Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-105

MORGANS CUT 138 KV

60 MW Capacity / 100 MW Energy

July 2020

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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.

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, Virginia. The installed facilities will have a total capability of 100 MW with 60 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is March 28, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-105
Project Name	MORGANS CUT 138 KV
State	Virginia
County	Pulaski
Transmission Owner	AEP
MFO	100
MWE	100
MWC	60
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

AF2-105 will interconnect with the AEP transmission system via a direct connection to the Morgans Cut 138 kV station.

To accommodate the interconnection at the Morgans Cut 138 kV substation, the substation will have to be expanded requiring the rebuild of the 138 kV bus, installation of four (4) 138 kV circuit breakers, physically constructed and operated as a ring bus (see 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.

5 Cost Summary

The AF2-105 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$10,686,000
Total System Network Upgrade Costs	$31,048,200
Total Costs	**$41,734,200**

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
138 kV Revenue Metering	$376,000
Generator Lead first span exiting the POI station, including the first structure outside the fence	$400,000
Total Attachment Facility Costs	$776,000

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
Construct a new four (4) circuit breaker 138 kV switching station physically configured in a ring bus arrangement and operated as a ring-bus. Installation of associated protection and control equipment, 138 kV line risers and SCADA will also be required.	$9,050,000
Total Direct Connection Facility Costs	$9,050,000

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
Upgrade Line Protections & Controls at the Claytor #2 138 kV Substation	$45,000
Upgrade Line Protections & Controls at the Glen Lyn #2 138 kV Substation	$45,000
Claytor #2– Glen Lyn #2 138kV circuit Cut Into Morgans Cut station	$770,000
Total Non-Direct Connection Facility Costs	$860,000

7 Incremental Capacity Transfer Rights (ICTRs)

None

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 AF2-105 was evaluated as a 100.0 MW (Capacity 60.0 MW) injection at the Morgans Cut 138kV substation in the AEP area. Project AF2-105 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-105 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)

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
95682573	937350	AD2-179 TAP	138.0	AEP	242651	05GLENL2	138.0	AEP	1	AEP_P4_#10191_05CLYTR3 138_C	breaker	146.0	97.99	124.58	DC	38.82
95683265	937350	AD2-179 TAP	138.0	AEP	242651	05GLENL2	138.0	AEP	1	AEP_P7-1_#10877-B	tower	146.0	98.68	123.43	DC	36.13
95682640	942640	AE2-280 TAP	138.0	AEP	242634	05EDGEMO	138.0	AEP	1	AEP_P4_#10191_05CLYTR3 138_C	breaker	240.0	99.74	113.36	DC	32.69

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
95682669	941430	AE2-140 TAP	138.0	AEP	242620	05DANVL2	138.0	AEP	1	AEP_P4_#10171_05AXTON 138_G	breaker	392.0	112.93	113.56	DC	5.5

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
95682828	242608	05CLYTR1	138.0	AEP	242791	05SCHRIS	138.0	AEP	1	AEP_P1-2_#10186-C	operation	180.0	90.29	104.29	DC	25.2
95682858	242620	05DANVL2	138.0	AEP	242631	05EDAN 1	138.0	AEP	1	AEP_P1-2_#1370	operation	402.0	114.56	115.23	DC	6.02
95682822	937350	AD2-179 TAP	138.0	AEP	242651	05GLENL2	138.0	AEP	1	AEP_P1-2_#10190	operation	146.0	96.4	123.33	DC	39.32
95682852	942640	AE2-280 TAP	138.0	AEP	242634	05EDGEMO	138.0	AEP	1	Base Case	operation	167.0	95.9	105.84	DC	16.6
95682853	942640	AE2-280 TAP	138.0	AEP	242634	05EDGEMO	138.0	AEP	1	AEP_P1-2_#10190	operation	240.0	99.25	112.67	DC	32.2

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
95682640	2	AE2-280 TAP 138.0 kV - 05EDGEMO 138.0 kV Ckt 1	AEP AEPA0025a (255) : Rebuild Edgemont-AE2-280 138 kV (3.5 miles) using 795 ACSR 26/7 DRAKE Project Type : FAC Cost : $5,250,000 Time Estimate : 18-24 Months AEPA0025b (256) : Replace Sub cond 795 AAC 37 Str. At Edgemont Project Type : FAC Cost : $100,000 Time Estimate : 12-18 Months	$5,350,000
95682669	3	AE2-140 TAP 138.0 kV - 05DANVL2 138.0 kV Ckt 1	AEP AEPA0006a (201) : Replace two sub cond 1590 AAC 61 Str at Danville Project Type : FAC Cost : $100,000 Time Estimate : 12-18 Months AEPA0006c (203) : Current Station Rating: S/N: 296, S/E: 398 1) Replace Axton - Danville Line, ACSR ~ 1033.5 ~ 45/7 ~ ORTOLAN Conductor Section 1, 0.06 Miles. $90,000 Project Type : FAC Cost : $90,000 Time Estimate : 18-24 Months AEPA0006d (204) : Current Station Rating: S/N: 300, S/E: 400 1) Replace Axton - Danville Line, ACSR ~ 336.4 ~ 30/7 ~ ORIOLE ~ FE Conductor Section 2, 16.3 Miles. $24.45M Project Type : FAC Cost : $24,450,000 Time Estimate : 18-24 Months AEPA0006e (205) : Current Station Rating: S/N: 439, S/E: 439 1) Replace Axton - Danville Line, ACSR/SSAC ~ 795 ~ 26/7 ~ DRAKE/S Conductor Section 3, 0.52 Miles. $780,000 Project Type : FAC Cost : $780,000 Time Estimate : 18-24 Months	$25,420,000

ID	Idx	Facility	Upgrade Description	Cost
95683265,95682573	1	AD2-179 TAP 138.0 kV - 05GLENL2 138.0 kV Ckt 1	<u>AEP</u> **AEPA0009a (209)** : A Sag Study will be required for the 20.8 miles of overhead conductor (ACSR ~ 397.5 ~ 30/7 ~ LARK ~ Fe Clamps 9 d) to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between $83,200 (no remediation required, just sag study) and $31.2 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** : $83,200 **Time Estimate** : 6 - 12 Months **AEPA0009b (210)** : Replace 0.13 mi. 300 CU Overhead Cond **Project Type** : FAC **Cost** : $195,000 **Time Estimate** : 24 - 36 Months	$278,200
			TOTAL COST	**$31,048,200**

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
95682573	937350	AD2-179 TAP	AEP	242651	05GLENL 2	AEP	1	AEP_P4_#10191_05CLYTR 3 138_C	breaker	146.0	97.99	124.58	DC	38.82

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
242907	05CLAY-2	1.8542	50/50	1.8542
247619	Y1-049	0.1316	50/50	0.1316
934751	AD1-102 C	5.5631	50/50	5.5631
934752	AD1-102 E	37.2325	50/50	37.2325
937341	AD2-178 C O1	13.0824	50/50	13.0824
937342	AD2-178 E O1	8.7216	50/50	8.7216
937351	AD2-179 C O1	23.9436	50/50	23.9436
937352	AD2-179 E O1	15.9624	50/50	15.9624
938131	**AE1-017 C (Withdrawn : 07/15/2020)**	**1.6906**	**50/50**	**1.6906**
938132	**AE1-017 E (Withdrawn : 07/15/2020)**	**1.3832**	**50/50**	**1.3832**
942641	AE2-280 C O1	18.6190	50/50	18.6190
942642	AE2-280 E O1	12.5521	50/50	12.5521
958111	AF2-105 C O1	23.2896	50/50	23.2896
958112	AF2-105 E O1	15.5264	50/50	15.5264
959291	AF2-220 C	7.7110	50/50	7.7110
959292	AF2-220 E	5.2575	50/50	5.2575
NEWTON	NEWTON	0.1225	Confirmed LTF	0.1225
CPLE	CPLE	0.1502	Confirmed LTF	0.1502
FARMERCITY	FARMERCITY	0.0054	Confirmed LTF	0.0054
G-007A	G-007A	0.1415	Confirmed LTF	0.1415
VFT	VFT	0.3741	Confirmed LTF	0.3741
CALDERWOOD	CALDERWOOD	0.0070	Confirmed LTF	0.0070
PRAIRIE	PRAIRIE	0.2480	Confirmed LTF	0.2480
CHEOAH	CHEOAH	0.0035	Confirmed LTF	0.0035
EDWARDS	EDWARDS	0.0409	Confirmed LTF	0.0409
CBM-S2	CBM-S2	1.0346	Confirmed LTF	1.0346
TILTON	TILTON	0.0781	Confirmed LTF	0.0781
MADISON	MADISON	0.0927	Confirmed LTF	0.0927
GIBSON	GIBSON	0.0688	Confirmed LTF	0.0688
BLUEG	BLUEG	0.2378	Confirmed LTF	0.2378
TRIMBLE	TRIMBLE	0.0768	Confirmed LTF	0.0768

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
95682640	942640	AE2-280 TAP	AEP	242634	05EDGEMO	AEP	1	AEP_P4_#10191_05CLYTR 3 138_C	breaker	240.0	99.74	113.36	DC	32.69

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
242907	05CLAY-2	2.4816	50/50	2.4816
247619	Y1-049	0.1829	50/50	0.1829
934751	AD1-102 C	7.5512	50/50	7.5512
934752	AD1-102 E	50.5380	50/50	50.5380
937341	AD2-178 C O1	18.1786	50/50	18.1786
937342	AD2-178 E O1	12.1190	50/50	12.1190
937351	AD2-179 C O1	19.2552	50/50	19.2552
937352	AD2-179 E O1	12.8368	50/50	12.8368
938131	**AE1-017 C (Withdrawn : 07/15/2020)**	**2.3912**	**50/50**	**2.3912**
938132	**AE1-017 E (Withdrawn : 07/15/2020)**	**1.9564**	**50/50**	**1.9564**
942641	AE2-280 C O1	35.0736	50/50	35.0736
942642	AE2-280 E O1	23.6451	50/50	23.6451
958111	AF2-105 C O1	19.6116	50/50	19.6116
958112	AF2-105 E O1	13.0744	50/50	13.0744
958121	AF2-106 C O1	2.7713	Adder	6.15
958122	AF2-106 E O1	1.8475	Adder	4.1
959291	AF2-220 C	7.6428	50/50	7.6428
959292	AF2-220 E	5.2110	50/50	5.2110
WEC	WEC	0.0910	Confirmed LTF	0.0910
LGEE	LGEE	0.1883	Confirmed LTF	0.1883
CBM-W2	CBM-W2	2.6126	Confirmed LTF	2.6126
NY	NY	0.0691	Confirmed LTF	0.0691
CBM-W1	CBM-W1	3.4152	Confirmed LTF	3.4152
TVA	TVA	0.5082	Confirmed LTF	0.5082
O-066	O-066	1.0483	Confirmed LTF	1.0483
CBM-S2	CBM-S2	0.6531	Confirmed LTF	0.6531
CBM-S1	CBM-S1	3.0416	Confirmed LTF	3.0416
G-007	G-007	0.1643	Confirmed LTF	0.1643
MADISON	MADISON	0.0262	Confirmed LTF	0.0262
MEC	MEC	0.4799	Confirmed LTF	0.4799

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
95682669	941430	AE2-140 TAP	AEP	242620	05DANVL2	AEP	1	AEP_P4_#10171_05AXTON 138_G	breaker	392.0	112.93	113.56	DC	5.5

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
244012	05PINNACLE	-1.4028	Adder	-1.65
247723	05PHILPOTT	0.6467	50/50	0.6467
926461	**AC1-117 C (Suspended)**	**3.6966**	**50/50**	**3.6966**
926462	**AC1-117 E (Suspended)**	**6.0312**	**50/50**	**6.0312**
934751	AD1-102 C	1.0347	Adder	1.22
934752	AD1-102 E	6.9248	Adder	8.15
937351	AD2-179 C O1	2.7810	Adder	3.27
937352	AD2-179 E O1	1.8540	Adder	2.18
938741	AE1-100 C O1	22.6662	50/50	22.6662
938742	AE1-100 E O1	13.0371	50/50	13.0371
938931	AE1-121 O1	261.2837	50/50	261.2837
939441	AE1-176	0.1226	Adder	0.14
940083	AE1-250 BAT	11.4435	Merchant Transmission	11.4435
940601	AE2-047 C O1	4.0847	50/50	4.0847
940602	AE2-047 E O1	2.2188	50/50	2.2188
941431	AE2-140 C O1	69.9176	50/50	69.9176
941432	AE2-140 E O1	46.6118	50/50	46.6118
941671	AE2-166 C	26.2651	50/50	26.2651
941672	AE2-166 E	17.5100	50/50	17.5100
942321	AE2-245	3.3610	50/50	3.3610
942641	AE2-280 C O1	3.6466	Adder	4.29
942642	AE2-280 E O1	2.4584	Adder	2.89
958111	AF2-105 C O1	1.4877	Adder	3.3
958112	AF2-105 E O1	0.9918	Adder	2.2
958121	AF2-106 C O1	2.2758	Adder	5.05
958122	AF2-106 E O1	1.5172	Adder	3.37
959291	AF2-220 C	0.5631	Adder	1.25
959292	AF2-220 E	0.3840	Adder	0.85
WEC	WEC	0.0891	Confirmed LTF	0.0891
LGEE	LGEE	0.1951	Confirmed LTF	0.1951
CALDERWOOD	CALDERWOOD	0.2127	Confirmed LTF	0.2127
NY	NY	0.0359	Confirmed LTF	0.0359
CBM-W1	CBM-W1	3.5028	Confirmed LTF	3.5028
O-066	O-066	0.8198	Confirmed LTF	0.8198
CHEOAH	CHEOAH	0.2352	Confirmed LTF	0.2352
G-007	G-007	0.1300	Confirmed LTF	0.1300
MEC	MEC	0.2654	Confirmed LTF	0.2654
CATAWBA	CATAWBA	0.5761	Confirmed LTF	0.5761

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
AC1-117	Stockton 34.5kV	Suspended
AD1-102	Wurno-Claytor Lake 138 KV	Active
AD2-178	Wurno 138kV	Active
AD2-179	Morgans Cut-Glen Lyn 138kV	Active
AE1-017	Peak Creek-Draper 34.5 kV	Withdrawn
AE1-100	Axton 138 kV	Active
AE1-121	Axton 138 kV	Active
AE1-176	Roanoke-Vinton 12 kV (Niagara Hydro)	In Service
AE1-250	Smith Mountain-E. Danville 138 kV	Active
AE2-047	Ridgeway-Solite 69 kV	Active
AE2-140	Axton-Danville 138 kV	Active
AE2-166	Stockton 138 kV	Active
AE2-245	Stockton 34.5 kV	Active
AE2-280	Claytor Lake-Edgemont 138 kV	Active
AF2-105	Morgans Cut 138 kV	Active
AF2-106	Hazel Hollow 138 kV	Active
AF2-220	Hickman-River Bend 69 kV	Active
Y1-049	Wurno 34.5kV	In Service

11.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
AEP_P4_#10171_05AXTON 138_G	CONTINGENCY 'AEP_P4_#10171_05AXTON 138_G' OPEN BRANCH FROM BUS 242509 TO BUS 242514 CKT 1 / 242509 05AXTON 765 242514 05J.FERR 765 1 OPEN BRANCH FROM BUS 242509 TO BUS 242545 CKT 1 / 242509 05AXTON 765 242545 05AXTONX 138 1 OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT SR / 242544 05AXTON 138 242545 05AXTONX 138 SR OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT ZB / 242544 05AXTON 138 242545 05AXTONX 138 ZB OPEN BRANCH FROM BUS 242544 TO BUS 943810 CKT 2 / 242544 05AXTON 138 943810 AF1-049 TAP 138 2 END
AEP_P1-2_#10190	CONTINGENCY 'AEP_P1-2_#10190' OPEN BRANCH FROM BUS 243969 TO BUS 242640 CKT 1 / 243969 05FLOYD EQ 999 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 243969 TO BUS 243967 CKT 1 / 243969 05FLOYD EQ 999 243967 05FLOYD 69.0 1 OPEN BRANCH FROM BUS 243969 TO BUS 243966 CKT 1 / 243969 05FLOYD EQ 999 243966 05FLOYD 34.5 1 OPEN BRANCH FROM BUS 242535 TO BUS 242610 CKT 1 / 242535 05ALUMRG 138 242610 05CLYTR3 138 1 OPEN BRANCH FROM BUS 242535 TO BUS 242640 CKT 1 / 242535 05ALUMRG 138 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242610 CKT Z1 / 242608 05CLYTR1 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242609 TO BUS 242610 CKT Z1 / 242609 05CLYTR2 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242640 TO BUS 242750 CKT 1 / 242640 05FLOYD 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 247723 TO BUS 242750 CKT 1 / 247723 05PHILPOTT 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 242750 TO BUS 242844 CKT 1 / 242750 05PHILPOTT Z 138 242844 05W.BASS 138 1 END
AEP_P1-2_#1370	CONTINGENCY 'AEP_P1-2_#1370' OPEN BRANCH FROM BUS 242509 TO BUS 242514 CKT 1 / 242509 05AXTON 765 242514 05J.FERR 765 1 OPEN BRANCH FROM BUS 242509 TO BUS 242545 CKT 1 / 242509 05AXTON 765 242545 05AXTONX 138 1 OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT SR / 242544 05AXTON 138 242545 05AXTONX 138 SR OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT ZB / 242544 05AXTON 138 242545 05AXTONX 138 ZB END

Contingency Name	Contingency Definition
AEP_P4_#10191_05CLYTR3 138_C	CONTINGENCY 'AEP_P4_#10191_05CLYTR3 138_C' OPEN BRANCH FROM BUS 243969 TO BUS 242640 CKT 1 / 243969 05FLOYD EQ 999 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 243969 TO BUS 243967 CKT 1 / 243969 05FLOYD EQ 999 243967 05FLOYD 69.0 1 OPEN BRANCH FROM BUS 243969 TO BUS 243966 CKT 1 / 243969 05FLOYD EQ 999 243966 05FLOYD 34.5 1 OPEN BRANCH FROM BUS 242535 TO BUS 242610 CKT 1 / 242535 05ALUMRG 138 242610 05CLYTR3 138 1 OPEN BRANCH FROM BUS 242535 TO BUS 242640 CKT 1 / 242535 05ALUMRG 138 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 247869 TO BUS 242608 CKT 1 / 247869 05CLAYTR HY1 138 242608 05CLYTR1 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242610 CKT Z1 / 242608 05CLYTR1 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242608 TO BUS 242666 CKT 1 / 242608 05CLYTR1 138 242666 05HAZELH 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242791 CKT 1 / 242608 05CLYTR1 138 242791 05SCHRIS 138 1 OPEN BRANCH FROM BUS 242609 TO BUS 242610 CKT Z1 / 242609 05CLYTR2 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242640 TO BUS 242750 CKT 1 / 242640 05FLOYD 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 247723 TO BUS 242750 CKT 1 / 247723 05PHILPOTT 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 242750 TO BUS 242844 CKT 1 / 242750 05PHILPOTT Z 138 242844 05W.BASS 138 1 OPEN BRANCH FROM BUS 247869 TO BUS 242906 CKT 1 / 247869 05CLAYTR HY1 138 242906 05CLAY-1 11.0 1 REMOVE UNIT 1 FROM BUS 242906 / 242906 05CLAY-1 11.0 REMOVE UNIT 2 FROM BUS 242906 / 242906 05CLAY-1 11.0 END
AEP_P1-2_#10186-C	CONTINGENCY 'AEP_P1-2_#10186-C' OPEN BRANCH FROM BUS 942640 TO BUS 242634 CKT 1 / 242609 AE2-280 TAP 138 242634 05EDGEMO 138 1 END
Base Case	

Contingency Name	Contingency Definition
AEP_P7-1_#10877-B	CONTINGENCY 'AEP_P7-1_#10877-B' OPEN BRANCH FROM BUS 242608 TO BUS 242791 CKT 1 / 242608 05CLYTR1 138 242791 05SCHRIS 138 1 OPEN BRANCH FROM BUS 942640 TO BUS 242634 CKT 1 / 942640 AE2-280 TAP 138 242634 05EDGEMO 138 1 OPEN BRANCH FROM BUS 242708 TO BUS 243874 CKT 1 / 242708 05M FUNK 138 243874 05TECHDR 138 1 OPEN BRANCH FROM BUS 242791 TO BUS 243874 CKT 1 / 242791 05SCHRIS 138 243874 05TECHDR 138 1 OPEN BRANCH FROM BUS 242791 TO BUS 244118 CKT 1 / 242791 05SCHRIS 138 244118 05SCHRISTB 69.0 1 OPEN BRANCH FROM BUS 244107 TO BUS 244118 CKT 1 / 244107 05CAMBRIA 69.0 244118 05SCHRISTB 69.0 1 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 Secondary Point of Interconnection

AF2-105 will interconnect with the AEP transmission system tapping the Glen Lyn to Morgans Cut 138 kV line.

To accommodate the interconnection on the Glen Lyn to Morgans Cut 138 kV line, a new three (3) circuit breaker 138 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, 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.

16 Summer Peak – Load Flow Analysis – Secondary POI

The Queue Project AF2-105 was evaluated as a 100.0 MW (Capacity 60.0 MW) injection tapping the Glen Lyn to Morgans Cut 138 kV line in the AEP area. Project AF2-105 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-105 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

16.1 Generation Deliverability

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

None

16.2 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
95682640	942640	AE2-280 TAP	138.0	AEP	242634	05EDGEMO	138.0	AEP	1	AEP_P4_#10191_05CLYTR3 138_C	breaker	240.0	99.74	112.28	DC	30.1
144715711	958110	AF2-105 TAP	138.0	AEP	242651	05GLENL2	138.0	AEP	1	AEP_P7-1_#10877-B	tower	146.0	98.68	127.2	DC	41.64

16.3 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
95682669	941430	AE2-140 TAP	138.0	AEP	242620	05DANVL2	138.0	AEP	1	AEP_P4_#10171_05AXTON 138_G	breaker	392.0	112.93	113.53	DC	5.28

16.4 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
95682828	242608	05CLYTR 1	138.0	AEP	242791	05SCHRIS	138.0	AEP	1	AEP_P1-2_#10186-C	operation	180.0	90.29	103.4	DC	23.59
144714919	937350	AD2-179 TAP	138.0	AEP	242721	05MORGAN	138.0	AEP	1	AEP_P1-2_#5381-A-A	operation	146.0	68.49	136.99	DC	100.0
144714922	937350	AD2-179 TAP	138.0	AEP	242721	05MORGAN	138.0	AEP	1	Base Case	operation	134.0	59.15	108.84	DC	66.59
95682852	942640	AE2-280 TAP	138.0	AEP	242634	05EDGEMO	138.0	AEP	1	Base Case	operation	167.0	95.9	105.16	DC	15.46
95682853	942640	AE2-280 TAP	138.0	AEP	242634	05EDGEMO	138.0	AEP	1	AEP_P1-2_#10190	operation	240.0	99.25	111.54	DC	29.5
144714924	958110	AF2-105 TAP	138.0	AEP	242651	05GLENL2	138.0	AEP	1	AEP_P1-2_#5381-B	operation	146.0	68.49	136.99	DC	100.0
144714925	958110	AF2-105 TAP	138.0	AEP	242651	05GLENL2	138.0	AEP	1	242721 05MORGAN 138 937350 AD2-179 TAP 138 1	operation	146.0	68.49	136.99	DC	100.0

16.5 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".

16.5.1 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
95682640	942640	AE2-280 TAP	AEP	242634	05EDGEMO	AEP	1	AEP_P4_#10191_05CLYTR 3 138_C	breaker	240.0	99.74	112.28	DC	30.1

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
242907	05CLAY-2	2.4816	50/50	2.4816
247619	Y1-049	0.1829	50/50	0.1829
934751	AD1-102 C	7.5512	50/50	7.5512
934752	AD1-102 E	50.5380	50/50	50.5380
937341	AD2-178 C O1	18.1786	50/50	18.1786
937342	AD2-178 E O1	12.1190	50/50	12.1190
937351	AD2-179 C O1	19.2552	50/50	19.2552
937352	AD2-179 E O1	12.8368	50/50	12.8368
938131	**AE1-017 C (Withdrawn : 07/15/2020)**	**2.3912**	**50/50**	**2.3912**
938132	**AE1-017 E (Withdrawn : 07/15/2020)**	**1.9564**	**50/50**	**1.9564**
942641	AE2-280 C O1	35.0736	50/50	35.0736
942642	AE2-280 E O1	23.6451	50/50	23.6451
958111	AF2-105 C O2	18.0582	50/50	18.0582
958112	AF2-105 E O2	12.0388	50/50	12.0388
958121	AF2-106 C O2	2.7713	Adder	6.15
958122	AF2-106 E O2	1.8475	Adder	4.1
959291	AF2-220 C	7.6428	50/50	7.6428
959292	AF2-220 E	5.2110	50/50	5.2110
WEC	WEC	0.0910	Confirmed LTF	0.0910
LGEE	LGEE	0.1883	Confirmed LTF	0.1883
CBM-W2	CBM-W2	2.6126	Confirmed LTF	2.6126
NY	NY	0.0691	Confirmed LTF	0.0691
CBM-W1	CBM-W1	3.4152	Confirmed LTF	3.4152
TVA	TVA	0.5082	Confirmed LTF	0.5082
O-066	O-066	1.0483	Confirmed LTF	1.0483
CBM-S2	CBM-S2	0.6531	Confirmed LTF	0.6531
CBM-S1	CBM-S1	3.0416	Confirmed LTF	3.0416
G-007	G-007	0.1643	Confirmed LTF	0.1643
MADISON	MADISON	0.0262	Confirmed LTF	0.0262
MEC	MEC	0.4799	Confirmed LTF	0.4799

16.5.2 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
144715711	958110	AF2-105 TAP	AEP	242651	05GLENL2	AEP	1	AEP_P7-1_#10877-B	tower	146.0	98.68	127.2	DC	41.64

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
242906	05CLAY-1	1.5667	50/50	1.5667
242907	05CLAY-2	1.5733	50/50	1.5733
247619	Y1-049	0.1124	50/50	0.1124
934751	AD1-102 C	4.7301	50/50	4.7301
934752	AD1-102 E	31.6571	50/50	31.6571
937341	AD2-178 C O1	11.1722	50/50	11.1722
937342	AD2-178 E O1	7.4482	50/50	7.4482
937351	AD2-179 C O1	22.4358	50/50	22.4358
937352	AD2-179 E O1	14.9572	50/50	14.9572
938131	**AE1-017 C (Withdrawn : 07/15/2020)**	**1.4487**	**50/50**	**1.4487**
938132	**AE1-017 E (Withdrawn : 07/15/2020)**	**1.1853**	**50/50**	**1.1853**
942641	AE2-280 C O1	18.3308	50/50	18.3308
942642	AE2-280 E O1	12.3578	50/50	12.3578
958111	AF2-105 C O2	24.9840	50/50	24.9840
958112	AF2-105 E O2	16.6560	50/50	16.6560
958121	AF2-106 C O2	16.1820	50/50	16.1820
958122	AF2-106 E O2	10.7880	50/50	10.7880
959291	AF2-220 C	6.9863	50/50	6.9863
959292	AF2-220 E	4.7634	50/50	4.7634
NEWTON	NEWTON	0.0430	Confirmed LTF	0.0430
CPLE	CPLE	0.2970	Confirmed LTF	0.2970
FARMERCITY	FARMERCITY	0.0008	Confirmed LTF	0.0008
G-007A	G-007A	0.0360	Confirmed LTF	0.0360
VFT	VFT	0.0903	Confirmed LTF	0.0903
CBM-W2	CBM-W2	0.1802	Confirmed LTF	0.1802
TVA	TVA	0.1036	Confirmed LTF	0.1036
PRAIRIE	PRAIRIE	0.0310	Confirmed LTF	0.0310
EDWARDS	EDWARDS	0.0178	Confirmed LTF	0.0178
CBM-S2	CBM-S2	2.1617	Confirmed LTF	2.1617
CBM-S1	CBM-S1	0.4090	Confirmed LTF	0.4090
TILTON	TILTON	0.0372	Confirmed LTF	0.0372
MADISON	MADISON	0.1351	Confirmed LTF	0.1351
GIBSON	GIBSON	0.0300	Confirmed LTF	0.0300
BLUEG	BLUEG	0.1163	Confirmed LTF	0.1163
TRIMBLE	TRIMBLE	0.0384	Confirmed LTF	0.0384

16.5.3 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
95682669	941430	AE2-140 TAP	AEP	242620	05DANVL2	AEP	1	AEP_P4_#10171_05AXTON 138_G	breaker	392.0	112.93	113.53	DC	5.28

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
244012	05PINNACLE	-1.4028	Adder	-1.65
247723	05PHILPOTT	0.6467	50/50	0.6467
926461	**AC1-117 C (Suspended)**	**3.6966**	**50/50**	**3.6966**
926462	**AC1-117 E (Suspended)**	**6.0312**	**50/50**	**6.0312**
934751	AD1-102 C	1.0347	Adder	1.22
934752	AD1-102 E	6.9248	Adder	8.15
937351	AD2-179 C O1	2.7810	Adder	3.27
937352	AD2-179 E O1	1.8540	Adder	2.18
938741	AE1-100 C O1	22.6662	50/50	22.6662
938742	AE1-100 E O1	13.0371	50/50	13.0371
938931	AE1-121 O1	261.2837	50/50	261.2837
939441	AE1-176	0.1226	Adder	0.14
940083	AE1-250 BAT	11.4435	Merchant Transmission	11.4435
940601	AE2-047 C O1	4.0847	50/50	4.0847
940602	AE2-047 E O1	2.2188	50/50	2.2188
941431	AE2-140 C O1	69.9176	50/50	69.9176
941432	AE2-140 E O1	46.6118	50/50	46.6118
941671	AE2-166 C	26.2651	50/50	26.2651
941672	AE2-166 E	17.5100	50/50	17.5100
942321	AE2-245	3.3610	50/50	3.3610
942641	AE2-280 C O1	3.6466	Adder	4.29
942642	AE2-280 E O1	2.4584	Adder	2.89
958111	AF2-105 C O2	1.4272	Adder	3.17
958112	AF2-105 E O2	0.9515	Adder	2.11
958121	AF2-106 C O2	2.2227	Adder	4.93
958122	AF2-106 E O2	1.4818	Adder	3.29
959291	AF2-220 C	0.5631	Adder	1.25
959292	AF2-220 E	0.3840	Adder	0.85
WEC	WEC	0.0891	Confirmed LTF	0.0891
LGEE	LGEE	0.1951	Confirmed LTF	0.1951
CALDERWOOD	CALDERWOOD	0.2127	Confirmed LTF	0.2127
NY	NY	0.0359	Confirmed LTF	0.0359
CBM-W1	CBM-W1	3.5028	Confirmed LTF	3.5028
O-066	O-066	0.8198	Confirmed LTF	0.8198
CHEOAH	CHEOAH	0.2352	Confirmed LTF	0.2352
G-007	G-007	0.1300	Confirmed LTF	0.1300
MEC	MEC	0.2654	Confirmed LTF	0.2654
CATAWBA	CATAWBA	0.5761	Confirmed LTF	0.5761

16.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
AEP_P4_#10171_05AXTON 138_G	CONTINGENCY 'AEP_P4_#10171_05AXTON 138_G' OPEN BRANCH FROM BUS 242509 TO BUS 242514 CKT 1 / 242509 05AXTON 765 242514 05J.FERR 765 1 OPEN BRANCH FROM BUS 242509 TO BUS 242545 CKT 1 / 242509 05AXTON 765 242545 05AXTONX 138 1 OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT SR / 242544 05AXTON 138 242545 05AXTONX 138 SR OPEN BRANCH FROM BUS 242544 TO BUS 242545 CKT ZB / 242544 05AXTON 138 242545 05AXTONX 138 ZB OPEN BRANCH FROM BUS 242544 TO BUS 943810 CKT 2 / 242544 05AXTON 138 943810 AF1-049 TAP 138 2 END
242721 05MORGAN 138 937350 AD2-179 TAP 138 1	CONTINGENCY '242721 05MORGAN 138 937350 AD2-179 TAP 138 1' OPEN BRANCH FROM BUS 242721 TO BUS 937350 CKT 1 END
AEP_P1-2_#5381-A-A	CONTINGENCY 'AEP_P1-2_#5381-A-A' OPEN BRANCH FROM BUS 242651 TO BUS 958110 CKT 1 / 242651 05GLENL2 138 958110 AF2-105 TAP 138 1 END
AEP_P1-2_#10190	CONTINGENCY 'AEP_P1-2_#10190' OPEN BRANCH FROM BUS 243969 TO BUS 242640 CKT 1 / 243969 05FLOYD EQ 999 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 243969 TO BUS 243967 CKT 1 / 243969 05FLOYD EQ 999 243967 05FLOYD 69.0 1 OPEN BRANCH FROM BUS 243969 TO BUS 243966 CKT 1 / 243969 05FLOYD EQ 999 243966 05FLOYD 34.5 1 OPEN BRANCH FROM BUS 242535 TO BUS 242610 CKT 1 / 242535 05ALUMRG 138 242610 05CLYTR3 138 1 OPEN BRANCH FROM BUS 242535 TO BUS 242640 CKT 1 / 242535 05ALUMRG 138 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242610 CKT Z1 / 242608 05CLYTR1 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242609 TO BUS 242610 CKT Z1 / 242609 05CLYTR2 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242640 TO BUS 242750 CKT 1 / 242640 05FLOYD 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 247723 TO BUS 242750 CKT 1 / 247723 05PHILPOTT 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 242750 TO BUS 242844 CKT 1 / 242750 05PHILPOTT Z 138 242844 05W.BASS 138 1 END

Contingency Name	Contingency Definition
AEP_P4_#10191_05CLYTR3 138_C	CONTINGENCY 'AEP_P4_#10191_05CLYTR3 138_C' OPEN BRANCH FROM BUS 243969 TO BUS 242640 CKT 1 / 243969 05FLOYD EQ 999 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 243969 TO BUS 243967 CKT 1 / 243969 05FLOYD EQ 999 243967 05FLOYD 69.0 1 OPEN BRANCH FROM BUS 243969 TO BUS 243966 CKT 1 / 243969 05FLOYD EQ 999 243966 05FLOYD 34.5 1 OPEN BRANCH FROM BUS 242535 TO BUS 242610 CKT 1 / 242535 05ALUMRG 138 242610 05CLYTR3 138 1 OPEN BRANCH FROM BUS 242535 TO BUS 242640 CKT 1 / 242535 05ALUMRG 138 242640 05FLOYD 138 1 OPEN BRANCH FROM BUS 247869 TO BUS 242608 CKT 1 / 247869 05CLAYTR HY1 138 242608 05CLYTR1 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242610 CKT Z1 / 242608 05CLYTR1 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242608 TO BUS 242666 CKT 1 / 242608 05CLYTR1 138 242666 05HAZELH 138 1 OPEN BRANCH FROM BUS 242608 TO BUS 242791 CKT 1 / 242608 05CLYTR1 138 242791 05SCHRIS 138 1 OPEN BRANCH FROM BUS 242609 TO BUS 242610 CKT Z1 / 242609 05CLYTR2 138 242610 05CLYTR3 138 Z1 OPEN BRANCH FROM BUS 242640 TO BUS 242750 CKT 1 / 242640 05FLOYD 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 247723 TO BUS 242750 CKT 1 / 247723 05PHILPOTT 138 242750 05PHILPOTT Z 138 1 OPEN BRANCH FROM BUS 242750 TO BUS 242844 CKT 1 / 242750 05PHILPOTT Z 138 242844 05W.BASS 138 1 OPEN BRANCH FROM BUS 247869 TO BUS 242906 CKT 1 / 247869 05CLAYTR HY1 138 242906 05CLAY-1 11.0 1 REMOVE UNIT 1 FROM BUS 242906 / 242906 05CLAY-1 11.0 REMOVE UNIT 2 FROM BUS 242906 / 242906 05CLAY-1 11.0 END
AEP_P1-2_#10186-C	CONTINGENCY 'AEP_P1-2_#10186-C' OPEN BRANCH FROM BUS 942640 TO BUS 242634 CKT 1 / 242609 AE2-280 TAP 138 242634 05EDGEMO 138 1 END
Base Case	

Contingency Name	Contingency Definition
AEP_P7-1_#10877-B	CONTINGENCY 'AEP_P7-1_#10877-B' OPEN BRANCH FROM BUS 242608 TO BUS 242791 CKT 1 / 242608 05CLYTR1 138 242791 05SCHRIS 138 1 OPEN BRANCH FROM BUS 942640 TO BUS 242634 CKT 1 / 942640 AE2-280 TAP 138 242634 05EDGEMO 138 1 OPEN BRANCH FROM BUS 242708 TO BUS 243874 CKT 1 / 242708 05M FUNK 138 243874 05TECHDR 138 1 OPEN BRANCH FROM BUS 242791 TO BUS 243874 CKT 1 / 242791 05SCHRIS 138 243874 05TECHDR 138 1 OPEN BRANCH FROM BUS 242791 TO BUS 244118 CKT 1 / 242791 05SCHRIS 138 244118 05SCHRISTB 69.0 1 OPEN BRANCH FROM BUS 244107 TO BUS 244118 CKT 1 / 244107 05CAMBRIA 69.0 244118 05SCHRISTB 69.0 1 END
AEP_P1-2_#5381-B	CONTINGENCY 'AEP_P1-2_#5381-B' OPEN BRANCH FROM BUS 244137 TO BUS 242721 CKT 1 / 244137 05MORGANEQ 999 242721 05MORGAN 138 1 OPEN BRANCH FROM BUS 244137 TO BUS 244136 CKT 1 / 244137 05MORGANEQ 999 244136 05MORGAN C 69.0 1 OPEN BRANCH FROM BUS 244137 TO BUS 244135 CKT 1 / 244137 05MORGANEQ 999 244135 05MORGAN C 34.5 1 OPEN BRANCH FROM BUS 242609 TO BUS 242721 CKT 1 / 242609 05CLYTR2 138 242721 05MORGAN 138 1 OPEN BRANCH FROM BUS 937350 TO BUS 242721 CKT 1 / 937350 AD2-179 TAP 138 242721 05MORGAN 138 1 END

17 Light Load Analysis

Light Load Studies (As applicable)

Not applicable.

18 Short Circuit Analysis

The following Breakers are overdutied:

To be determined during later study phases.

19 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.

20 Affected Systems

20.1 TVA

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

20.2 Duke Energy Progress

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

20.3 MISO

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

20.4 LG&E

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