Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-286

JOHNSON MOUNTAIN 138 KV

6 MW Capacity / 10 MW Energy

January 2021

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.

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.

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 Campbell County, Virginia. The installed facilities will have a total capability of 10 MW with 6 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-286
Project Name	JOHNSON MOUNTAIN 138 KV
State	Virginia
County	Campbell
Transmission Owner	AEP
MFO	10
MWE	10
MWC	6
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

AG1-286 will interconnect with the AEP Transmission system via the South Side Electric Cooperative (SSEC) Evington 24 kV Distribution circuit. The AEP Johnson Mountain 138 kV tap serves the SSEC Evington Delivery Point. (See Attachment 1.)

Because the physical connection will occur on the SSEC system, Attachment and Direct Connection Facility cost estimates will have to be provided by SSEC. SSEC may also have some Non-Direct Connection Upgrades.

Under the terms of the Interconnection & Local Delivery Service Agreement (ILDSA) governing the AEP relationship with SSEC as an ODEC member, AEP may conduct studies related to the impact of the generation addition (whether or not it participates in a PJM market) on the affected Delivery Point. These studies would be carried out separately from the PJM AG1-queue studies, and billed directly to SSEC/ODEC.

5 Cost Summary

The AG1-286 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$ TBD by SSEC
Total System Network Upgrade Costs	$27,700,000
Total Costs	$27,700,000 + Costs TBD by SSEC

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:

Description	Total Cost
Total Physical Interconnection Costs	$ TBD by SSEC

7 Transmission Owner Analysis

AEP may conduct studies related to the impact of the generation addition (whether or not it participates in a PJM market) on the affected Delivery Point. These studies would be carried out separately from the PJM AG1-queue studies, and billed directly to SSEC/ODEC.

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 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 Revenue Metering and SCADA Requirements

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

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)

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

The Queue Project AG1-286 was evaluated as a 10.0 MW (Capacity 6.0 MW) injection at the Johnson Mountain 138 kV substation in the AEP area. Project AG1-286 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-286 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

11.3 Contribution to Previously Identified Overloads

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
161663210	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	AEP_P2-2_#13260_05SKIMMR 69.0_1	bus	240.0	145.22	147.54	DC	5.57
161663211	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	AEP_P2-2_#10163_05EDAN 2 138_2	bus	240.0	144.68	146.98	DC	5.51
161663577	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	AEP_P7-1_#10778	tower	240.0	144.68	146.98	DC	5.51
161663578	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	AEP_P7-1_#10830	tower	240.0	140.26	142.54	DC	5.46
167368381	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	AEP_P4_#2914_05J.FERR	breaker	240.0	135.7	137.9	DC	5.27
167368382	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	AEP_P4_#311_05CLOVRD	breaker	240.0	135.7	137.9	DC	5.27
168173468	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	Base Case	single	167.0	141.3	143.24	DC	3.23
168173470	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	AEP_P1-2_#3174_6	single	240.0	100.81	101.97	DC	2.78
164050810	314667	4ALTVSTA	138.0	DVP	314666	3ALTVSTA	115.0	DVP	2	AEP_P2-2_#10292_05NEWLDN 138_1	bus	146.600006104	100.06	101.88	DC	2.67

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
168173467	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	Base Case	operation	167.0	176.07	179.29	DC	5.39
168173469	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	AEP_P1-2_#3174_6	operation	240.0	123.27	125.2	DC	4.63
168173601	242734	05NEWLDN	138.0	AEP	242569	05BRUSHT	138.0	AEP	1	AEP_P2-1_242641 05FOREST 138 242734 05NEWLDN 138 1	operation	207.0	114.04	116.21	DC	4.48
168173694	242734	05NEWLDN	138.0	AEP	242641	05FOREST	138.0	AEP	1	AEP_P2-1_242569 05BRUSHT 138 242734 05NEWLDN 138 1	operation	240.0	101.65	103.58	DC	4.62
168173659	243892	05MEADS8	138.0	AEP	242607	05CLOVRD	138.0	AEP	1	Base Case	operation	348.0	99.92	100.21	DC	1.01
169186450	314667	4ALTVSTA	138.0	DVP	314666	3ALTVSTA	115.0	DVP	1	DVP_P1-3: 4ALTVSTA-TX#4	operation	126.524002075	105.89	107.3	DC	1.79
169186470	314667	4ALTVSTA	138.0	DVP	314666	3ALTVSTA	115.0	DVP	2	AEP_P2-1_242687 05JOHNMT 138 242734 05NEWLDN 138 1	operation	130.472000122	112.25	114.3	DC	2.67

11.5 System Reinforcements - Summer Peak Load Flow

ID	Idx	Facility	Upgrade Description	Cost
164050810	2	4ALTVSTA 138.0 kV - 3ALTVSTA 115.0 kV Ckt 2	DVP dom-122 (1475) : Add additional 138/115 kV transformer at Altavista substation Project Type : CON Cost : $6,000,000 Time Estimate : 16-18 Months	$6,000,000
168173468,161663211,161663210,167368381,161663577,167368382,161663578,168173470	1	05JOHNMT 138.0 kV - 05NEWLDN 138.0 kV Ckt 1	AEP AEPA0020a (250) : Current Station Rating: S/N: 167, S/E: 240 1) Rebuild/reconductor ACSR ~ 397.5 ~ 30/7 ~ LARK ~ Fe Clamps 9 d, Conductor Section 1, 14.43 miles Project Type : FAC Cost : $21,650,000 Time Estimate : 12-18 Months AEPA0020b (251) : Replace 1200 A Wavetrap at New London Project Type : FAC Cost : $50,000 Time Estimate : 24-36 Months	$21,700,000
			TOTAL COST	$27,700,000

11.6 Flow Gate Details

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
161663210	242687	05JOHNMT	AEP	242734	05NEWLDN	AEP	1	AEP_P2-2_#13260_05SKIMMR 69.0_1	bus	240.0	145.22	147.54	DC	5.57

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246843	05SMG1	1.1693	50/50	1.1693
246844	05SMG2	3.1786	50/50	3.1786
246845	05SMG3	1.9928	50/50	1.9928
246846	05SMG4	3.1292	50/50	3.1292
246847	05SMG5	1.2187	50/50	1.2187
247284	05LEESVG	1.8564	50/50	1.8564
315156	1HALLBR1	2.9223	50/50	2.9223
316118	AC1-105 C	1.8331	Adder	2.16
316123	AC1-075 C	1.2269	50/50	1.2269
925661	AC1-042 C	5.9959	50/50	5.9959
925662	AC1-042 E	9.7827	50/50	9.7827
925997	AC1-075 E	4.4060	50/50	4.4060
926023	AC1-080 C	0.4100	50/50	0.4100
926024	AC1-080 E	1.4619	50/50	1.4619
926051	AC1-083 C O1	2.5478	Adder	3.0
926052	AC1-083 E O1	4.1570	Adder	4.89
926274	AC1-105 E	0.9006	Adder	1.06
926645	AC1-145 C	1.1261	50/50	1.1261
926646	AC1-145 E	6.4053	50/50	6.4053
927261	AC1-222 C	1.9259	Adder	2.27
927262	AC1-222 E	1.8334	Adder	2.16
933941	AD1-017 C	0.5096	Adder	0.6
933942	AD1-017 E	0.8314	Adder	0.98
934311	AD1-055 C	1.3372	Adder	1.57
934312	AD1-055 E	0.3448	Adder	0.41
938451	AE1-064 C	4.7778	Adder	5.62
938452	AE1-064 E	2.4705	Adder	2.91
939941	AE1-230 C	2.7049	50/50	2.7049
939942	AE1-230 E	4.8087	50/50	4.8087
941801	AE2-185 C	13.5245	50/50	13.5245
941802	AE2-185 E	9.0163	50/50	9.0163
941821	AE2-187 C	13.5245	50/50	13.5245
941822	AE2-187 E	6.0109	50/50	6.0109
942671	AE2-283 C	14.8769	50/50	14.8769
942672	AE2-283 E	7.8141	50/50	7.8141
942751	AE2-291 C	15.1898	50/50	15.1898
942752	AE2-291 E	10.1266	50/50	10.1266
942761	AE2-292 C O1	18.9128	50/50	18.9128
942762	AE2-292 E O1	12.6086	50/50	12.6086
943901	AF1-058 C	0.7117	Adder	0.84
943902	AF1-058 E	0.4744	Adder	0.56

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
945081	AF1-173	5.2407	50/50	5.2407
960061	AF2-297 C	2.8466	Adder	3.35
960062	AF2-297 E	1.8977	Adder	2.23
961121	AF2-403	3.0054	50/50	3.0054
962441	AG1-093 C O1	2.5908	Adder	5.75
962442	AG1-093 E O1	0.7885	Adder	1.75
963601	AG1-209 C	1.0519	50/50	1.0519
963602	AG1-209 E	1.5779	50/50	1.5779
964141	AG1-275 C	4.5082	50/50	4.5082
964142	AG1-275 E	3.0054	50/50	3.0054
964151	AG1-276 C	4.5082	50/50	4.5082
964152	AG1-276 E	3.0054	50/50	3.0054
964251	AG1-286 C	3.3401	50/50	3.3401
964252	AG1-286 E	2.2268	50/50	2.2268
964261	AG1-287 C	0.2829	Adder	0.63
964262	AG1-287 E	0.1886	Adder	0.42
964471	AG1-310 C	1.4850	50/50	1.4850
964472	AG1-310 E	0.7314	50/50	0.7314
964533	AG1-316 BAT	1.6207	Merchant Transmission	1.6207
966253	AG1-494 BAT	2.5943	Merchant Transmission	2.5943
966691	AG1-539 C	7.9424	50/50	7.9424
966692	AG1-539 E	10.6726	50/50	10.6726
966761	AG1-547 C	12.2246	50/50	12.2246
966762	AG1-547 E	6.5594	50/50	6.5594
CPLE	CPLE	0.9111	Confirmed LTF	0.9111
NY	NY	0.0210	Confirmed LTF	0.0210
PRAIRIE	PRAIRIE	0.4288	Confirmed LTF	0.4288
O-066	O-066	0.0673	Confirmed LTF	0.0673
CBM-S2	CBM-S2	8.1014	Confirmed LTF	8.1014
COTTONWOOD	COTTONWOOD	0.0105	Confirmed LTF	0.0105
G-007	G-007	0.0084	Confirmed LTF	0.0084
GIBSON	GIBSON	0.1381	Confirmed LTF	0.1381
BLUEG	BLUEG	0.4826	Confirmed LTF	0.4826
TRIMBLE	TRIMBLE	0.1564	Confirmed LTF	0.1564

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
164050810	314667	4ALTVSTA	DVP	314666	3ALTVSTA	DVP	2	AEP_P2-2_#10292_05NEWLDN 138_1	bus	146.6	100.06	101.88	DC	2.67

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247284	05LEESVG	1.3809	50/50	1.3809
925661	AC1-042 C	4.2551	50/50	4.2551
925662	AC1-042 E	6.9425	50/50	6.9425
926051	AC1-083 C O1	2.0730	Adder	2.44
926052	AC1-083 E O1	3.3823	Adder	3.98
926522	AC1-123 E O1	1.2579	Adder	1.48
926645	AC1-145 C	0.7992	50/50	0.7992
926646	AC1-145 E	4.5457	50/50	4.5457
927261	AC1-222 C	-1.6354	Adder	-1.92
933941	AD1-017 C	0.4146	Adder	0.49
933942	AD1-017 E	0.6765	Adder	0.8
934311	AD1-055 C	-1.1355	Adder	-1.34
938451	AE1-064 C	4.3075	Adder	5.07
938452	AE1-064 E	2.2274	Adder	2.62
939941	AE1-230 C	1.9196	50/50	1.9196
939942	AE1-230 E	3.4126	50/50	3.4126
941801	AE2-185 C	9.5980	50/50	9.5980
941802	AE2-185 E	6.3986	50/50	6.3986
941821	AE2-187 C	9.5980	50/50	9.5980
941822	AE2-187 E	4.2658	50/50	4.2658
942671	AE2-283 C	10.5578	50/50	10.5578
942672	AE2-283 E	5.5455	50/50	5.5455
943901	AF1-058 C	-0.5827	Adder	-0.69
945081	AF1-173	3.7192	50/50	3.7192
961121	AF2-403	2.1329	50/50	2.1329
962443	AG1-093 BAT	1.3486	Merchant Transmission	1.3486
963601	AG1-209 C	0.7465	50/50	0.7465
963602	AG1-209 E	1.1198	50/50	1.1198
964141	AG1-275 C	3.1993	50/50	3.1993
964142	AG1-275 E	2.1329	50/50	2.1329
964151	AG1-276 C	3.1993	50/50	3.1993
964152	AG1-276 E	2.1329	50/50	2.1329
964251	AG1-286 C	1.5997	50/50	1.5997
964252	AG1-286 E	1.0664	50/50	1.0664
966693	AG1-539 BAT	16.6215	50/50	16.6215
966761	AG1-547 C	8.6755	50/50	8.6755
966762	AG1-547 E	4.6550	50/50	4.6550
WEC	WEC	0.0501	Confirmed LTF	0.0501
LGEE	LGEE	0.1112	Confirmed LTF	0.1112
CBM-W2	CBM-W2	1.0752	Confirmed LTF	1.0752
NY	NY	0.0371	Confirmed LTF	0.0371

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
TVA	TVA	0.1442	Confirmed LTF	0.1442
O-066	O-066	0.6057	Confirmed LTF	0.6057
SIGE	SIGE	0.0268	Confirmed LTF	0.0268
CBM-S1	CBM-S1	0.0441	Confirmed LTF	0.0441
G-007	G-007	0.0956	Confirmed LTF	0.0956
HAMLET	HAMLET	0.1559	Confirmed LTF	0.1559
MEC	MEC	0.2320	Confirmed LTF	0.2320
LAGN	LAGN	0.1593	Confirmed LTF	0.1593
CATAWBA	CATAWBA	0.0388	Confirmed LTF	0.0388
CBM-W1	CBM-W1	2.1591	Confirmed LTF	2.1591

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
AC1-042	Altavista-Mt. Airy 69kV	Engineering and Procurement
AC1-075	Perth-Hickory Grove 115kV	Engineering and Procurement
AC1-080	Perth-Hickory Grove 115kV	Engineering and Procurement
AC1-083	Smith Mountain-Bearskin 138kV	Active
AC1-105	Halifax-Mt. Laurel 115kV	Engineering and Procurement
AC1-123	Smith Mountain-Candler's Mountain 138kV	Under Construction
AC1-145	Gretna DP 69 kV	Engineering and Procurement
AC1-222	Crystal Hill-Halifax 115kV	Engineering and Procurement
AD1-017	Smith Mountain-Bearskin 138 kV	Active
AD1-055	Crystal Hill-Halifax 115 kV	Engineering and Procurement
AE1-064	Rockcastle 138 kV	Active
AE1-230	Shockoe 69 kV	Active
AE2-185	Gladys DP-Stonemill Switching Station 69 kV	Active
AE2-187	Shockoe DP-Chatham 69 kV	Active
AE2-283	Gladys-Stone Mill 69 kV	Active
AE2-291	Grit DP-Perth 115 kV	Active
AE2-292	Grit DP-Perth 115 kV	Active
AF1-058	Welco 34.5 kV	Engineering and Procurement
AF1-173	Gretna DP-Shockoe DP 69 kV	Active
AF2-297	Sedge Hill 115 kV	Active
AF2-403	Shockoe DP-Chatham 69 kV	Active
AG1-093	Halifax-Chase City 115 kV	Active
AG1-209	Gretna 12.5 kV	Active
AG1-275	Gladys DP-Stone Mill 69 kV	Active
AG1-276	Gladys DP-Stone Mill 69 kV	Active
AG1-286	Johnson Mountain 138 kV	Active
AG1-287	South Boston 12.5 kV	Active
AG1-310	Crystal Hill-Perth 115 kV	Active
AG1-316	Rustburg 138 kV	Active
AG1-494	Boxwood-Riverville 138 kV	Active
AG1-539	Grit DP-Perth 115 kV	Active
AG1-547	Mount Airy-Chatham 69 kV	Active

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P2-1_242641 05FOREST 138 242734 05NEWLDN 138 1	CONTINGENCY 'AEP_P2-1_242641 05FOREST 138 242734 05NEWLDN 138 1' OPEN BRANCH FROM BUS 242641 TO BUS 242734 CKT 1 END
AEP_P1-2_#3174_6	CONTINGENCY 'AEP_P1-2_#3174_6' OPEN BRANCH FROM BUS 242512 TO BUS 242515 CKT 1 / 242512 05CLOVRD 765 242515 05JOSHUA 765 1 END
AEP_P4_#311_05CLOVRD	CONTINGENCY '"AEP_P4_#311_05CLOVRD' 765_CC2" / 1395 OPEN BRANCH FROM BUS 242512 TO BUS 242514 CKT 1 / 242512 05CLOVRD 765 242514 05J.FERR 765 1 END
AEP_P7-1_#10778	CONTINGENCY 'AEP_P7-1_#10778' OPEN BRANCH FROM BUS 242531 TO BUS 304094 CKT 1 / 242531 05EDANV2 230 304094 6YANCY TAP 230 1 OPEN BRANCH FROM BUS 242531 TO BUS 242632 CKT 4 / 242531 05EDANV2 230 242632 05EDAN 2 138 4 OPEN BRANCH FROM BUS 242549 TO BUS 242632 CKT 1 / 242549 05BANSTR 138 242632 05EDAN 2 138 1 OPEN BRANCH FROM BUS 242629 TO BUS 242632 CKT 1 / 242629 05E.MONU 138 242632 05EDAN 2 138 1 OPEN BRANCH FROM BUS 242629 TO BUS 242770 CKT 1 / 242629 05E.MONU 138 242770 05RIGIS 138 1 OPEN BRANCH FROM BUS 242631 TO BUS 242632 CKT Z1 / 242631 05EDAN 1 138 242632 05EDAN 2 138 Z1 OPEN BRANCH FROM BUS 242629 TO BUS 243948 CKT 1 / 242629 05E.MONU 138 243948 05BRANTLY 69.0 1 OPEN BRANCH FROM BUS 242770 TO BUS 243988 CKT 1 / 242770 05RIGIS 138 243988 05RIGIS 69.0 1 OPEN BRANCH FROM BUS 243974 TO BUS 243988 CKT 1 / 243974 05GOODYEAR 69.0 243988 05RIGIS 69.0 1 END
AEP_P2-2_#10292_05NEWLDN 138_1	CONTINGENCY 'AEP_P2-2_#10292_05NEWLDN 138_1' OPEN BRANCH FROM BUS 242569 TO BUS 242734 CKT 1 / 242569 05BRUSHT 138 242734 05NEWLDN 138 1 OPEN BRANCH FROM BUS 242641 TO BUS 242734 CKT 1 / 242641 05FOREST 138 242734 05NEWLDN 138 1 OPEN BRANCH FROM BUS 242687 TO BUS 242734 CKT 1 / 242687 05JOHNMT 138 242734 05NEWLDN 138 1 END
Base Case	

Contingency Name	Contingency Definition
AEP_P2-1_242569 05BRUSHT 138 242734 05NEWLDN 138 1	CONTINGENCY 'AEP_P2-1_242569 05BRUSHT 138 242734 05NEWLDN 138 1' OPEN BRANCH FROM BUS 242569 TO BUS 242734 CKT 1 END
AEP_P2-2_#10163_05EDAN 2 138_2	CONTINGENCY 'AEP_P2-2_#10163_05EDAN 2 138_2' OPEN BRANCH FROM BUS 242531 TO BUS 304094 CKT 1 / 242531 05EDANV2 230 304094 6YANCY TAP 230 1 OPEN BRANCH FROM BUS 242531 TO BUS 242632 CKT 4 / 242531 05EDANV2 230 242632 05EDAN 2 138 4 OPEN BRANCH FROM BUS 242549 TO BUS 242632 CKT 1 / 242549 05BANSTR 138 242632 05EDAN 2 138 1 OPEN BRANCH FROM BUS 242629 TO BUS 242632 CKT 1 / 242629 05E.MONU 138 242632 05EDAN 2 138 1 OPEN BRANCH FROM BUS 242631 TO BUS 242632 CKT Z1 / 242631 05EDAN 1 138 242632 05EDAN 2 138 Z1 END
AEP_P4_#2914_05J.FERR	CONTINGENCY '"AEP_P4_#2914_05J.FERR' 765_B2" / 1487 OPEN BRANCH FROM BUS 242512 TO BUS 242514 CKT 1 / 242512 05CLOVRD 765 242514 05J.FERR 765 1 OPEN BRANCH FROM BUS 242514 TO BUS 245993 CKT 4 / 242514 05J.FERR 765 245993 05J.FERR SVS 20.6 4 REMOVE SWSHUNT FROM BUS 242514 /* 242514 05J.FERR 765 END
DVP_P1-3: 4ALTVSTA-TX#4	CONTINGENCY 'DVP_P1-3: 4ALTVSTA-TX#4' OPEN BRANCH FROM BUS 314666 TO BUS 314667 CKT 2 /* 3ALTVSTA 115.00 - 4ALTVSTA 138.00 END
AEP_P2-2_#13260_05SKIMMR 69.0_1	CONTINGENCY 'AEP_P2-2_#13260_05SKIMMR 69.0_1' OPEN BRANCH FROM BUS 242886 TO BUS 314861 CKT 1 / 242886 05SKIMMR 69.0 314861 3SKIMMER 115 1 OPEN BRANCH FROM BUS 242886 TO BUS 314861 CKT 2 / 242886 05SKIMMR 69.0 314861 3SKIMMER 115 2 OPEN BRANCH FROM BUS 242860 TO BUS 242886 CKT 1 / 242860 05ABERT 69.0 242886 05SKIMMR 69.0 1 OPEN BRANCH FROM BUS 242884 TO BUS 242886 CKT 1 / 242884 05S.LYNCHB 69.0 242886 05SKIMMR 69.0 1 REMOVE SWSHUNT FROM BUS 242886 / 242886 05SKIMMR 69.0 END

Contingency Name	Contingency Definition
AEP_P7-1_#10830	CONTINGENCY 'AEP_P7-1_#10830' OPEN BRANCH FROM BUS 242555 TO BUS 242843 CKT 1 / 242555 05BLAINE 138 242843 05WLAKE 138 1 OPEN BRANCH FROM BUS 242748 TO BUS 243951 CKT 1 / 242748 05PENHOK 138 243951 05REDWOOD 138 1 OPEN BRANCH FROM BUS 242748 TO BUS 242802 CKT 1 / 242748 05PENHOK 138 242802 05SMITHMTN 138 1 OPEN BRANCH FROM BUS 242843 TO BUS 243951 CKT 1 / 242843 05WLAKE 138 243951 05REDWOOD 138 1 END
AEP_P2-1_242687 05JOHNMT 138 242734 05NEWLDN 138 1	CONTINGENCY 'AEP_P2-1_242687 05JOHNMT 138 242734 05NEWLDN 138 1' OPEN BRANCH FROM BUS 242687 TO BUS 242734 CKT 1 END

12 Short Circuit Analysis

The following Breakers are overdutied

None

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).