LG&E

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